Push or Request: An Investigation of HTTP/2 Server Push for Improving Mobile Performance

Sanae Rosen[1][2], Bo Han[4], Shuai Hao[4], Z. Morley Mao[1], Feng Qian[3]

[1]University of Michigan

[2]Yelp, Inc.

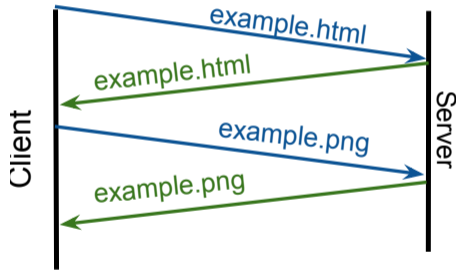[3]Indiana University

[4]AT&T Labs –Research

What is Server Push?

Part of HTTP/2: an update to HTTP/1.1 meant to improve performance

Normal HTTP Requests

Server Push

Introduction

- Goal: Understand how Server Push impacts performance
    - Focus on mobile, where it's more useful
- What should be pushed?
- What is the impact of factors that affect performance:
    - Device type
    - Network type and conditions
    - Webpage structure
- What is the impact on energy?

Related work

- Performance of SPDY complex, dependent on network conditions[1]
  - Looked at Server Push briefly
- SPDY has inconsistent benefits on cellular networks[2]
- Server Push doesn't work well with caching [3]
- HTTP/2 usage is small but growing; shows benefits in the wild[4]

Motivates a deeper look at Server Push performance

---

[1]How Speedy is SPDY?, Wang et al, NSDI '14

[2]Towards a SPDYier Mobile Web?, Erman et al, CoNEXT '13

[3]MetaPush: Cellular-Friendly Server Push For HTTP/2, Han et al, AllThingsCellular '15

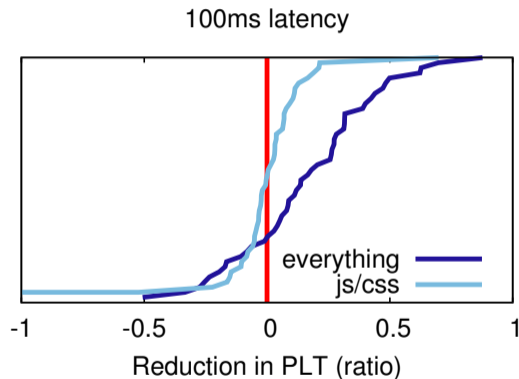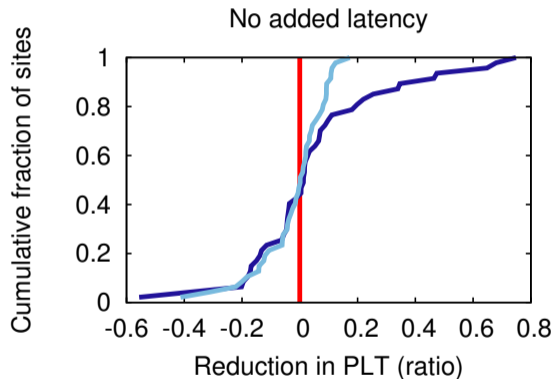[4]Is the Web HTTP/2 Yet?, Varvello et al, PAM '16

Methodology

- 5 of 10,000 top sites adopted it as of last year
- Mirrored 50 sites on a local server
- Automatically load pages repeatedly and measure performance
  - Built on Chrome utilities - their definition of PLT (page load time)
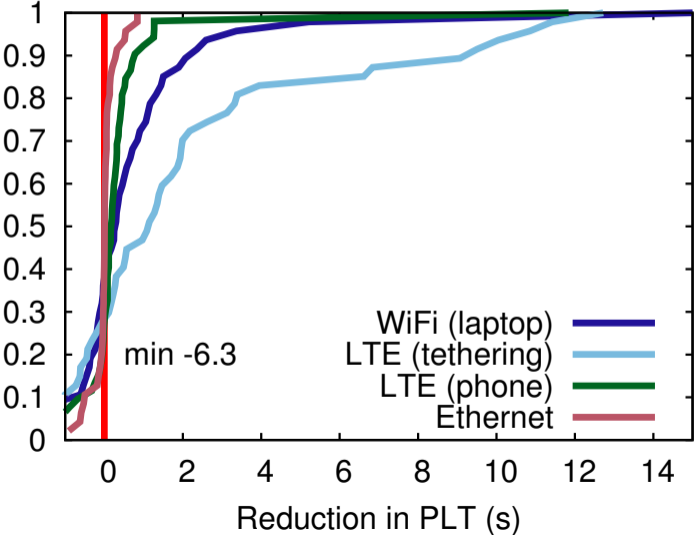
Server Push Example
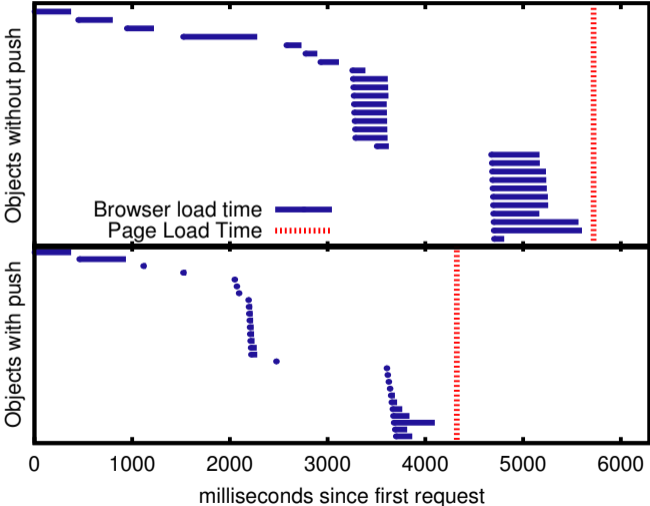
How Much to Push

