THE BROWSER HACKER'S GUIDE TO INSTANTLY LOADING EVERYTHING

@addyosmani

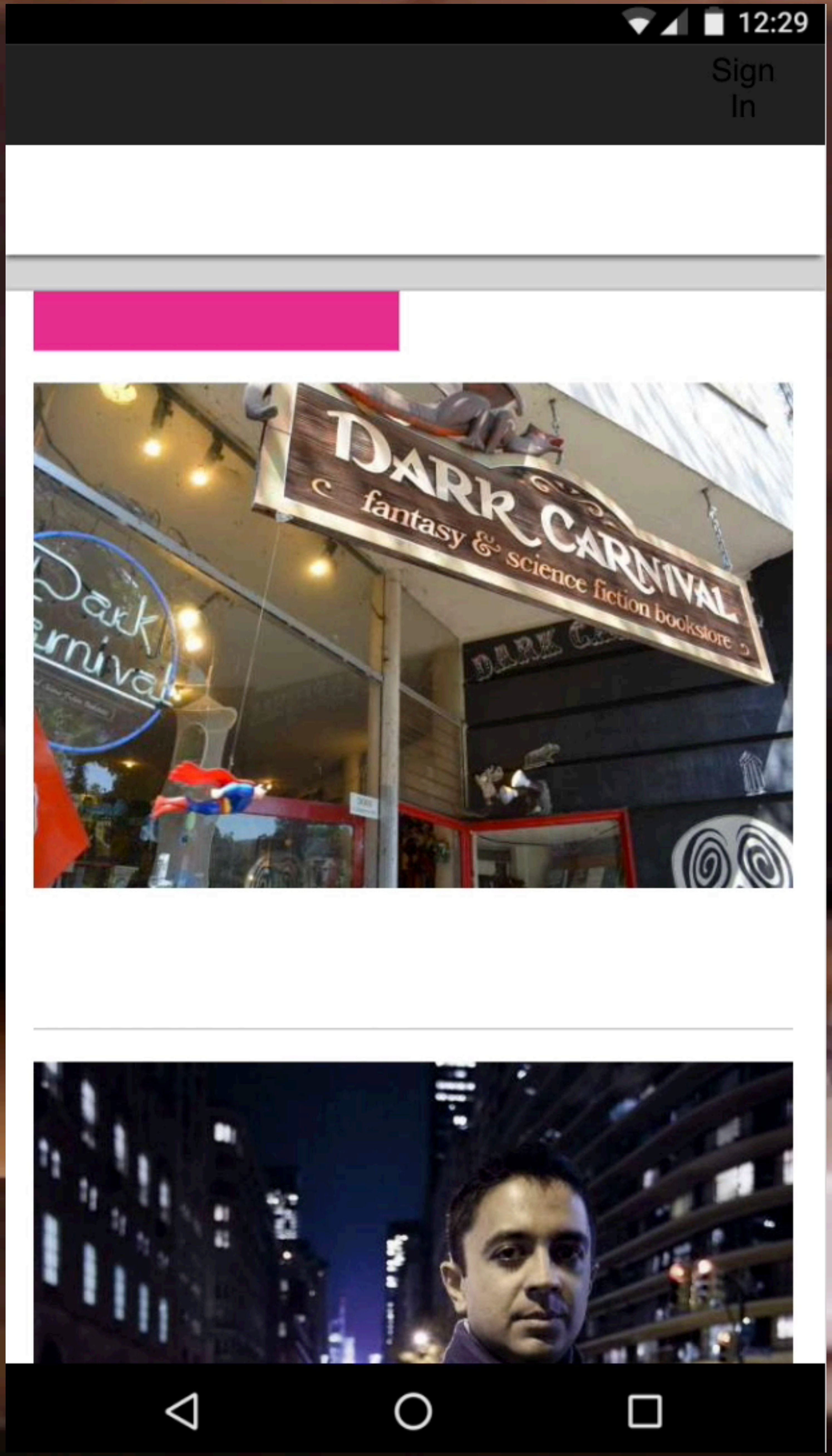
LOADING IS A USER JOURNEY

WITH MANY DISPARATE EXPECTATIONS

YOU'VE PROBABLY HEARD TO REDUCE DNS LOOKUPS, REDUCE ROUND-TRIP TIMES, MINIMIZE REDIRECTS, ELIMINATE UNN

LOADING IS SLOW BECAUSE OF...

the network, idling,
JavaScript, css, parsing,
compiling, third parties,
parser blocking patterns,
disk i/o, eviction, IPC jank,
thermal throttling,
RTTs, images, fonts,
kitten GIFs...

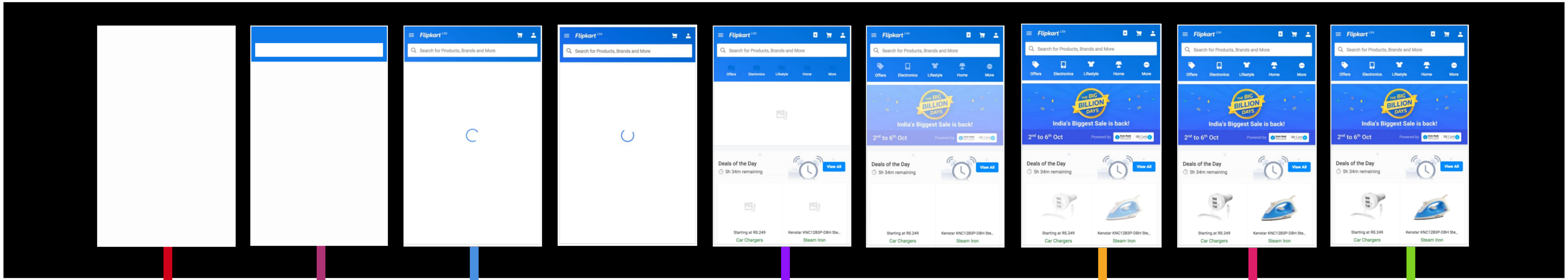


USERS LOOK FOR VISUAL FEEDBACK TO REASSURE THEM EVERYTHING IS WORKING AS EXPECTED.

is it happening?

is it useful?

is it usable?



Navigation begins

Time to first byte

First Paint

The first non-blank paint on screen

First Contentful Paint

Navigation has successfully started

First Meaningful Paint

Page's primary content is visible

Visually ready

Page looks nearly done

Time to Interactive

first Interactive
consistently Interactive

Visually usable and engagable

Fully Loaded

End of load lifecycle

GOAL

Time to Interactive

<5s

on an average mobile device over 3G

*2s on repeat-load after Service Worker registered

The average web page on mobile in 2017

16s

UNTIL INTERACTIVE

19s

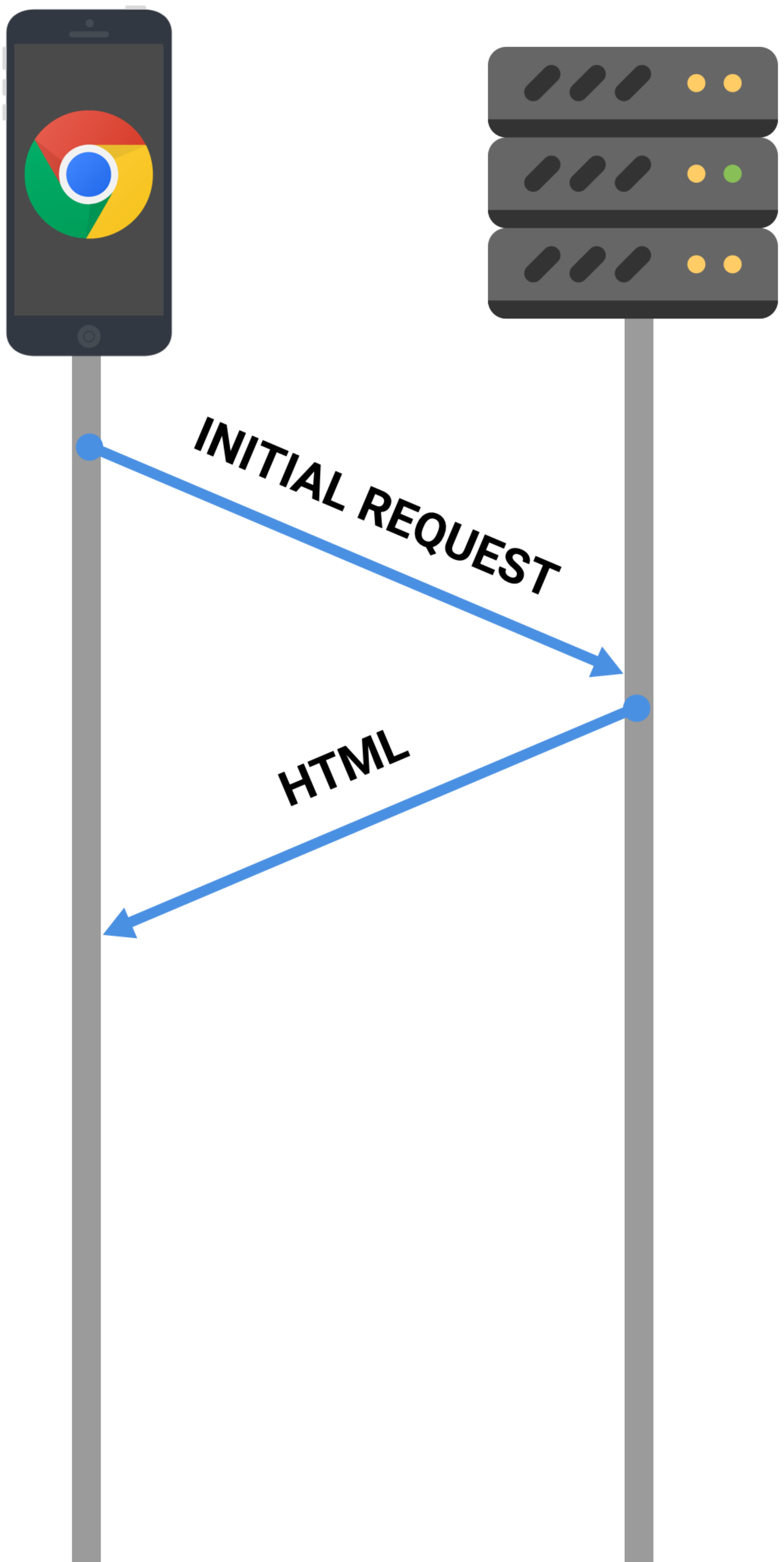
FULLY LOADED

420KB

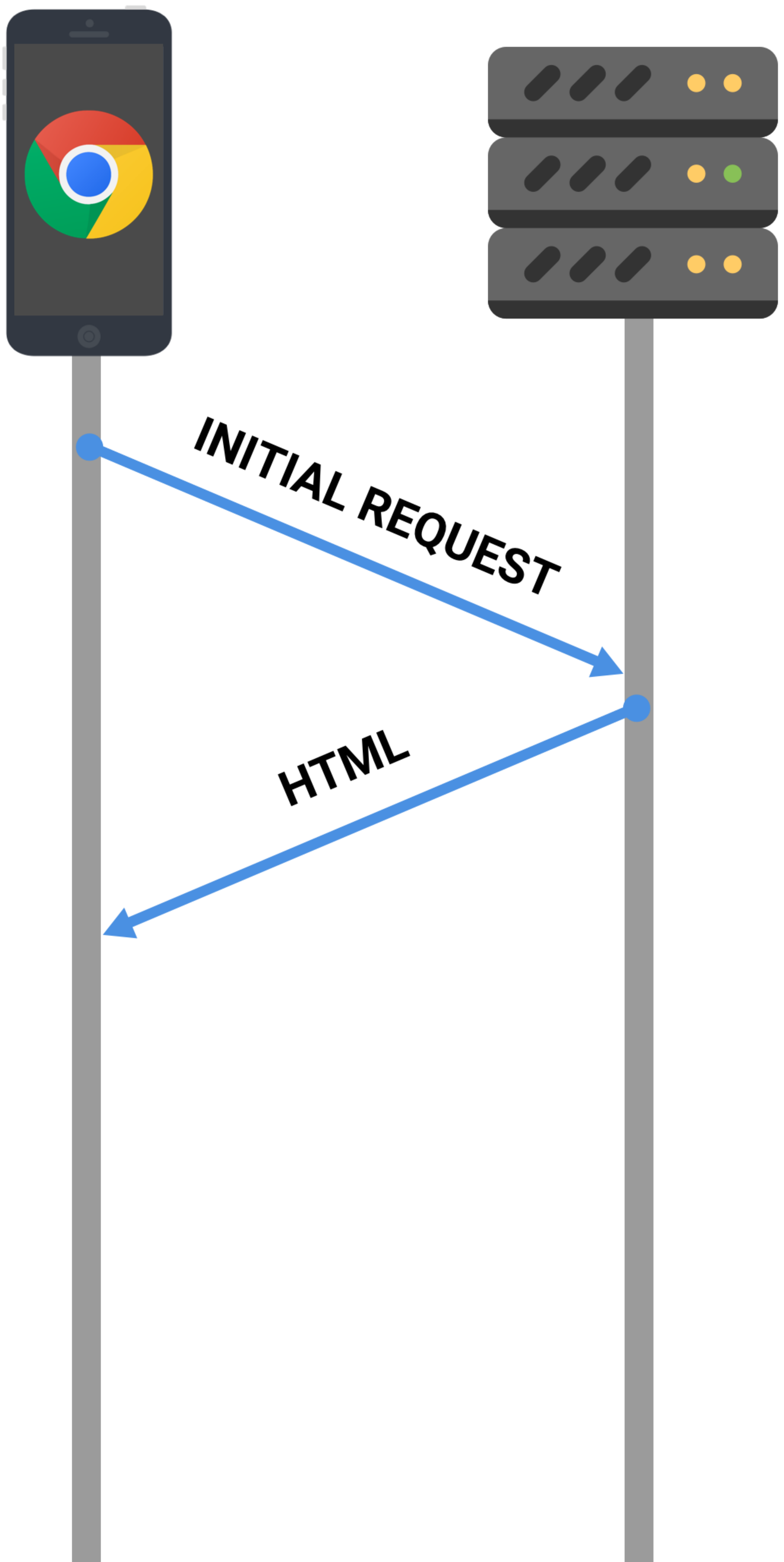
JAVASCRIPT

JavaScript Startup Performance, Double-Click Mobile Speed Matters report & the HTTP Archive

