HTTP/1.1 vs HTTP/2

a performance analysis

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LOAD IMPACT

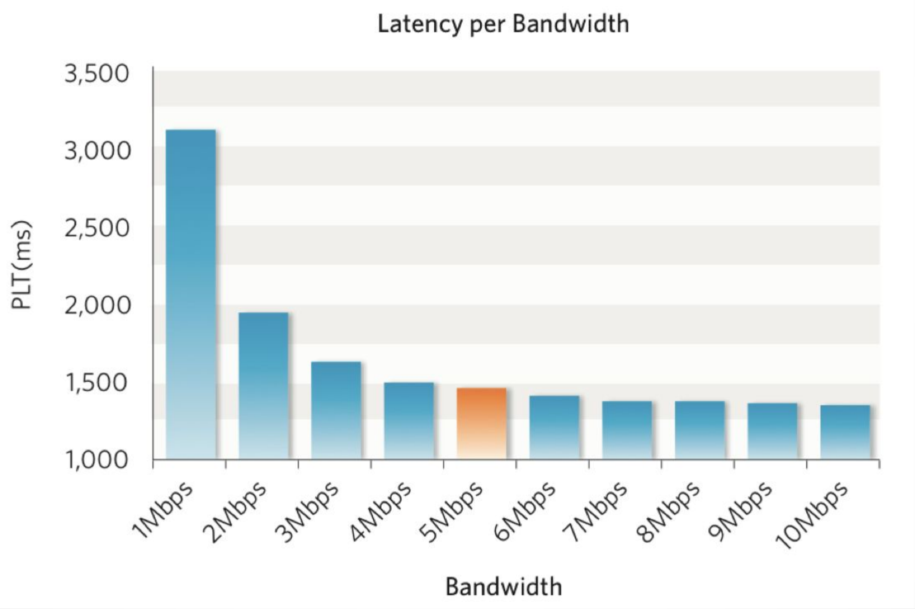
@loadimpact

Load. . .Impact?

- LOAD TESTING SAAS
- LAUNCHED 2009
- 150,000+ ACCOUNTS
- 1.5M+ LOAD TESTS
- APPLICATION-POSITIVE

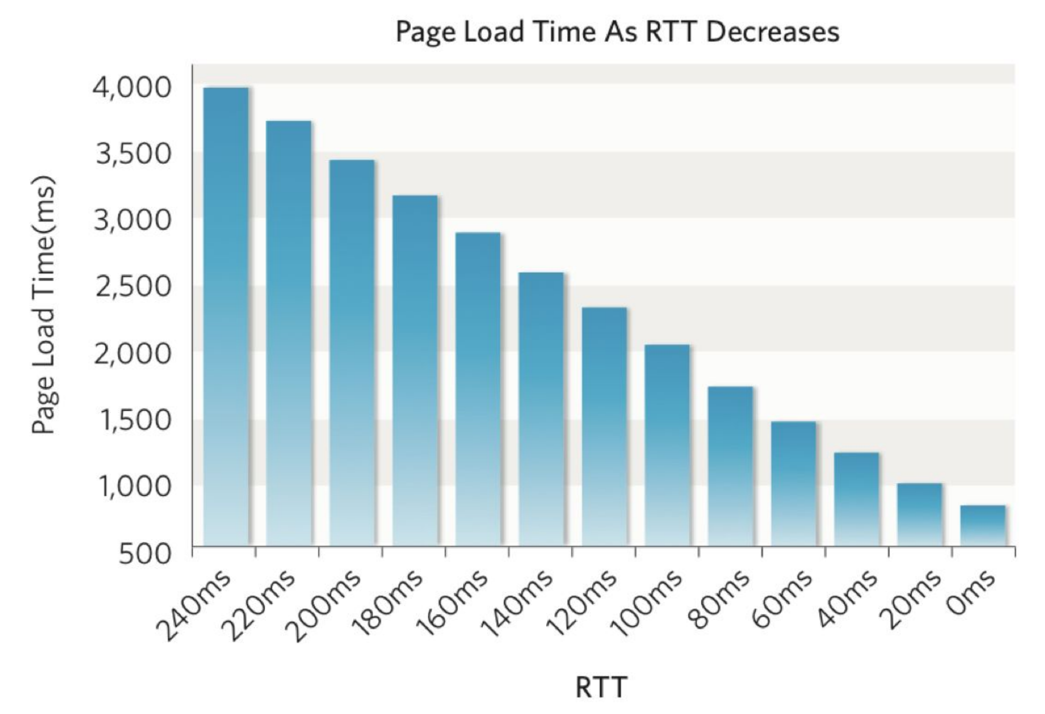
Part 1: The protocol

What is the problem?



