

Promise of Push

HTTP/2 Web Performance

@ColinBendell
Director, CTO Office

Hi. I'm Colin

- Dad,
- Coder,
- Runner,
- (part crazy)

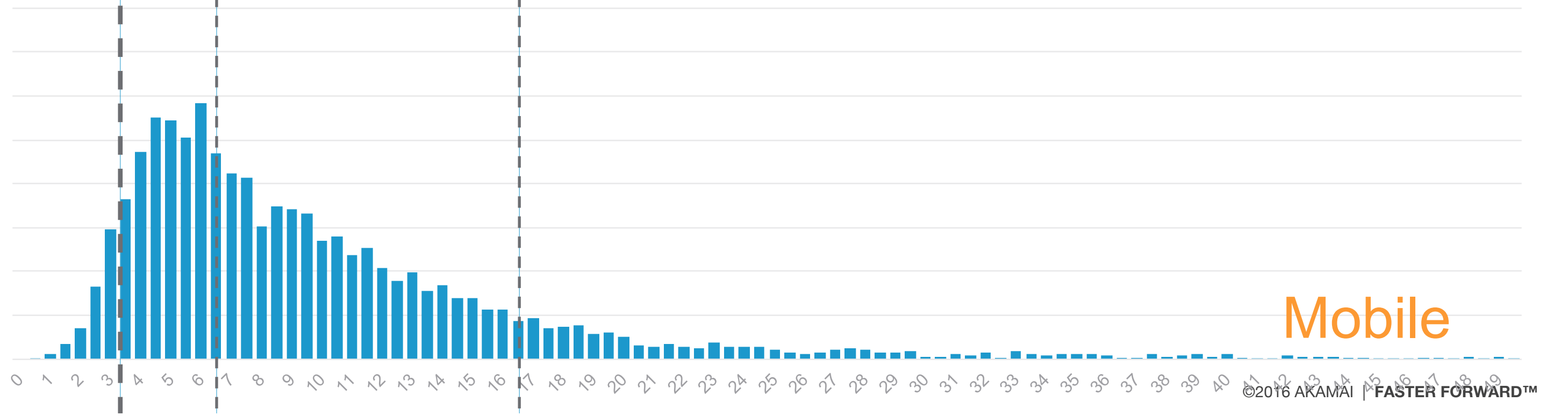
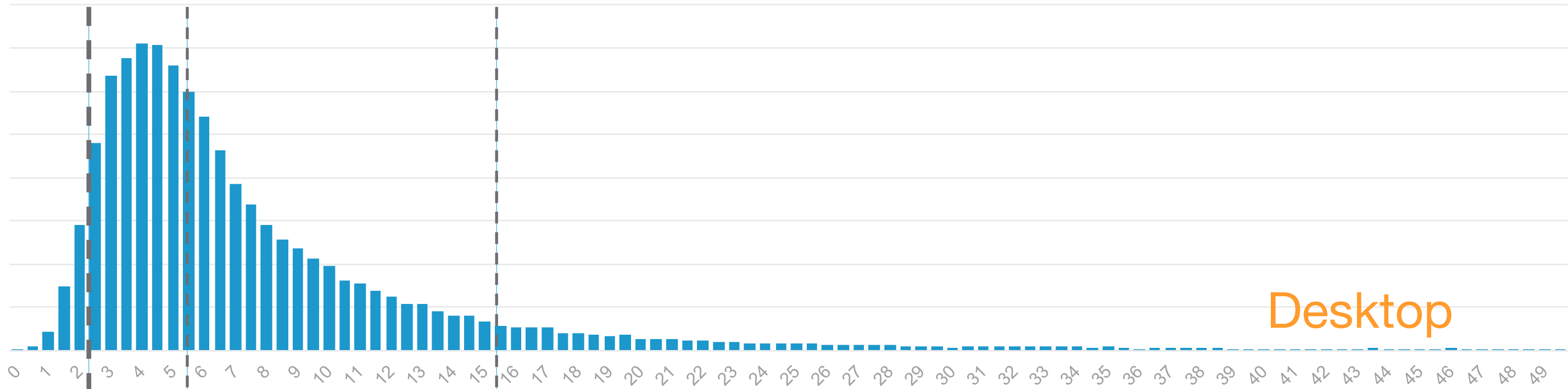




Chapter 1: What is (h2) PUSH?

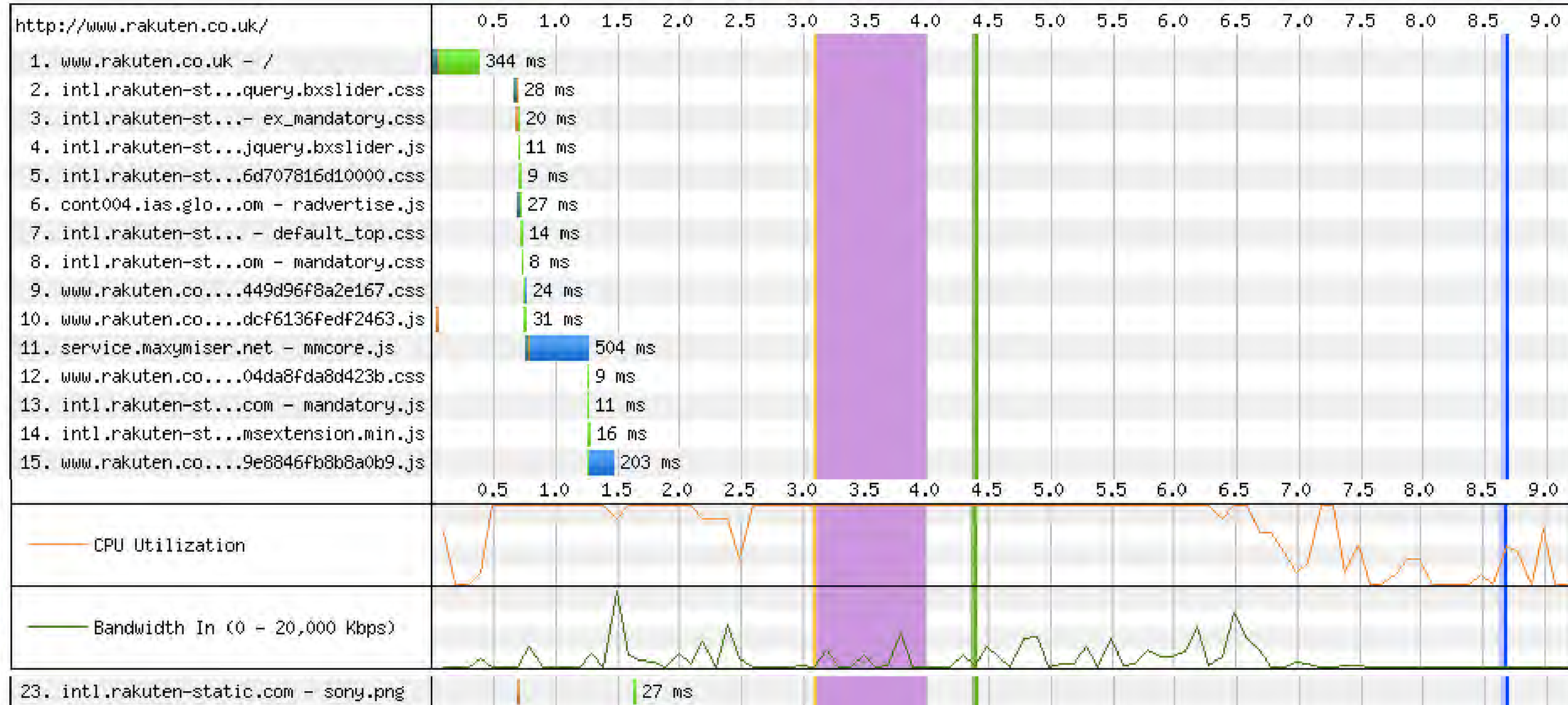
Budget

90th



WebPageTest

Looking for culprits



#PerfMatters

Perf 101

▼ Wait

- Caching
- Protocol opt
- Route opt.
- Sharding
- Use time machine

▼ Bits

- gzip/br
- Resp. img
- jp2 /webp
- webfonts

▼ Reqs

- webpack / concat
- spriting / inlining
- lazyload

▲ Render

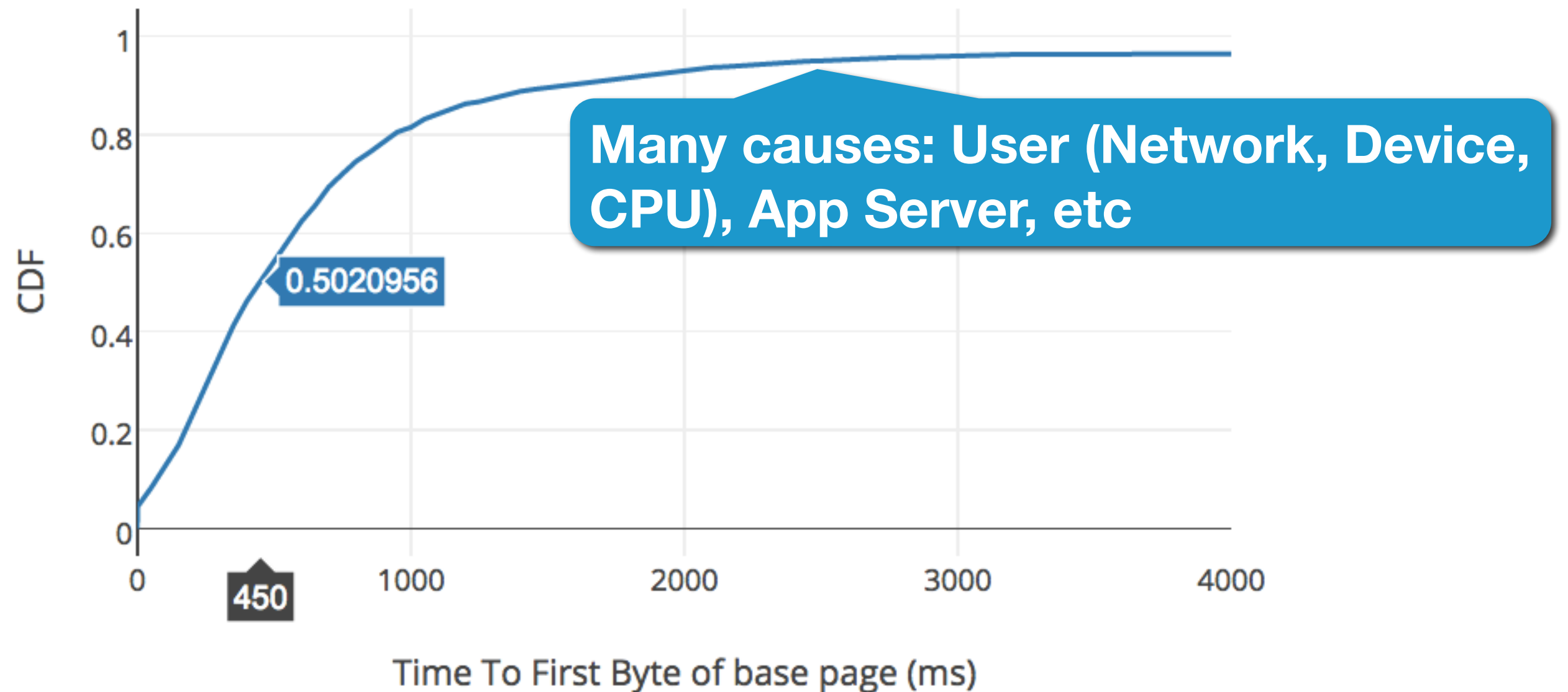
- Critical CSS
- javascript
- AMP
- Chroma
- Sub-Sampling





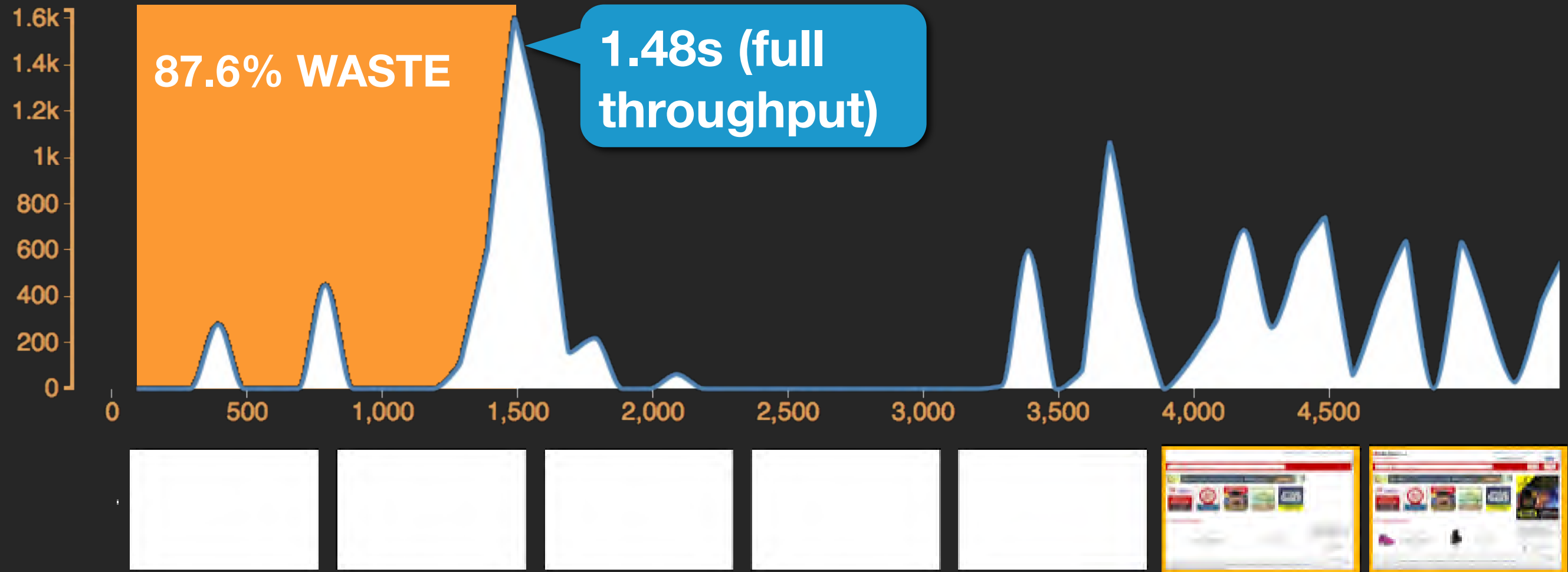
Time-To-First-Byte

25% of Perf. Budget is waiting



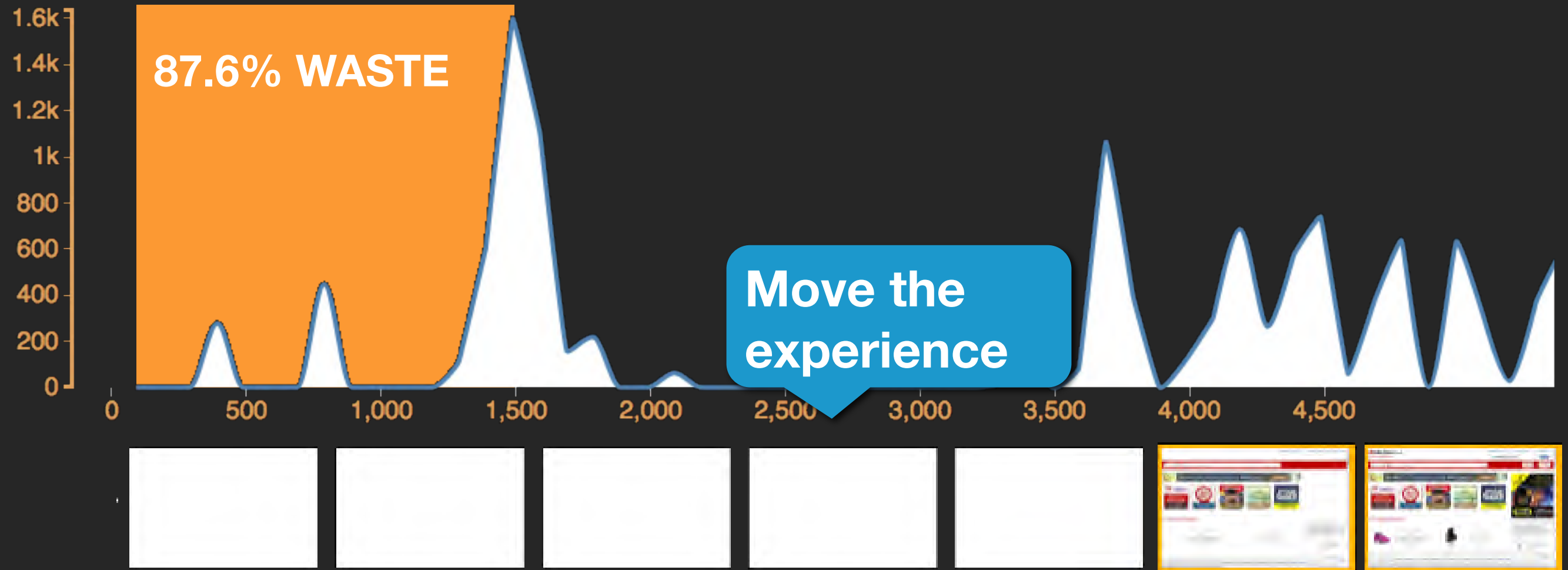
Introducing

Network Waste



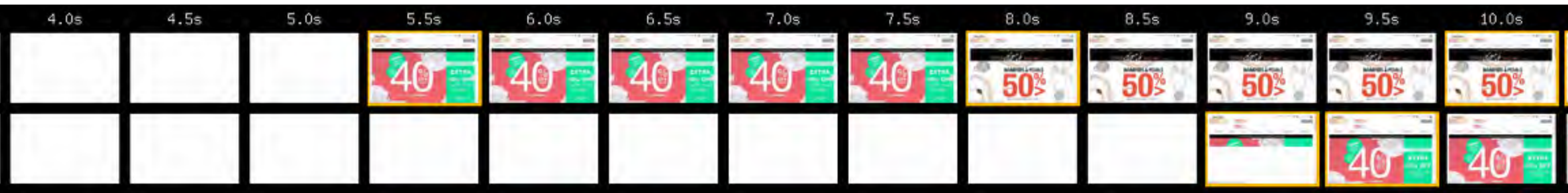
Network Waste

An opportunity to PUSH content



PUSH_PROMISE

When you get it Right:



↑
5.27s

↑
8.59s

Don't we already have PUSH?

How to PUSH

Polling / Long Polling

```
GET /messages HTTP/1.1
Host: queue.example.com
Authorization: ...
```

```
HTTP/1.1 200 OK
Content-Length: 100
{ "from": "adbram@montague.net",
  "to": "sampson@capulet.com",
  "message": "Do you bite your
             thumb at us, sir?"
}
```

One-to-One with

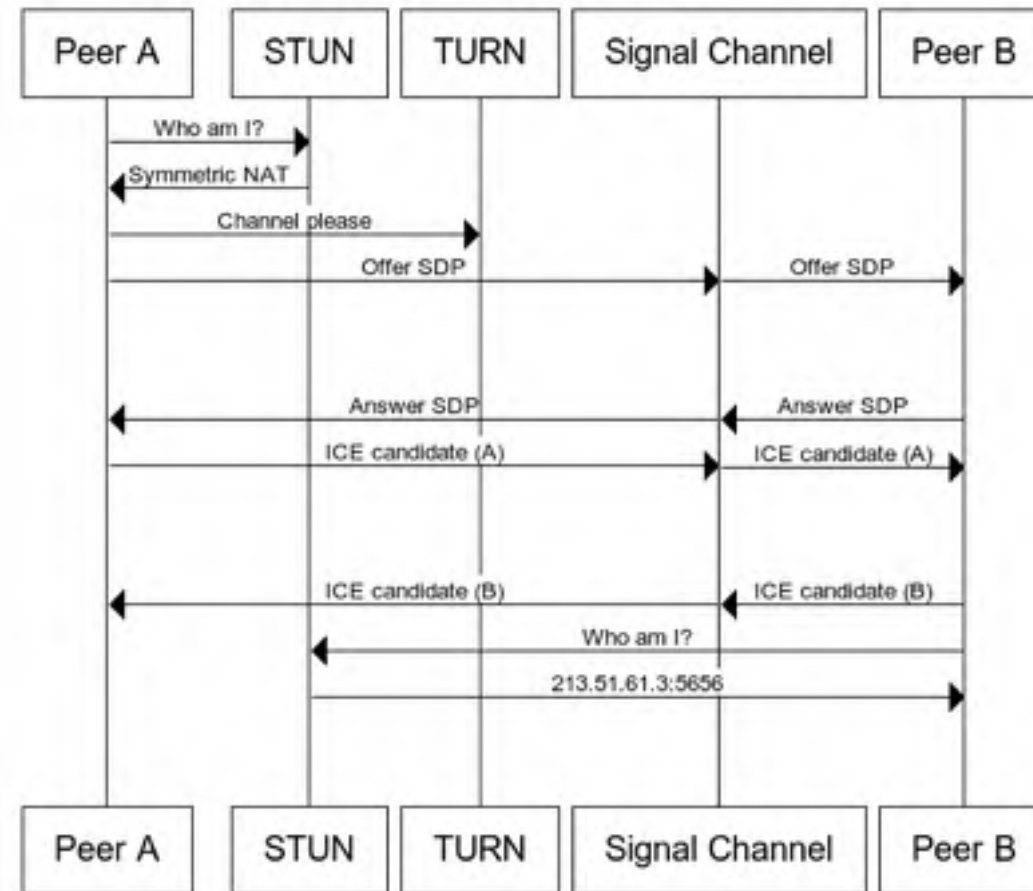
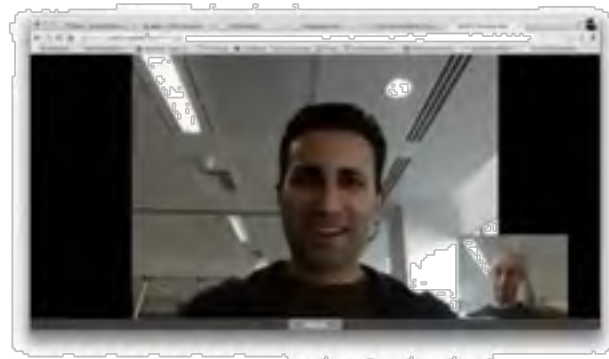
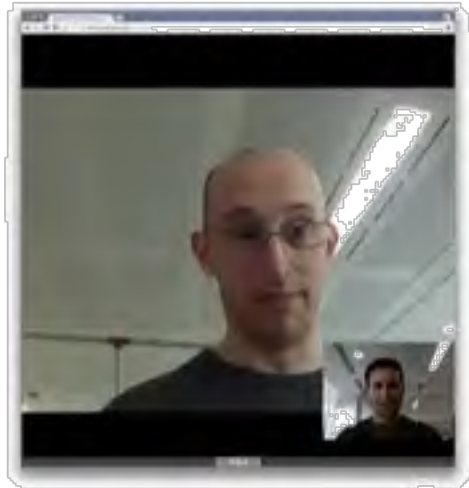
WebSockets

Not cacheable; meant for special apps, not webpages

```
var ws = new WebSocket('wss://example.com/socket');
ws.onmessage = function(msg) {
  if(msg.data instanceof Blob) {
    processBlob(msg.data);
  } else {
    processText(msg.data);
  }
}
function sendMessage(msgText) {
  ws.send(msgText);
}
```

Peer-to-Peer with WebRTC

Great for video chat,
not webpages



How to PUSH

Server-Side-Events

```
GET /messages HTTP/1.1
Host: api.example.com
Accept: text/event-stream
Authorization: ...
Last-Event-ID: 41
```

```
HTTP/1.1 200 OK
Connection: keep-alive
Content-Type: text/event-stream
Transfer-Encoding: chunked
```

```
id: 42
event: receiveMessage
data: { "from": "adbram@montague.net",
      "to": "sampson@capulet.com",
      "message": "Do you bite your
                thumb at us, sir?"}
```

```
id: 43
event: stageAction
data: { "from": "adbram@montague.net",
      "to": "sampson@capulet.com",
      "message": "Do you bite your
                thumb at us, sir?"}
```


How to PUSH

Server-Side-Events

Close – but realtime & text only (not resources)

```
HTTP/1.1 200 OK
Connection: keep-alive
Content-Type: text/event-stream
Transfer-Encoding: chunked

id: 42
event: recieveMessage
data: { "from": "adbram@montague.net",
  "to": "sampson@capulet.com",
  "message": "Do you bite your
    thumb at us, sir?"}

id: 43
event: stageAction
data: { "from": "adbram@montague.net",
  "to": "sampson@capulet.com",
  "message": "Do you bite your
    thumb at us, sir?"}
```

```
<script type="text/javascript">
var evtSource = new EventSource("/messages");

evtSource.addEventListener("receiveMessage",
  function(e) {

    var newElement = document.createElement("p");

    var obj = JSON.parse(e.data);
    newElement.innerHTML = "Message: " + obj.message;
    eventList.appendChild(newElement);
  }, false);

</script>
```

HTTP/2



6+ (4.4)

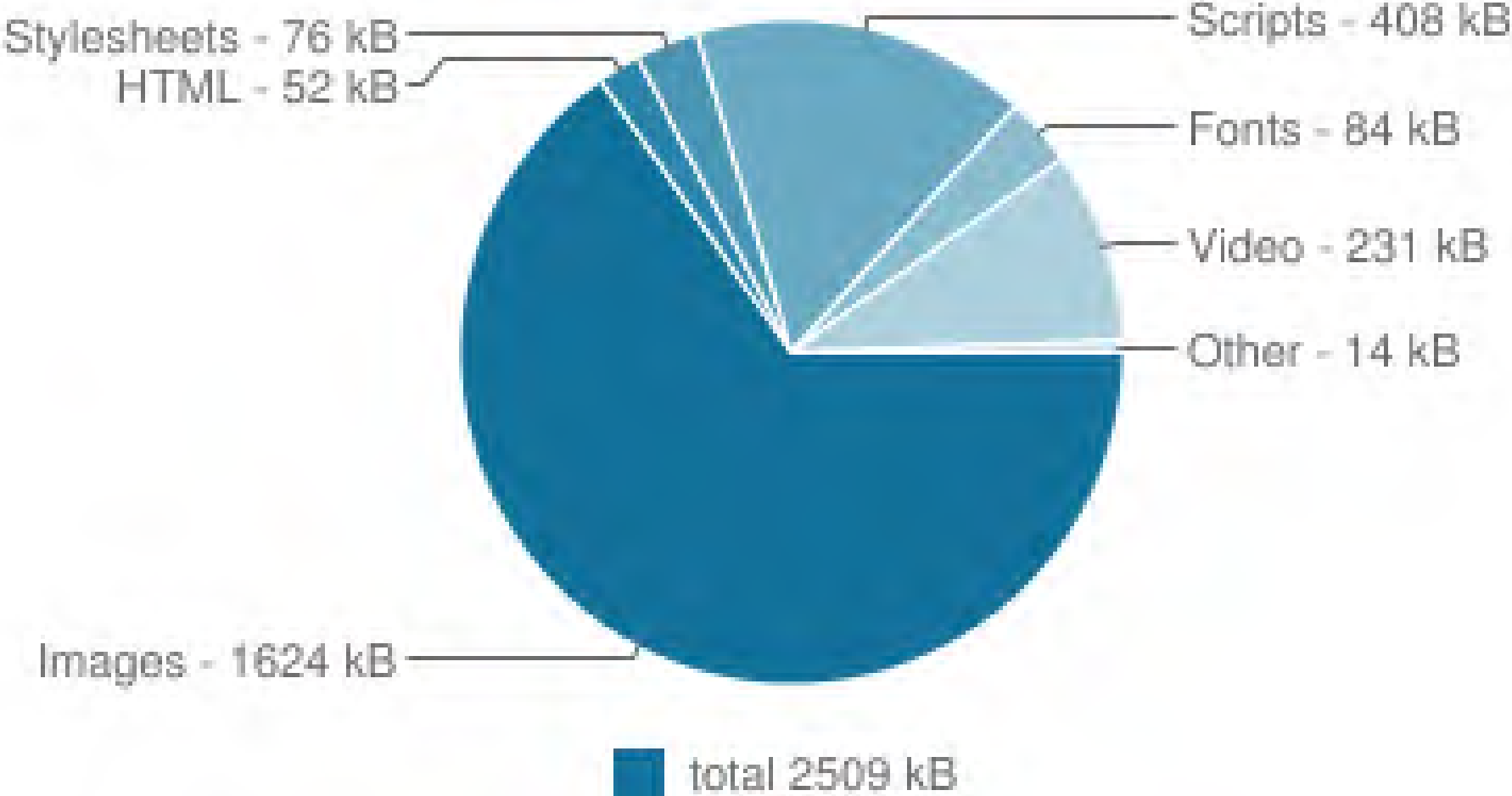


9 (8+)

TCP Slow Start



Average Bytes per Page by Content Type



Client Side Receive Window

20mbps @100ms RTT

256KB

192KB

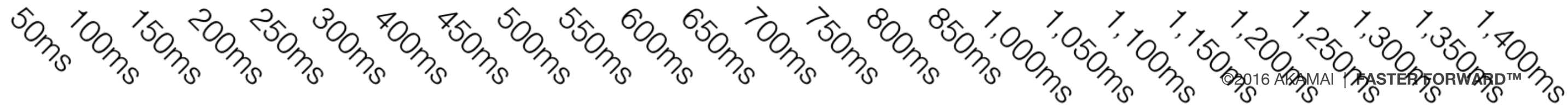
128KB

64KB

0KB

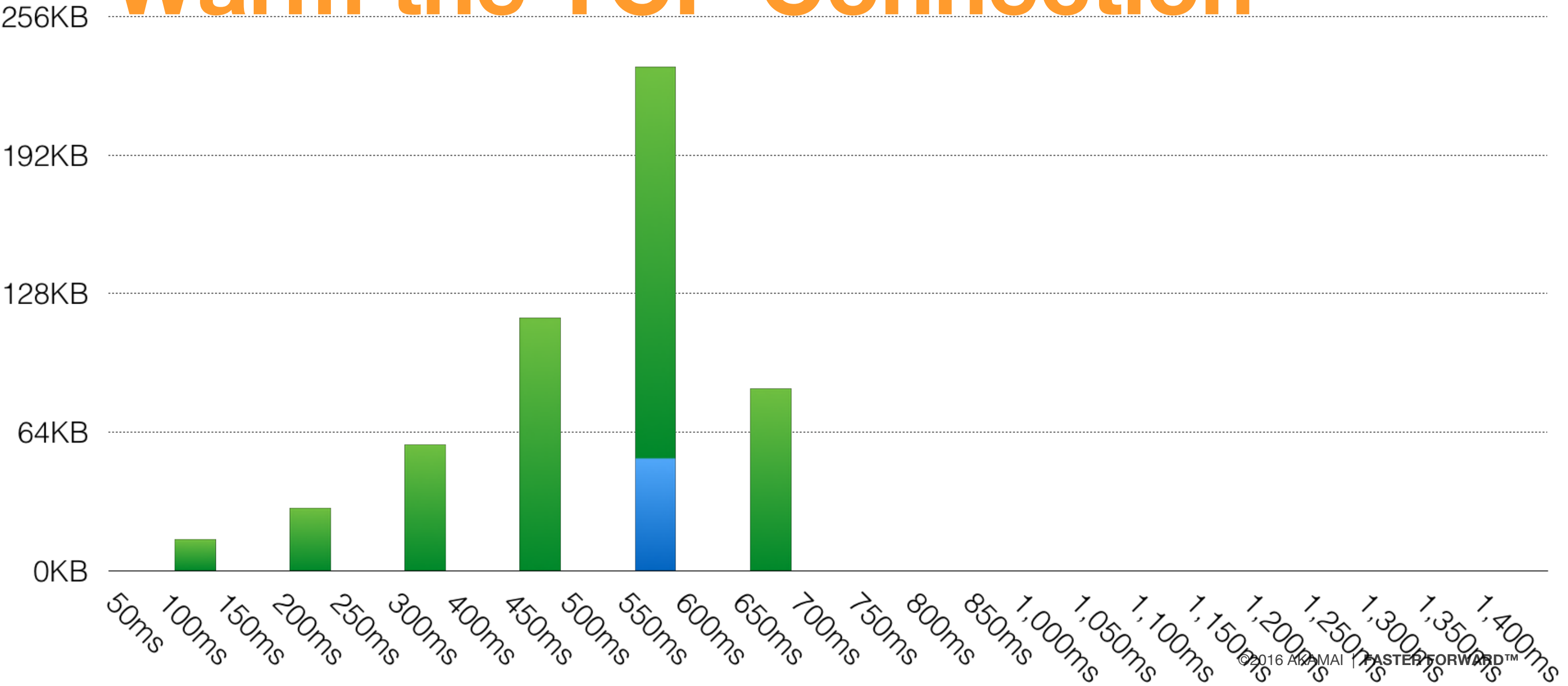
Time-To-First-Byte

Time-To-First-Res.