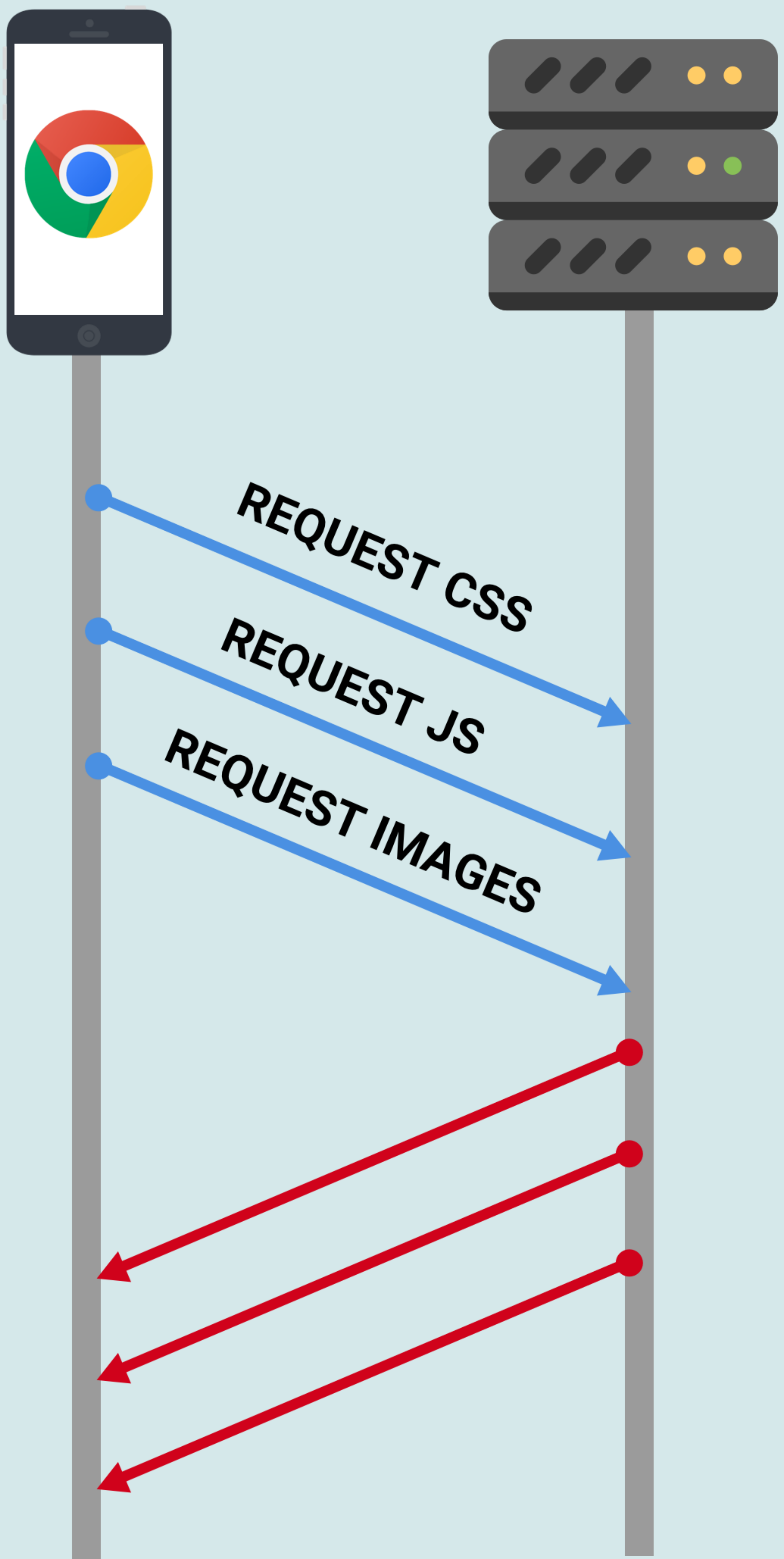
First request



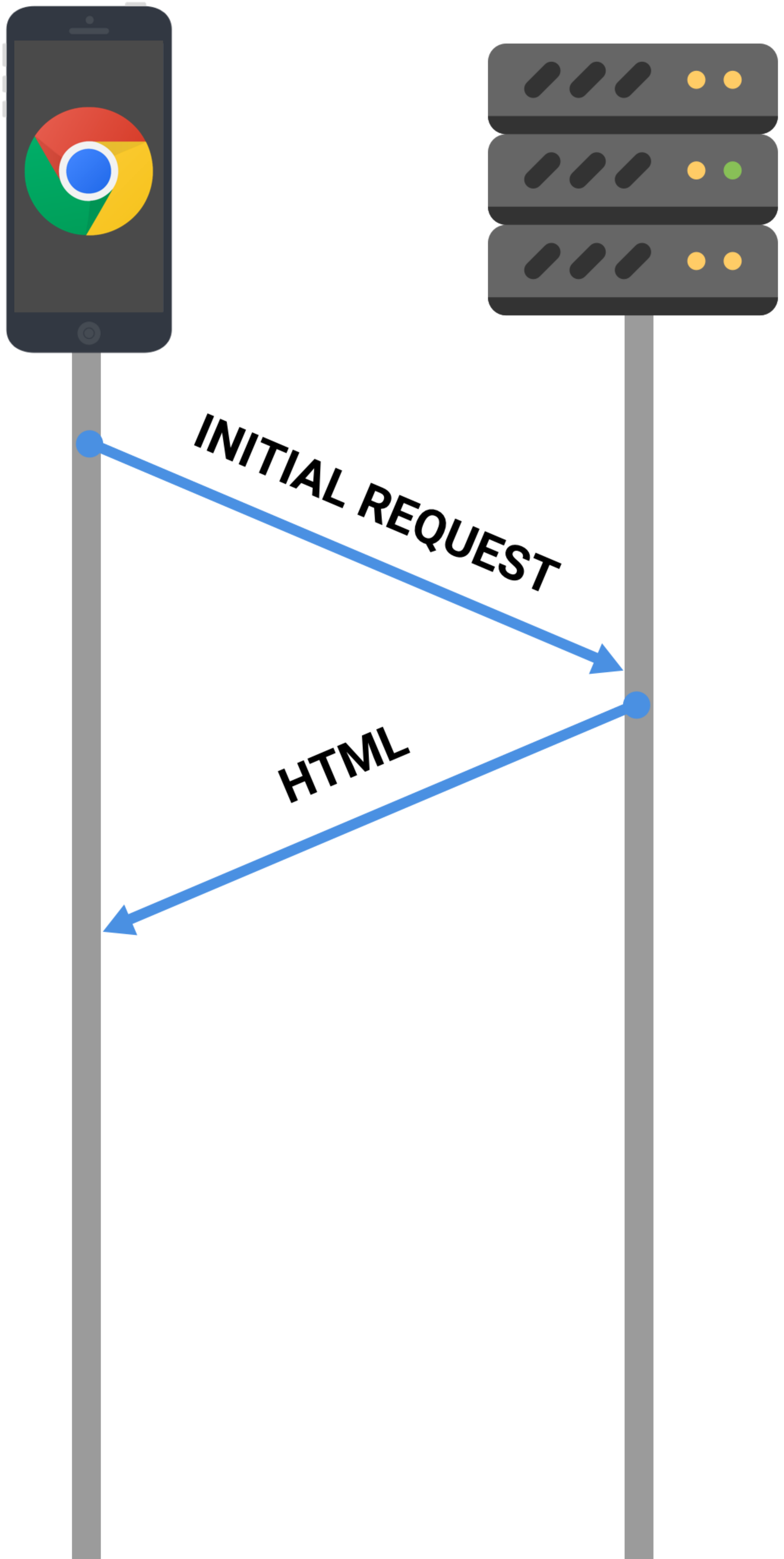
First request



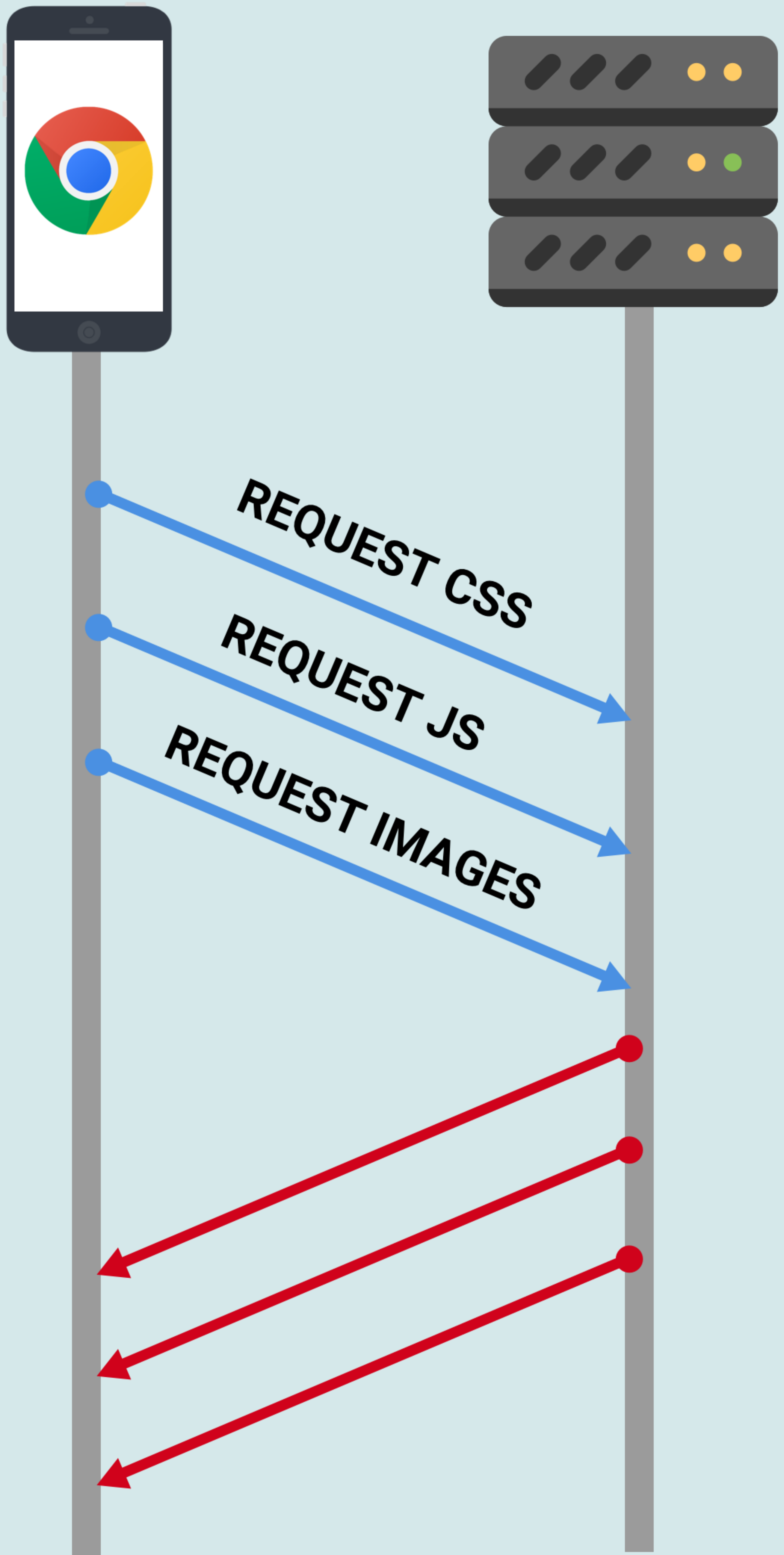
Fetch resources



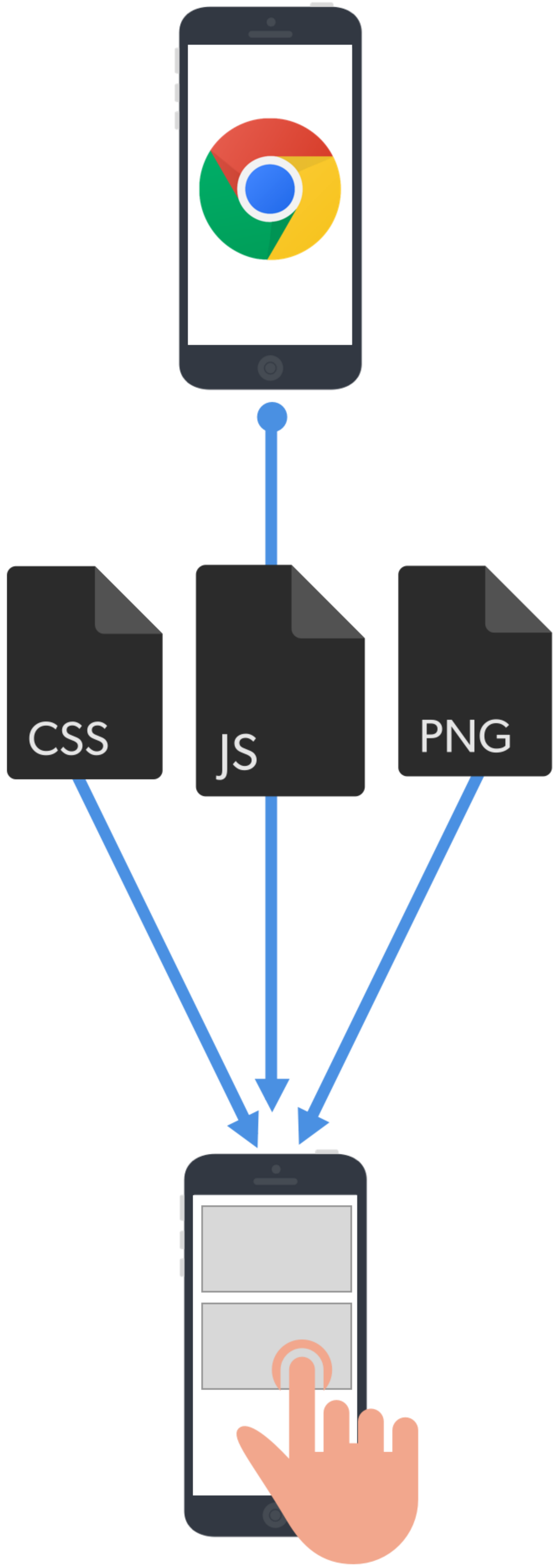
First request



Fetch resources

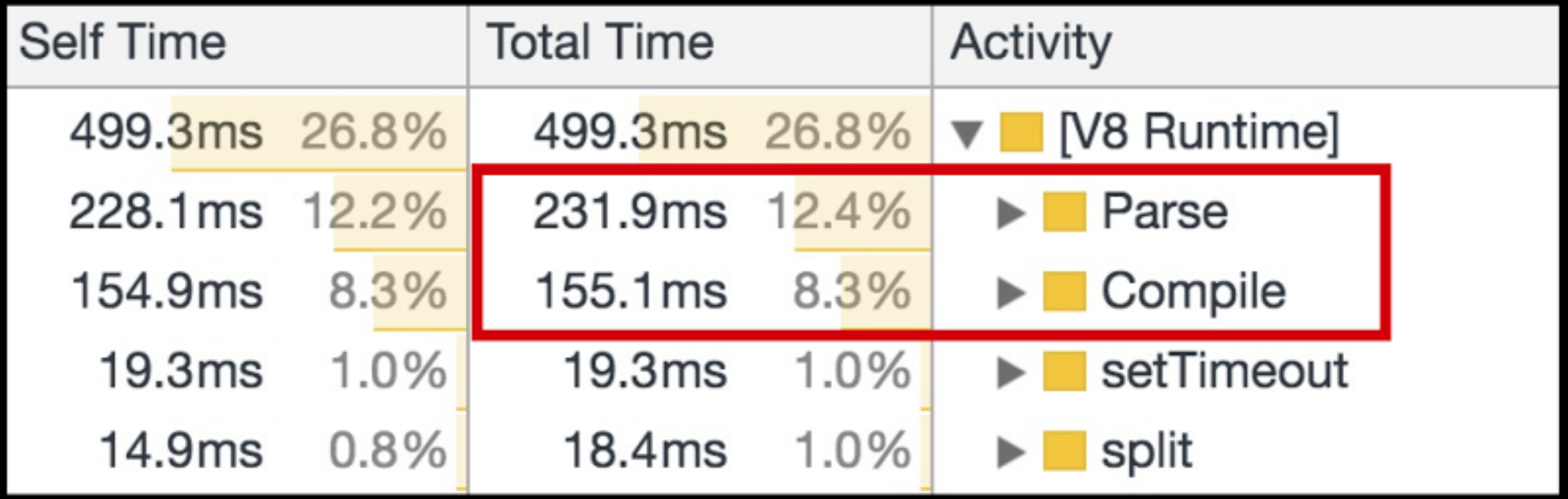


Parse, compile & render



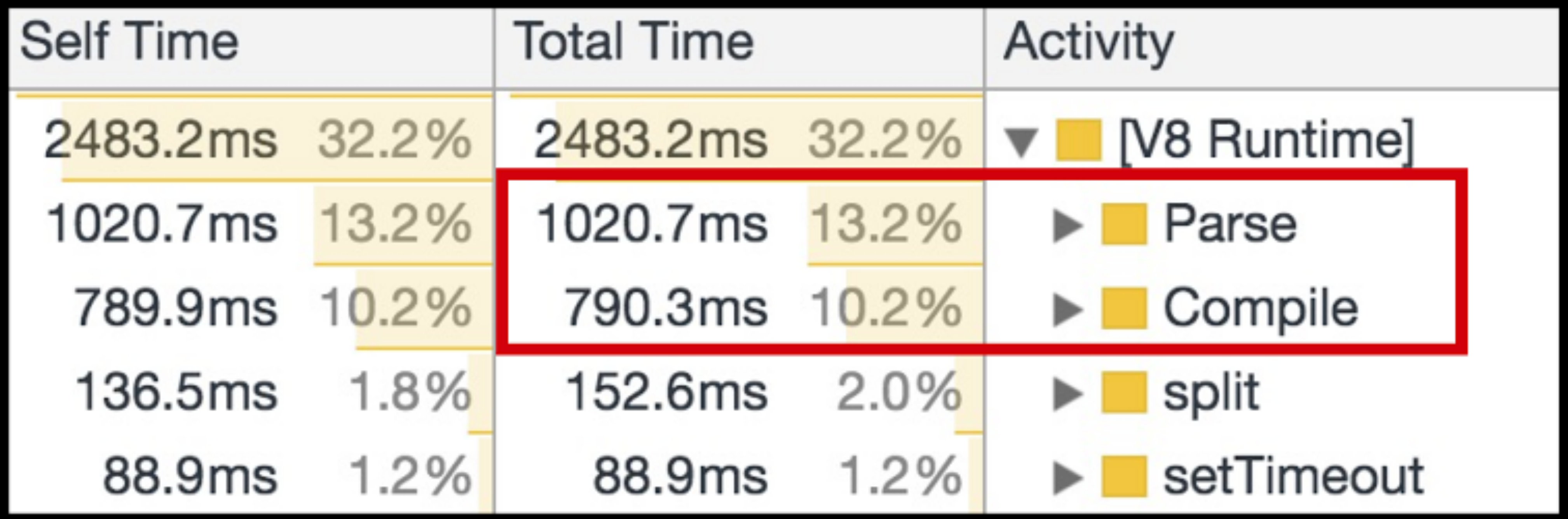
JavaScript *Start-up* PERFORMANCE

Desktop



Self Time		Total Time		Activity
499.3ms	26.8%	499.3ms	26.8%	▼ 🟨 [V8 Runtime]
228.1ms	12.2%	231.9ms	12.4%	▶ 🟨 Parse
154.9ms	8.3%	155.1ms	8.3%	▶ 🟨 Compile
19.3ms	1.0%	19.3ms	1.0%	▶ 🟨 setTimeout
14.9ms	0.8%	18.4ms	1.0%	▶ 🟨 split

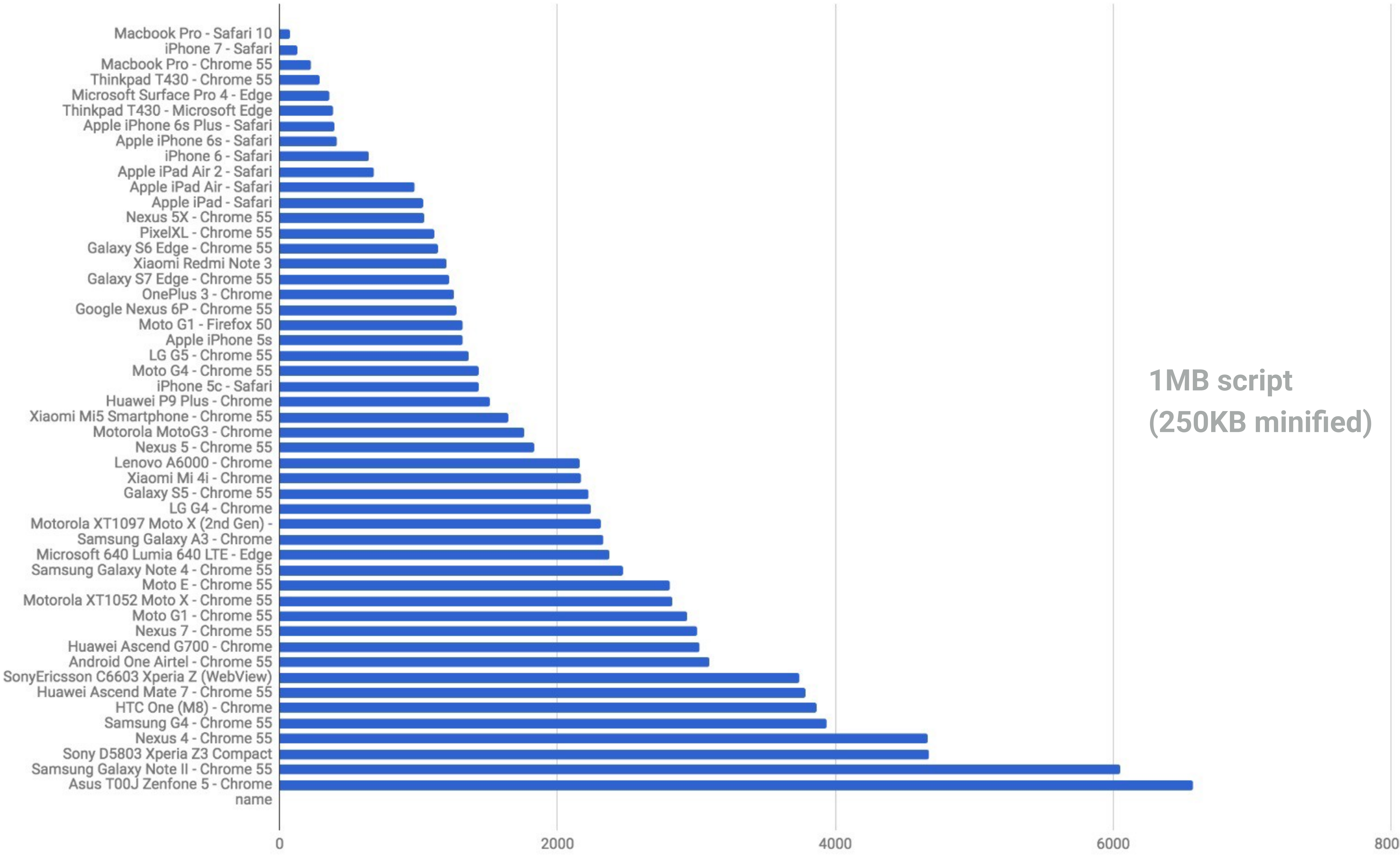
Mobile (with slower CPU)



Self Time		Total Time		Activity
2483.2ms	32.2%	2483.2ms	32.2%	▼ 🟨 [V8 Runtime]
1020.7ms	13.2%	1020.7ms	13.2%	▶ 🟨 Parse
789.9ms	10.2%	790.3ms	10.2%	▶ 🟨 Compile
136.5ms	1.8%	152.6ms	2.0%	▶ 🟨 split
88.9ms	1.2%	88.9ms	1.2%	▶ 🟨 setTimeout

V8 Runtime Call Stats

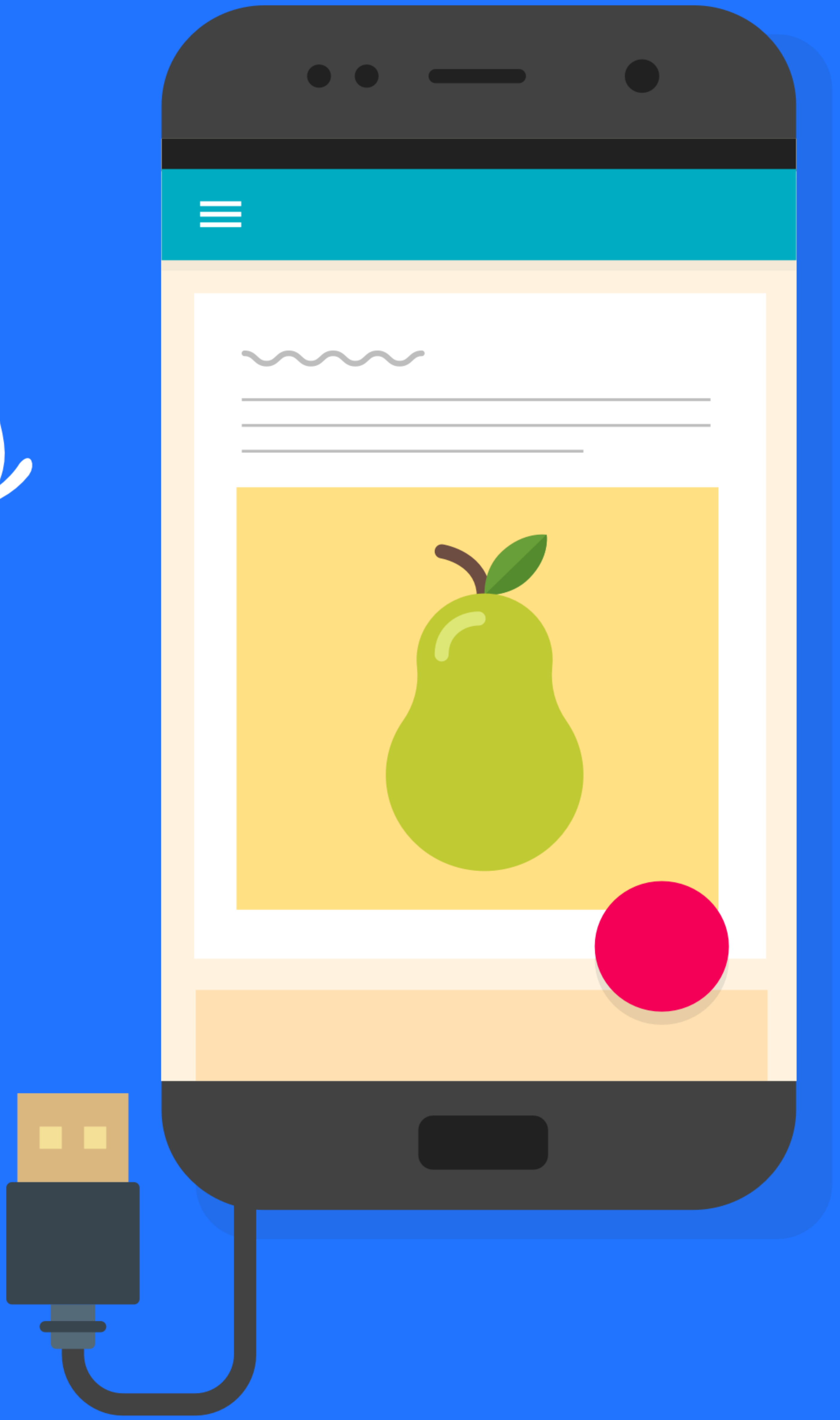
JS Parse Time On Mobile



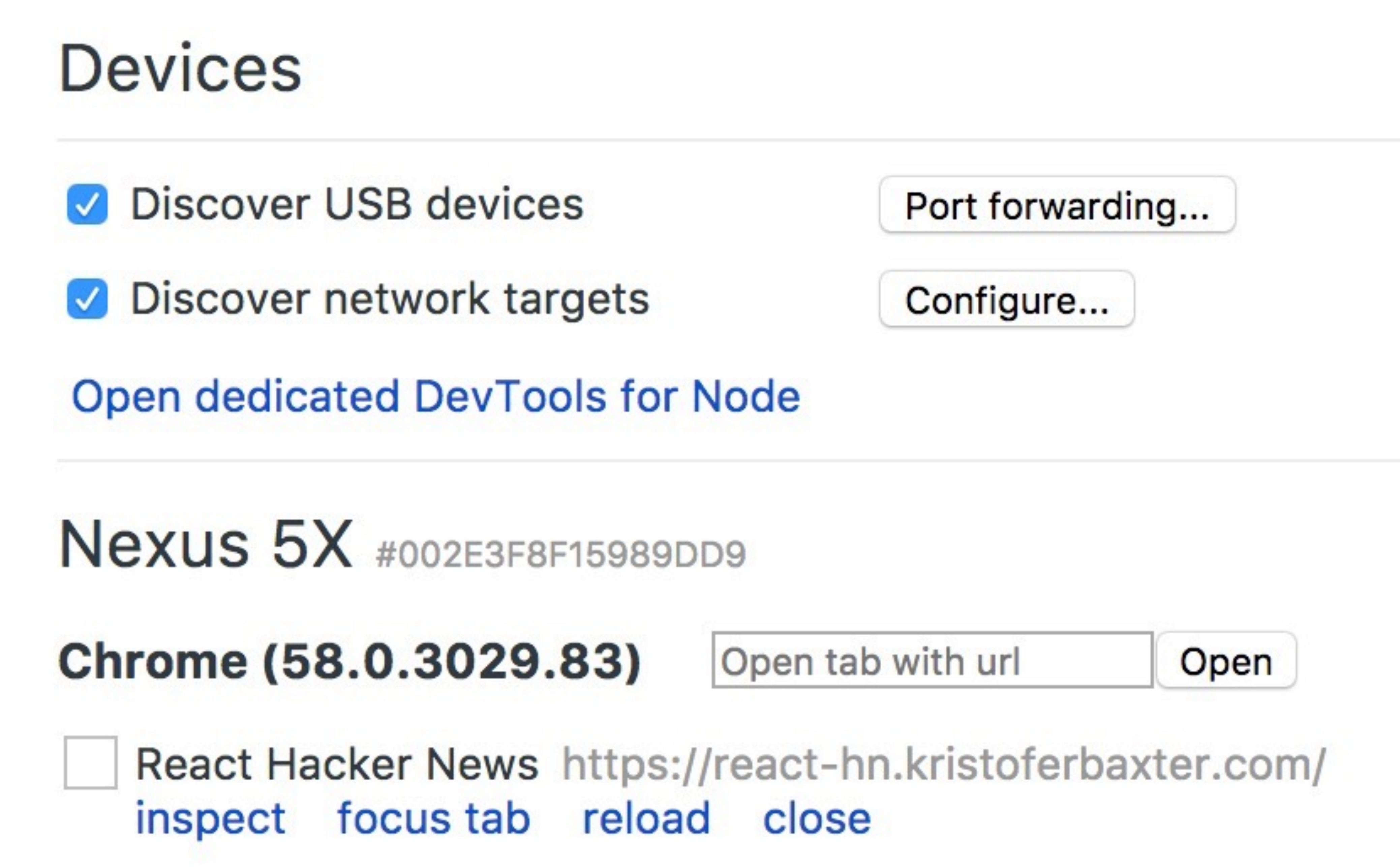
1MB script
(250KB minified)

Test on real phones & real networks

THERE'S NO SUBSTITUTE.



about:inspect in Chrome DevTools



Devices

☑ Discover USB devices — Port forwarding...