Source: Mike Belshe, Google

Load time and delay



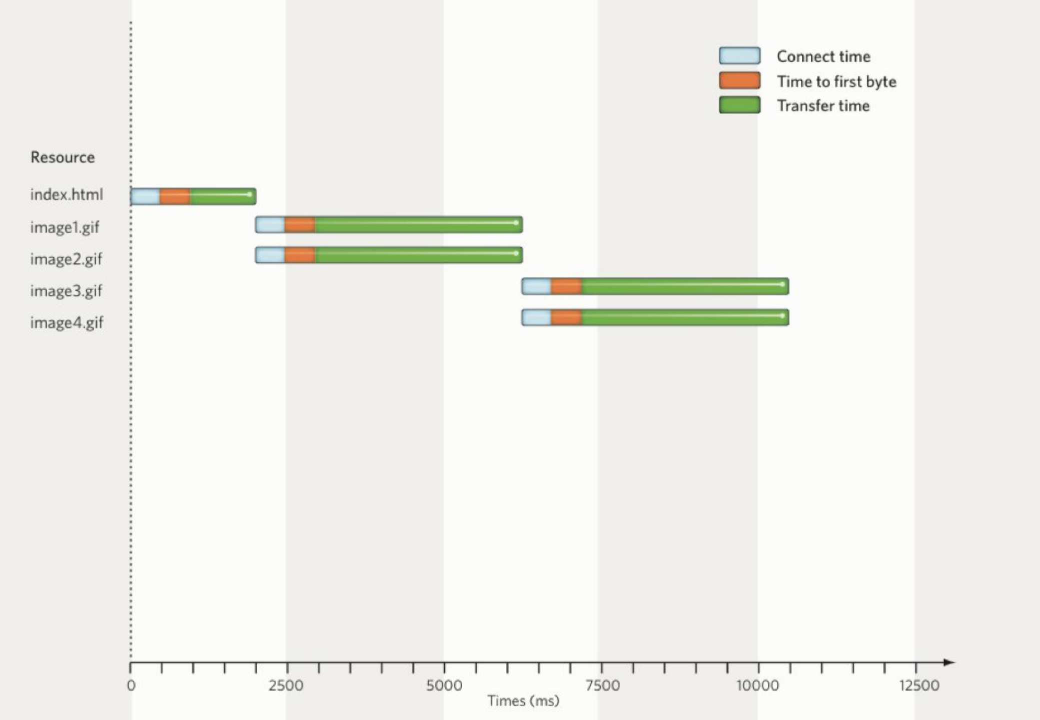
Source: Mike Belshe, Google

Some history

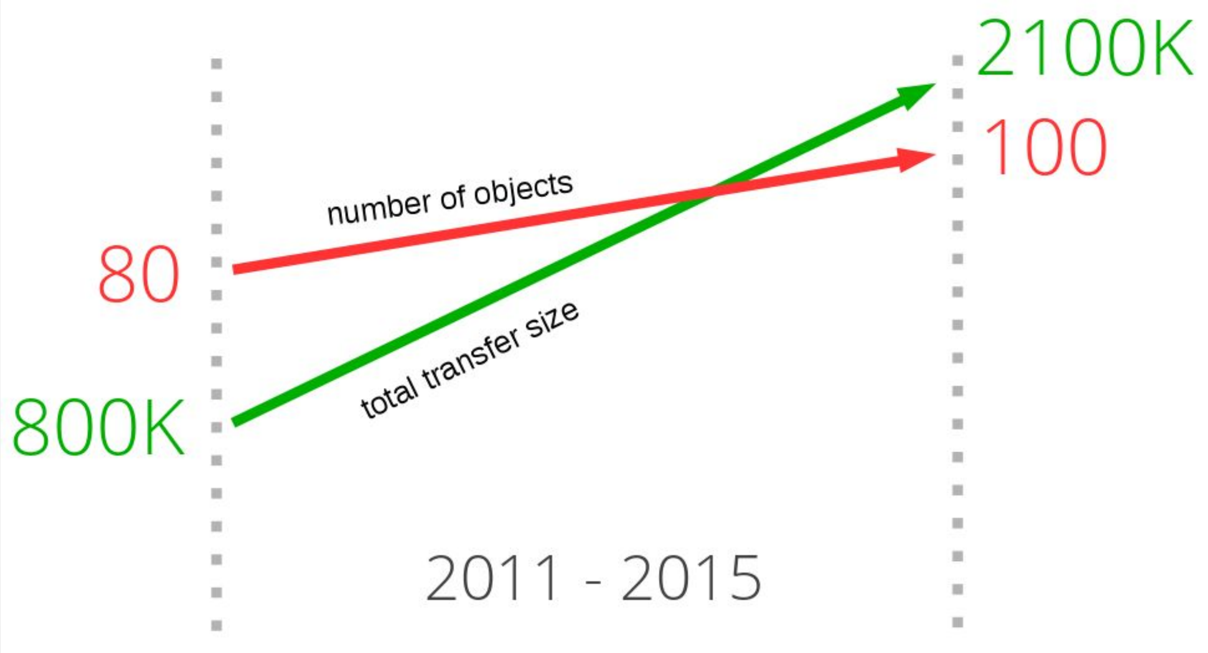
1996

- Web pages were tiny
- Internet bandwidth was tinier
- HTTP/1.0 spec released (RFC1945)