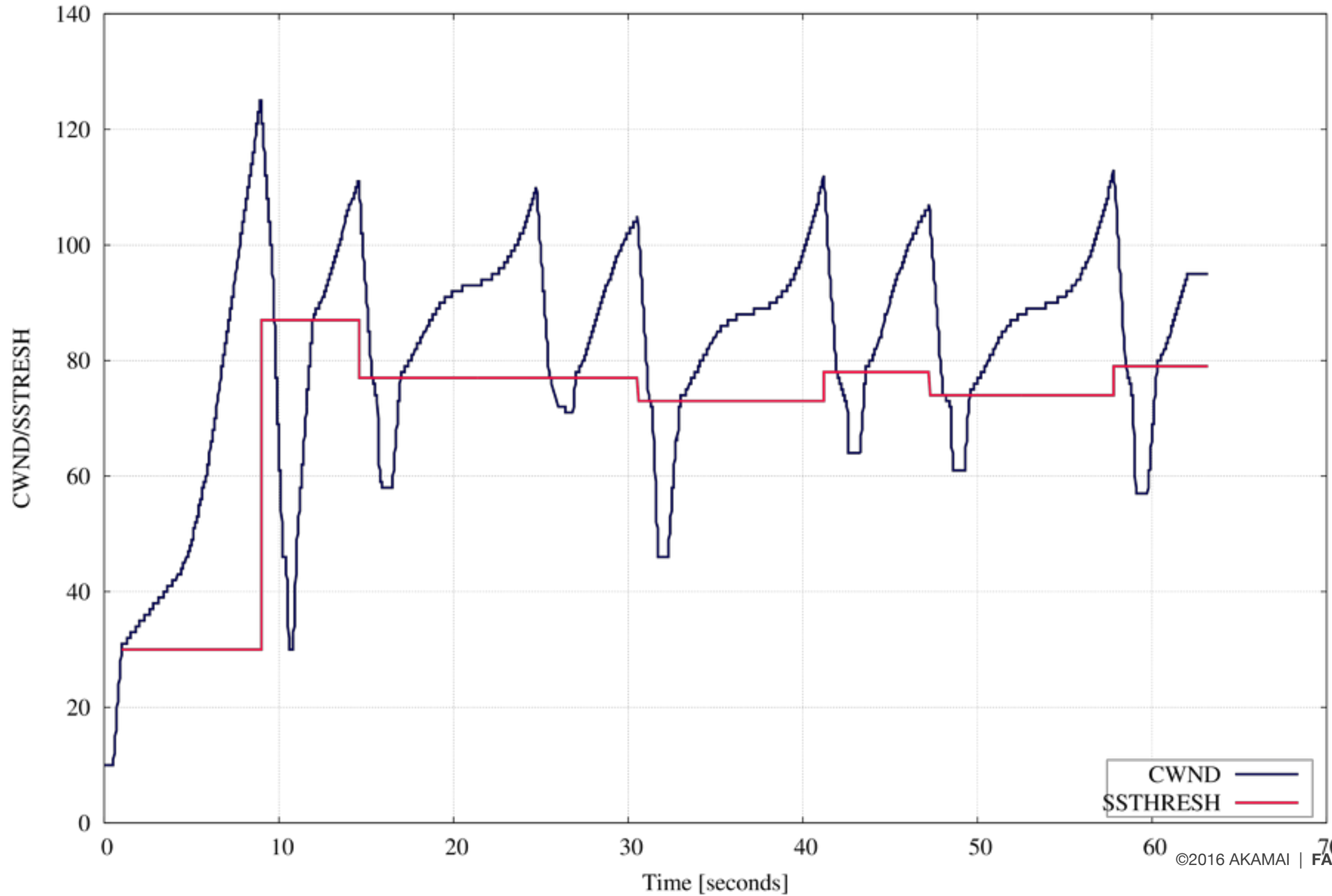


HTTP/2 PUSH:

Warm the TCP Connection

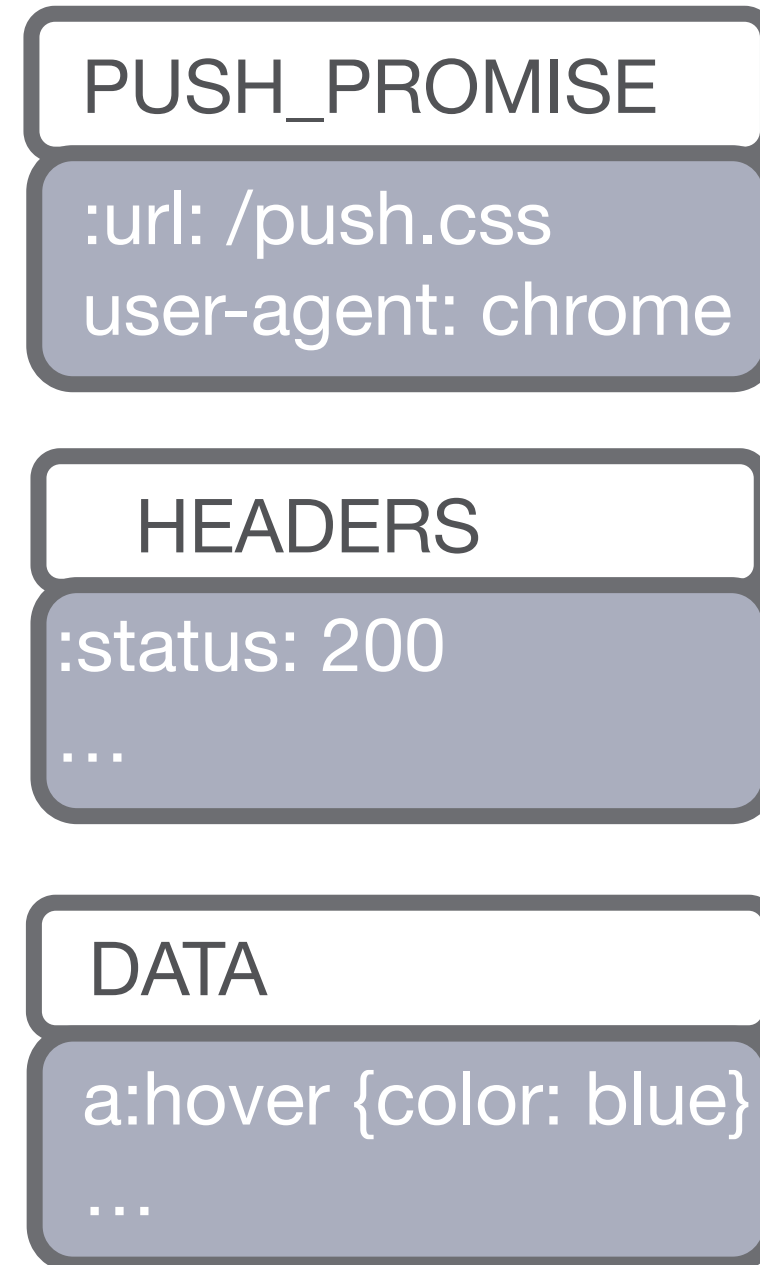
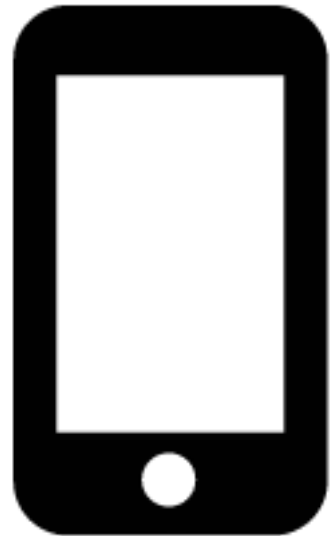


TCP Congestion Window and Slow Start Threshold



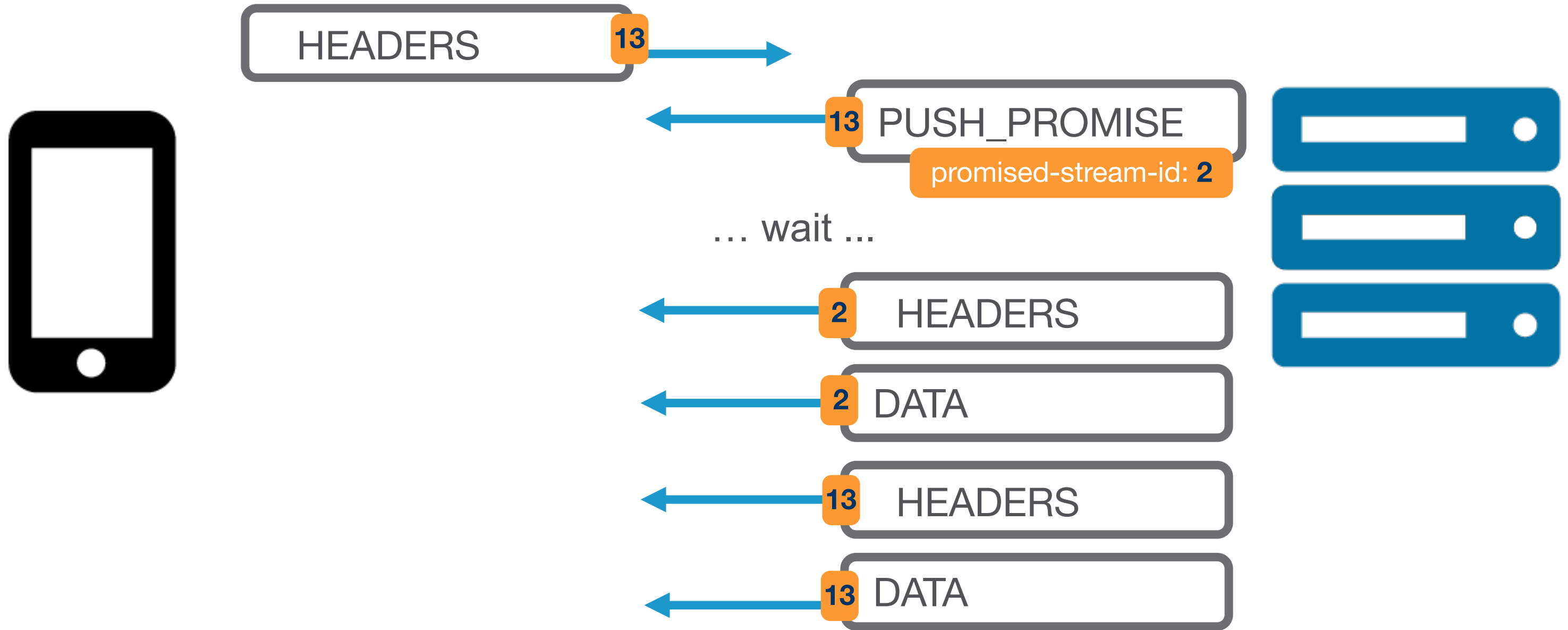
HTTP/2 PUSH_PROMISE

Frame Basics



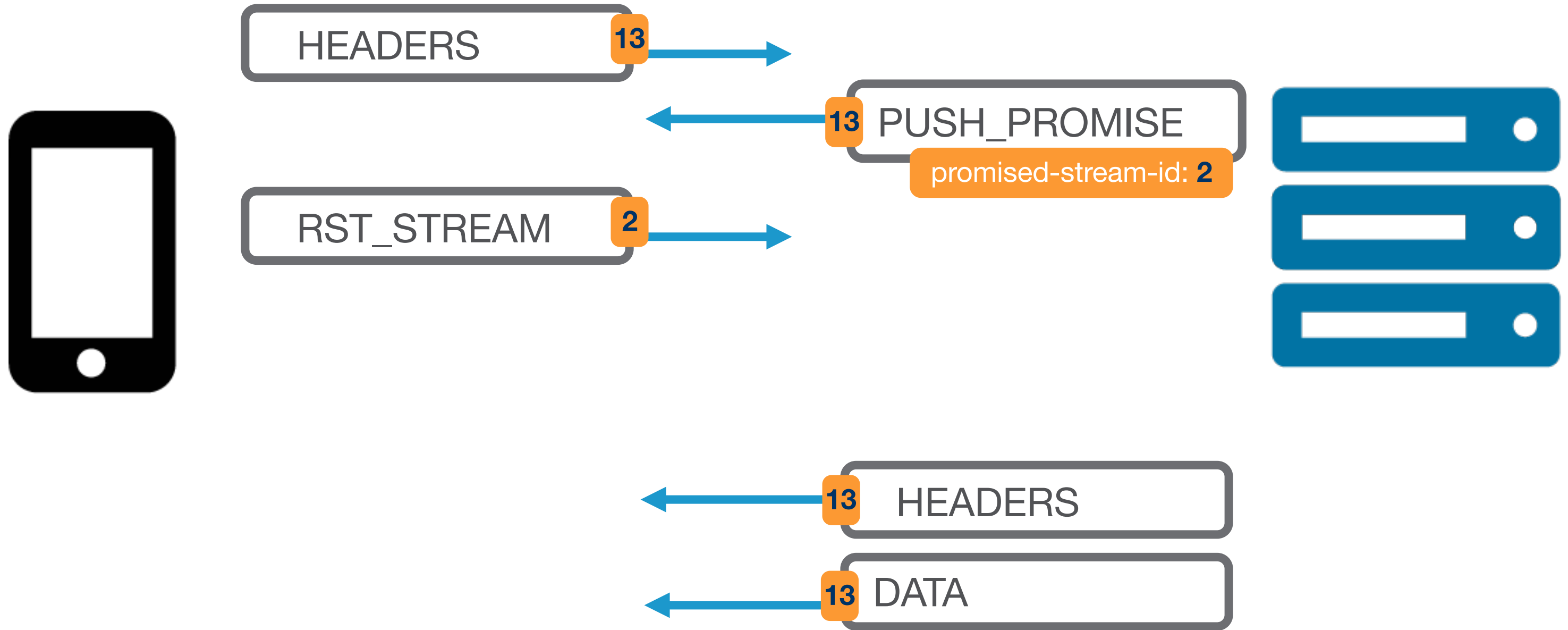
HTTP/2 PUSH_PROMISE

Expected Lifecycle



HTTP/2 PUSH_PROMISE

Expected Lifecycle



HTTP/2

PUSH_PROMISE

```
$ nhttp https://www.colinbendell.com/demo/h2/pushtest.html -vv --no-push
[ 0.123] Connected
The negotiated protocol: h2
[ 0.518] send SETTINGS frame <length=18, flags=0x00, stream_id=0>
        (niv=3)
        [SETTINGS_MAX_FRAME_SIZE(0x03):100]
        [SETTINGS_INITIAL_WINDOW_SIZE(0x04):65535]
        [SETTINGS_ENABLE_PUSH(0x02):0]
```