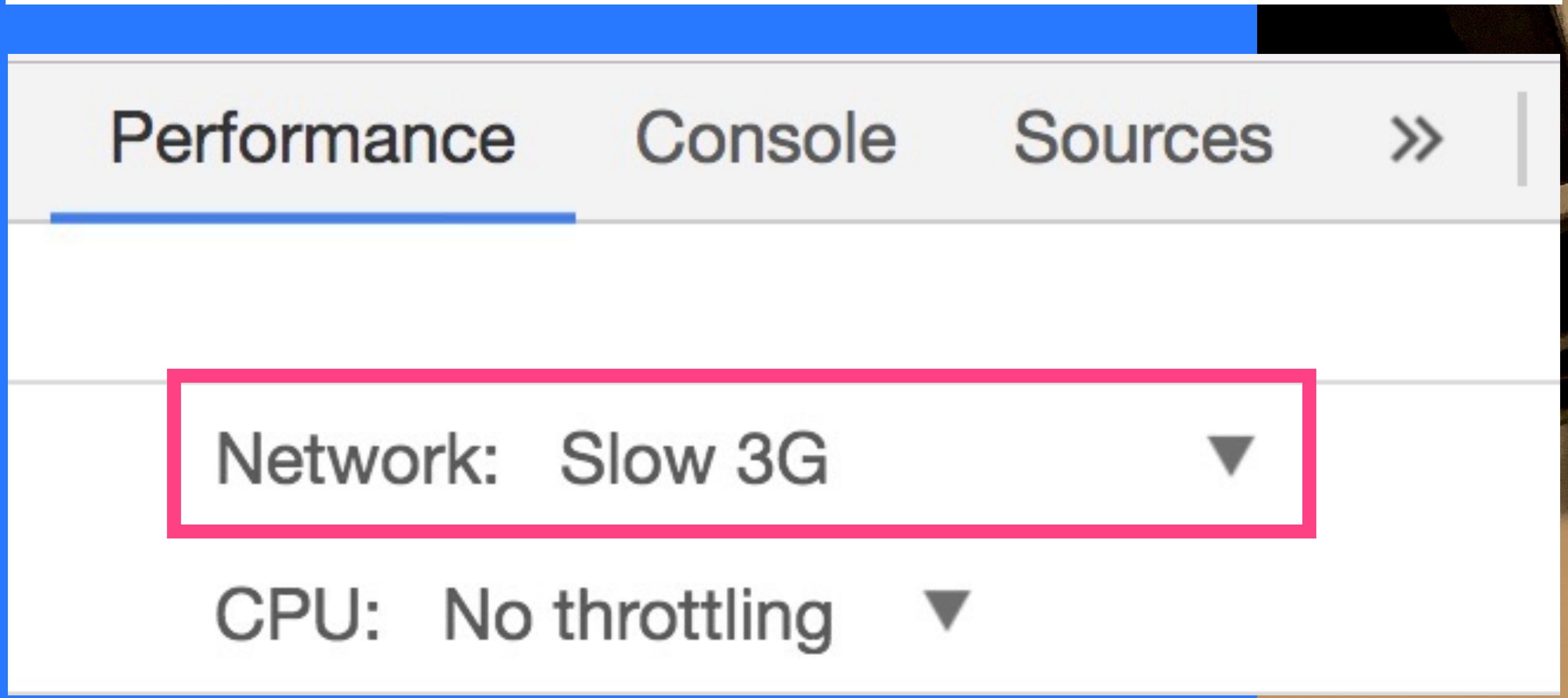
☑ Discover network targets — Configure...

Open dedicated DevTools for Node

Nexus 5X #002E3F8F15989DD9

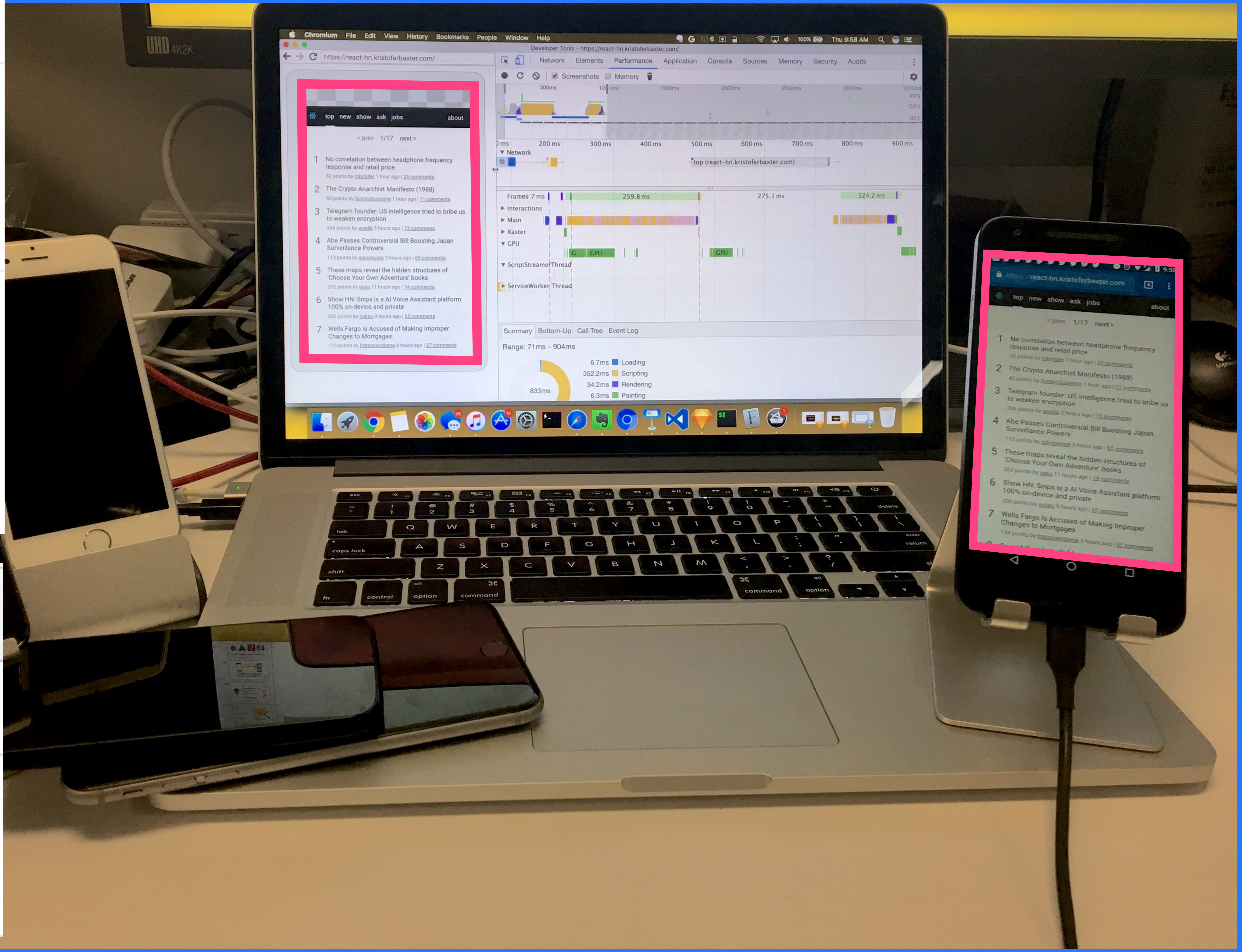
Chrome (58.0.3029.83) Open tab with url — Open

□ React Hacker News https://react-hn.kristoferbaxter.com/
inspect focus tab reload close



Network: Slow 3G ▼

CPU: No throttling ▼



geekaphone BETA

Compare up to 5 phones side by side

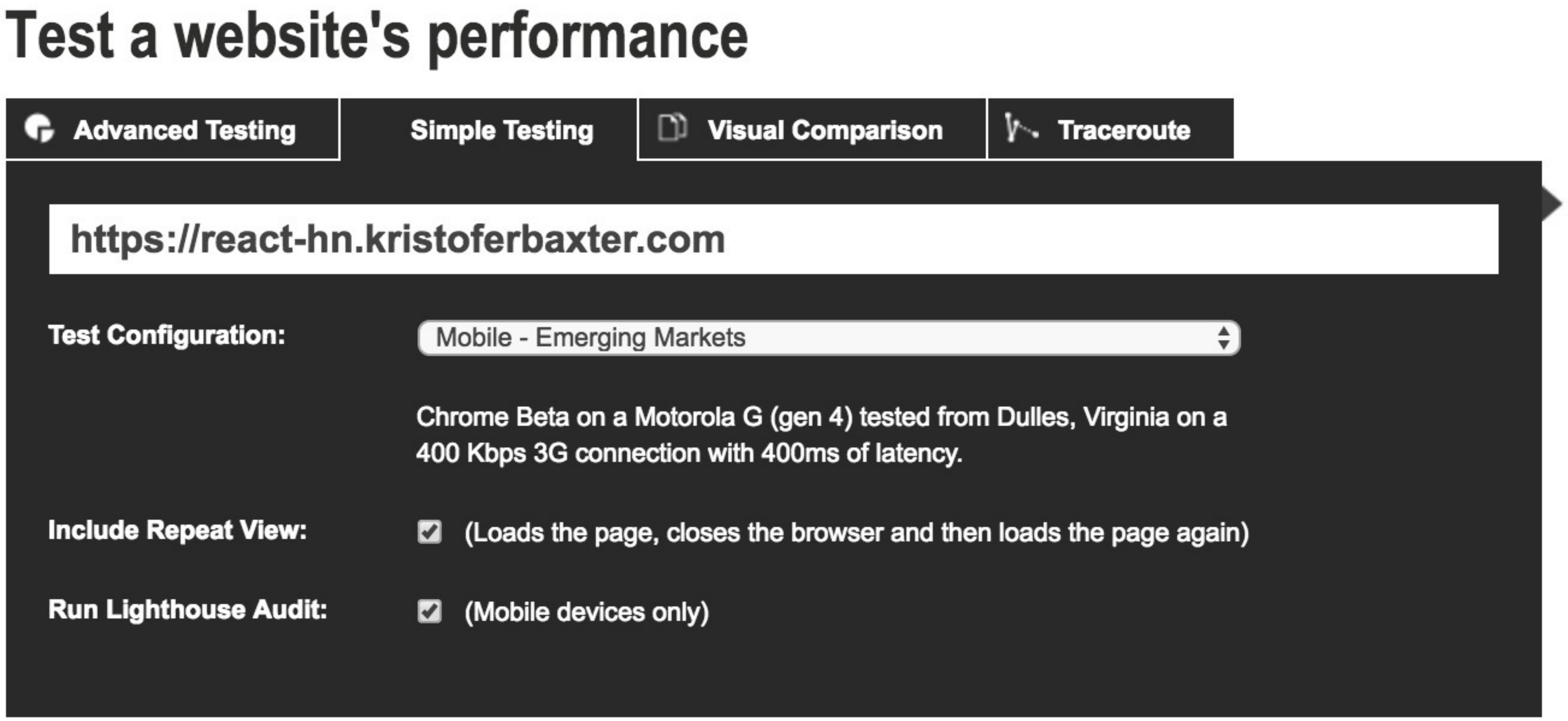
Apple iPhone 7 Plus vs Motorola Moto G4 Play

	iPhone 7 Plus APPLE	Moto G4 Play MOTOROLA
clock speed	2.34 GHz	1.2 GHz
ram	3 GB	2 GB
size	5.5 inches	5 inches
resolution	400 ppi	293 ppi

0
Like
0
G+1
Tweet
0
NEW Sep 2016
NEW Sep 2016
12
36
Compare against
iPhone 6
APPLE
P9
HUAWEI
Pixel
GOOGLE
Moto G5 Plus
MOTOROLA

webpagetest.org/easy

Moto G4 + 3G



Test a website's performance

Advanced Testing | Simple Testing | Visual Comparison | Traceroute

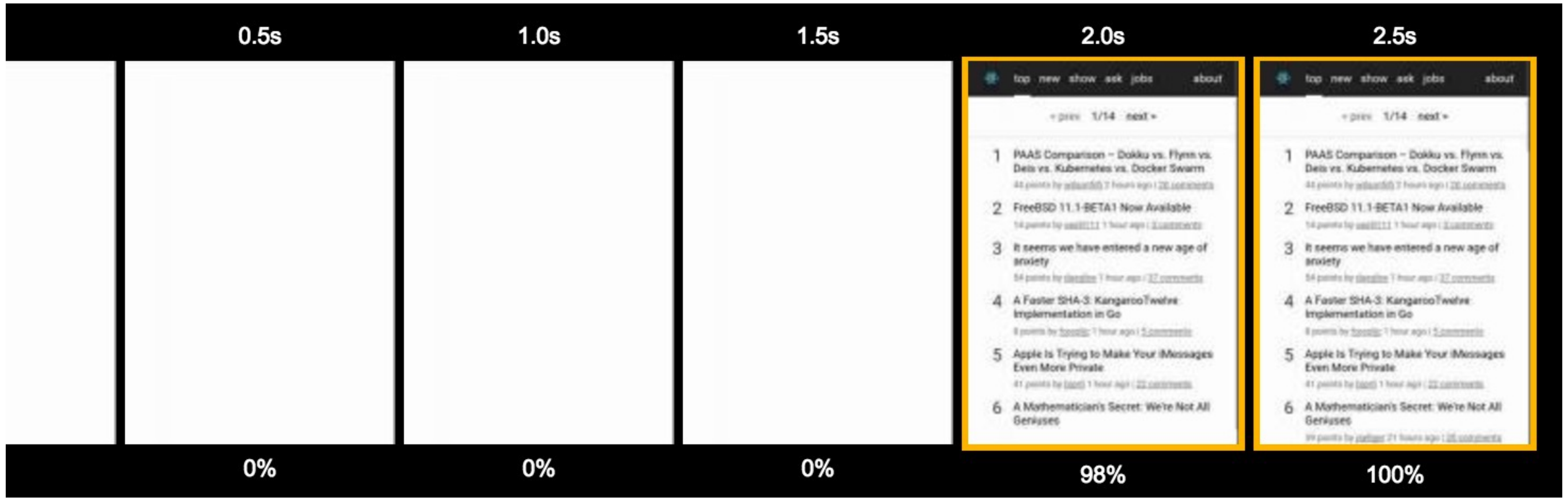
https://react-hn.kristoferbaxter.com

Test Configuration: Mobile - Emerging Markets

Chrome Beta on a Motorola G (gen 4) tested from Dulles, Virginia on a 400 Kbps 3G connection with 400ms of latency.

Include Repeat View: ☑ (Loads the page, closes the browser and then loads the page again)

Run Lighthouse Audit: ☑ (Mobile devices only)



LOADING TIP 1

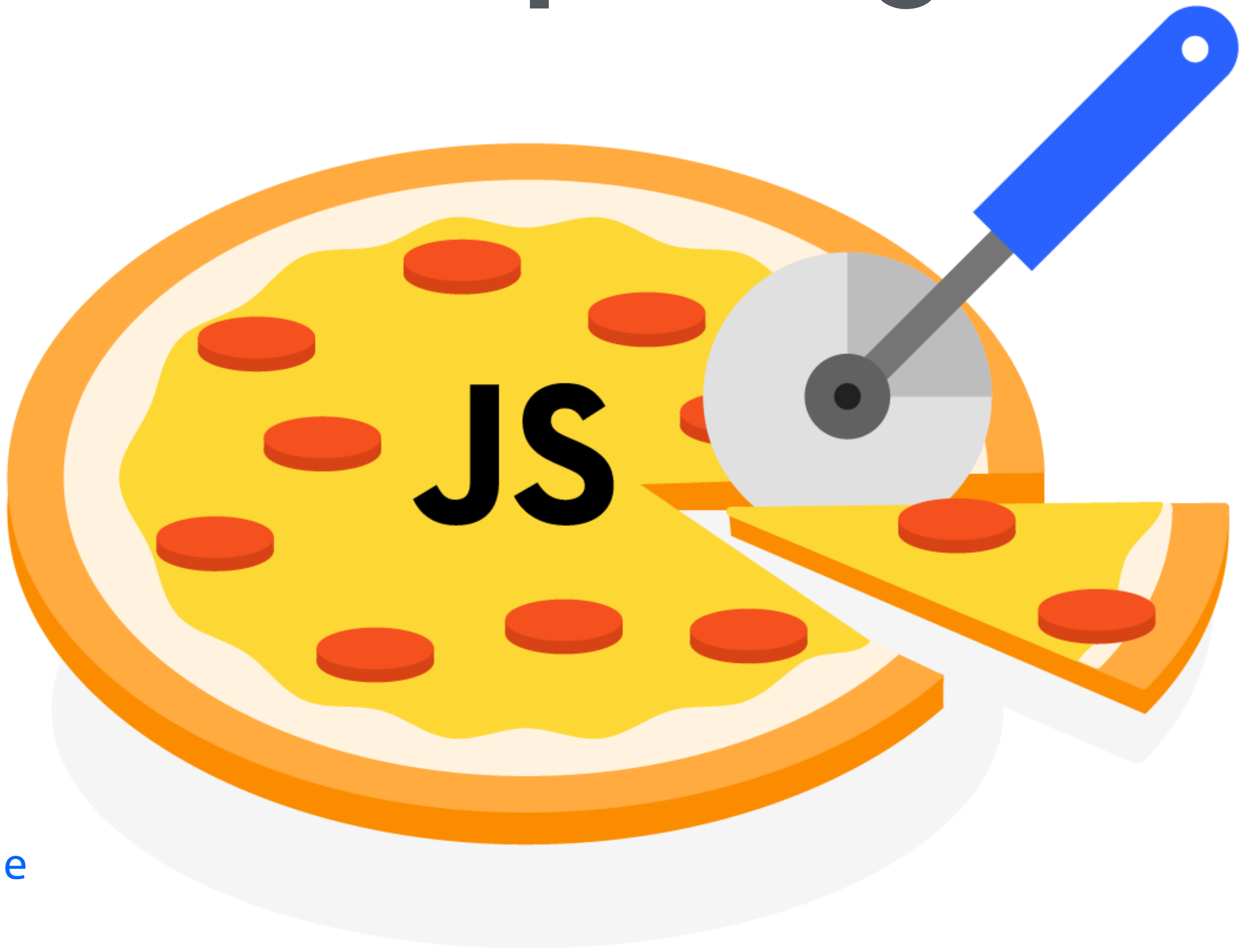
ONLY LOAD WHAT YOU NEED

webpack

Code-splitting

Webpack 2+

```
import('./UserProfile')
  .then(loadRoute(cb))
  .catch(errorLoading)
```



Webpack 1

```
// Defines a “split-point” for a separate bundle
require.ensure([], () => {
   const profile = require('./UserProfile', cb);
});
```

Also see Splittable, Closure Compiler
or Browserify

Smaller Pictures
Person 1
Secure
https://smaller-pictures.appspot.com
Nexus 5X ▼ 412 × 732 75% ▼
12:29
Smaller Pictures
PHOTO
Select a photo to compress!
Elements
Performance
Network
Application
Console
Sources
Memory
Security
Styles
Computed
Event Listeners
Filter
:hov .cls +
html
body
Console
Request blocking
Coverage

```
▶<head>…</head>
…▼<body> == $0
  ▶<div class="mdl-layout__container">…</div>
```

URL	Type	Total Bytes	Unused Bytes	
https://smaller-pict… /bundle.min.css	CSS	141 203	124 151	87.9 %
https://smaller-pictures…/main.min.js	JS	95 009	47 613	50.1 %
https://www.google-an… /analytics.js	JS	29 486	9 112	30.9 %
https://smaller-pictures…. /webfont.js	JS	16 587	4 025	24.3 %
https://smaller-pictures.appspot.c… /	CSS…	9 120	411	4.5 %
https://f…/css?family=Material+Icons	CSS	640	289	45.2 %

181 KB of 285 KB bytes are not used. (64%)

Do I need to split?