- Work started on HTTP/1.1

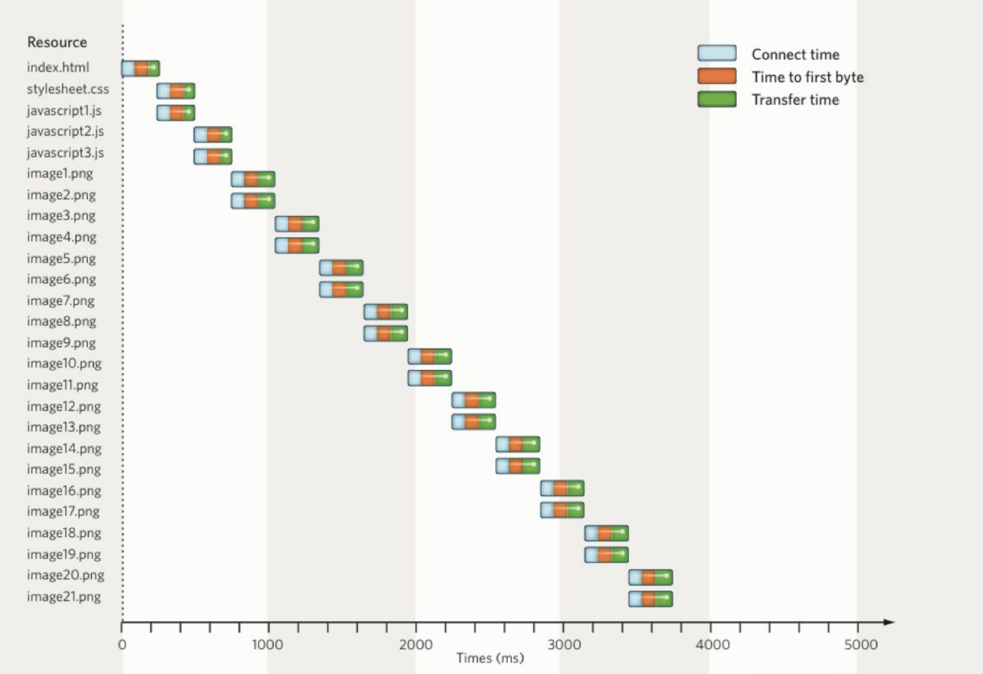
Page load circa 1996



Page composition



Page load today



Some more history

1997

- HTTP/1.1 spec released (RFC2068)
- A lot of stuff already implemented…
- Some performance improvements