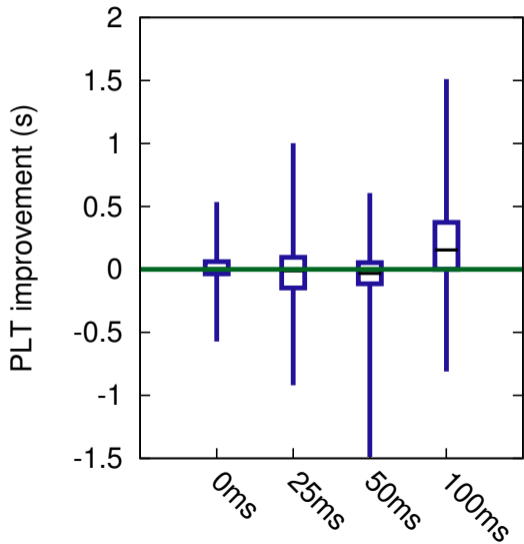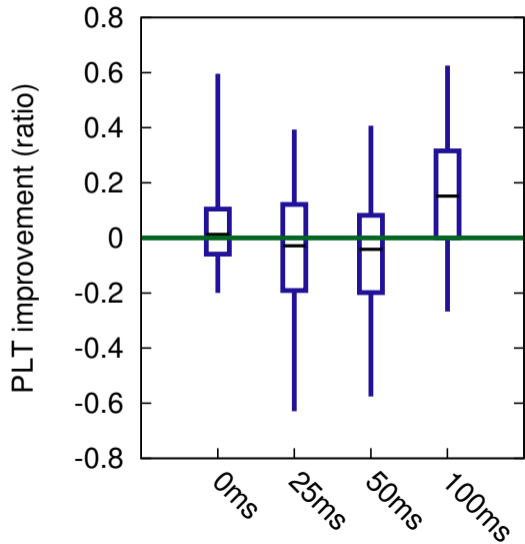Ratio of PLT reduction to original PLT:

- Conclusion: Push everything!
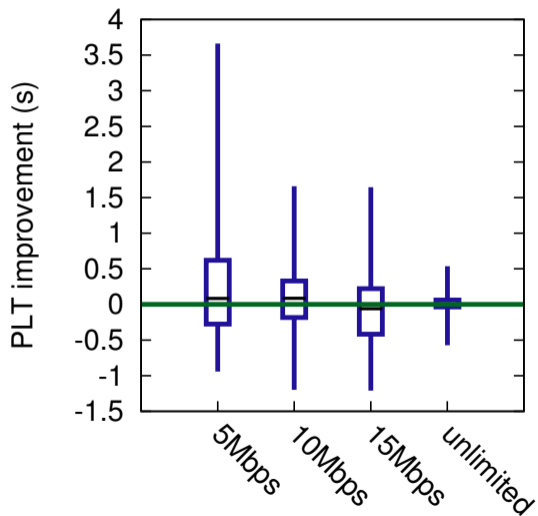- Negative values: Server Push delays the HTML object load

Which Networks?