Try Code Coverage
in Chrome DevTools

Tree-shaking

```
// app.js
import { a } from ‘./module.js’;

// module.js
export function a () {}

export function b () {}
```

✗

webpack

Only transpile what you need with BABEL

Use **babel-preset-env** to only transpile code for browsers that need it

```
{
  "presets": [
    ["env", {
      "targets": {
        "browsers": ["last 2 versions"]
      }
    }]
  ]
}
```

webpack workflow

Minify _everything_

Babelified ES5 w/Uglify
ES2015+ with Babili
css-loader + minimize:true

Code-splitting

Dynamic import()
Route-based chunking

Tree-shaking

Webpack 2+ with Uglify
RollUp
DCE w/ Closure Compiler

Optimize “Vendor” libs

NODE_ENV=production
CommonsChunk + HashedModuleIdsPlugin()

Transpile less code

babel-preset-env + modules:false
Browserlist
useBuiltIns: true

Scope Hoisting:

Webpack 3
RollUp

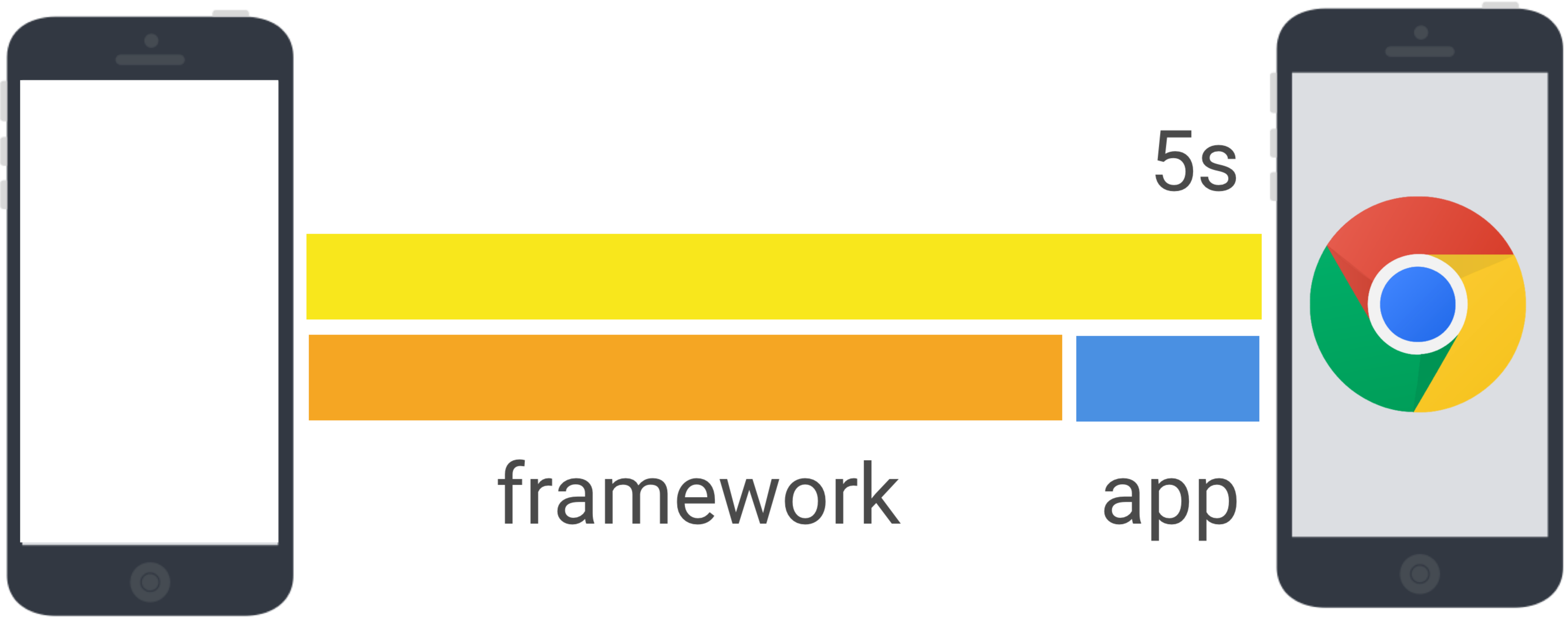
Strip unused Lodash modules

lodash-webpack-plugin
babel-plugin-lodash

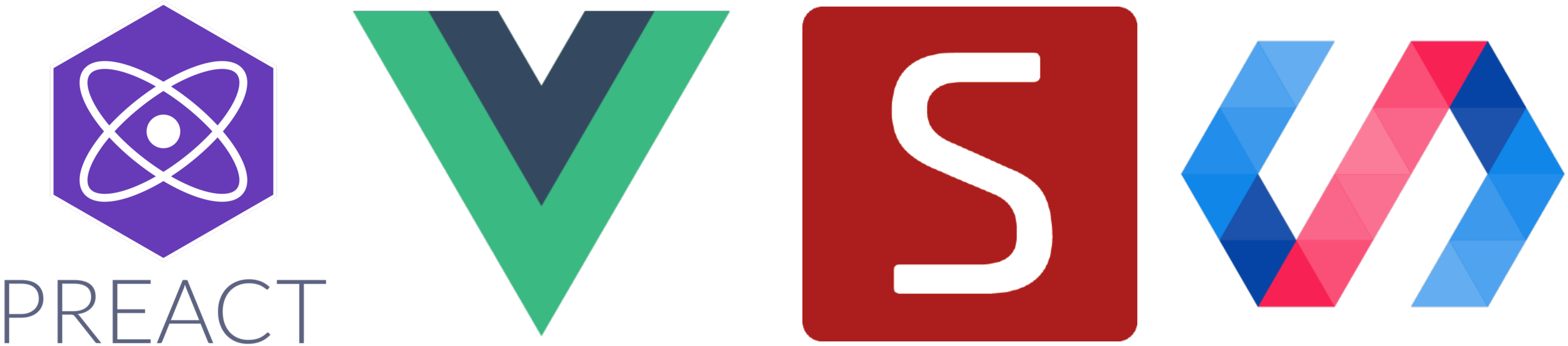
Fewer Moment.js locales

ContextReplacementPlugin()

The bloat of your **baseline** defines how much headroom you have for **app code**. How much is taken by your framework?



Plenty of lightweight options for mobile



Lower total cost on size + parse times from the get-go

ATTACK OF THE THIRD PARTY SCRIPTS

Third-party Badging

Request Blocking

412 × 732
Application
Elements
Performance
Network
Memory
Console
Audits
Sources
Security
View:
Group by frame
Preserve log
Disable cache
Offline
No throttling
Filter
Regex
Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
5000 ms
10000 ms
15000 ms
20000 ms
25000 ms
30000 ms
35000 ms
12:29
THE VERGE
TECH
SCIENCE
CULTURE
MORE
TE
COMMUTING AT 700MPH WITHOUT WINGS. IT'S AWESOME
DISCOVER MORE
THE FUTURE OF TRANSPORTATION
Console
What's New
Coverage
Request blocking

With Whole Foods purchase, Amazon is one step closer to the Everything Store

by Jacob Kastrenakes and Lauren Goode

The Last Night was one of E3's most dazzling games — and also its most frustrating

by Adi Robertson

storage.selectmedia.asia

Selectmedia International LTD.

Report mismatch

Name	Status	Type	Size	Time
SI Hitachi.Jan17.mp4	206	media	624 KB	1
VXC_LIN_002_v4-1_FINAL_CONFORM…	200	webp	552 KB	4
vrg_header_purpleReef.0.jpg	200	jpeg	363 KB	3
tldr-logo.1473954443.png	200	png	173 KB	3
AVmanager.js	200	script		1
KD controltag.js.2b39b1cbcb1e3e057…	200	script		

323 requests | 3.8 MB transferred | Finish: 36.59 s | DOMContentLoaded: 414 ms | Load: 1.92 s

☑ Enable request blocking

☑ infinityid.condenastdigital.com

☑ beacon.krxd.net

☑ cdn0.vox-cdn.com/uploads/chorus_image/image/50858597/tldr-logo.1473954443.png

Byte savings @ Google

Display Ads from Google now served using Brotli compression!

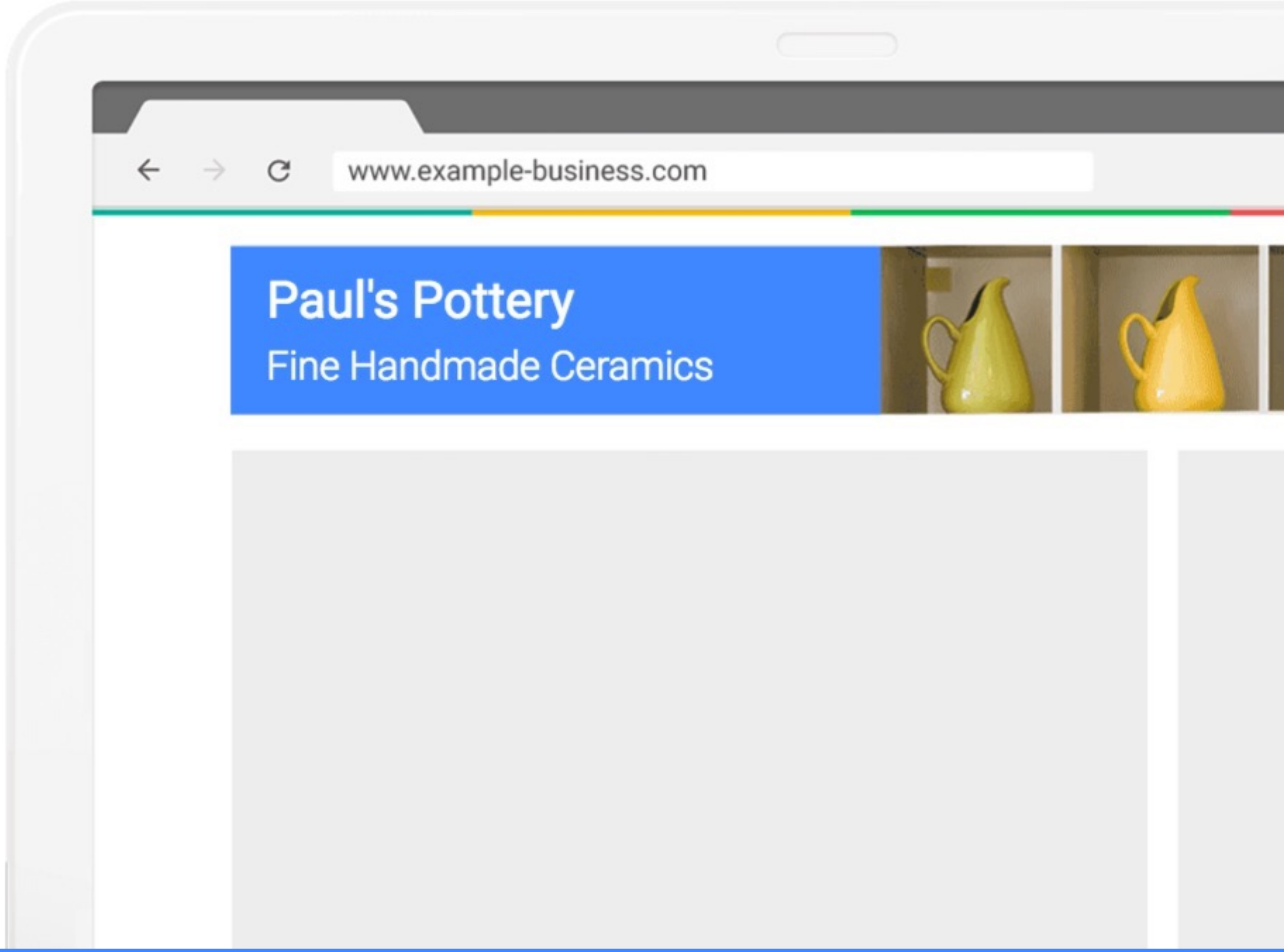
https://developers.googleblog.com/

Brotli

Data-savings up to

40%

15% in aggregate over gzip



Brotli

Google Play

1.5 petabytes (million gigs) saved a day

bit.ly/playstore-brotli

LinkedIn™

Improved load time by 7% in India & 4% U.S

bit.ly/linkedin-brotli

Dropbox

Decreased the size of static assets by 20%

bit.ly/dropbox-brotli

CertSimple

17% improvement for largest JS bundles

bit.ly/certsimple-brotli

30% smaller than JPEG
25% smaller than PNG

WebP

WebP image format - UNOFF

Global 73.44% + 0.27% = 73.7%

Image format that supports lossy and lossless compression, as well as animation and alpha transparency.

Current aligned
Usage relative
Date relative
Show all

IE	Edge *	Firefox	Chrome	Safari	Opera	iOS Safari *	Opera Mini *	Android Browser *	Chrome for Android
			49						
			56						
		52	57			9.2		4.4	
	14	53	58			10.2		4.4.4	
11	15	54	59	10.1	46	10.3	all	56	59
	16	55	60	11	47	11			
		56	61	TP	48				
		57	62						

25-30%

savings for WebP on average (26% lossless)

bit.ly/webp-format

WebP

Data Saver + Web Store

Serving over 43B image requests a day

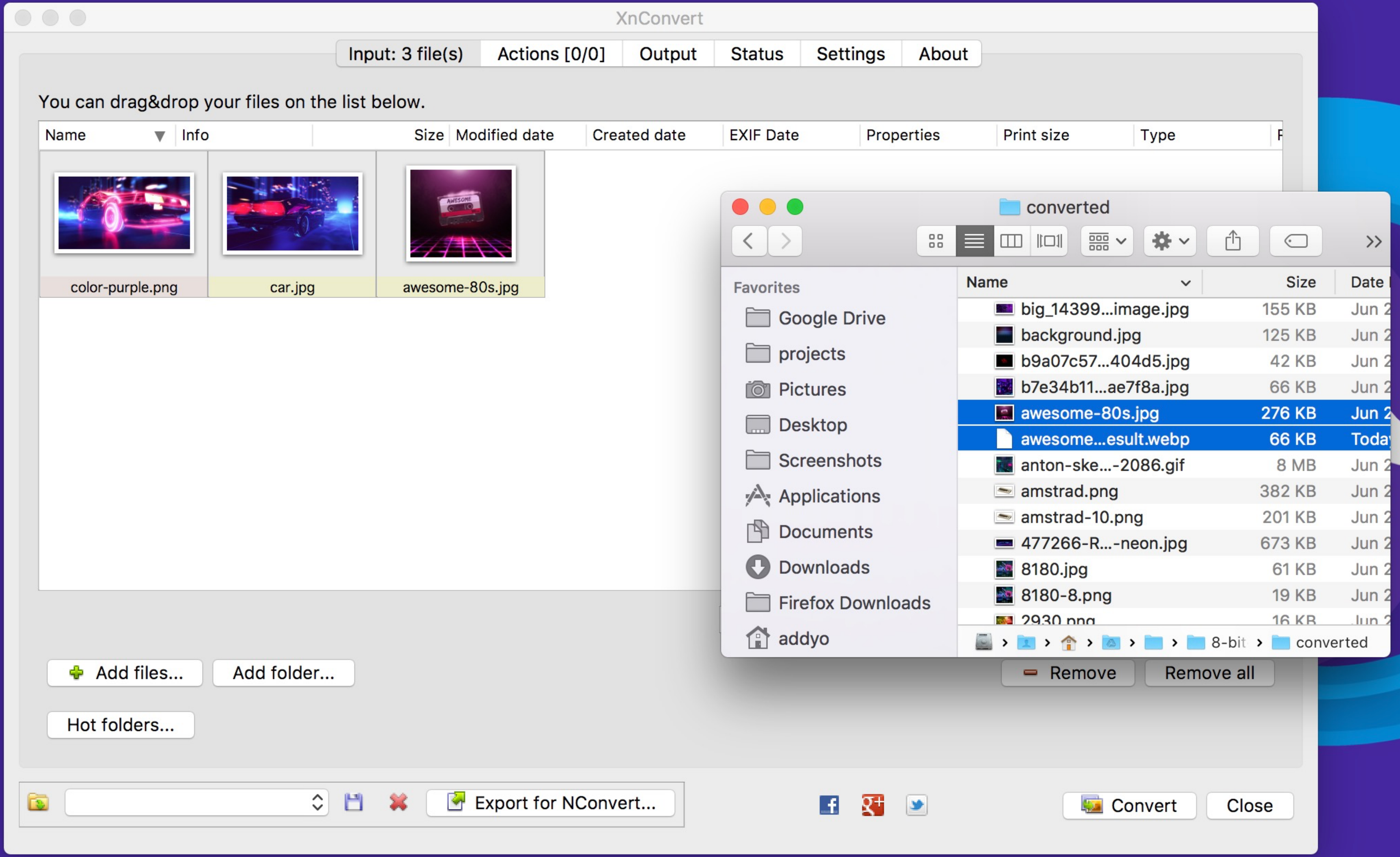
XNConvert

WebP Conversion

Windows/Mac/Linux
Can convert in batch
Supports most formats

Alternatively:

imagemin
Pixelmator
ImageMagick
GIMP
Leptonica



You can drag&drop your files on the list below.

Name	Size	Date
big_14399...image.jpg	155 KB	Jun 2
background.jpg	125 KB	Jun 2
b9a07c57...404d5.jpg	42 KB	Jun 2
b7e34b11...ae7f8a.jpg	66 KB	Jun 2
awesome-80s.jpg	276 KB	Jun 2
awesome...esult.webp	66 KB	Toda
anton-ske...-2086.gif	8 MB	Jun 2
amstrad.png	382 KB	Jun 2
amstrad-10.png	201 KB	Jun 2
477266-R...-neon.jpg	673 KB	Jun 2
8180.jpg	61 KB	Jun 2
8180-8.png	19 KB	Jun 2
2930.png	16 KB	Jun 2

WebP Serving

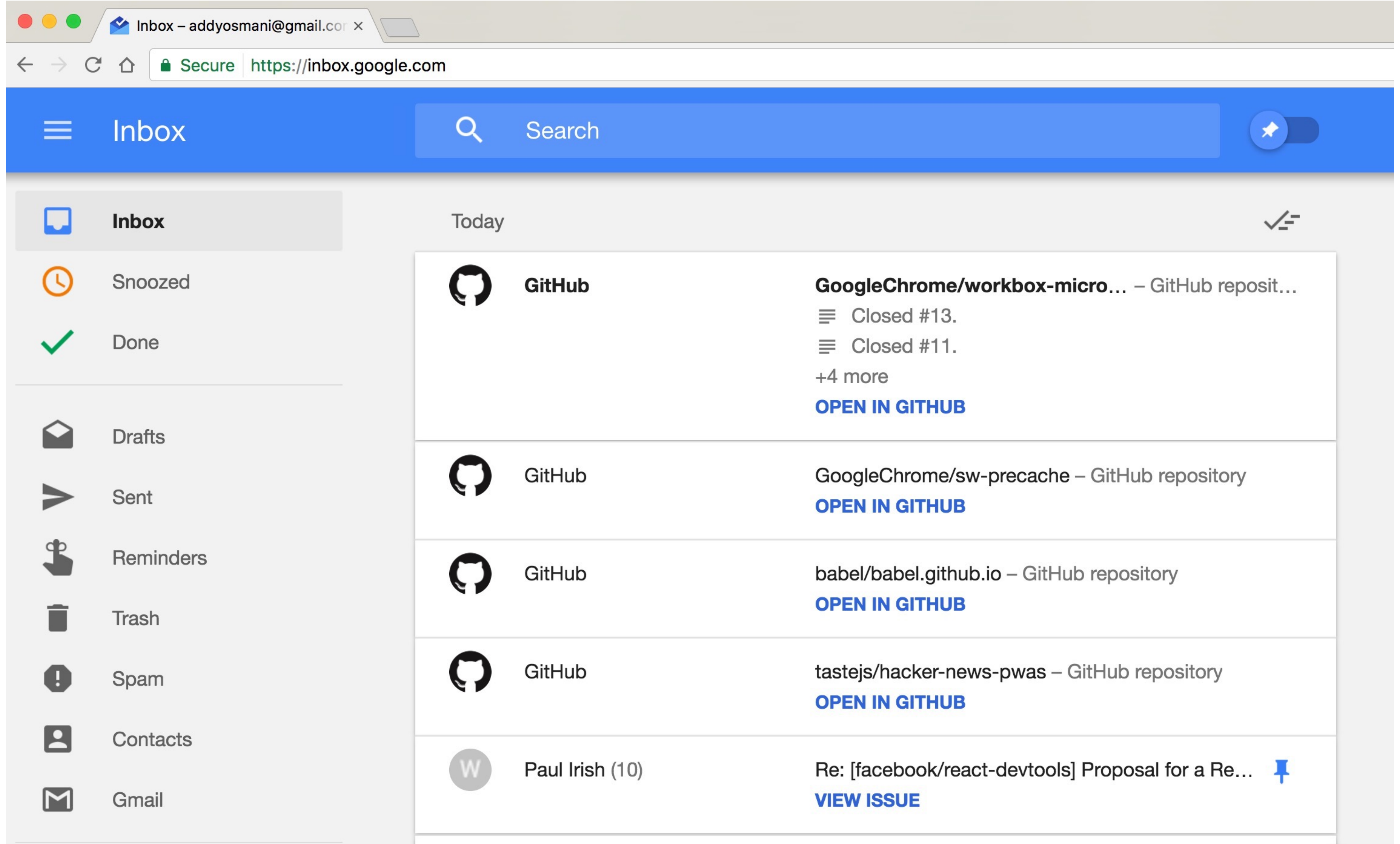
```html
<picture>
   <!-- Chrome: WebP -->
   <source srcset="photo.webp" type="image/webp">
   <!-- Edge: JPEG-XR -->
   <source srcset="photo.jxr" type="image/vnd.ms-photo">
   <!-- Safari: JPEG 2000 -->
   <source srcset="photo.jp2" type="image/jp2">
   <!-- Firefox: Fallback -->
   <img srcset="photo.jpg">
</picture>
```

Or use the Accept header + .htaccess to serve WebP if a browser supports it and it exists on disk.