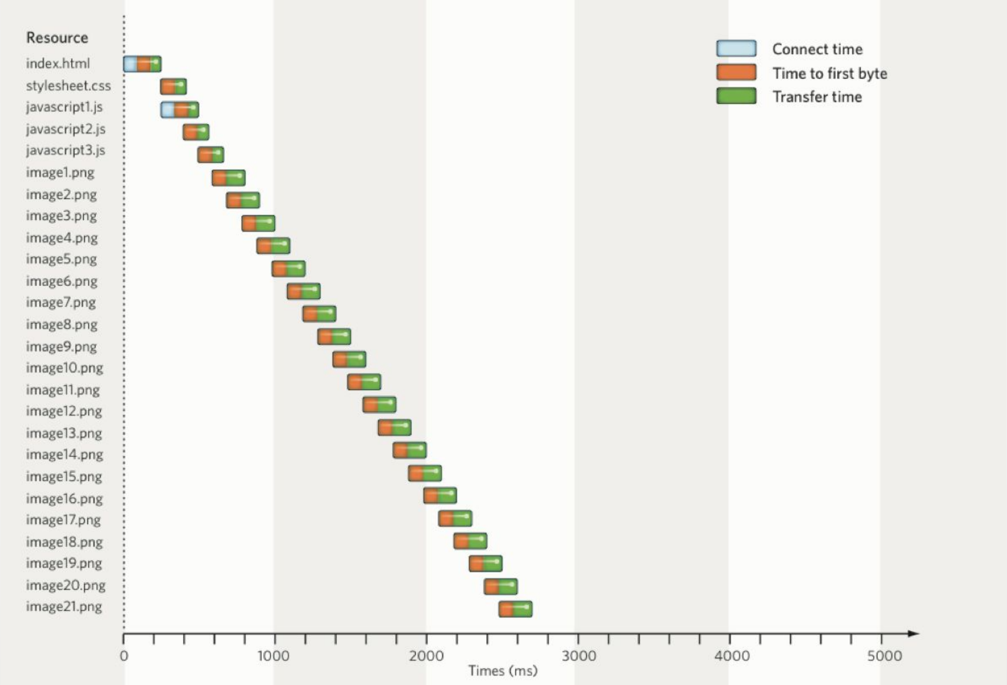
Pipelining

Connection re-use

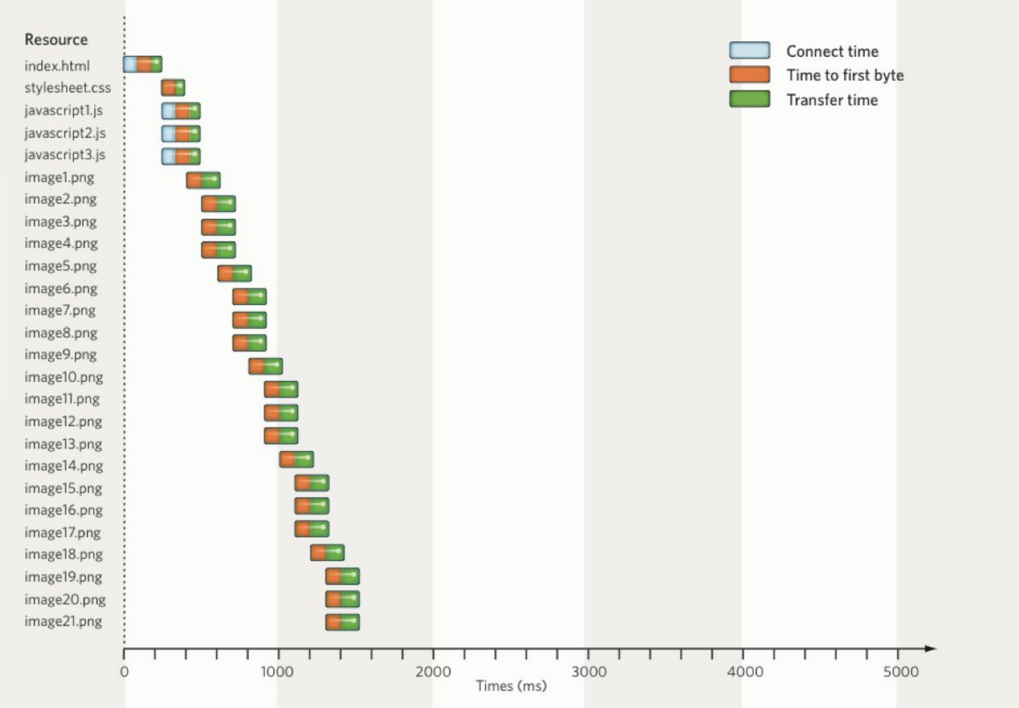
Improved caching

Range requests