Push Not Supported

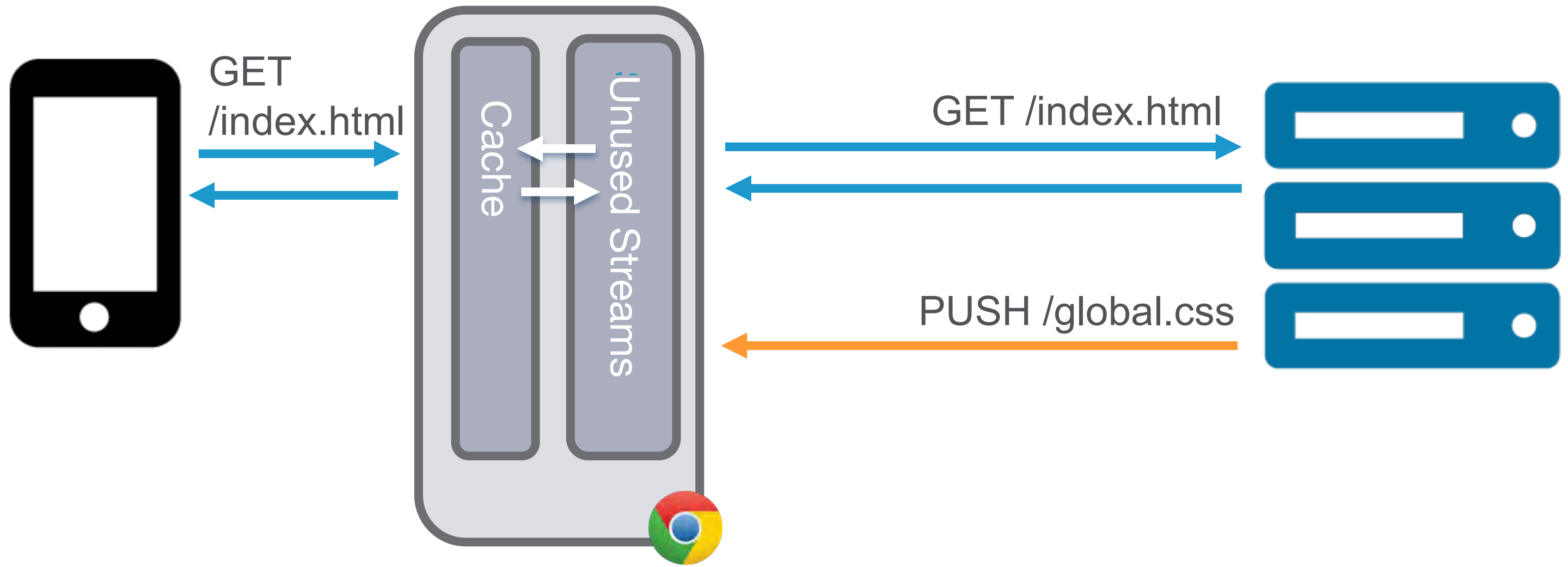
Push not accepted

```
[ 0.230] send RST_STREAM frame <length=5, flags=0x07, stream_id=4>
```

Chapter 2: Can **i** Push?

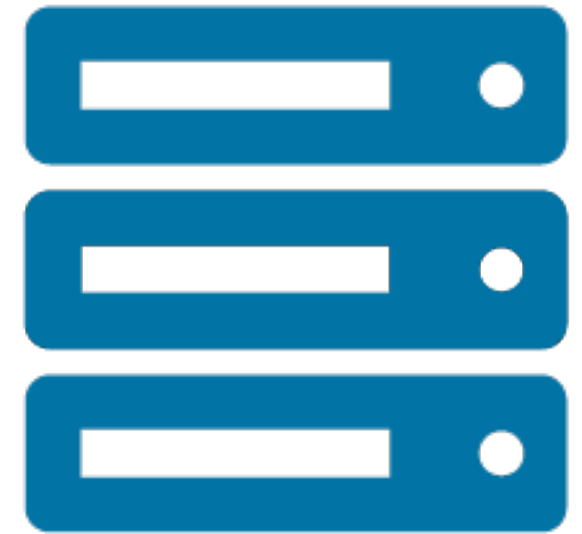
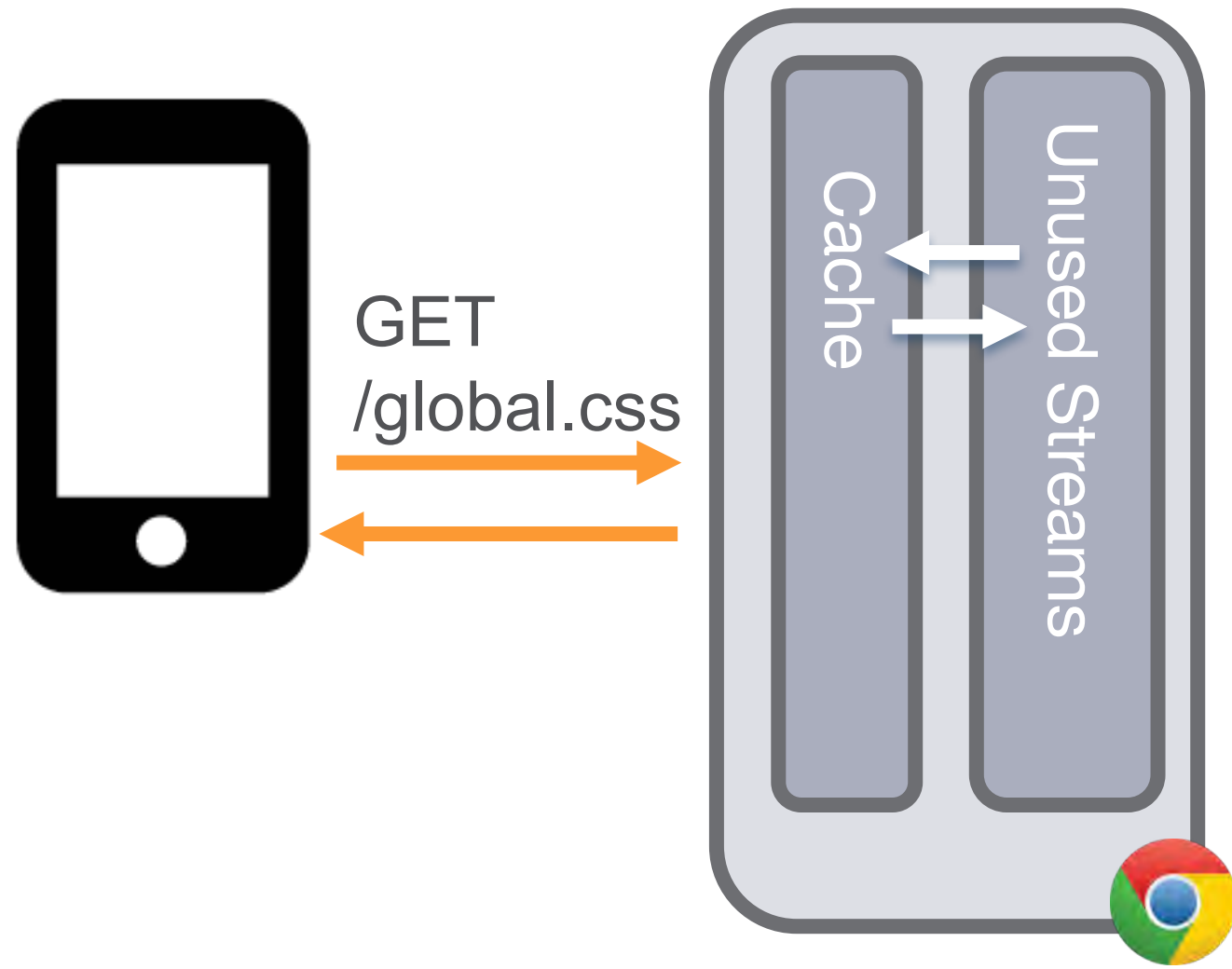
HTTP/2 PUSH

Browsers & Apps



HTTP/2 PUSH in a Secret Cache / Queue

Browsers & Apps



Developer Tools - https://www.colinbendell.com/demo/h2/pushtest.html

Elements Console Sources Network Timeline Profiles Resources Security Audits Piez >>

View: [Icons] Preserve log Disable cache No throttling

Filter Hide data URLs All XHR JS CSS Img Media Font Doc WS Manifest Other

500 ms 1000 ms 1500 ms 2000 ms 2500 ms

Name	Headers	Preview	Response	Timing
pushtest.html				
h2.css				
sanpush.css				
push.css				

General

- Request URL: https://www.colinbendell.com/demo/h2/push.css
- Request Method: GET
- Status Code: 200
- Remote Address: 172.230.196.217:443

Response Headers

- accept-ranges: bytes
- cache-control: max-age=3600
- content-length: 64
- content-type: text/css
- date: Mon, 09 May 2016 21:09:31 GMT
- etag: "e00af44aba37028e02014b6842fd3748:1461342896"
- expires: Mon, 09 May 2016 22:09:31 GMT
- last-modified: Fri, 22 Apr 2016 16:34:56 GMT
- server: Apache
- status: 200

Request Headers

- Provisional headers are shown**
- Accept: text/css,*/*;q=0.1
- Referer: https://www.colinbendell.com/demo/h2/pushtest.html
- User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_11_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/50.0.2661.86 Safari/537.36

Push headers are 'provisional'



Elements Console Sources **Network** Timeline Profiles Resources Security >> | ⋮ | ✕

View: [Icons] | Preserve log Disable cache | No throttling ▾

Filter Regex Hide data URLs

All | XHR | JS | CSS | Img | Media | Font | Doc | WS | Manifest | Other

100 ms 200 ms 300 ms 400 ms 500 ms 600 ms 700 ms 800 ms 900 ms 1000 ms

Name	Status	Type	Initiator	Size	Time	Timeline – Start Time
pushtest.html	200	doc	Other	2.2 KB	78 ms	
h2.css	200	style...	pushtest.html	247 B		
push.css	200	style...	pushtest.html	247 B		
sanpush.css	200	style...	pushtest.html	247 B		

Chrome shows PUSH in Timeline

Server Push	TIME
Receiving Push	0.02 ms
Connection Setup	TIME
Queueing	0.49 ms
Request/Response	TIME
Reading Push	0.64 ms
Explanation	3.42 ms

chrome://net-internals/#ev x

chrome://net-internals/#events&q

chrome://net-internals

Events Capturing halted

id:4013582 1 of 66

ID	Source Type	Description
4013582	HTTP2_SESSION	colinbendell.com:443 (DIRECT)

4013582: HTTP2_SESSION
colinbendell.com:443 (DIRECT)
Start Time: 2016-04-30 03:53:05.928

```
t= 14784 [st= 0] +HTTP2_SESSION [dt=816097958+]
--> host = "colinbendell.com:443"
--> proxy = "DIRECT"
t= 14784 [st= 0] HTTP2_SESSION_INITIALIZED
--> protocol = "h2"
--> source_dependency = 4013580 (SOCKET)
t= 14784 [st= 0] HTTP2_SESSION_SEND_SETTINGS
--> settings = ["[id:3 flags:0 value:1000]", "[id:4 flags:0
t= 14784 [st= 0] HTTP2_STREAM_UPDATE_RECV_WINDOW
--> delta = 15663105
--> window_size = 15728640
t= 14784 [st= 0] HTTP2_SESSION_SENT_WINDOW_UPDATE_FRAME
--> delta = 15663105
--> stream_id = 0
t= 14785 [st= 1] HTTP2_SESSION_SEND_HEADERS
--> exclusive = false
--> fin = true
--> has_priority = true
--> :method: GET
```

HTTP/2 (Chrome)

Adopted Push Stream

Adopted pushes are logged (not a frame)

```
t=      2457 [st=      137] HTTP2_STREAM_ADOPTED_PUSH_STREAM
--> stream_id = 2
--> url = "https://www.colinbendell.com/demo/h2/push.css"
```

chrome://net-internals to find unclaimed pushes

Host	Proxy	ID	Protocol Negotiated	Active streams	Unclaimed pushed	Max	Initiated	Pushed	Pushed and claimed	Abandoned	Received frames	Secure
1.bendell.ca:443	direct://	4052647	h2	0	0	100	1	0	0	0	2	true
www.colinbendell.com:443	direct://	4052633	h2	1	1	100	2	3	0	0	18	true

* PUSH is kept in memory for 5 minutes and then get deleted if unclaimed

Does the browser behave
as I expect?

Announcing: canipush.com

The screenshot shows a browser window with the title "Can I Push? (HTTP/2 PUSH_P" and the URL "https...". The main heading is "Can I Push?". Below the heading is a description: "The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content." The test results are as follows:

- HTTP/2 enabled ... PASS
- Connection coalescing (css) ... PASS
- Connection coalescing (xhr) ... FAIL

Current host PUSH

- » javascript ... PASS
- » css ... PASS
- » xhr ... PASS

Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... PASS
- » css ... PASS
- » xhr ... FAIL

Cross-Origin PUSH (reject 3rd party cert)

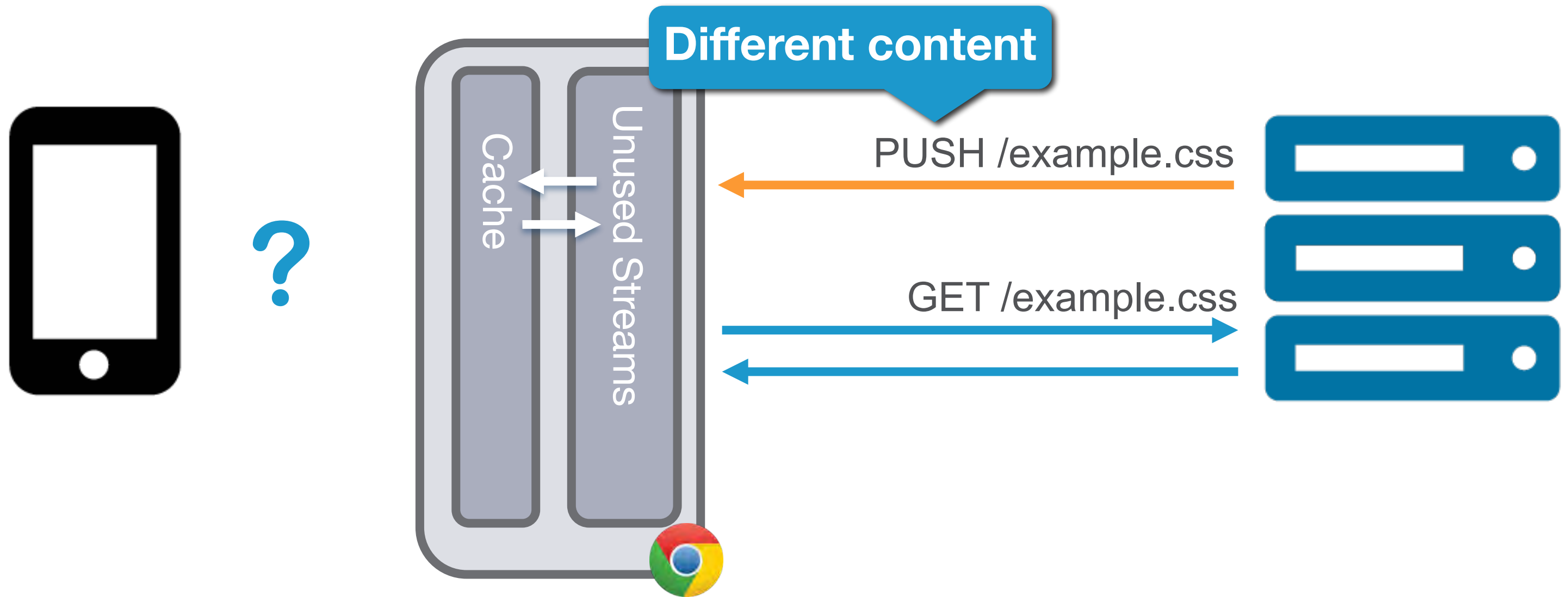
- » javascript ... PASS
- » css ... PASS
- » xhr ... PASS

PUSH 404 Response

- » javascript ... PASS
- » css ... PASS
- » xhr ... PASS

Should I Push?