10%

improvement in Time-to-Interactive

Service Workers



Today

GitHub GoogleChrome/workbox-micro… – GitHub reposit…
Closed #13.
Closed #11.
+4 more
OPEN IN GITHUB

GitHub GoogleChrome/sw-precache – GitHub repository
OPEN IN GITHUB

GitHub babel/babel.github.io – GitHub repository
OPEN IN GITHUB

GitHub tastejs/hacker-news-pwas – GitHub repository
OPEN IN GITHUB

W Paul Irish (10) Re: [facebook/react-devtools] Proposal for a Re…
VIEW ISSUE

Inbox
by Gmail

Inbox by Gmail

LOADING TIP 2

CACHE AGGRESSIVELY

HTTP Caching Checklist

bit.ly/caching-checklist

1. Use consistent URLs and minimize resource churn
2. Provide a validation token (ETag) to avoid transferring unchanged bytes
3. Identify resources that can be cached by intermediaries (like CDNs)
4. Determine the optimal cache lifetime of resources (max-age)
5. Consider a Service Worker for more control over your repeat visit caching

LOADING TIP 3

ORDER LOADING THOUGHTFULLY

Let’s hack

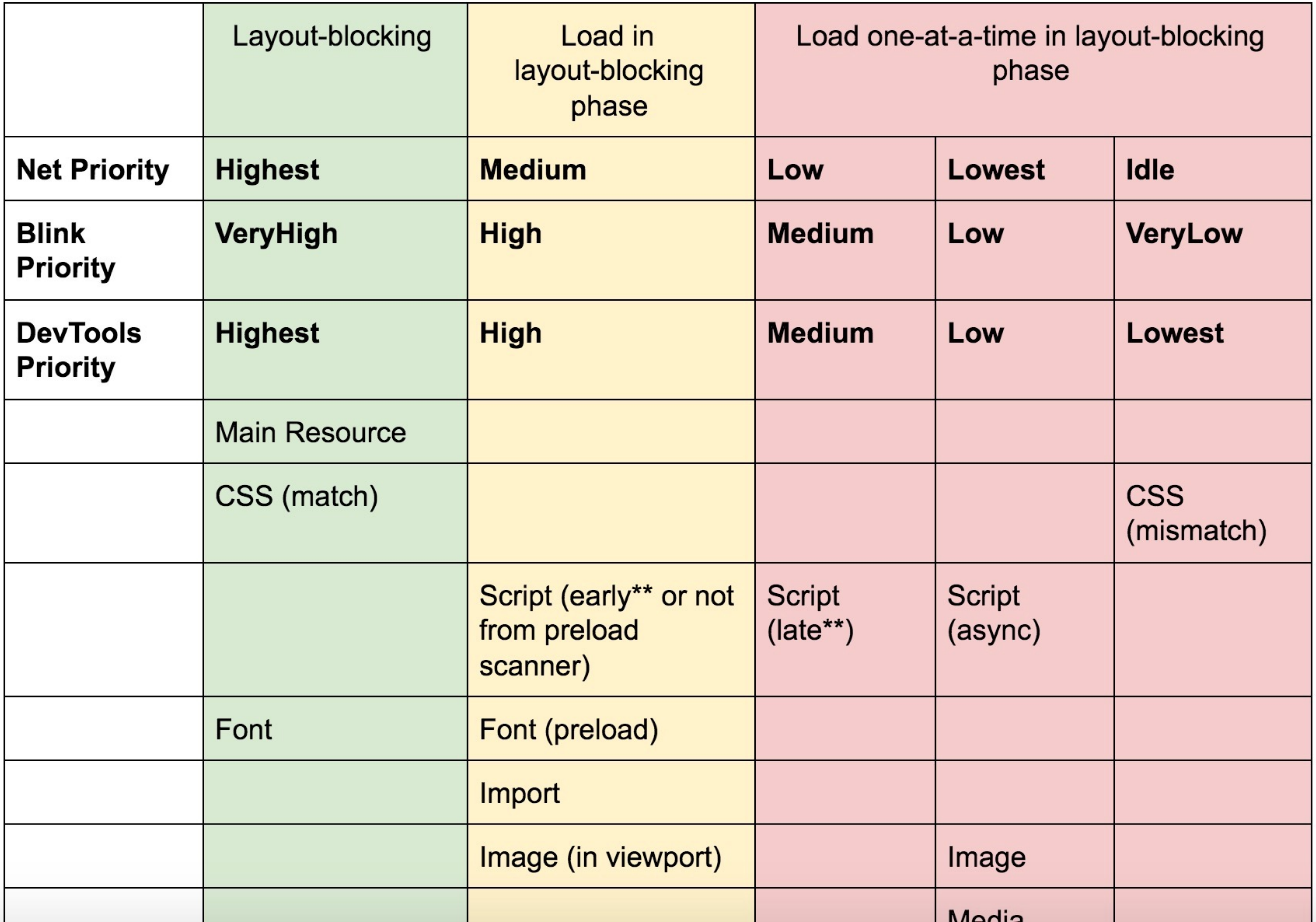
ResourceFetcher.cpp - chromium
EXPLORER
OPEN EDITORS
ResourceFetcher.cpp src/third_party/WebKit/...
CHROMIUM
MemoryCache.h
MemoryCacheCorrectnessTes...
MemoryCacheTest.cpp
PreloadKey.h
RawResource.cpp
RawResource.h
RawResourceTest.cpp
Resource.cpp
Resource.h
ResourceFetcher.h
ResourceFetcherTest.cpp
ResourceLoader.cpp
ResourceLoader.h
ResourceLoaderOptions.h
ResourceLoaderOptionsTest.c...
ResourceLoadInfo.h
ResourceLoadingLog.h
ResourceLoadPriority.h
ResourceLoadTiming.cpp
ResourceFetcher.cpp ×
⊗ 0 ⚠ 0
Ln 139, Col 42 Spaces: 2 UTF-8 LF C++

```
ResourceLoadPriority TypeToPriority(Resource::Type type) {
  switch (type) {
    case Resource::kMainResource:
    case Resource::kCSSStyleSheet:
    case Resource::kFont:
      // Also parser-blocking scripts (set explicitly in loadPriority)
      return kResourceLoadPriorityVeryHigh;
    case Resource::kXSLStyleSheet:
      DCHECK(RuntimeEnabledFeatures::xsltEnabled());
    case Resource::kRaw:
    case Resource::kImportResource:
    case Resource::kScript:
      // Also visible resources/images (set explicitly in loadPriority)
```

ResourceLoadPriorityVeryHigh

```
    case Resource::kImage:
    case Resource::kTextTrack:
    case Resource::kMedia:
    case Resource::kSVGDocument:
      // Also async scripts (set explicitly in loadPriority)
      return kResourceLoadPriorityLow;
    case Resource::kLinkPrefetch:
      return kResourceLoadPriorityVeryLow;
  }

  NOTREACHED();
  return kResourceLoadPriorityUnresolved;
}
```



	Layout-blocking	Load in layout-blocking phase	Load one-at-a-time in layout-blocking phase		
Net Priority	**Highest**	**Medium**	**Low**	**Lowest**	**Idle**
Blink Priority	**VeryHigh**	**High**	**Medium**	**Low**	**VeryLow**
DevTools Priority	**Highest**	**High**	**Medium**	**Low**	**Lowest**
	Main Resource				
	CSS (match)				CSS (mismatch)
		Script (early** or not from preload scanner)	Script (late**)	Script (async)	
	Font	Font (preload)			
		Import			
		Image (in viewport)		Image	
				Media	

JSConf EU 2017
2017.jsconf.eu
Person
Nexus 5X ▼ 412 × 732 75% ▼
12:29
JSCONF.EU
MAY 6-7 2017
BERLIN, GERMANY
SCHEDULE
NEWS SPEAKERS SPONSORS ABOUT SCHEDULE
Network Elements Performance Application Console Sources Memory Security »
12 ms 716 ms 1.04 s 1.05 s 1.06 s 1.19 s 1.57 s 1.69 s 1.76 s 1.95 s 2.97 s 2.99 s 3.02 s
View: □ Preserve log □ Disable cache □ Offline WebPageTest 3G (300r ▼
Filter □ Regex □ Hide data URLs All XHR JS CSS Img Media Font Doc WS Manifest Other
500 ms 1000 ms 1500 ms 2000 ms 2500 ms 3000 ms 3500 ms 4000 ms 4500 ms
Waterfall

Name	Protocol	Type	Size	Time	Priority
2017.jsconf.eu	http/1.1	document	6.9 KB	335 ms	Highest
screen.css	http/1.1	stylesheet	5.8 KB	359 ms	Highest
ekp1paj.js	h2	script	7.8 KB	374 ms	High
heroku.svg	http/1.1	svg+xml	2.0 KB	315 ms	Low
projecta.svg	http/1.1	svg+xml	1.8 KB	322 ms	Low
saucelabs.svg	http/1.1	svg+xml	2.4 KB	315 ms	Low
sencha.svg	http/1.1	svg+xml	4.2 KB	328 ms	Low
twilio.svg	http/1.1	svg+xml	1.2 KB	307 ms	Low
zalando.svg	http/1.1	svg+xml	2.3 KB	314 ms	Low
ebaytech.svg	http/1.1	svg+xml	41.3 KB	594 ms	Low
nearform.svg	http/1.1	svg+xml	2.7 KB	330 ms	Low
ableton.svg	http/1.1	svg+xml	2.0 KB	336 ms	Low
home24.svg	http/1.1	svg+xml	2.5 KB	337 ms	Low

48 requests | 491 KB transferred | Finish: 3.86 s | DOMContentLoaded: 1.91 s | Load: 3.87 s

ResourceFetcher.cpp - chromium
EXPLORER
OPEN EDITORS 1 UNSAVED
ResourceFetcher.cpp src/third_party/WebKit/...
CHROMIUM
MemoryCache.h
MemoryCacheCorrectnessTes...
MemoryCacheTest.cpp
PreloadKey.h
RawResource.cpp
RawResource.h
RawResourceTest.cpp
Resource.cpp
Resource.h
ResourceFetcher.h
ResourceFetcherTest.cpp
ResourceLoader.cpp
ResourceLoader.h
ResourceLoaderOptions.h
ResourceLoaderOptionsTest.c...
ResourceLoadInfo.h
ResourceLoadingLog.h
ResourceLoadPriority.h
ResourceLoadTiming.cpp
ResourceFetcher.cpp
0 0
Ln 150, Col 16
Spaces: 2
UTF-8
LF
C++

```cpp

ResourceLoadPriority TypeToPriority(Resource::Type type) {
  switch (type) {
    case Resource::kMainResource:
    case Resource::kCSSStyleSheet:
    case Resource::kFont:
      // Also parser-blocking scripts (set explicitly in loadPriority)
      return kResourceLoadPriorityVeryHigh;
    case Resource::kXSLStyleSheet:
      DCHECK(RuntimeEnabledFeatures::xsltEnabled());
    case Resource::kRaw:
    case Resource::kImportResource:
    case Resource::kScript:
      // Also visible resources/images (set explicitly in loadPriority)
```

ResourceLoadPriorityVeryHigh

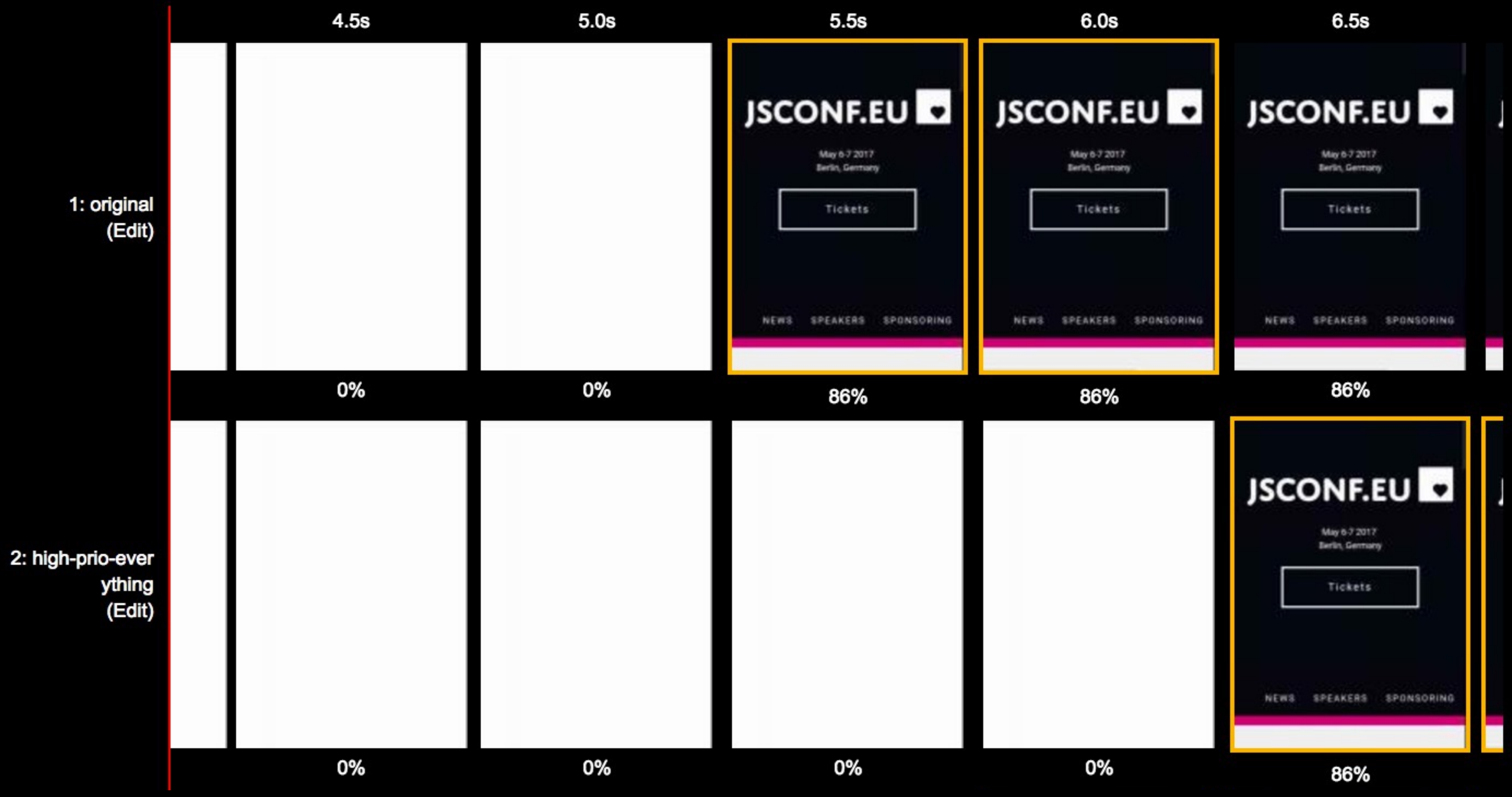
```cpp
    case Resource::kImage:
    case Resource::kTextTrack:
    case Resource::kMedia:
    case Resource::kSVGDocument:
      // Also async scripts (set explicitly in loadPriority)
      return kResourceLoadPriorityVeryHigh;
    case Resource::kLinkPrefetch:
      return kResourceLoadPriorityVeryHigh;
  }

  NOTREACHED();
  return kResourceLoadPriorityUnresolved;
```

FLUENTinium

Original

Everything is high priority

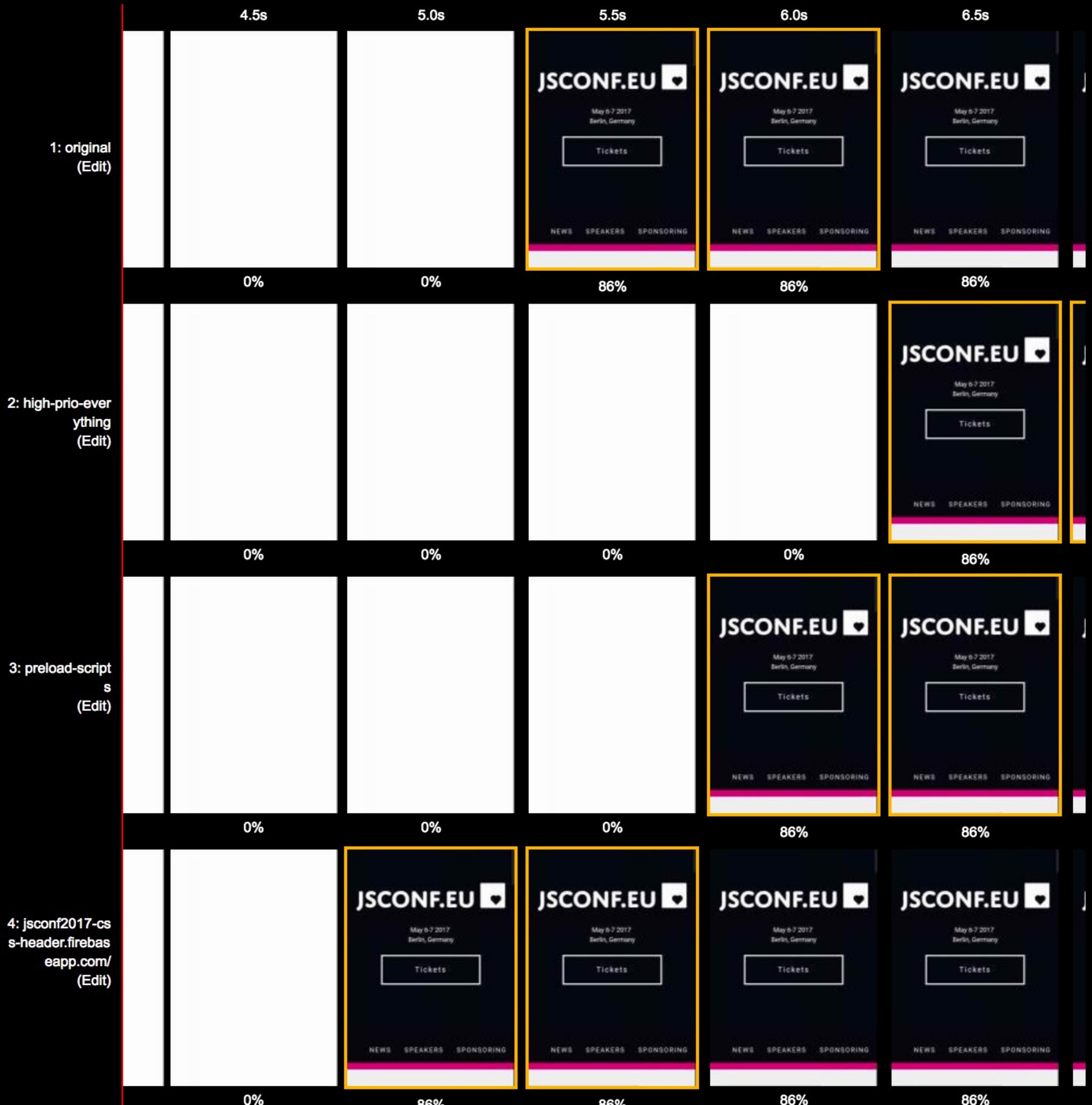


Original

Everything is high priority

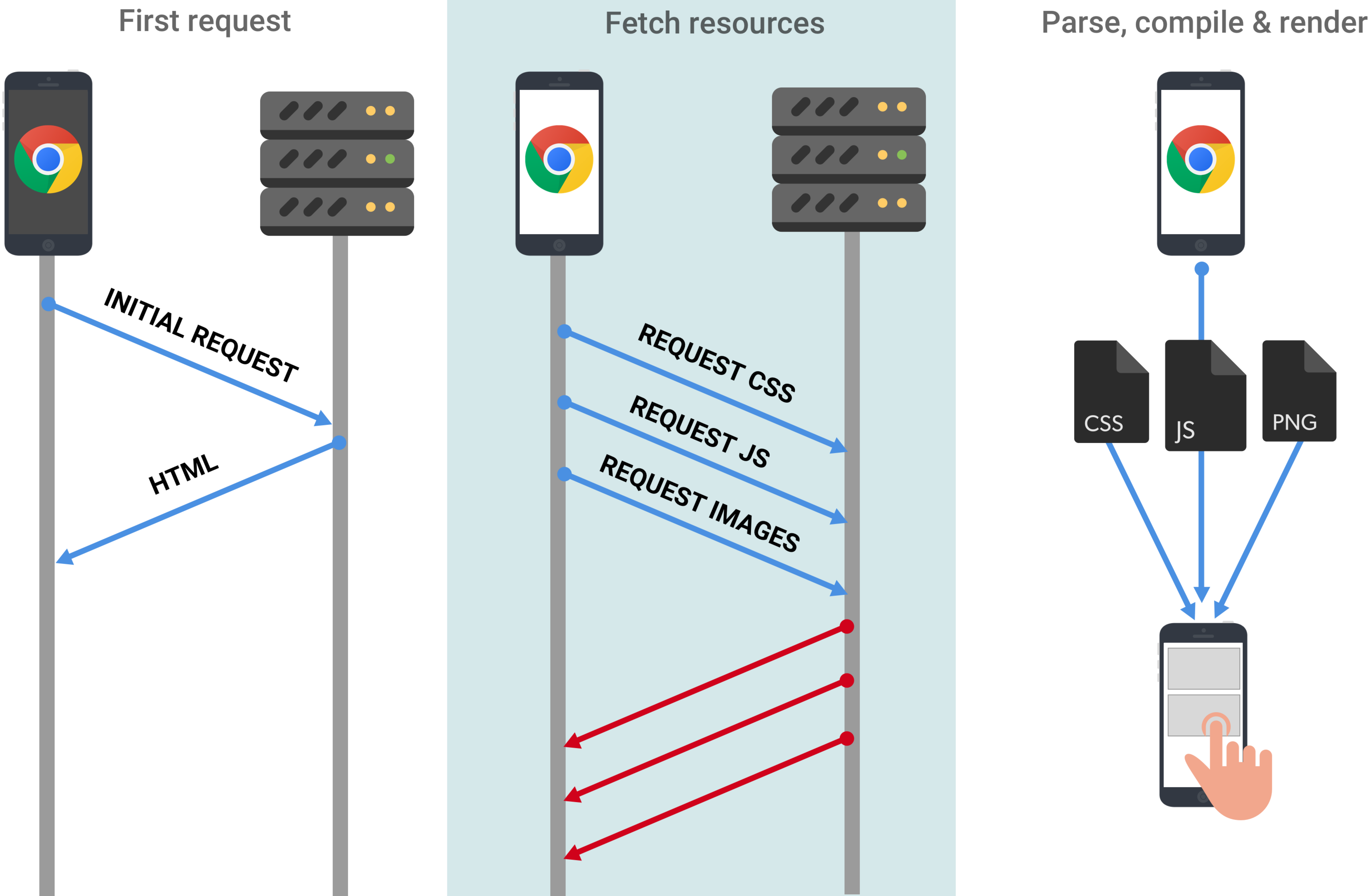
JS + CSS is high priority

CSS + fonts are high prio



	4.5s	5.0s	5.5s	6.0s	6.5s
1: original (Edit)	0%	0%	86%	86%	86%
2: high-prio-everything (Edit)	0%	0%	0%	0%	86%
3: preload-scripts (Edit)	0%	0%	0%	86%	86%
4: jsconf2017-css-header.firebaseapp.com/ (Edit)	0%	86%	86%	86%	86%

FIRST DO IT.
THEN DO IT RIGHT.
THEN DO IT BETTER.