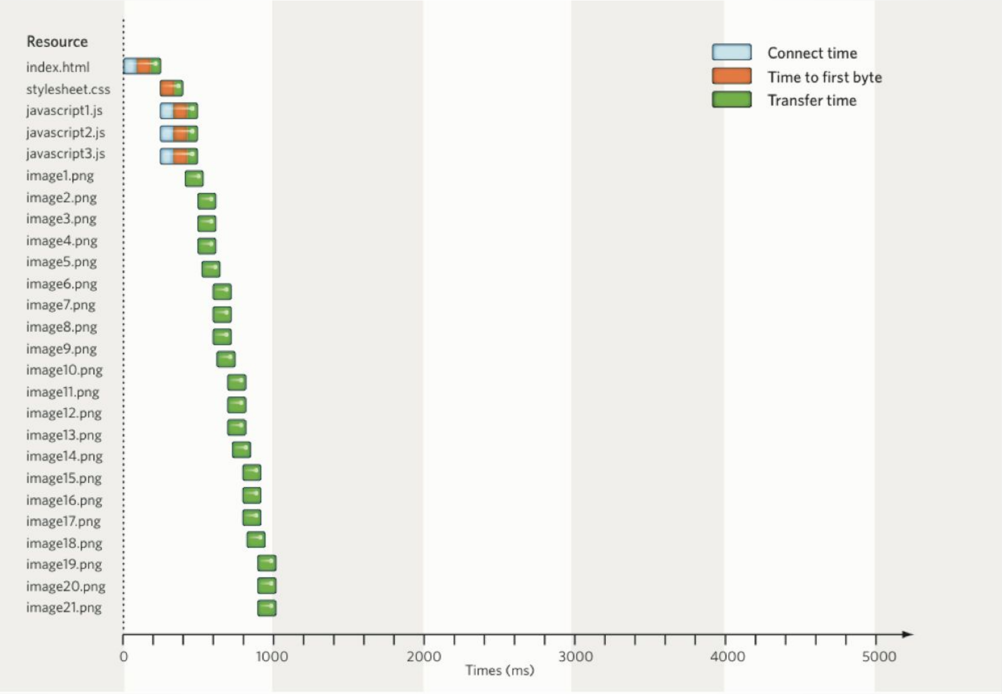
Connection re-use



Moar connections!



Pipelining - if it worked



Performance optimizations

a.k.a. “ugly hacks”