Browser Test Harness



canipush.com

H2 Basics: Coalescing

<https://canipush.com/?test=1>

<https://canipush.com/?test=2>

canipush.com

H2 Basics: Coalescing



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✘ FAIL

Connection coalescing (xhr) ... ✘ FAIL

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✔ PASS

Connection coalescing (xhr) ... ✘ FAIL

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✔ PASS

Connection coalescing (xhr) ... ✘ FAIL

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✘ FAIL

Connection coalescing (xhr) ... ✘ FAIL

Should I Push?



canipush.com

Simple Push

<https://canipush.com/?test=3>

canipush.com

Simple Push



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✘ FAIL

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✔ PASS

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✔ PASS

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✘ FAIL

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✘ FAIL

Should I Push?



canipush.com

Sharded Resource (Same Cert)

<https://canipush.com/?test=4>

canipush.com

Sharded Resource (Same Cert)

Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... **PASS**

Connection coalescing (css) ... **FAIL**

Connection coalescing (xhr) ... **FAIL**

Current host PUSH

- » javascript ... **PASS**
- » css ... **PASS**
- » xhr ... **PASS**

Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... **FAIL**
- » css ... **FAIL**
- » xhr ... **FAIL**

Should I Push?

Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... **PASS**

Connection coalescing (css) ... **PASS**

Connection coalescing (xhr) ... **FAIL**

Current host PUSH

- » javascript ... **PASS**
- » css ... **PASS**
- » xhr ... **PASS**

Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... **PASS**
- » css ... **PASS**
- » xhr ... **FAIL**

Should I Push?

Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... **PASS**

Connection coalescing (css) ... **PASS**

Connection coalescing (xhr) ... **FAIL**

Current host PUSH

- » javascript ... **PASS**
- » css ... **PASS**
- » xhr ... **PASS**

Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... **FAIL**
- » css ... **FAIL**
- » xhr ... **FAIL**

Should I Push?

Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... **PASS**

Connection coalescing (css) ... **FAIL**

Connection coalescing (xhr) ... **FAIL**

Current host PUSH

- » javascript ... **PASS**
- » css ... **PASS**
- » xhr ... **FAIL**

Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... **FAIL**
- » css ... **FAIL**
- » xhr ... **FAIL**

Should I Push?

canipush.com

Sharded Resource (Diff Cert)

<https://canipush.com/?test=5>

canipush.com

Shard w/ diff cert (should reject)

Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✘ FAIL

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS


Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... ✘ FAIL
- » css ... ✘ FAIL
- » xhr ... ✘ FAIL

Cross-Origin PUSH (reject 3rd party cert)

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✔ PASS

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS


Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✘ FAIL

Cross-Origin PUSH (reject 3rd party cert)

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✔ PASS

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS


Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... ✘ FAIL
- » css ... ✘ FAIL
- » xhr ... ✘ FAIL

Cross-Origin PUSH (reject 3rd party cert)

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



Can I Push?

The web is still evolving! This will test if your browser supports HTTP/2 PUSH and how it behaves when it receives PUSHed content.

HTTP/2 enabled ... ✔ PASS

Connection coalescing (css) ... ✘ FAIL

Connection coalescing (xhr) ... ✘ FAIL

Current host PUSH

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✘ FAIL

Cross-Origin PUSH (using SAN/coalesced connection)

- » javascript ... ✘ FAIL
- » css ... ✘ FAIL
- » xhr ... ✘ FAIL

Cross-Origin PUSH (reject 3rd party cert)

- » javascript ... ✔ PASS
- » css ... ✔ PASS
- » xhr ... ✔ PASS

Should I Push?



canipush.com

Error pages (eg: 404)

<https://canipush.com/?test=6>

canipush.com

Shard w/ diff cert (should reject)

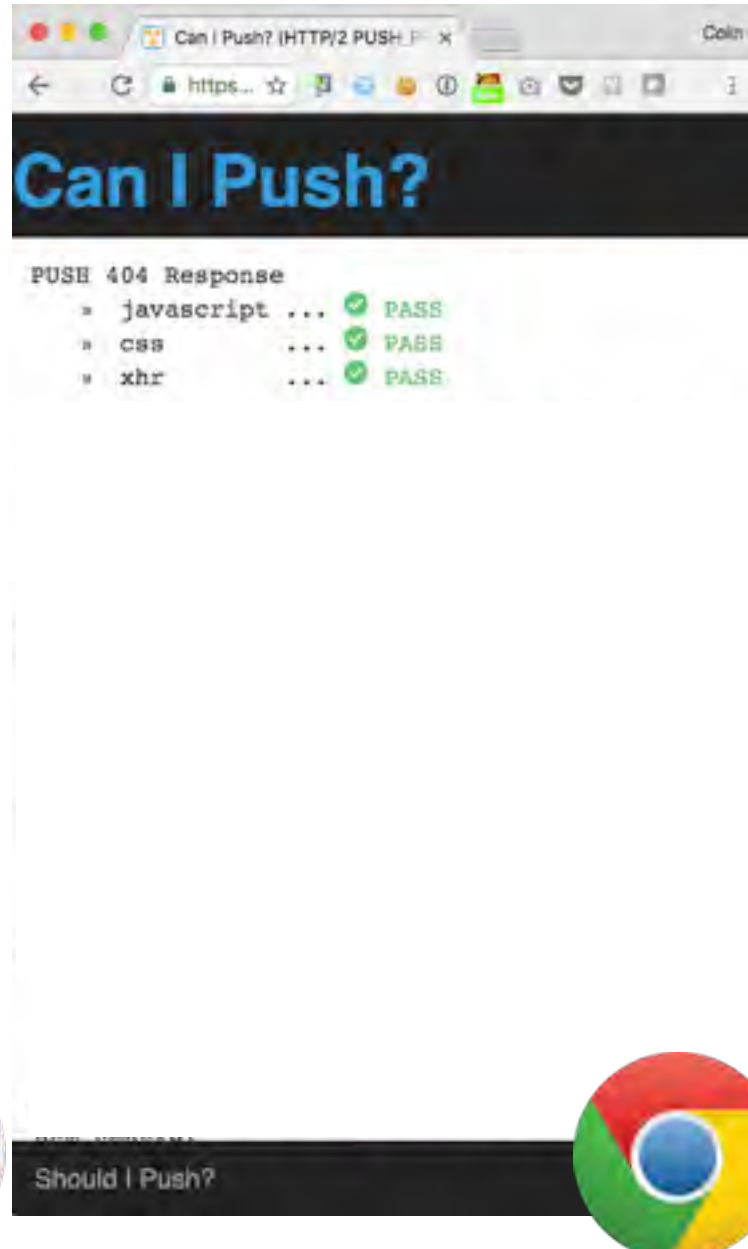


Can I Push?

PUSH 404 Response

- » javascript ... PASS
- » css ... PASS
- » xhr ... PASS

Should I Push?




Can I Push?

PUSH 404 Response

- » javascript ... PASS
- » css ... PASS
- » xhr ... PASS

Should I Push?

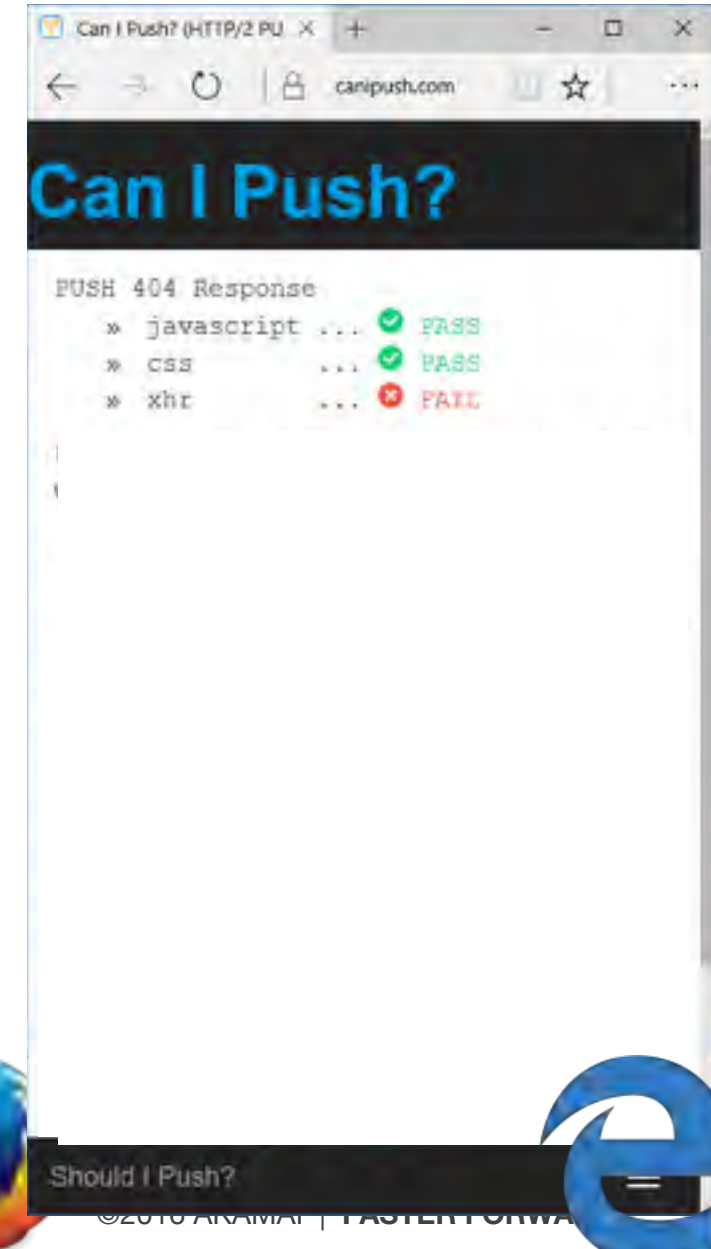


Can I Push?

PUSH 404 Response

- » javascript ... PASS
- » css ... PASS
- » xhr ... PASS

Should I Push?




Can I Push?

PUSH 404 Response

- » javascript ... PASS
- » css ... PASS
- » xhr ... FAIL

Should I Push?



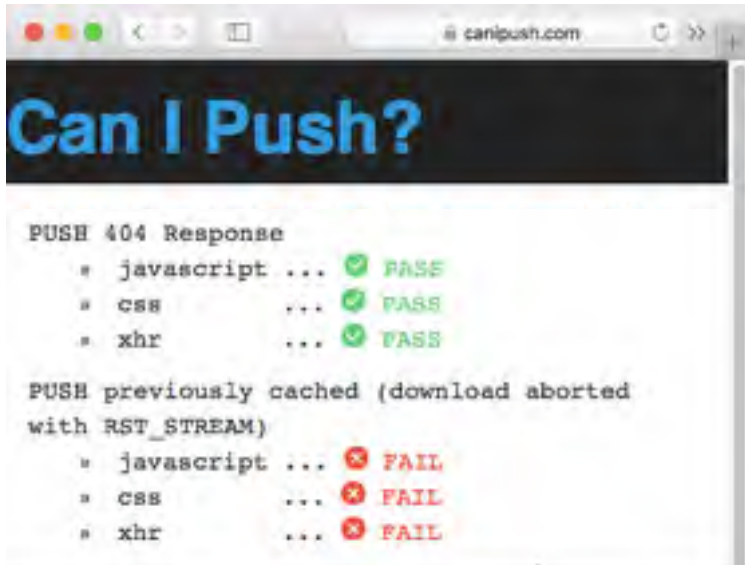
canipush.com

Previously Cached

<https://canipush.com/?test=7>

canipush.com

Previously Cached



Can I Push?

PUSH 404 Response

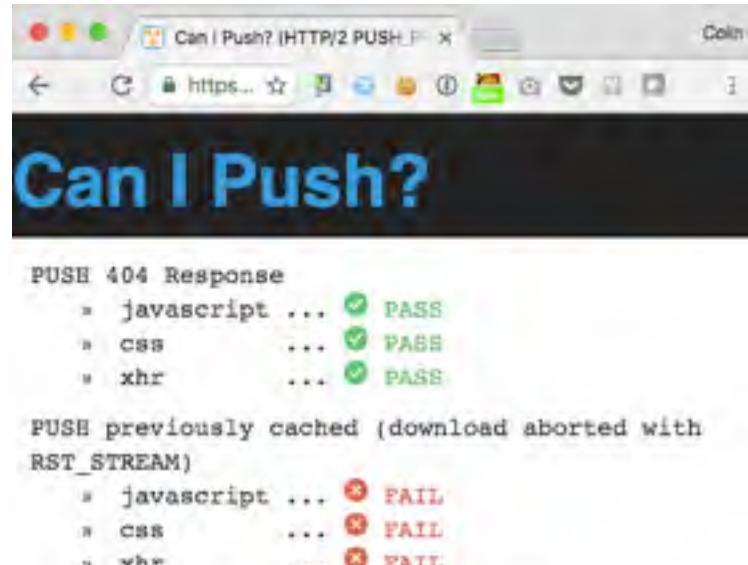
- » javascript ... ✓ PASS
- » css ... ✓ PASS
- » xhr ... ✓ PASS

PUSH previously cached (download aborted with RST_STREAM)

- » javascript ... ✗ FAIL
- » css ... ✗ FAIL
- » xhr ... ✗ FAIL



Should I Push?



Can I Push?

PUSH 404 Response

- » javascript ... ✓ PASS
- » css ... ✓ PASS
- » xhr ... ✓ PASS

PUSH previously cached (download aborted with RST_STREAM)

- » javascript ... ✗ FAIL
- » css ... ✗ FAIL
- » xhr ... ✗ FAIL



Should I Push?



Can I Push?

PUSH 404 Response

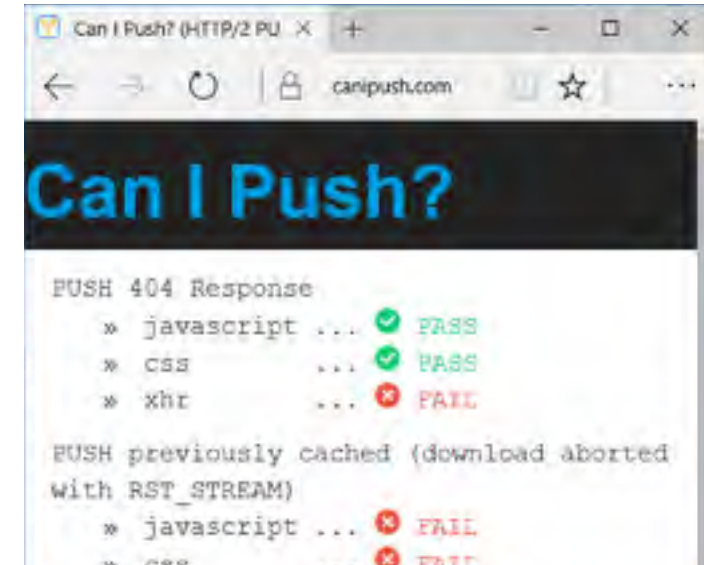
- » javascript ... ✓ PASS
- » css ... ✓ PASS
- » xhr ... ✓ PASS

PUSH previously cached (download aborted with RST_STREAM)

- » javascript ... ✗ FAIL
- » css ... ✗ FAIL
- » xhr ... ✗ FAIL



Should I Push?



Can I Push?

PUSH 404 Response

- » javascript ... ✓ PASS
- » css ... ✓ PASS
- » xhr ... ✗ FAIL

PUSH previously cached (download aborted with RST_STREAM)

- » javascript ... ✗ FAIL
- » css ... ✗ FAIL
- » xhr ... ✗ FAIL



Should I Push?

Implementation notes

- Cross Origin XHR are *different*
- PUSHed content must be pulled
(no programatic alerting – use SSE for that)
- FF uses init flow control of 64kb
- Browsers don't (yet) sync caches

What is coming?

[[Docs](#)] [[txt](#)|[pdf](#)|[xml](#)|[html](#)] [[Tracker](#)] [[WG](#)] [[Email](#)] [[Diff1](#)] [[Diff2](#)] [[Nits](#)]

Versions: ([draft-kazuho-h2-cache-digest](#)) [00](#)
[01](#)

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: May 5, 2017

K. Oku
DeNA Co, Ltd.
M. Nottingham
November 1, 2016

Cache Digests for HTTP/2 draft-ietf-httpbis-cache-digest-01

Abstract

This specification defines a HTTP/2 frame type to allow clients to inform the server of their cache's contents. Servers can then use this to inform their choices of what to push to clients.

Note to Readers

Chapter 3: Should **i** Push?