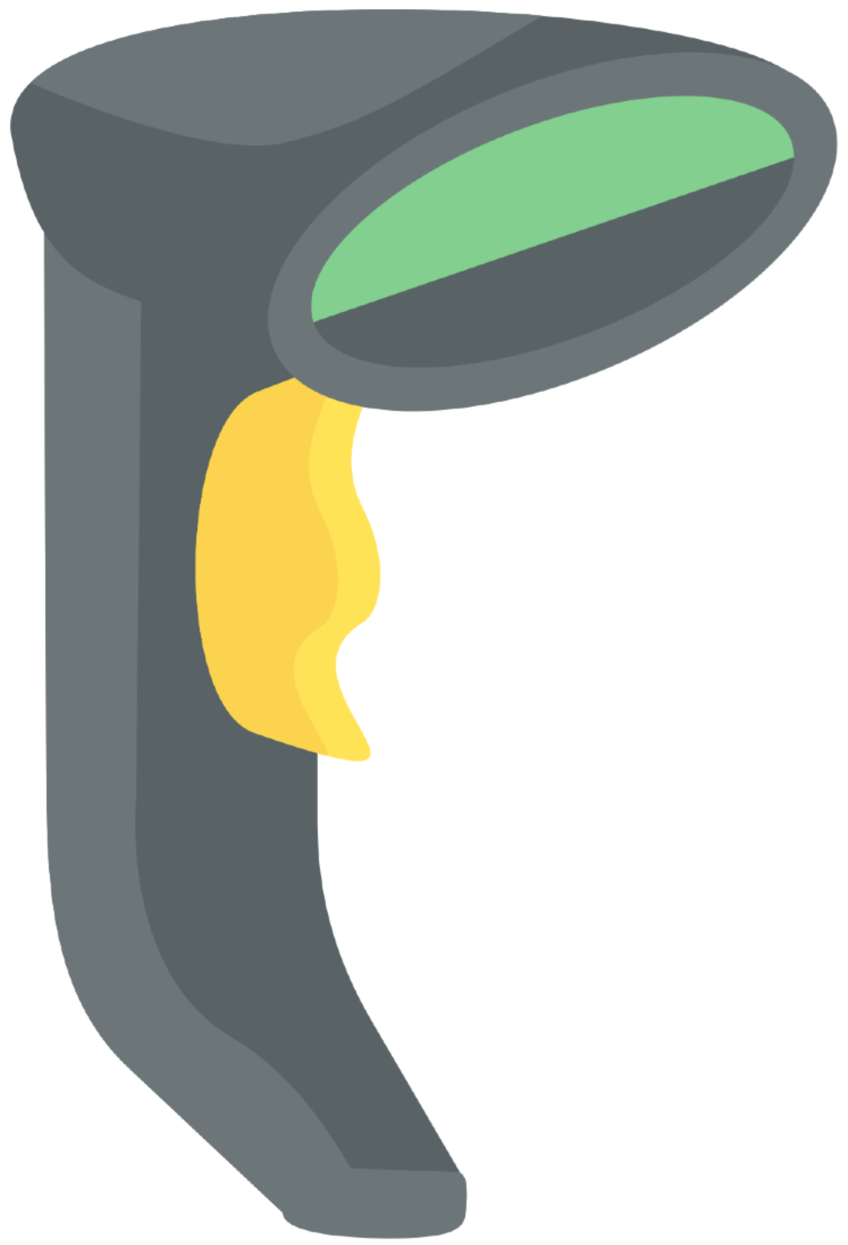


First request

Fetch resources

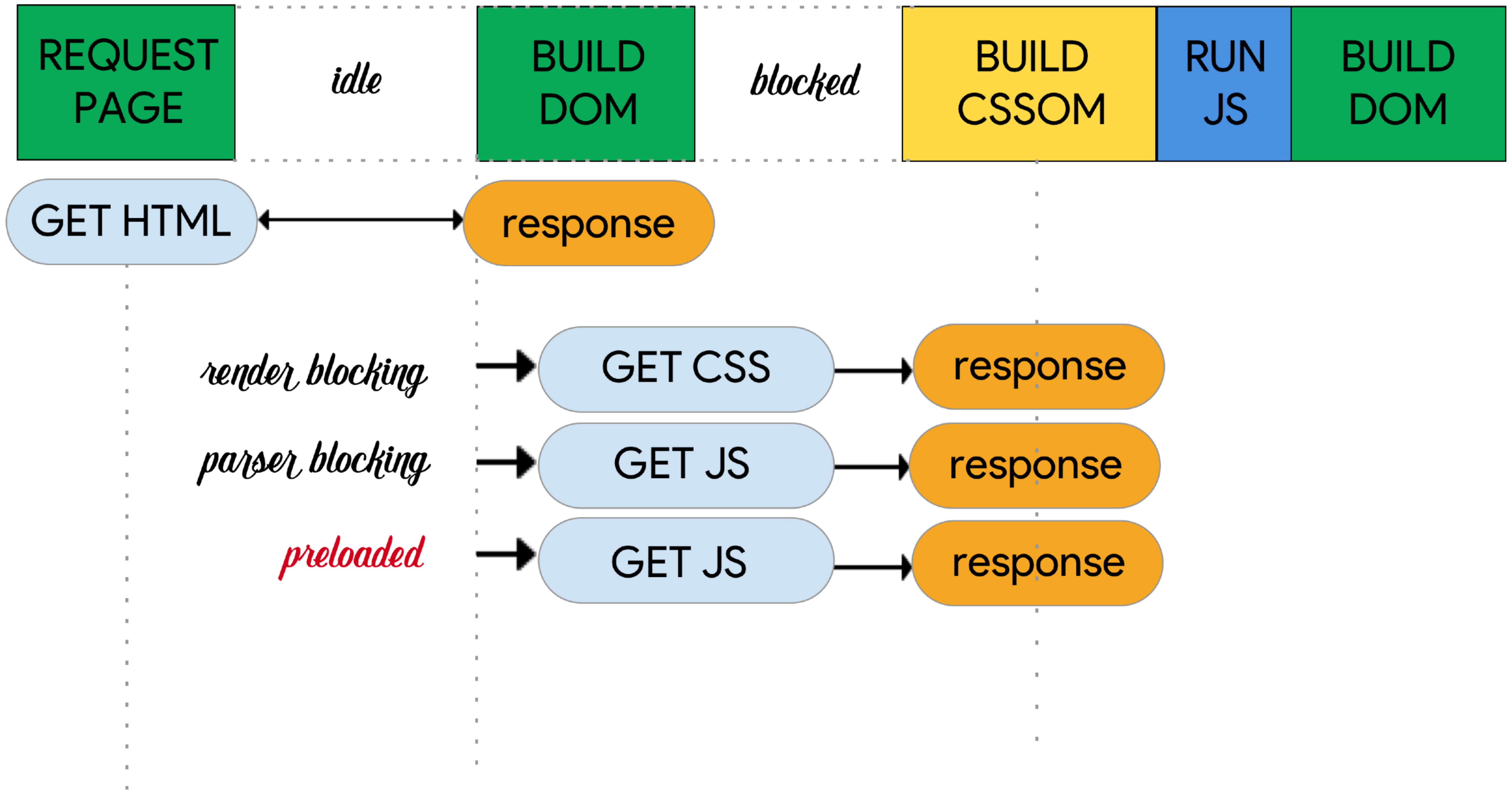
Parse, compile & render

PRELOAD SCANNER



DOCUMENT PARSER BLOCKED? PRELOAD SCANNER LOOKS AHEAD FOR RESOURCES WE CAN DOWNLOAD

```
<html>
  <head>
    <link href="style.css" rel="stylesheet">
    <script src="a.js"></script>
    <script src="b.js"></script>
  </head>
  <body>...</body>
</html>
```



REQUEST PAGE

idle

BUILD DOM

blocked

BUILD CSSOM

RUN JS

BUILD DOM

GET HTML

response

render blocking

GET CSS

response

parser blocking

GET JS

response

preloaded

GET JS

response

00.68
44.02
33.91
99.57
55.1 3
44.02
00.68
77.35
77.35
5
77.35
3.91
99.57
22.80

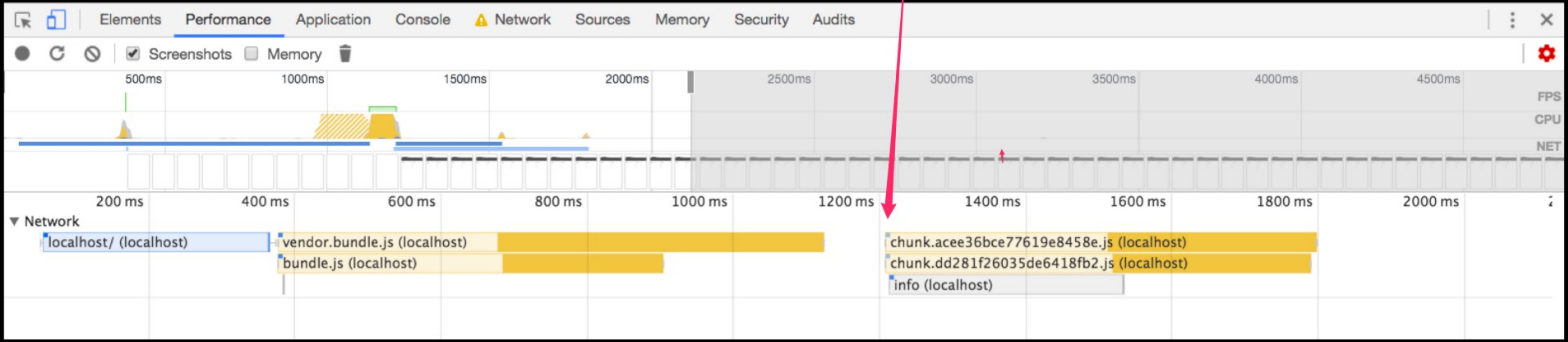
PRELOAD

<link rel=“preload”>

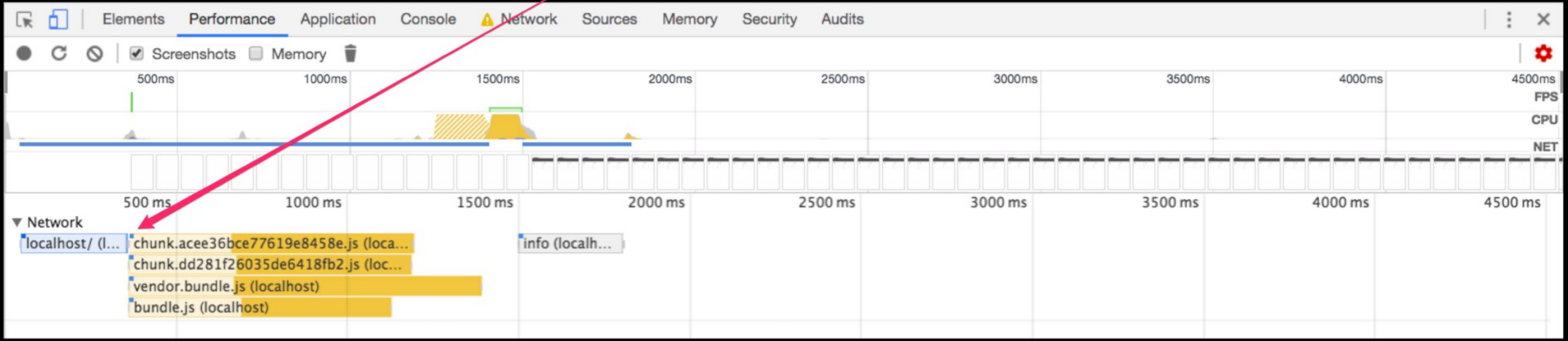
```
<head>
<link rel="preload" as="script" href="1.js">
<link rel="preload" as="script" href="2.js">
<link rel="preload" as="script" href="3.js">
..
```

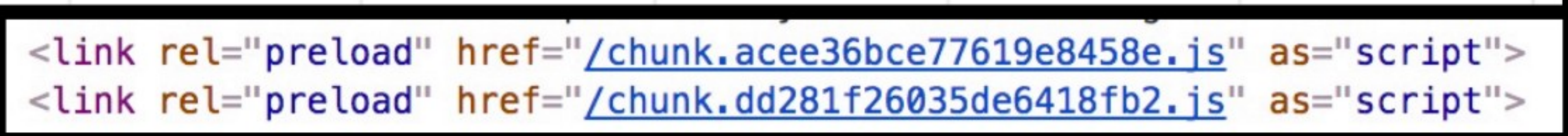
```
Link: 1.js; rel="preload"; as="script"
```

Before preload, the network request started here



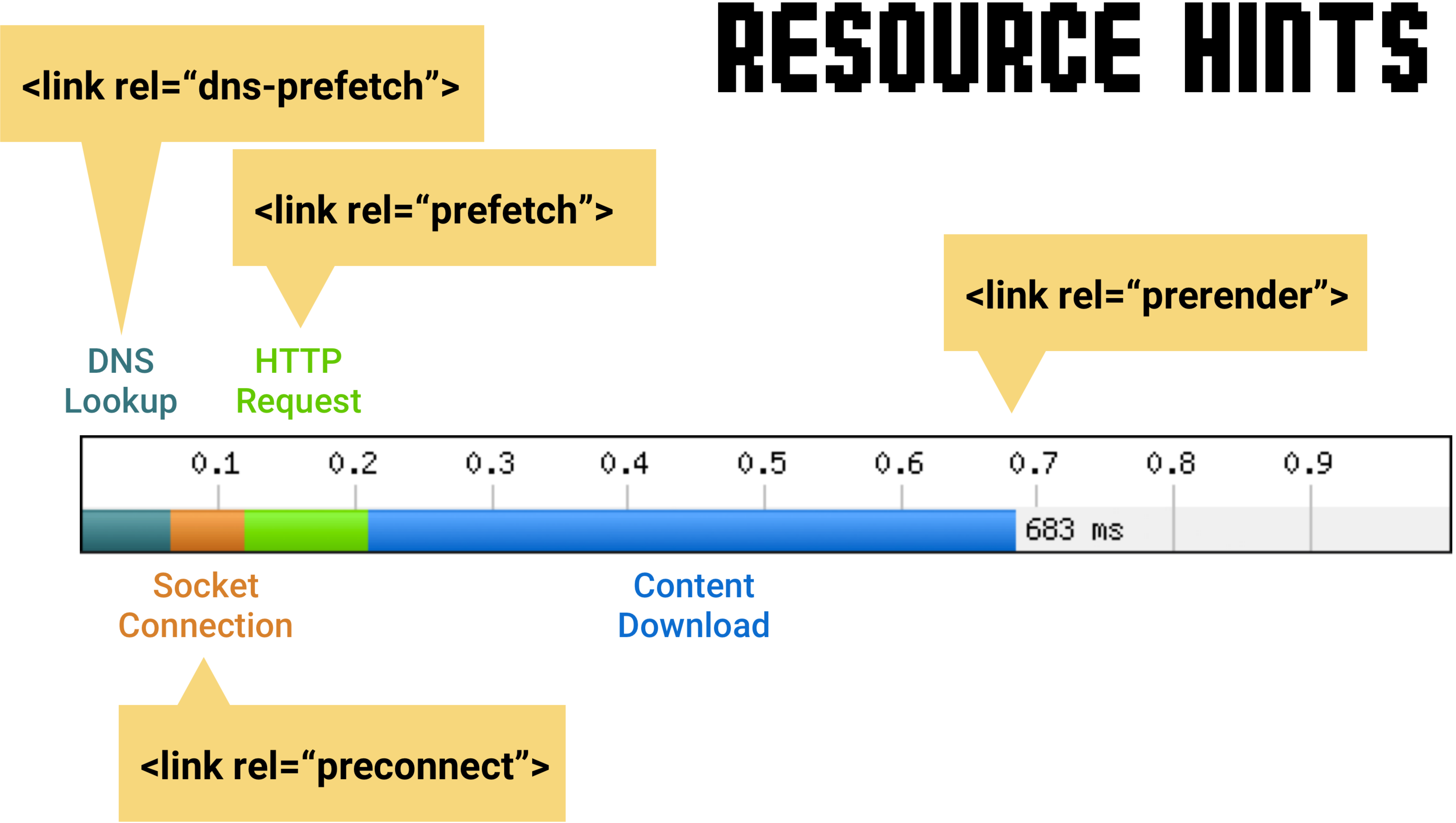
After preload, it has shifted left - right at parse time





```
<link rel="preload" href="/chunk.acee36bce77619e8458e.js" as="script">
<link rel="preload" href="/chunk.dd281f26035de6418fb2.js" as="script">
```