- Spriting
- Inlining
- Concatenating
- Sharding

Spriting

Performance optimizations

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- Spriting
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```
GET host1.domain.com/resourceA
GET host2.domain.com/resourceB
GET host3.domain.com/resourceC
...
```

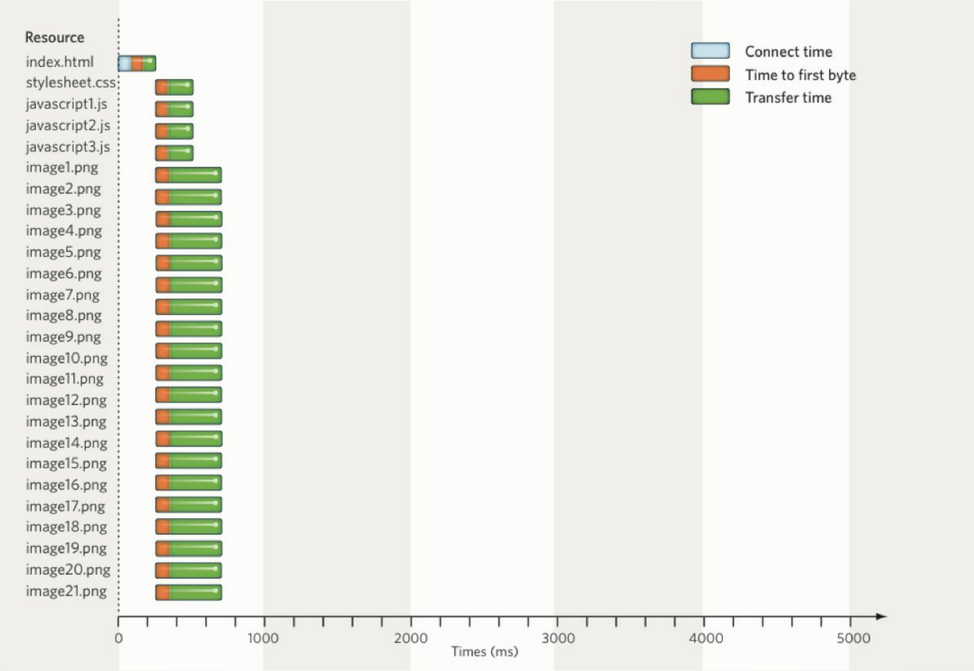
Sharding

Ugh.

Yes. So what if there was a protocol that:

- ...was less sensitive to network delay
- ...fixed pipelining and the head of line blocking
- ...performed well regardless of the number of TCP connections used
- ...used the same addressing/URL schemes etc for compatibility with HTTP 1.1

HTTP/2 multiplexing



Multiplexing

Multiplexing

HTTP/2 at a glance

- HTTP/2 is binary and (mostly) encrypted
- “Upgrade:” header or TLS ALPN negotiation
- Multiplexing is done with “streams”
    - Streams can be prioritized, re-prioritized and cancelled at any time
    - Streams can have dependencies
    - Streams have individual flow control
- Headers are compressed
- Servers can push content to clients

HTTP/2 penetration

- >70% of installed browsers support HTTP/2