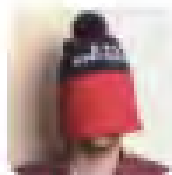
SEPTEMBER 2, 2016

HTTP2 server push: Lower latencies around the world



HTTP2 Push at FB





Sam Saccone ✓

@samccone



 Follow

Contrary to what the hive mind may be saying, h2 push for the general case will make your site measurably slower not faster.

RETWEETS

7

LIKES

9

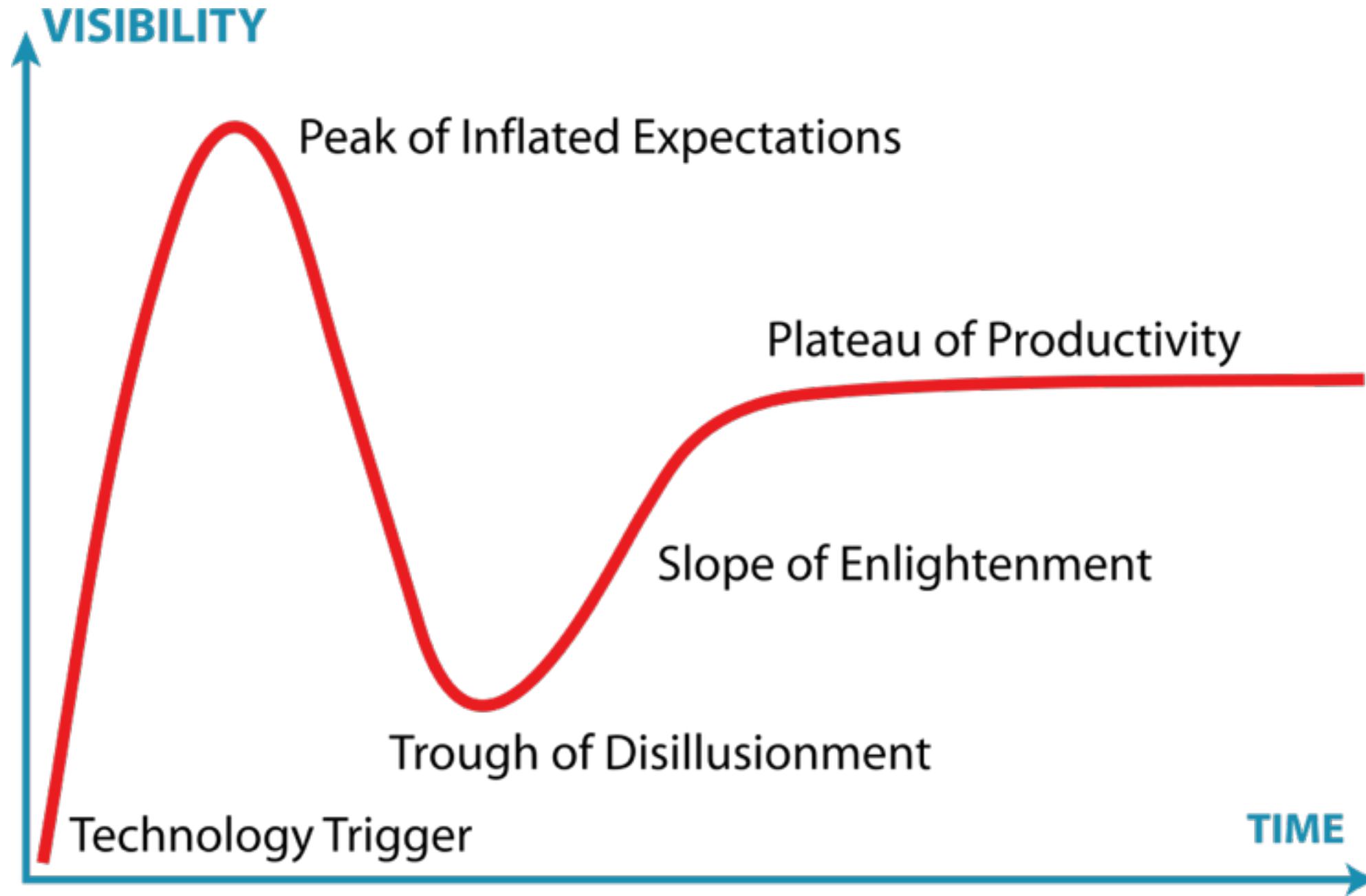


12:17 PM - 26 Oct 2016



Gartner's Hype-Cycle

Where is HTTP/2 PUSH?



How do you push?

Hint (late) with Headers

Link: <URL>; rel=preload; as=style

```
HTTP/2 200 OK
```

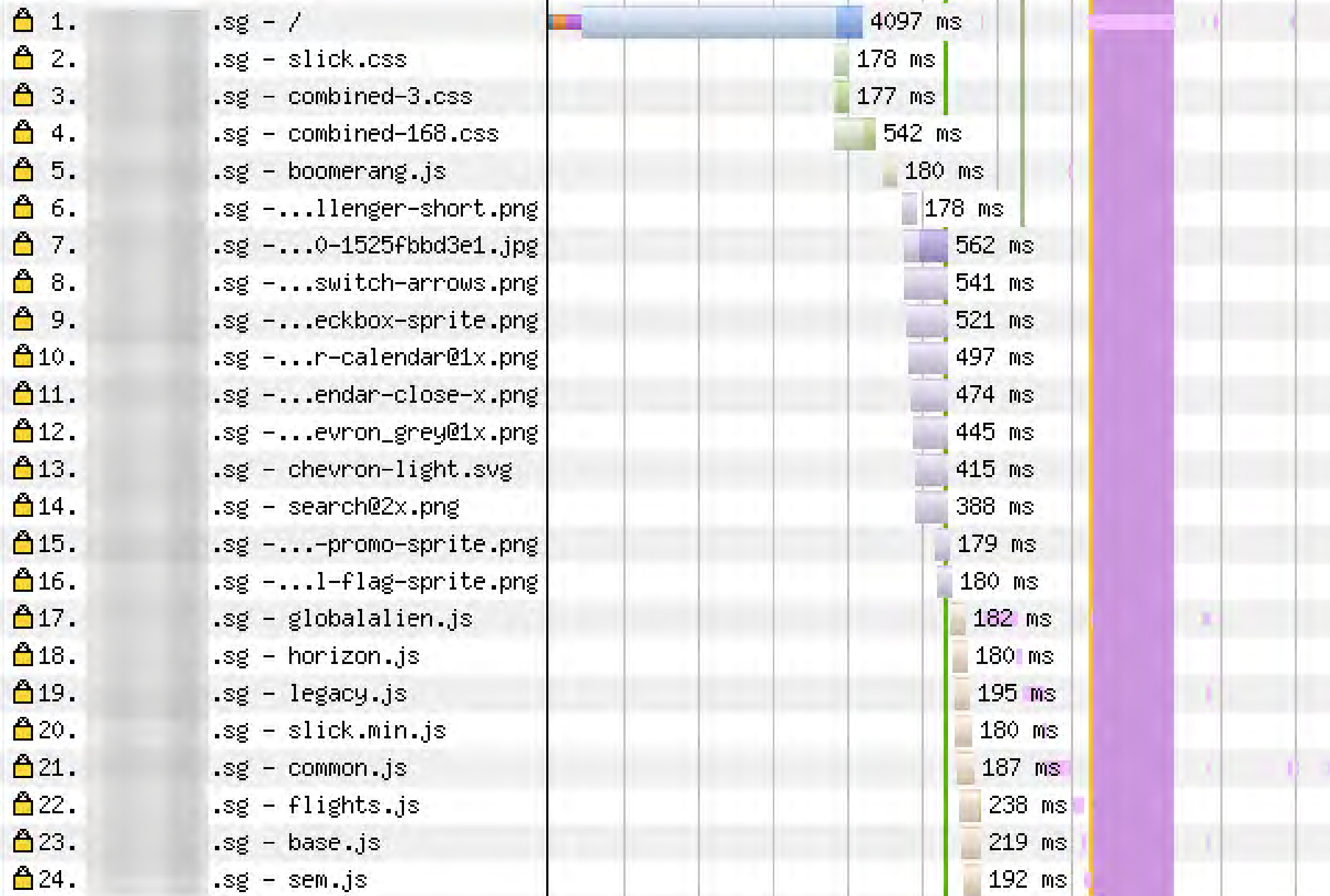
```
Content-Type: text/html
```

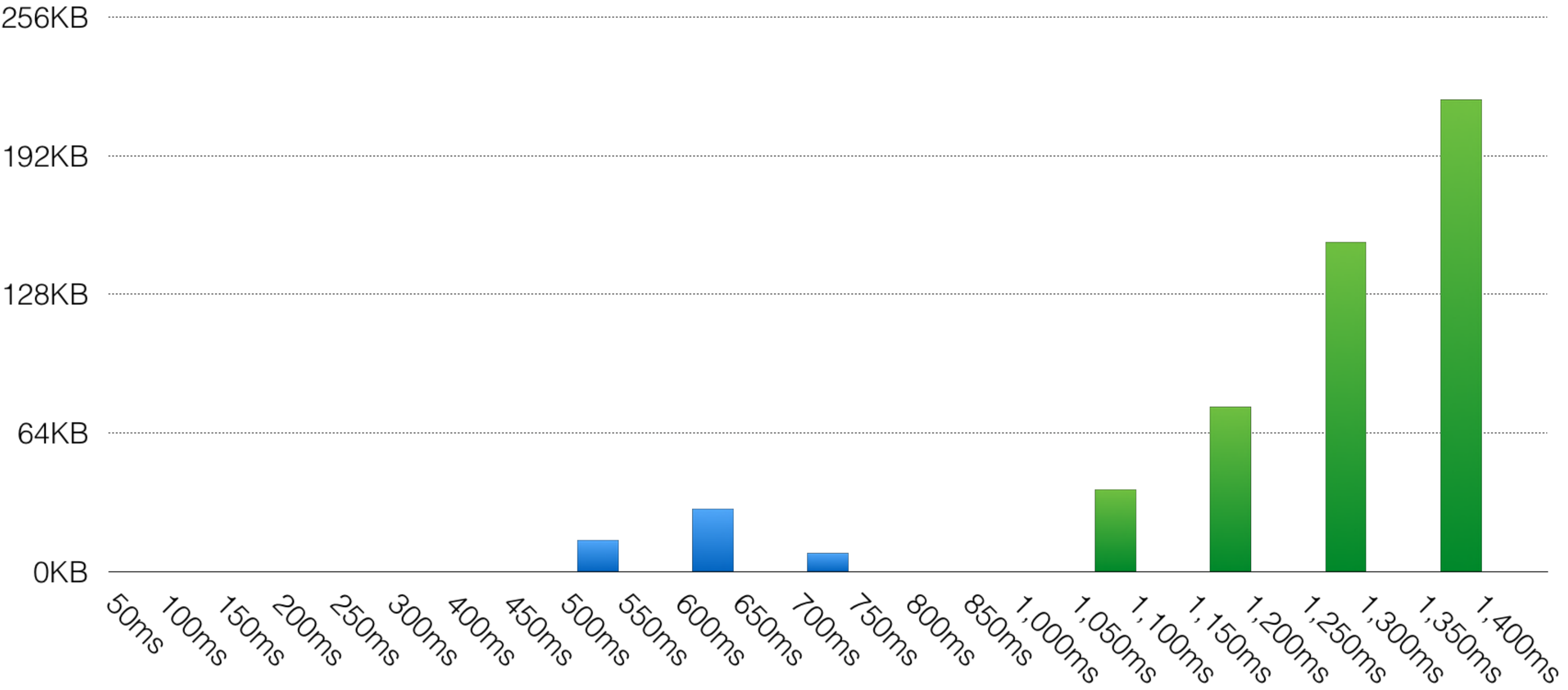
```
Link: /jquery.js; rel=preload; as=script
```

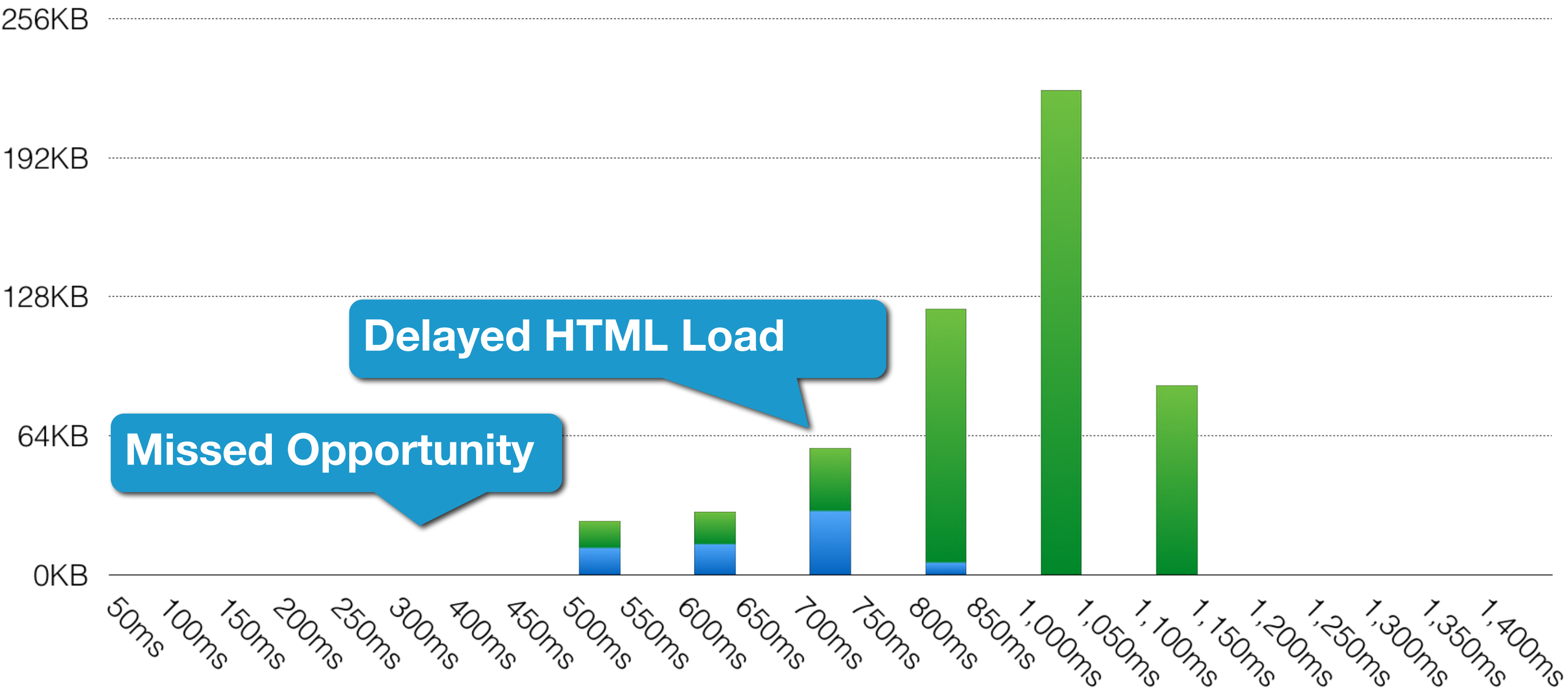
```
Link: /global.css; rel=preload; as=style; nopush
```

https://[redacted].sg

1 2 3 4 5 6 7 8 9 10

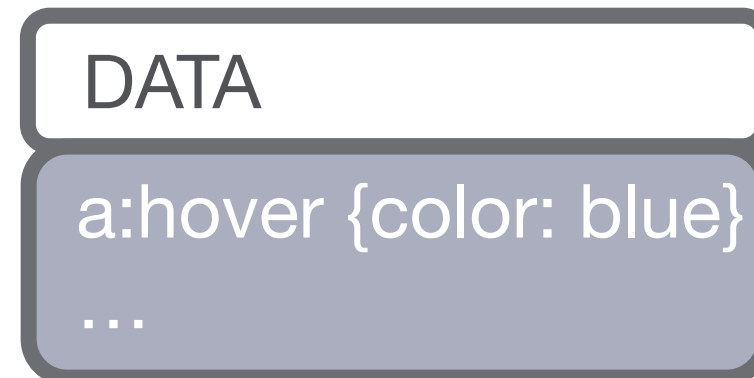
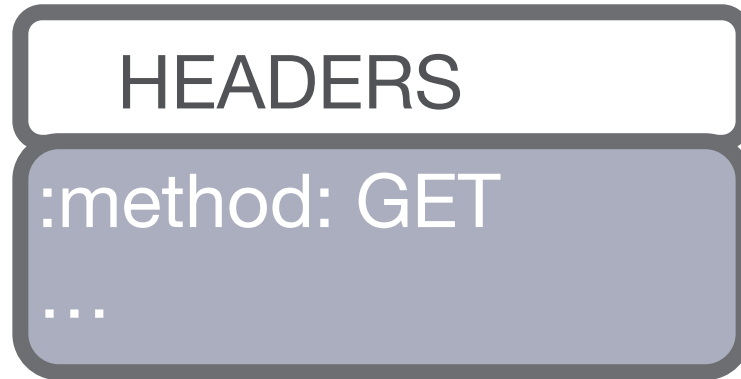
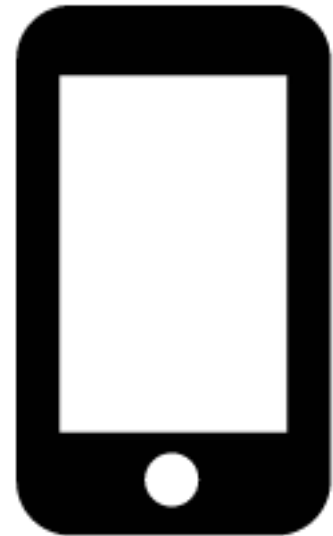






HTTP/2 PUSH_PROMISE

Why can't you send Link early?