RESOURCE HINTS



<link rel=“dns-prefetch”>

<link rel=“prefetch”>

<link rel=“prerender”>

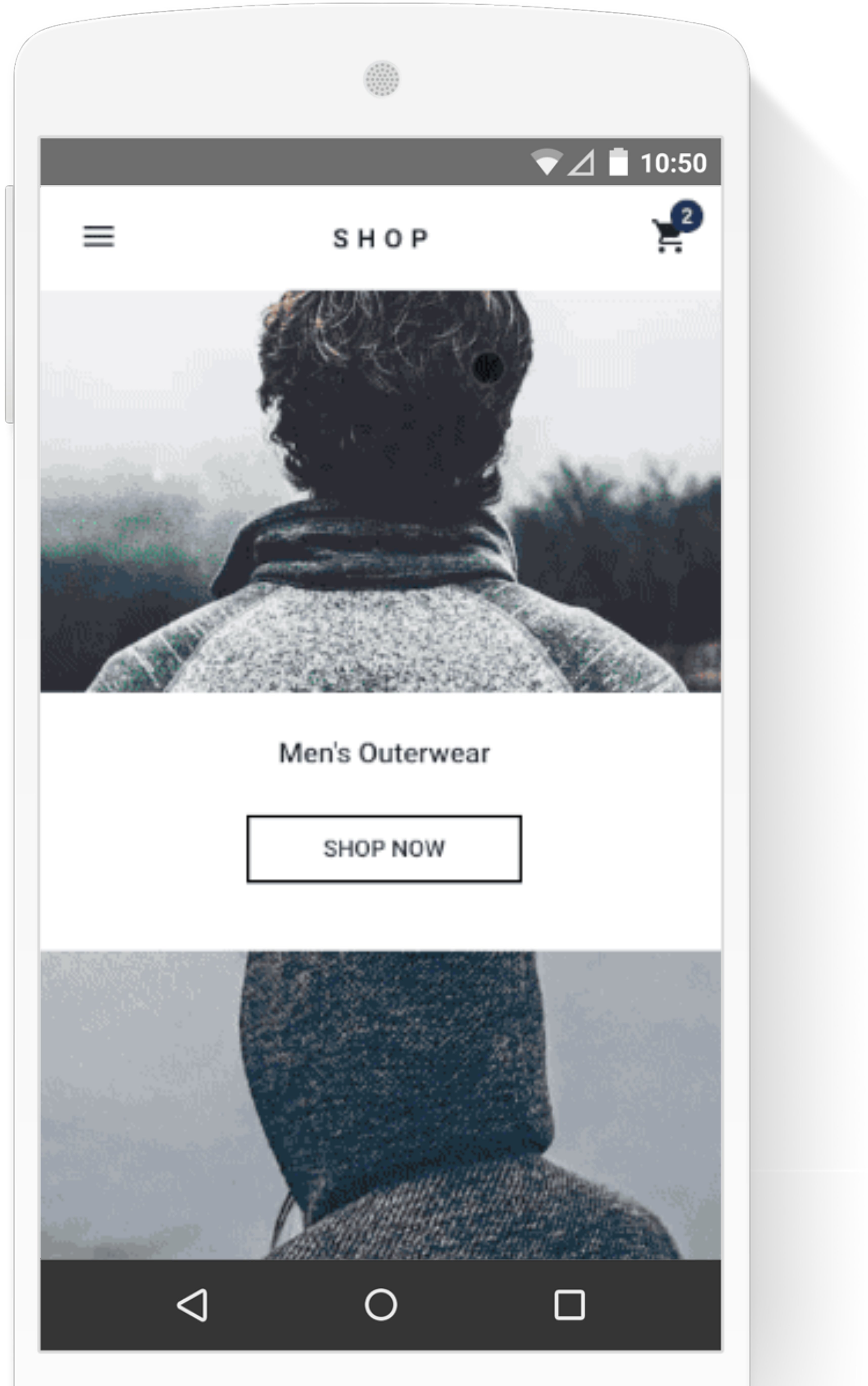
DNS Lookup

HTTP Request

Socket Connection

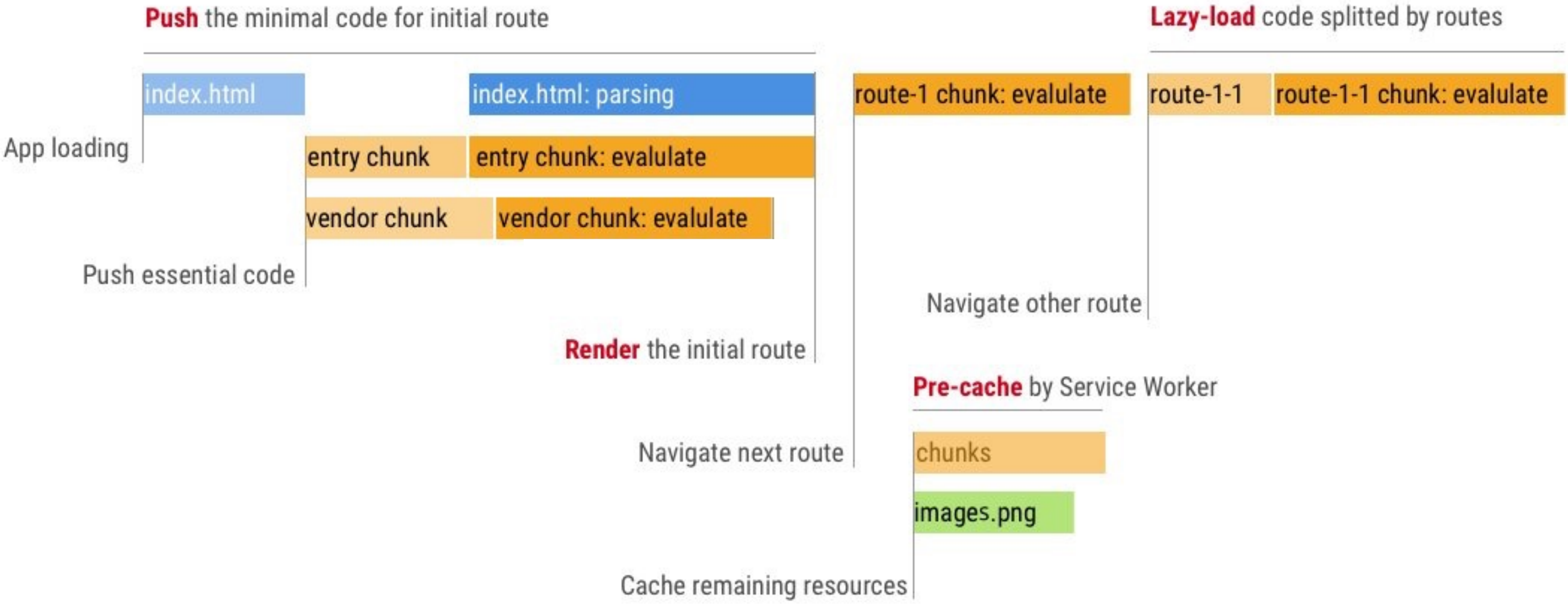
Content Download

<link rel=“preconnect”>


10:50
SHOP
2
Men's Outerwear
SHOP NOW

PRPL
PATTERN

PRPL



bit.ly/prpl-pattern

HTTP/2 with 3G

Developer Tools - https://shop.polymer-project.org/

Capture: ☑ Network ☑ JS Profile ☑ Screenshots □ Memory □ Paint

No CPU throttling

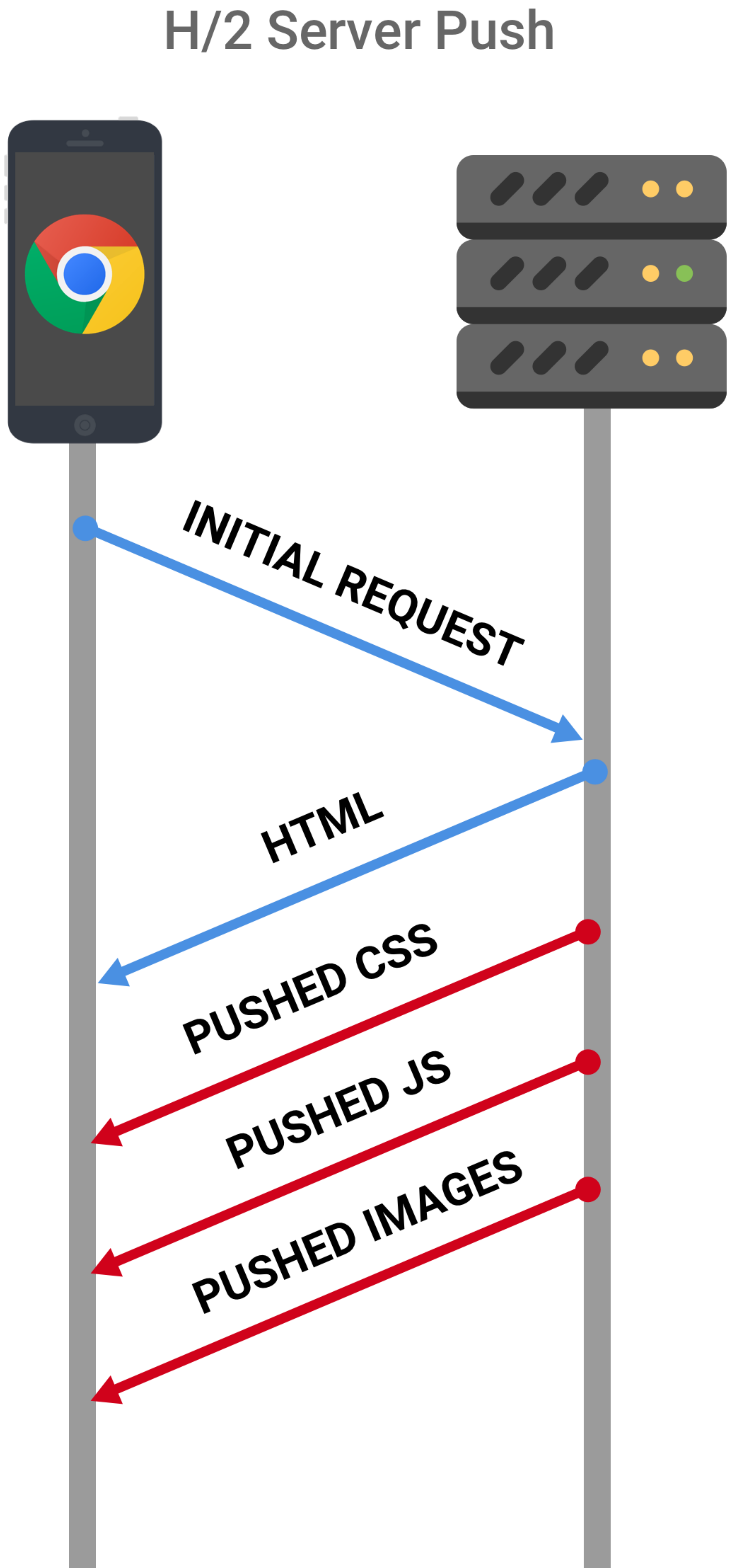
Range: 0 – 10.92s

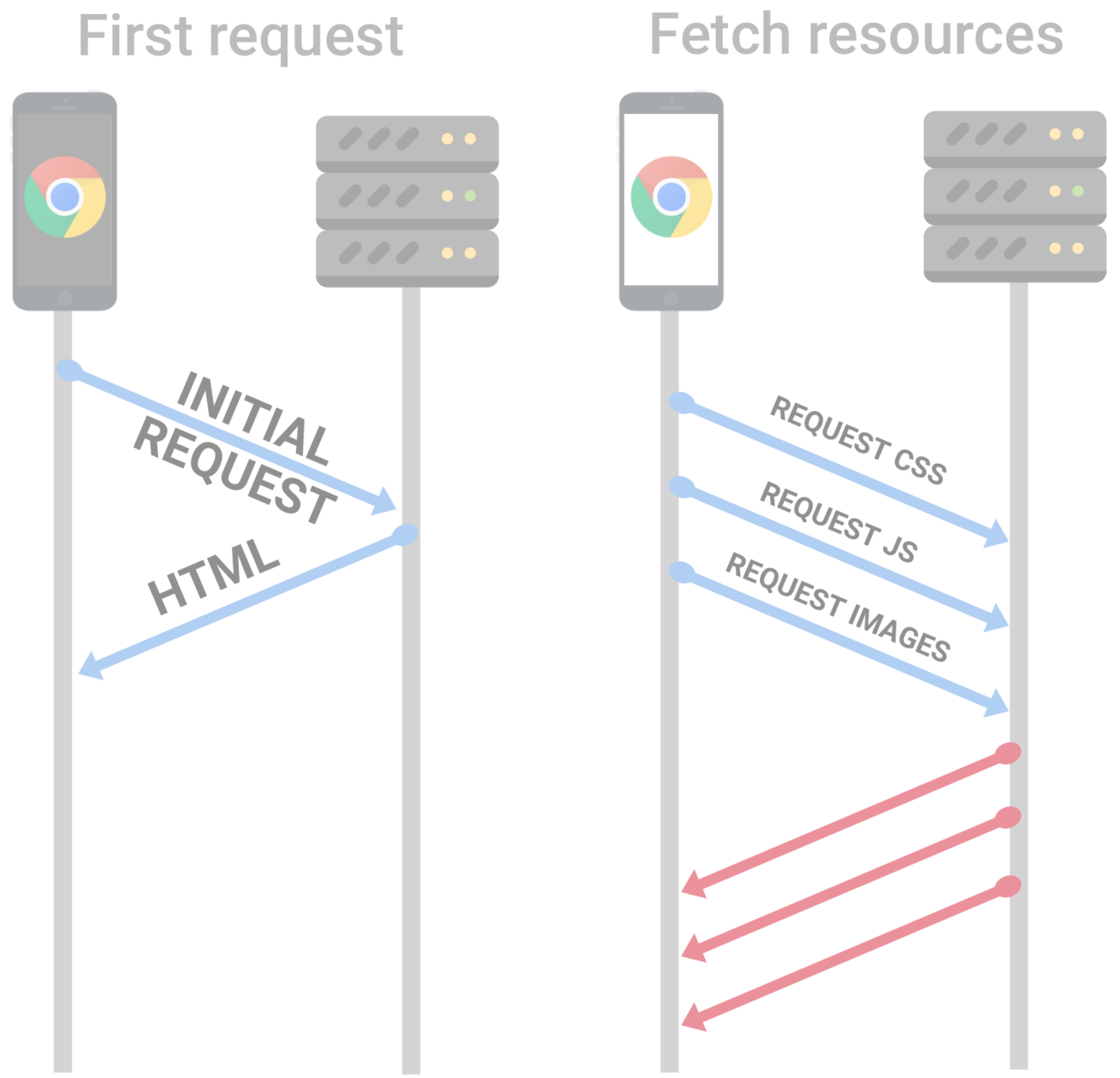
Elements
Profiles
Timeline
Network
Application
Console
Sources
Security
Audits
6
500ms
1000ms
1500ms
2000ms
2500ms
3000ms
3500ms
4000ms
4500ms
5000ms
5500ms
6000ms
6500ms
7000ms
7500ms
8000ms
8500ms
9000ms
9500ms
10000ms
10500ms
11000
FPS
CPU
NET
https://localhost/
https://lo...p-app.html
https://loc...olymer.html
https://loc...header.html
https://local...terfall.html
https://loca...oolbar.html
https://loca...elpers.html
https://loca...cation.html
https://loca...-route.html
https://loca...layout.html
https://loc...-query.html
https://loc...-pages.html
https://loca...lector.html
https://loca...y-data.html
https://loc...-home.html
https://local...er-mini.html
https://local...behavior.html
https://local...behavior.html
https://local...location.html
https://local...-params.html
https://local...behavior.html
https://local...lectable.html
https://local...lectable.html
https://local...-button.html
https://local...p-image.html
https://loca...-micro.html
https://loca...ehavior.html
https://local...lection.html
https://loca...terwear.jpg
https://loca...terwear.jpg
https://loca..._tshirts.jpg
https://loca..._tshirts.jpg
https://loc...ources.html
https:/...r.html
https:/...n.html
2973.8 ms
4370.9 ms
1055.8 ms
Interactions
Animation
Main
Summary
Bottom-Up
Call Tree
Event Log

Developer Tools - https://shop.polymer-project.org/
Elements
Profiles
Timeline
Network
Application
Console
Sources
Security
Audits
6
Capture:
☑ Network
☑ JS Profile
☑ Screenshots
☐ Memory
☐ Paint
No CPU throttling
500ms
1000ms
1500ms
2000ms
2500ms
3000ms
3500ms
4000ms
4500ms
5000ms
5500ms
6000ms
6500ms
7000ms
7500ms
8000ms
8500ms
9000ms
9500ms
FPS
CPU
NET
https://localhost/
https://localhost...ron-location.html
https://localhost/...pers/helpers.html
https://localhost...mer/polymer.html
https://localhost...polymer-mini.html
https://localhost...olymer-micro.html
https://localhost...r/app-header.html
https://localhost/...-flex-layout.html
https://localhost/...ble-behavior.html
https://localhost/...cts-behavior.html
https://localhost/...get-behavior.html
https://localhost.../shop-image.html
https://localhost/...cts/waterfall.html
https://localhost.../app-toolbar.html
https://localhost/...app-location.html
https://localhost.../shop-button.html
https://localhost...query-params.html
https://localhost/...ter-behavior.html
https://localhost/...te/app-route.html
https://localhost...-media-query.html
https://localhost/...s/iron-pages.html
https://localhost/...n-selectable.html
https://localhost/...on-selection.html
https://localhost/...iron-selector.html
https://localhost/...ti-selectable.html
https://localhost/...ategory-data.html
https://localhost...c/shop-home.html
https://localhost/src/shop-app.html
https://localh...op-icon-32.png
https://localhost...y-resources.html
https://loc...drawer.html
https://loc...button.html
https://loca...lytics.html
5754.1 ms
1514.4 ms
Interactions
Main
Summary
Bottom-Up
Call Tree
Event Log
Range: 0 – 9.60s

HTTP/2 + preload with 3G

HTTP2 PUSH





2 ROUND TRIPS

Express + HTTP/2 Push Headers

```
const express = require('express'),
let app = express();

app
  .use('/js', express.static('js'))
  .get('/', function (req, res) {
        res.set('Link',  `
        </style.css>; rel=preload; as='style',
        </js/vendor.bundle.js>; rel=preload; as='script',
        </js/app.bundle.js>; rel=preload; as='script'`)
```

Developer Tools - https://shop.polymer-project.org/

Capture: ☑ Network ☑ JS Profile ☑ Screenshots □ Memory □ Paint

No CPU throttling

https://shop.polymer-project.org/

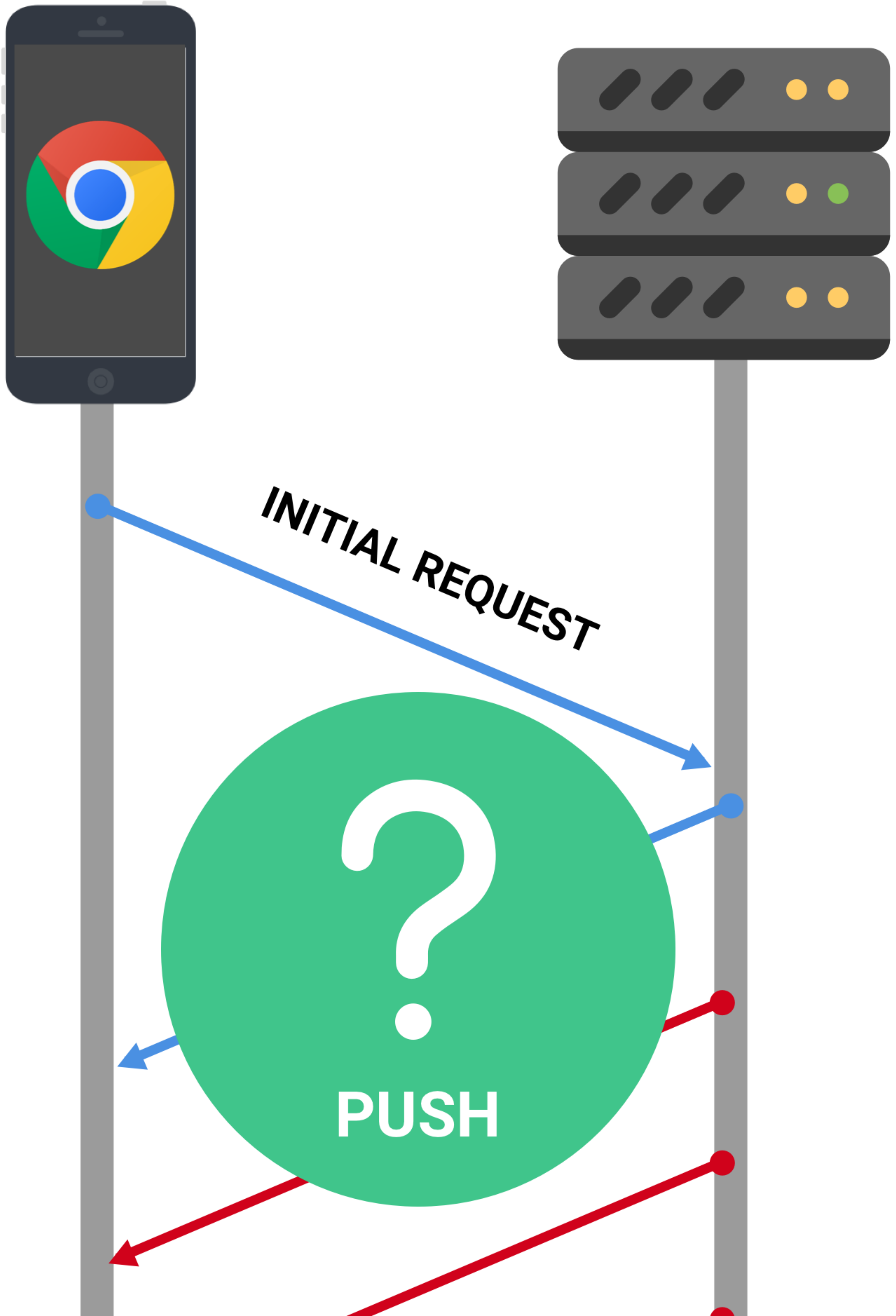
https://shop.pol...rc/shop-app.html

H/2 Push

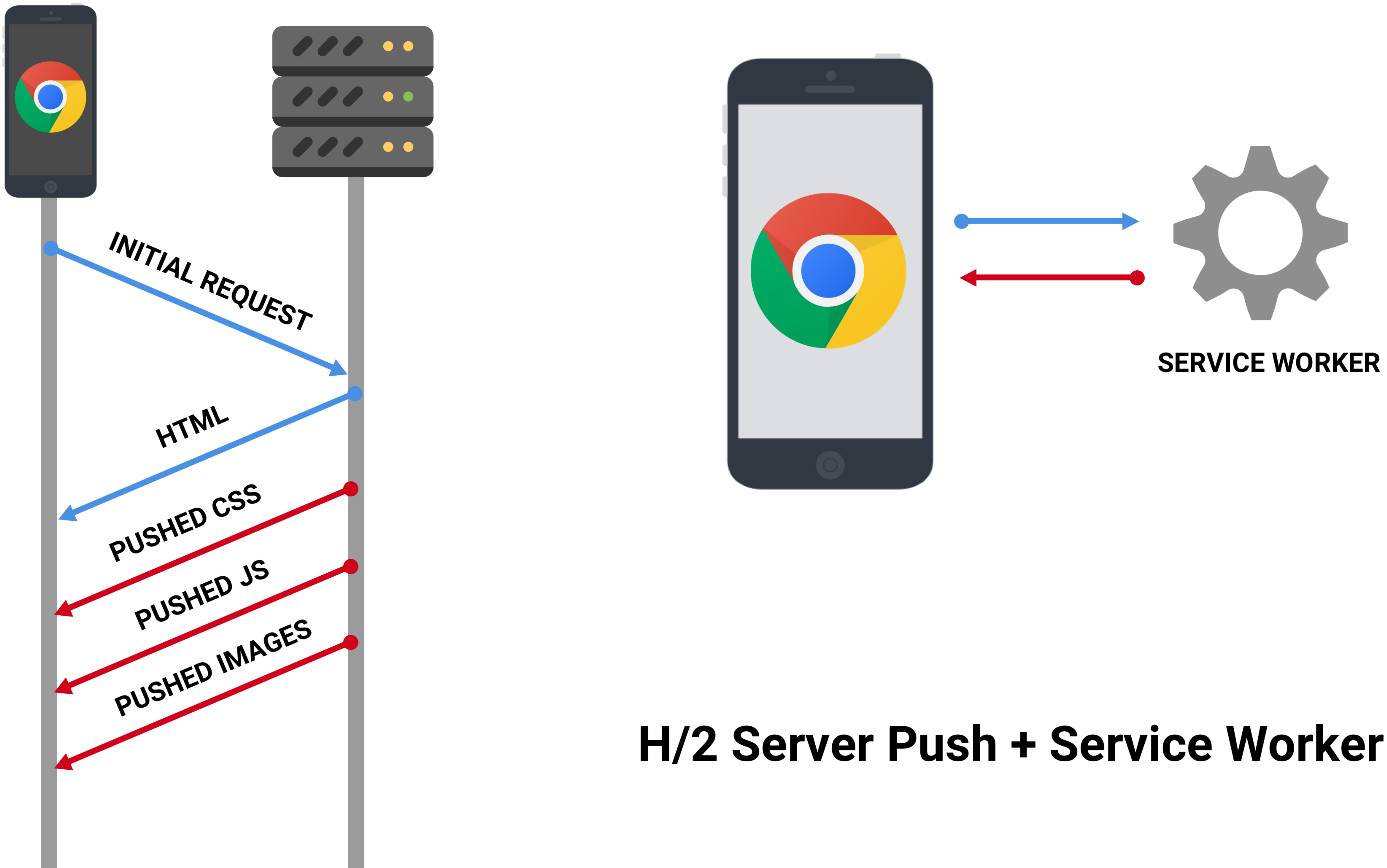
Range: 1.78s – 5.57s

Elements
Profiles
Timeline
Network
Application
Console
Sources
Security
Audits
1
500ms
1000ms
1500ms
2000ms
2500ms
3000ms
3500ms
4000ms
4500ms
5000ms
5500ms
6000ms
FPS
CPU
NET
2000 ms
2500 ms
3000 ms
4000 ms
4500 ms
5000 ms
5500 ms
3500 ms
SHOP
Men's Outerwear
SHOP NOW
Ladies Outerwear
Summary
Bottom-Up
Call Tree
Event Log

When can we run into problems?