HTTP/2 server side

facebook

Google

twitter

Microsoft IIS

CADDY

APACHE HTTP SERVER

traffic server™

LITESPEED

NGINX

HTTP/2 penetration

- 24% of Firefox traffic is HTTP/2
- 18% of Alexa top 500 support HTTP/2

Part 2: The experiment

Objective:

Try to get a sense of real-world performance impact of going from HTTP/1.1 to HTTP/2

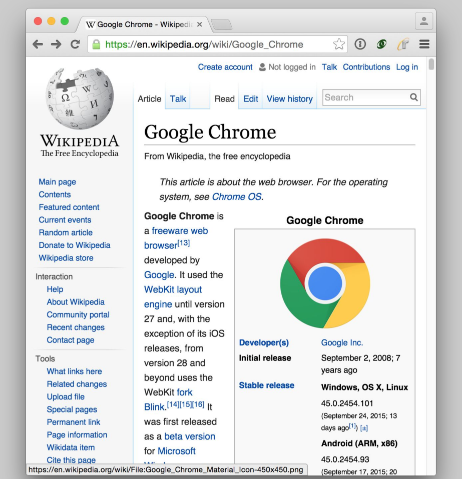
Approach

- Choose a well-known site
- Download all resources used by main page
- Host everything locally, in controlled environment
- Measure load times while simulating different network characteristics

Site: www.amazon.com

- ~230-240 resources to get to onload()
- ...but “only” ~10 javascript files
- ~10 unique source hosts
- ~7 Mbyte data

The setup



Google Chrome

From Wikipedia, the free encyclopedia

This article is about the web browser. For the operating system, see Chrome OS.

Google Chrome is a freeware web browser[13] developed by Google. It used the WebKit layout engine until version 27 and, with the exception of its iOS releases, from version 28 and beyond uses the WebKit fork Blink.[14][15][16] It was first released as a beta version for Microsoft