min -6.3

Legend:
- WiFi (laptop)
- LTE (tethering)
- LTE (phone)
- Ethernet

y-axis: 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1
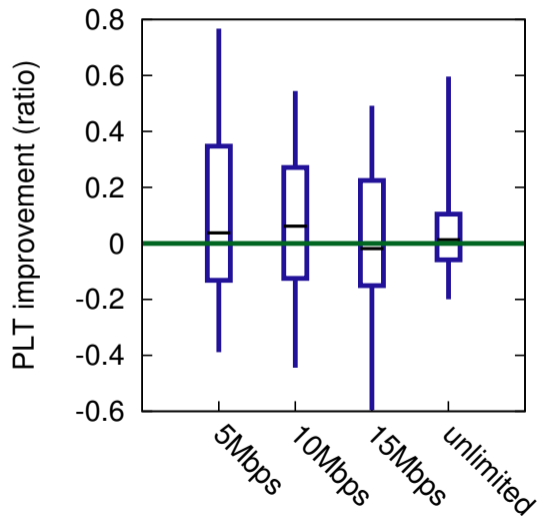
x-axis: Reduction in PLT (s) — 0, 2, 4, 6, 8, 10, 12, 14
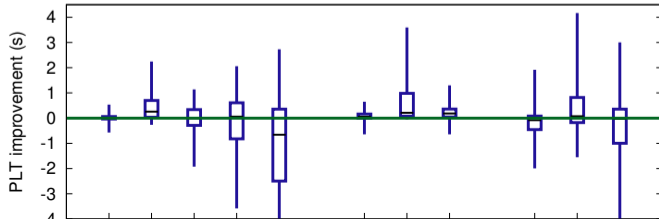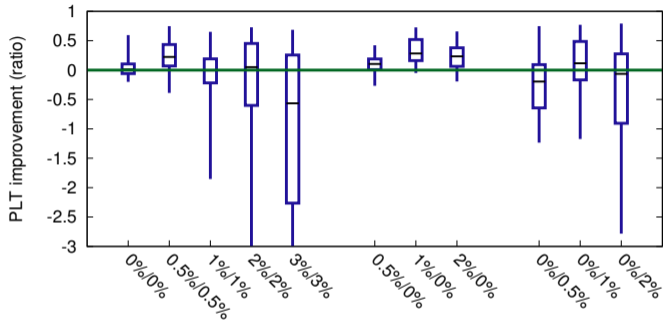
Impact of latency

Impact of bandwidth

Impact of loss rates

Impact of the website

Performance improvement vs. Number of images delayed (out of 5)

Time

When the script runs, the body of connections ... Source: Derived the left ...

Impact of Energy

LTE

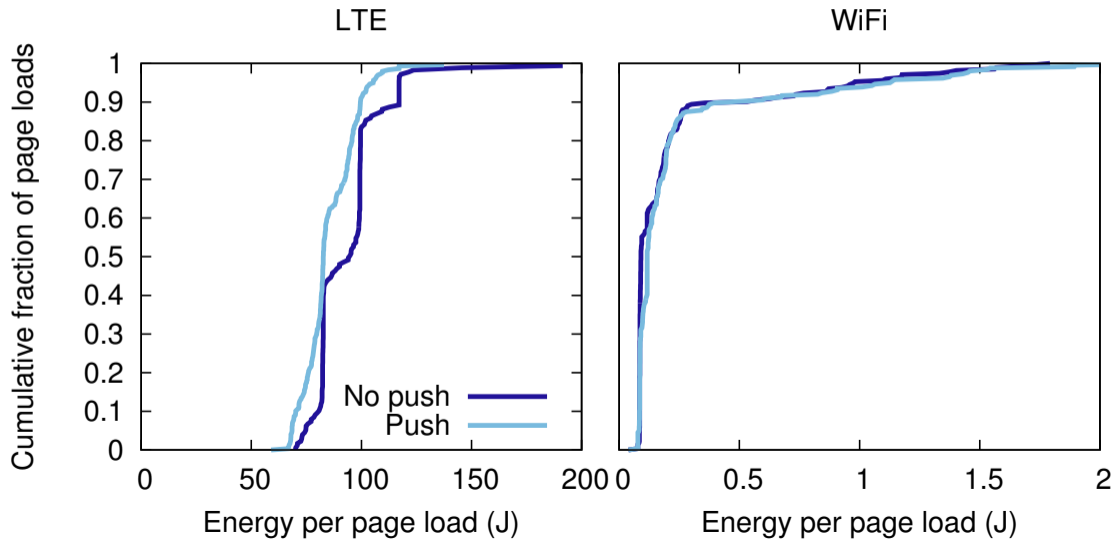Cumulative fraction of page loads vs Energy per page load (J)

No push
Push

WiFi

Energy per page load (J)
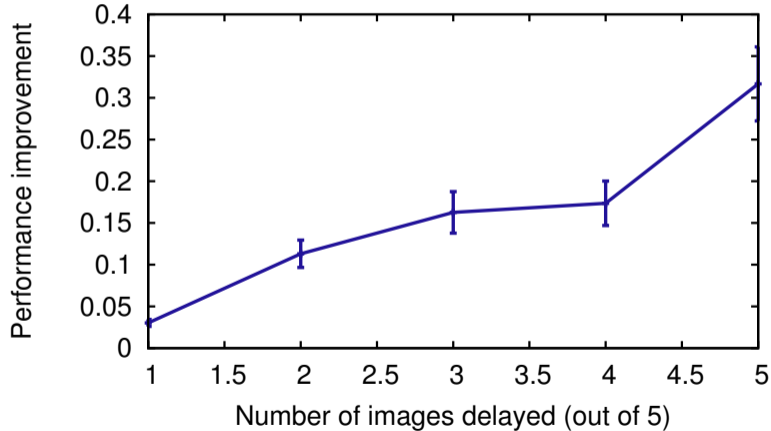
Conclusion

Overall:

- Mitigates the effects of poor network conditions
- Benefits not consistent
- Most useful for cellular and wireless networks — especially as mobile devices become more powerful

Recommendations:

- Each site should check if it benefits from Server Push
- Push as much content as possible

Questions?

- Thanks to Yelp for sending me here!
- Yelp has a public dataset for researchers (Yelp Dataset Challenge)