Proposal

[[Docs](#)] [[txt](#)|[pdf](#)] [[Tracker](#)] [[Email](#)] [[Nits](#)]

Versions: [00](#)

Network Working Group
Internet-Draft
Intended status: Informational
Expires: May 4, 2017

K. Oku
DeNA Co., Ltd.
October 31, 2016

An HTTP Status Code for Indicating Hints
draft-kazuho-early-hints-status-code-00

Abstract

This memo introduces an informational status code for HTTP that can be used for indicating hints to help a client start making preparations for processing the final response.

Status of This Memo

This Internet-Draft is submitted in full conformance with the

RFC 7540:

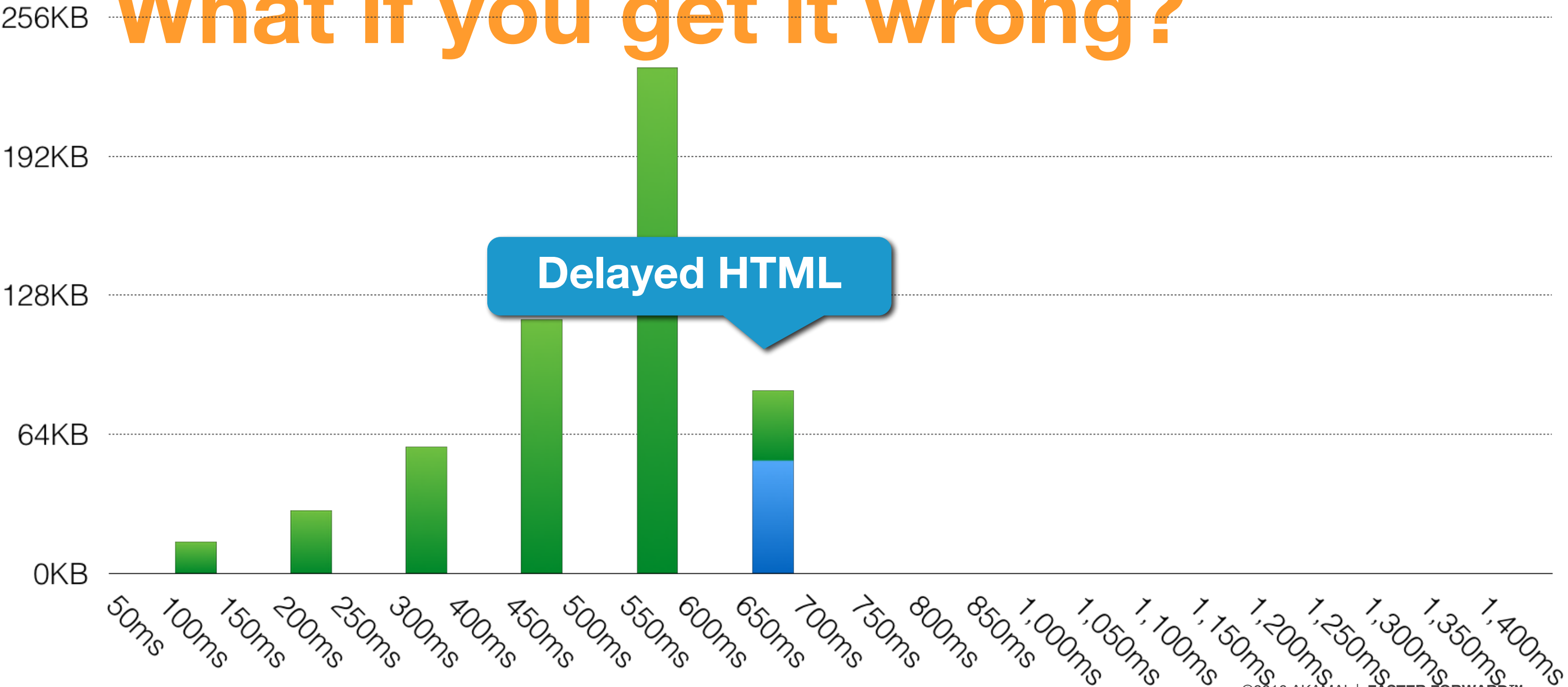
The server SHOULD send PUSH_PROMISE (Section 6.6) frames **prior to sending any frames that reference the promised responses**. This avoids a race where clients issue requests prior to receiving any PUSH_PROMISE frames.

How do you push?

Push while waiting

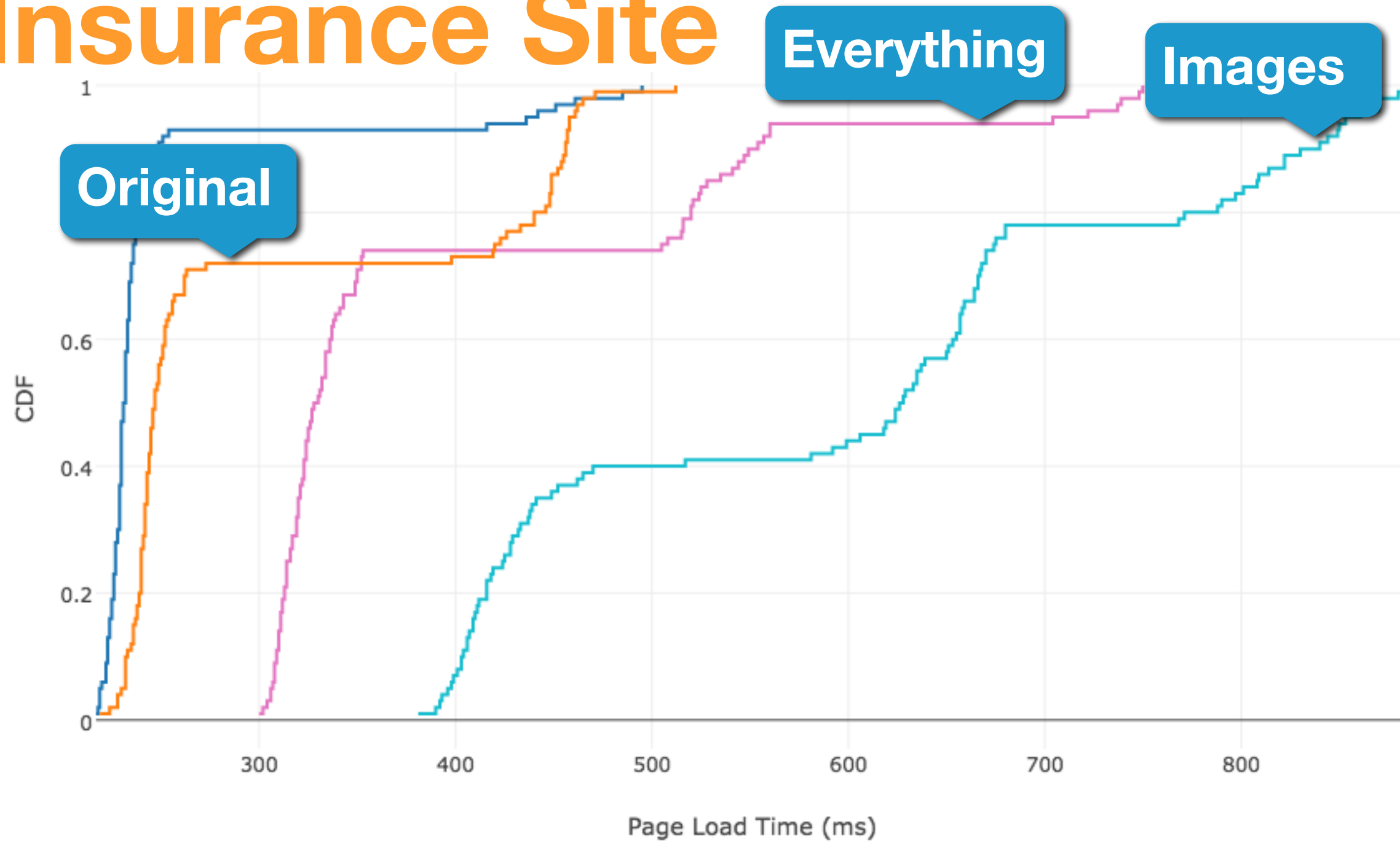
```
public class MyServlet extends HttpServlet
{
    public void doGet(HttpServletRequest request, HttpServletResponse response)
    {
        String uri = request.getRequestURI();
        if ("/index.html".equals(uri))
        {
            String resourceToPush = "/js/jquery.js";
            RequestDispatcher dispatcher =
                request.getRequestDispatcher(resourceToPush);
            dispatcher.push(request);
        }
    }
}
```


What if you get it wrong?



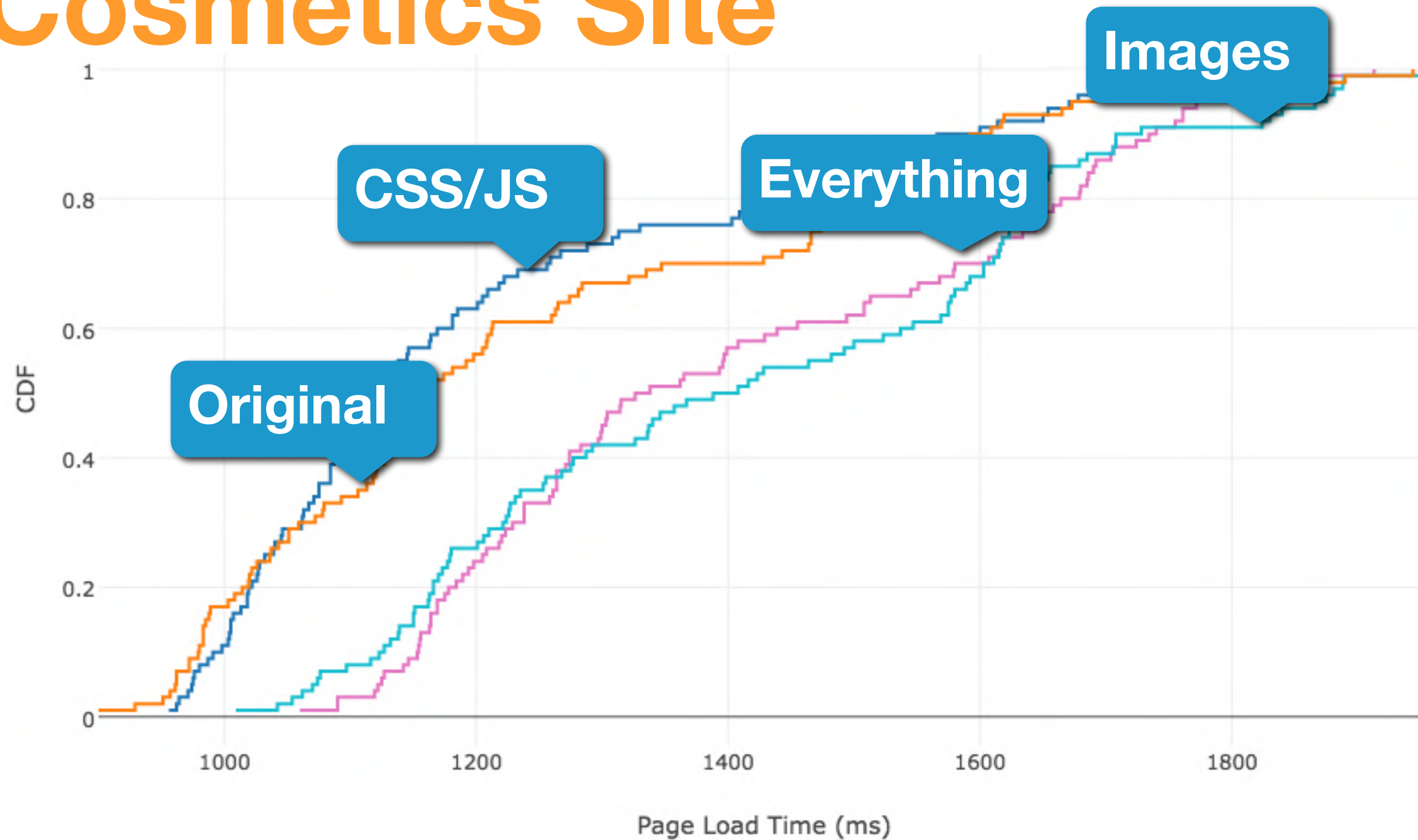
PUSH Results

Insurance Site



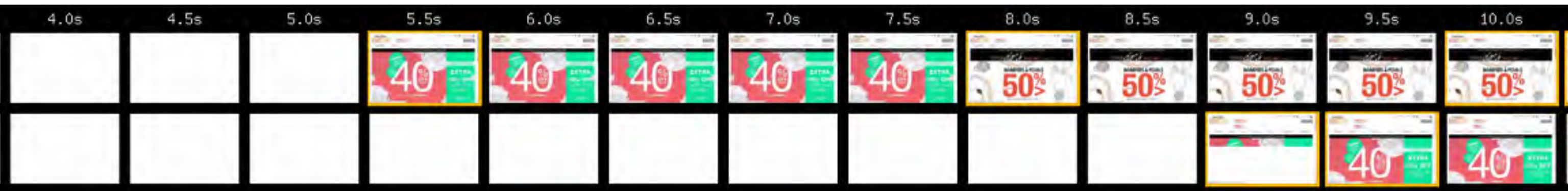
PUSH Results

Cosmetics Site



Automatic PUSH_PROMISE

But when you get it Right:



↑
5.27s

↑
8.59s

<https://goo.gl/M98bWr>

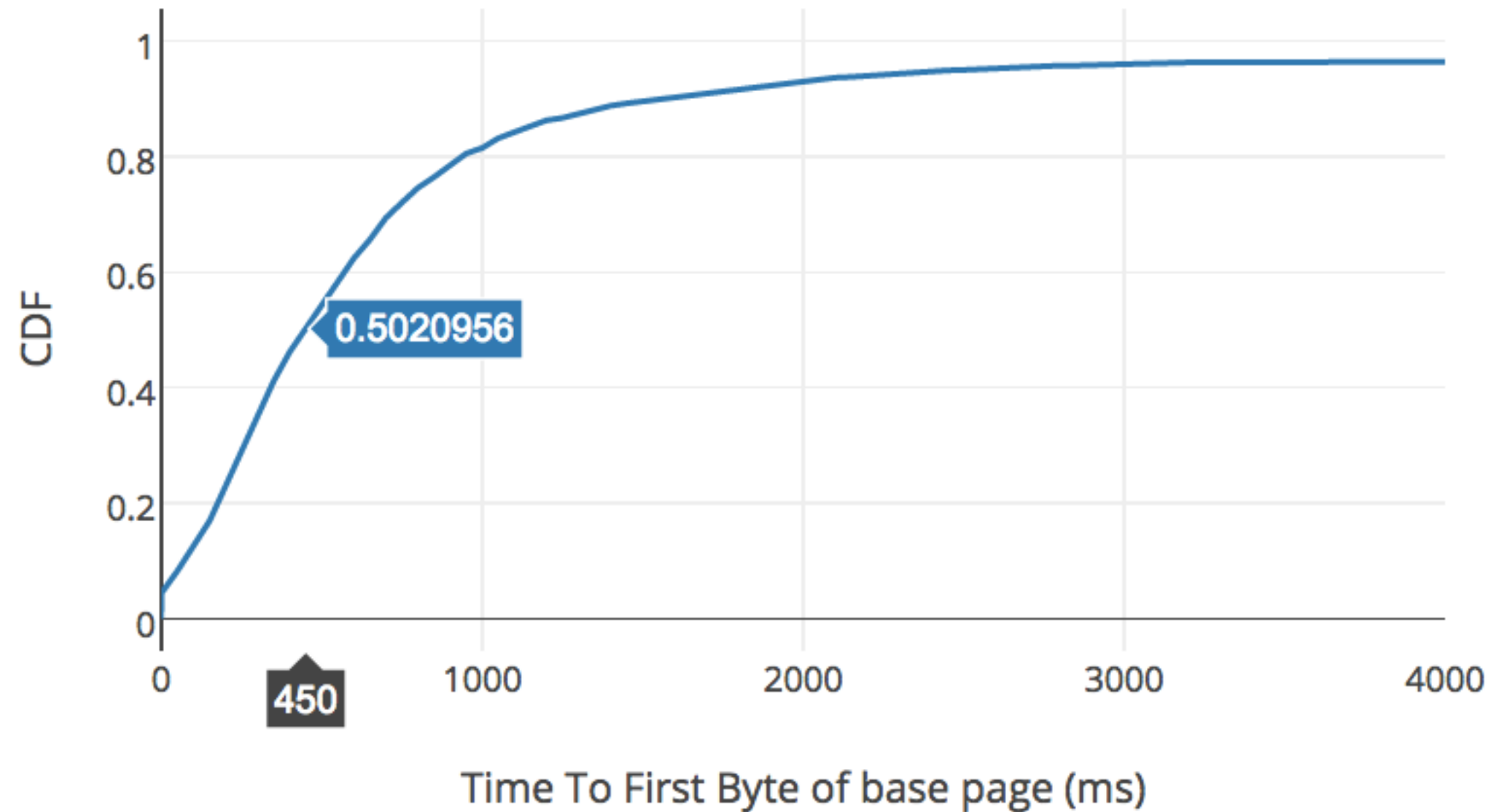
Google' Recommendations

1. Push just enough to fill idle network time, and no more
2. Push resources in right order.
3. Use special strategies to track the client-side cache
4. Use the right cookies when pushing resources that vary by cookie
5. Use server push to fill the initial cwnd and use preload to reveal the remaining critical or hidden resources.



Time-To-First-Byte

TTFB delays impact TCP HOL



Minimally send to TCP Send Buffer

TCP Head OF Line Blocking

Branch: master workshop2016 / talks / tcpprog.pdf Find file Copy path

mnot add tcpprog 9b94ed9 on Jul 26

1 contributor

226 KB Download History

Programming TCP for responsiveness

DeNA

DeNA Co., Ltd.
Kazuho Oku

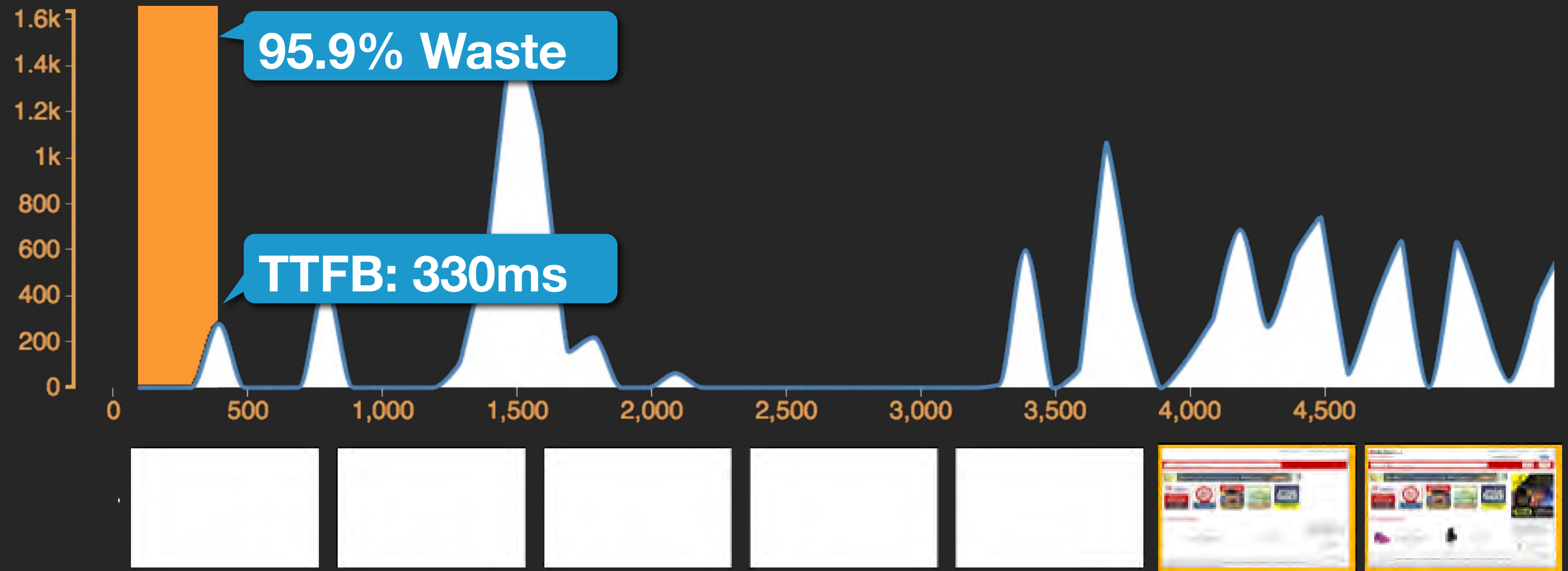
Copyright (C) 2016 DeNA Co., Ltd. All Rights Reserved.



Announcing:
shouldipush.com

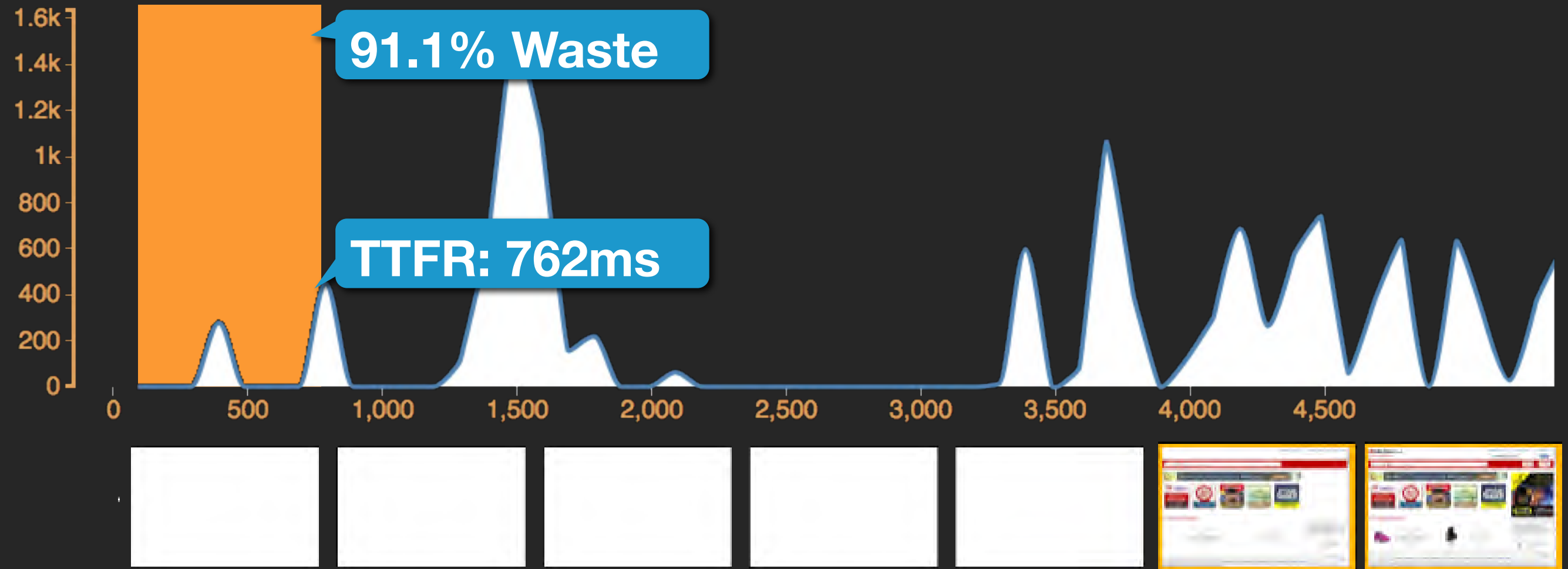
www.rakuten.co.uk

TTFB: Network Waste



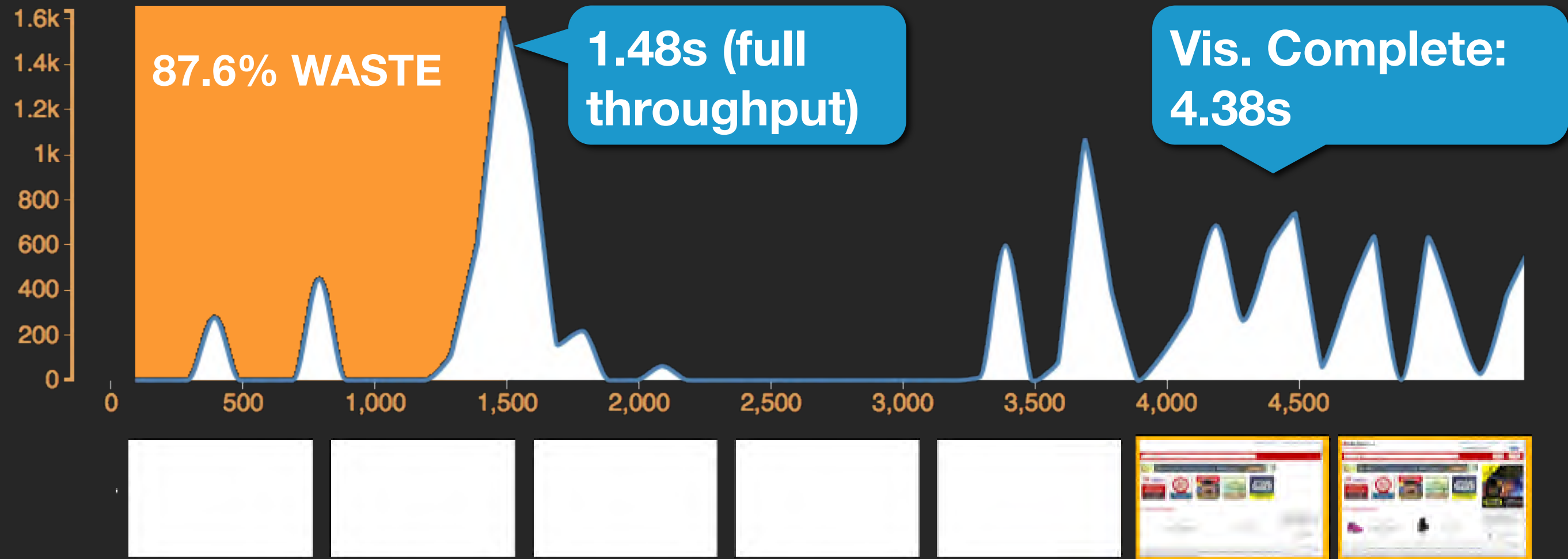
www.rakuten.co.uk

Time-to-First-Resource

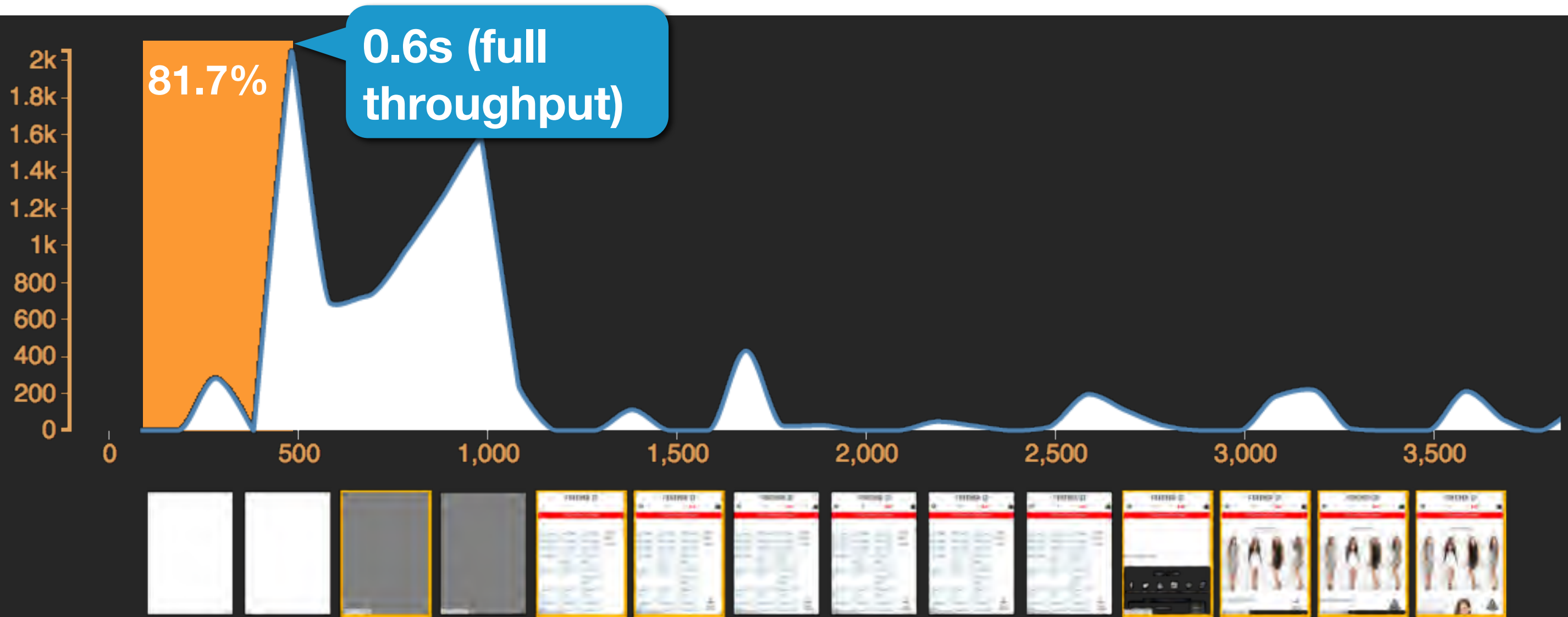


www.rakuten.co.uk

33.7% Vis. Complete Time



WPT: Network Waste



Implementation notes

- Measures opportunity to use the network
- Synthetic indicator metric – NOT silver bullet
- Uses WPT results

Chapter 4: Epilogue

PUSH

Questions & Predictions

- First request: ClientHints, Session Cookies
- PUSH to surrogate but not client
- Cache Management / Invalidation
- Next page resources
- DDOS countermeasures using PUSH

PUSH

HTTP/2



HTTP/2 PUSH

Take Action

Optimize for the Browser

- Cache Everything
- Remove 3rd Party Content
- Federated development: move APIs to the 1st party domain
- Plan for coalescing (use TLS SANs)

Experiment

- shouldipush.com
- Test TTFB globally



Thanks!
@ColinBendell