Google Chrome

Developer(s)	Google Inc.
Initial release	September 2, 2008; 7 years ago
Stable release	**Windows, OS X, Linux** 45.0.2454.101 (September 24, 2015; 13 days ago[1]) [±] **Android (ARM, x86)** 45.0.2454.93 (September 17, 2015; 20

https://en.wikipedia.org/wiki/File:Google_Chrome_Material_Icon-450x450.png

Chrome

Linux 3.19.0-25 (Ubuntu)
2 CPU cores, 2G RAM

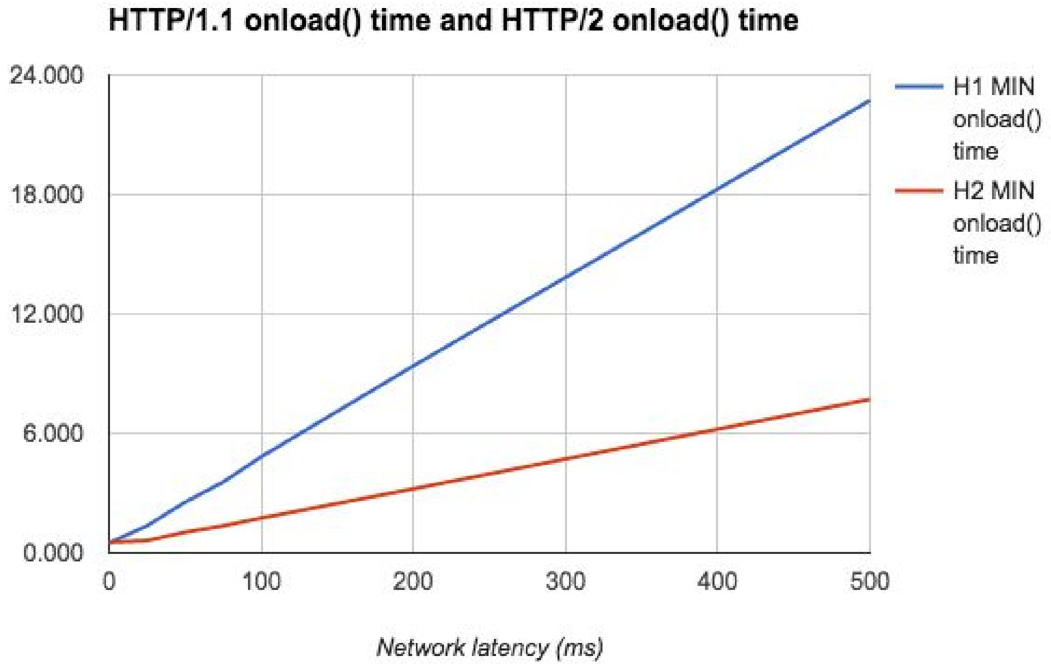
eth0:1
…
…
…
eth0:n

- Nginx 1.9.5/http2
- Shimmer Cat 0.1
- Linux Netem

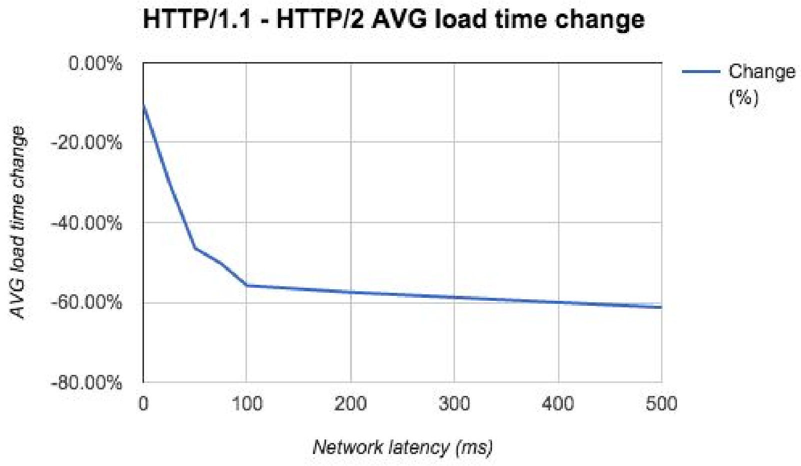
VMware Fusion

MacOS X 10.10.3 (4 CPU cores, 16G RAM)

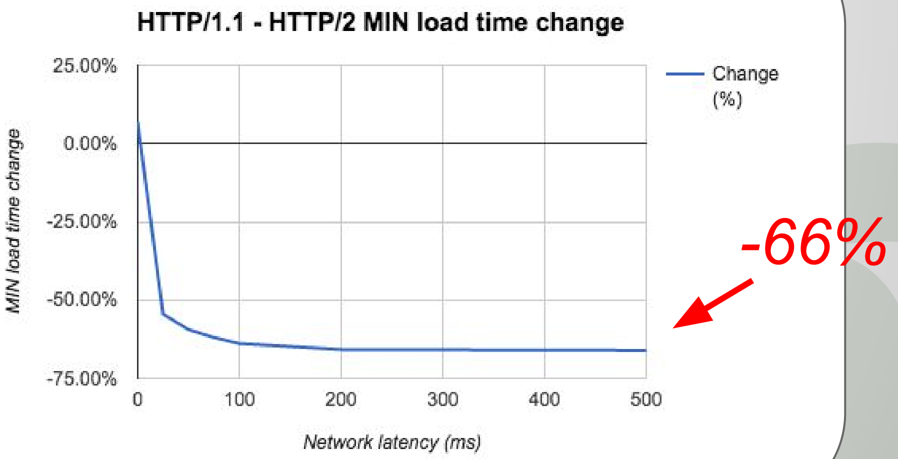
Test results



Test results



50-70% reduced load time

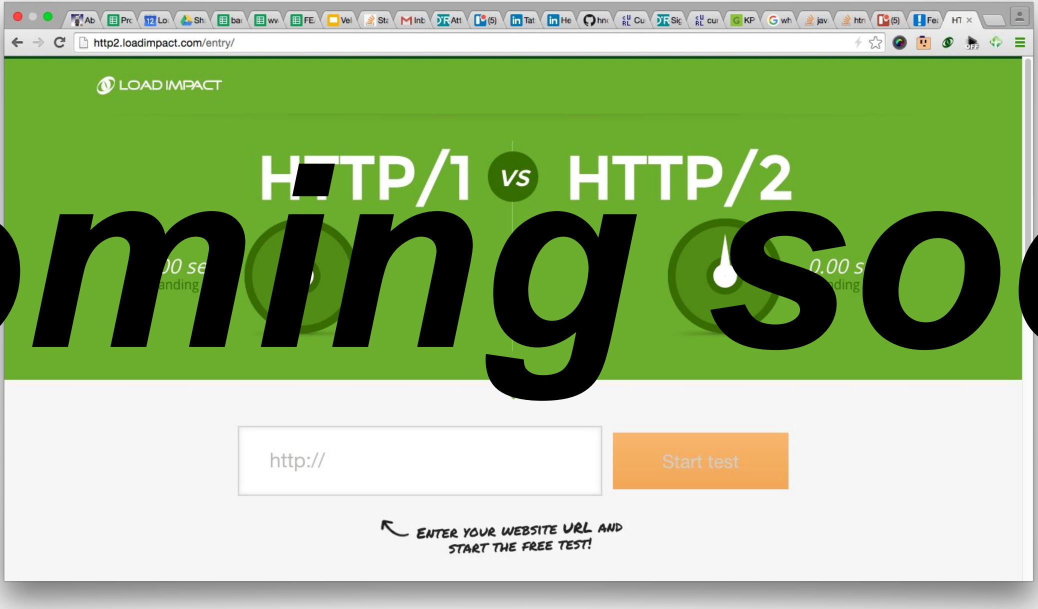


But remember:

- HTTP/2 implementations still in their infancy
- Sites are optimized for HTTP/1.1
- Our lab setup is not 100% realistic

So who knows… But still, hey - 60%!

http2.loadimpact.com



http2.loadimpact.com/entry/
LOAD IMPACT
HTTP/1 vs HTTP/2
0.00 s
http://
Start test
Enter your website URL and start the free test!

Coming soon

Code @ https://github.com/loadimpact

@loadimpact