Towards a Faster Mobile Web

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The Akamai Network

A GLOBAL PLATFORM
Consists of 210,000+ Servers
Deployed in 1,400+ Networks
Located in 650+ Cities and 120+ Countries

DELIVERING > 13 MILLION DOMAINS
All top 60 e-Commerce sites
All top 30 media & entertainment companies
13 of the top 15 largest auto manufacturers
All of the top anti-virus companies
All top 10 banks

ACCELERATING DAILY TRAFFIC OF
40+ million hits per second
2+ trillion deliveries per day
30+ terabits per second

Slide credits: Moritz Steiner [HTTP Workshop’16]
Research with Akamai

• Summer of 2015
  – Exploring cellular network infrastructures [PAM’16]
  – Investigating IPv6 performance [MobiCom’16]

• Summer of 2016
  – Optimizing 3rd parties on webpages [ACM S3’16, workshop]
  – Measuring HTTP/2 performance [MobiCom’16, poster]
Concluding HTTP/1.1

• The **legacy protocol** for Web communications
  • Standardized by IETF in late 90’s
  • Works on a **request – response** model
  • Also widely **adopted for Video streaming and P2P**

• Does not speedup webpages, **much**
  • Client has to always ask
  • Only **one request at a time**
  • Creates a **head-of-line** blocking

• HTTP/1.1 **hacks** to bring parallelism
  • Browsers open **6 connections per hostname**
  • Developers use **multiple hostnames** across webpage
Welcoming HTTP/2

• 16 years later, finally!
  • No need to open multiple connections
  • No need to use multiple hostnames
  • One connection serves all

• High level overview
  • Allows multiple requests and responses to *interleave and multiplex*.
  • Eliminates head-of-line blocking
  • Servers can send response *without being asked*
https://http2.akamai.com/demo/

HTTP/1.1
Latency: 18ms
Load time: 1.91s

HTTP/2
Latency: 18ms
Load time: 0.62s
Should we move to HTTP/2?

• For webpages with many small objects - Yes

• For other types of webpages - Maybe
  • HTTP/2 uses just one TCP connection
  • In case of packet loss, this connection hurts performance of HTTP/2.

• With HTTP/1.1, browsers make 6 connections
  • Loss on one connection does not affect much

• Unclear as to how HTTP/2 performs under loss
Contributions

• Developed a measurement platform that replicates loss in cellular networks.

• **Compared HTTP/2 with HTTP/1.1** under various mobile network conditions.
  • **HTTP/2 degrades** page load times of webpages with **large-sized objects** under lossy conditions.

• **Side-stepped from the HTTP/2 standard**
  • Evaluated multiple HTTP/2 connections
  • Significant improvements
Thank you

Questions?

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Background Slides
Webpage with few large objects

Page Load Time (Seconds)

- h1 (CWND 10, 6 Connections)
- h2 (CWND 10, 6 Connections)
- h2 (CWND 10, 1 Connection)
- h2 (CWND 10, 10 Connections)
- h2 (CWND 10, 2 Connections)
- h2 (CWND 60, 1 Connection)
- h2 (CWND 10, 3 Connections)

Network Condition
- Good
- Median
- Poor

Akamai
MONTANA STATE UNIVERSITY
NSF
A real 8 MB webpage – designed from HTTP Archive data

Page Load Time (Seconds)

- h1 (CWND 10, 6 Connections)
- h2 (CWND 10, 1 Connection)
- h2 (CWND 10, Sharded)
- h2 (CWND 60, 1 Connection)

Network Condition

- Good
- Median
- Poor