1. Client may already have the resource
2. H/2 Push might delay response from origin



INITIAL LOAD

INITIAL REQUEST

HTML

PUSHED CSS

PUSHED JS

PUSHED IMAGES

FUTURE LOADS

SERVICE WORKER

H/2 Server Push + Service Worker

Alternatively: Track cache content using cookies

```
if (supports_http2() && !http_cached('/app.js')) {
   header('link:</app.js>;  rel=preload;  as=script’);
   setcookie('/app.js', 'is-cached', 0, '/');
}
```

Alternatively: Track cache content using cookies

```php
function http_cached($filename) {
    if ('is-cached' === $_COOKIE[$filename]) {
        return true;
    } else {
        return false;
    }
}
```

H2O

Try CASPer

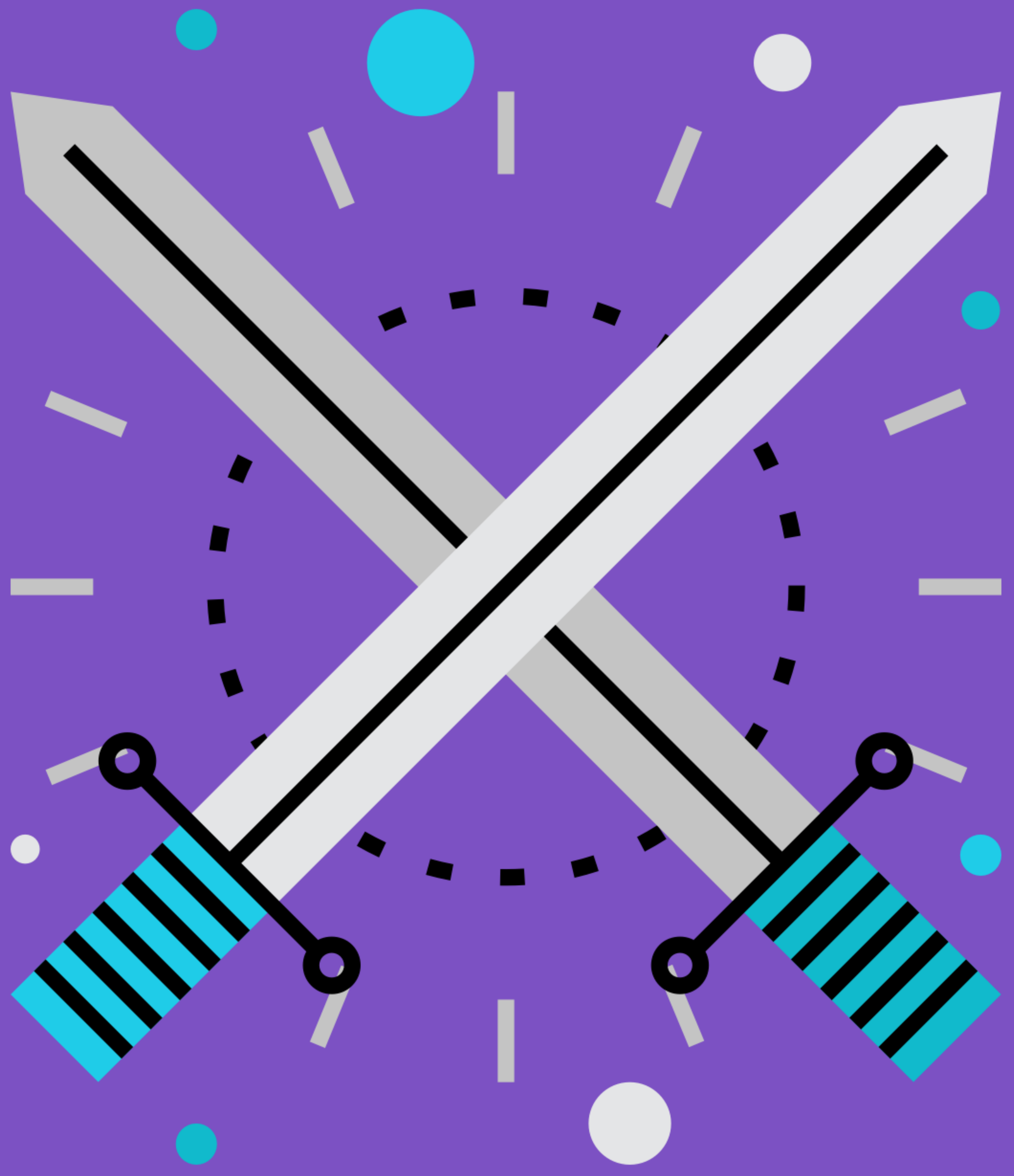
the optimized HTTP/1.x, HTTP/2 server

Push Vs. preload

Cuts out an RTT

Useful if you have a Service Worker or Cache Digests

Not cache aware
No prioritization



Move resource download time closer to initial request

Cross-origin
Cache & cookies
Load/error events
Content negotiation

Developer Tools - https://shop.polymer-project.org/
Elements
Performance
Network
Application
Console
Sources
Memory
Security
Audits
2
☑ Screenshots
□ Memory
200 ms
400 ms
600 ms
800 ms
1000 ms
1200 ms
1400 ms
1600 ms
1800 ms
2000 ms
2200 ms
2400 ms
2600 ms
2800 ms
3000 ms
FPS
CPU
NET
20 ms
40 ms
60 ms
80 ms
100 ms
120 ms
140 ms
160 ms
180 ms
200 ms
220 ms
240 ms
260 ms
280
Network
sho…
poly…
ap…
wa…
ap…
hel…
ap…
ap…
iro…
iro…
iro…
ir…
sh…
sh…
i…
ap…
i…
i…
ap…
iro…
iro…
sh…
sh…
po…
app-d
pape
shop-
shop-
shop
sho
sho
sho
sho
Frames
31.3 ms
48.5 ms
69.5 ms
71.0 ms
Interactions
Main
Ev…)
Layout
Eval…:1)
(…)
Evaluate Script (shop-app.html:298)
(anonymous)
D…)
Summary
Bottom-Up
Call Tree
Event Log

Repeat visit with Service Worker

Fully loaded from Disk Cache

Range: 0 – 274 ms

Next: Differential Serving based on browser compatibility?

HTTP/2 works better when resources are more granular (unbundled)

Serve an unbundled build for server/browser combinations supporting HTTP/2. Trigger delivery with <link rel="preload"> or HTTP/2 Push

HTTP/1 works better when resources are concatenated (bundled)

Serve a bundled build to minimize round-trips to get the app running on server/browser combinations that don't support HTTP/2 Push

Debugging: HTTP/2 Server Push in DevTools

Name

- hn.kristoferbaxter.com
- bundle.application.e61940299d08…
- favicon.png
- sw.js
- bundle.ItemHome.aa603a8d1a…
- bundle.AboutHome.77fcdd715…
- bundle.UserHome.79bca5f249…
- bundle.application.e61940299d…
- manifest.json?__uncache=5%2…
- shell?__uncache=5%2F24%2F…

10 requests | 19.9 KB transferred | Fini…

×
Headers
Preview
Response
Cookies
Timing

Queued at 136.56 ms
Started at 136.80 ms

Server Push	TIME
Receiving Push	11.71 ms
Resource Scheduling	**TIME**
Queueing	0.24 ms
Request/Response	**TIME**
Reading Push	3.72 ms
Explanation	**4.46 ms**

Debugging: HTTP/2 Server Push in DevTools

View:
☐ Preserve log
☐ Disable cache
☐ Offline
No throttling
Filter
☐ Regex
☐ Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
10 ms
20 ms
30 ms
40 ms
50 ms
60 ms
70 ms
80 ms
90 ms
100
Name
×
Headers
Preview
Response
Cookies
Timing

link: `</image.jpg>; rel=preload; as=image`

- http2-server-push-demo.keksi.io
- image.jpg
- style.css
- main.js
- ga.js
- cloudflare.min.js
- __utm.gif?utmwv=5.6.7&utms=4&…

7 requests | 1.4 KB transferred | Finish…

```
content-type: text/html; charset=UTF-8
date: Tue, 13 Jun 2017 06:15:15 GMT
link: </image.jpg>; rel=preload; as=image
server: cloudflare-nginx
status: 200
strict-transport-security: max-age=31536000; includeSubDomains; preload
vary: Accept-Encoding
x-content-type-options: nosniff
x-frame-options: DENY
x-xss-protection: 1; mode=block
```

▼ Request Headers

HTTP/2 Server Push Rules Of Thumb

bit.ly/h2push

1. Push just enough resources to **fill idle network time**, and no more.
2. Push resources in **evaluation-dependence** order.
3. Consider using strategies to **track the client-side cache**.
4. Use the **right cookies** when pushing resources.
5. Use server push to fill the initial cwnd. Consider **preload links** to reveal remaining critical resources.

Jake Archibald wrote…

HTTP/2 push is tougher than I thought

Posted 30 May 2017

"HTTP/2 push will solve that" is something I've heard a lot when it comes to page load performance problems, but I didn't know much about it, so I decided to dig in.

HTTP/2 push is more complicated and low-level than I initially thought, but what really caught me off-guard is how inconsistent it is between browsers – I'd assumed it was a done deal & totally ready for production.

This isn't an "HTTP/2 push is a douchebag" hatchet job – I think HTTP/2 push is really powerful and will improve over time, but I no longer think it's a silver bullet from a golden gun.

Map of fetching

Between your page and the destination server there's a series of caches & things that can

Hello, I'm Jake and that is my face. I'm a developer advocate for Google Chrome.

Elsewhere

- Twitter
- Lanyrd
- Github
- Google+
- Flickr

Contact

Feel free to throw me an email, unless you're a recruiter, in which case destroy every email-capable device you own to prevent this possibility.

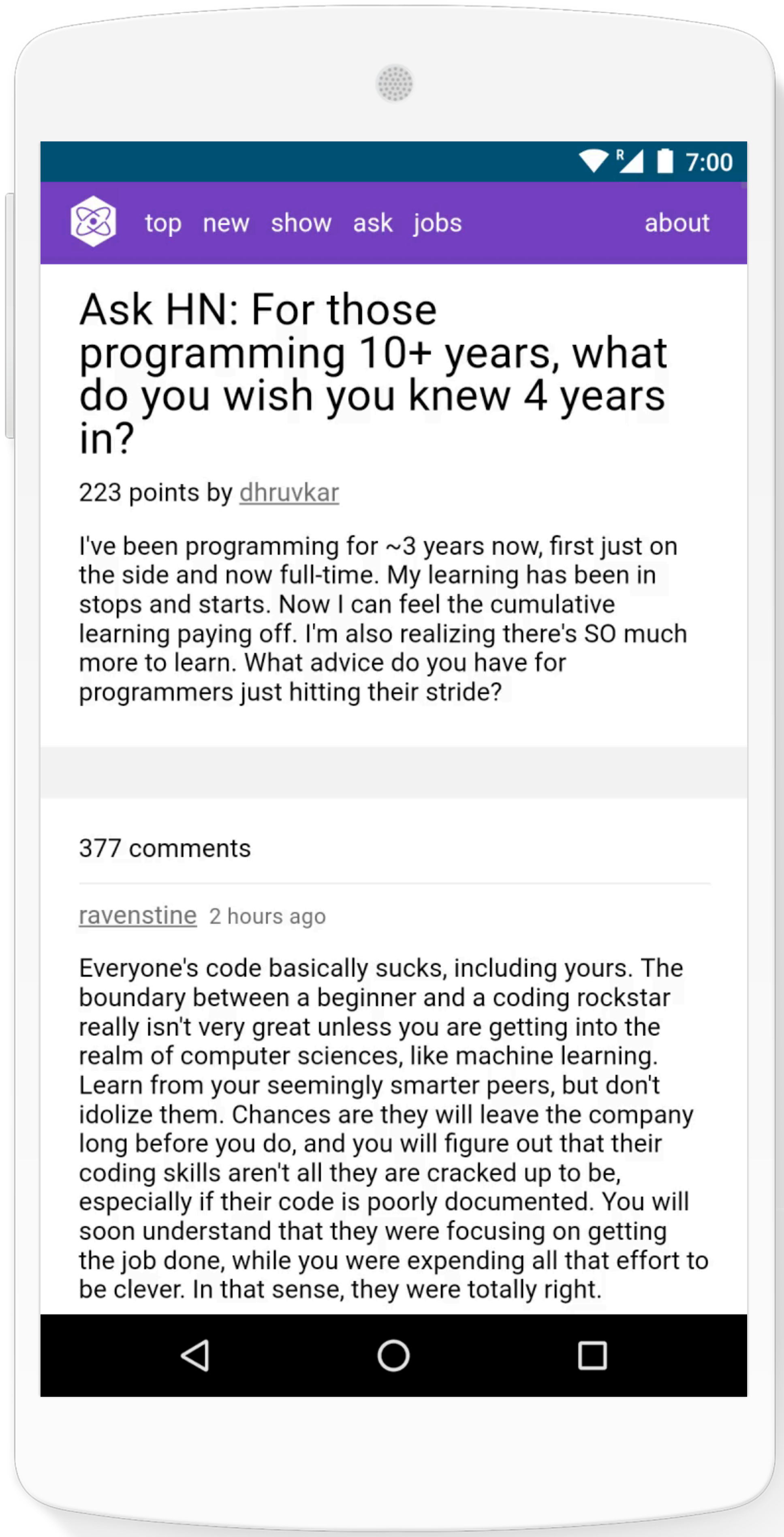
PRPL In-A-Box

Polymer App Toolbox

PREACT CLI

HNPWA

Hacker News readers as Progressive Web Apps



Ask HN: For those programming 10+ years, what do you wish you knew 4 years in?

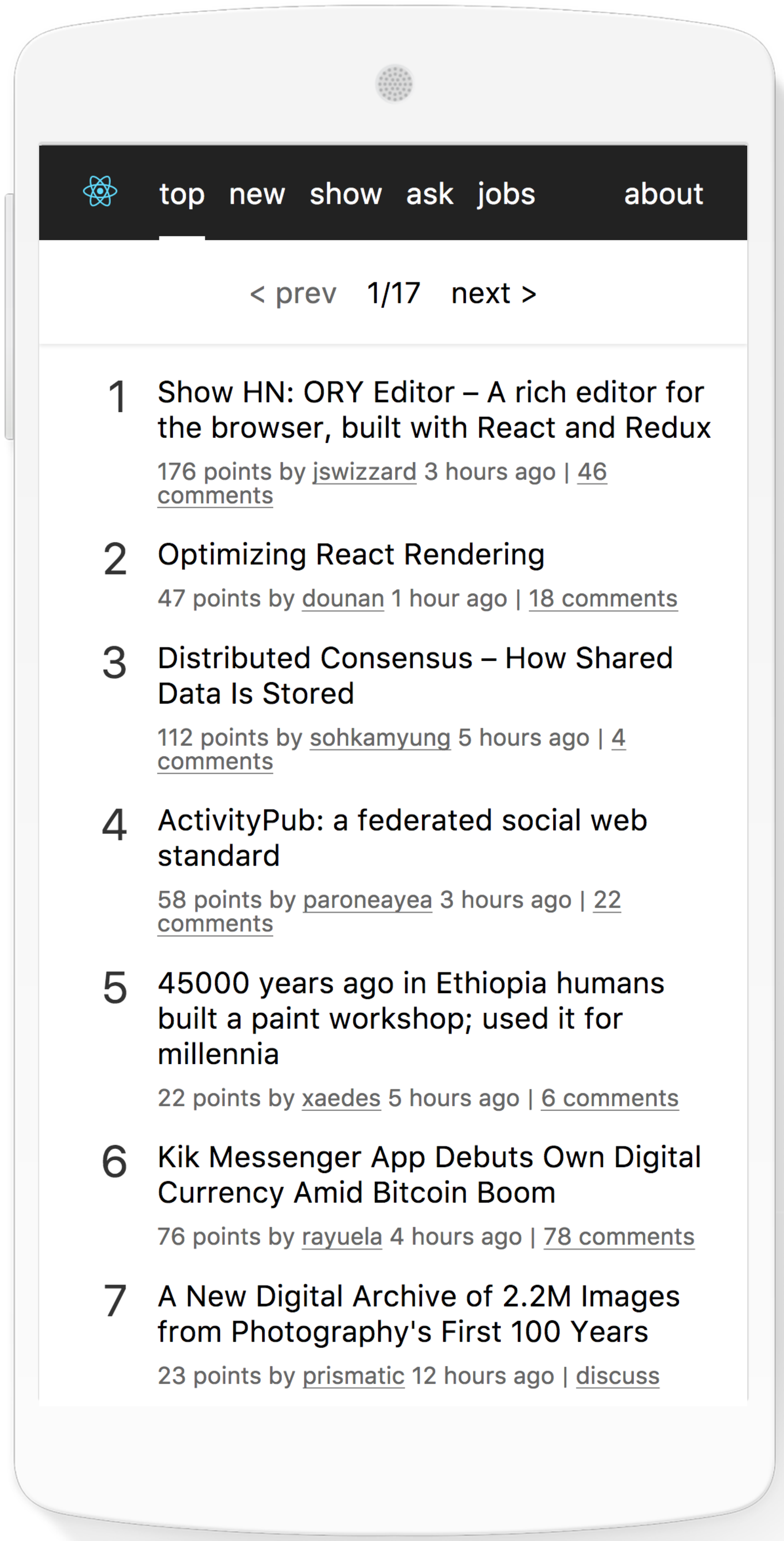
223 points by dhruvkar

I've been programming for ~3 years now, first just on the side and now full-time. My learning has been in stops and starts. Now I can feel the cumulative learning paying off. I'm also realizing there's SO much more to learn. What advice do you have for programmers just hitting their stride?

377 comments

ravenstine 2 hours ago

Everyone's code basically sucks, including yours. The boundary between a beginner and a coding rockstar really isn't very great unless you are getting into the realm of computer sciences, like machine learning. Learn from your seemingly smarter peers, but don't idolize them. Chances are they will leave the company long before you do, and you will figure out that their coding skills aren't all they are cracked up to be, especially if their code is poorly documented. You will soon understand that they were focusing on getting the job done, while you were expending all that effort to be clever. In that sense, they were totally right.



< prev 1/17 next >

1 Show HN: ORY Editor – A rich editor for the browser, built with React and Redux
176 points by jswizzard 3 hours ago | 46 comments

2 Optimizing React Rendering
47 points by dounan 1 hour ago | 18 comments

3 Distributed Consensus – How Shared Data Is Stored
112 points by sohkamyung 5 hours ago | 4 comments

4 ActivityPub: a federated social web standard
58 points by paroneayea 3 hours ago | 22 comments

5 45000 years ago in Ethiopia humans built a paint workshop; used it for millennia
22 points by xaedes 5 hours ago | 6 comments

6 Kik Messenger App Debuts Own Digital Currency Amid Bitcoin Boom
76 points by rayuela 4 hours ago | 78 comments

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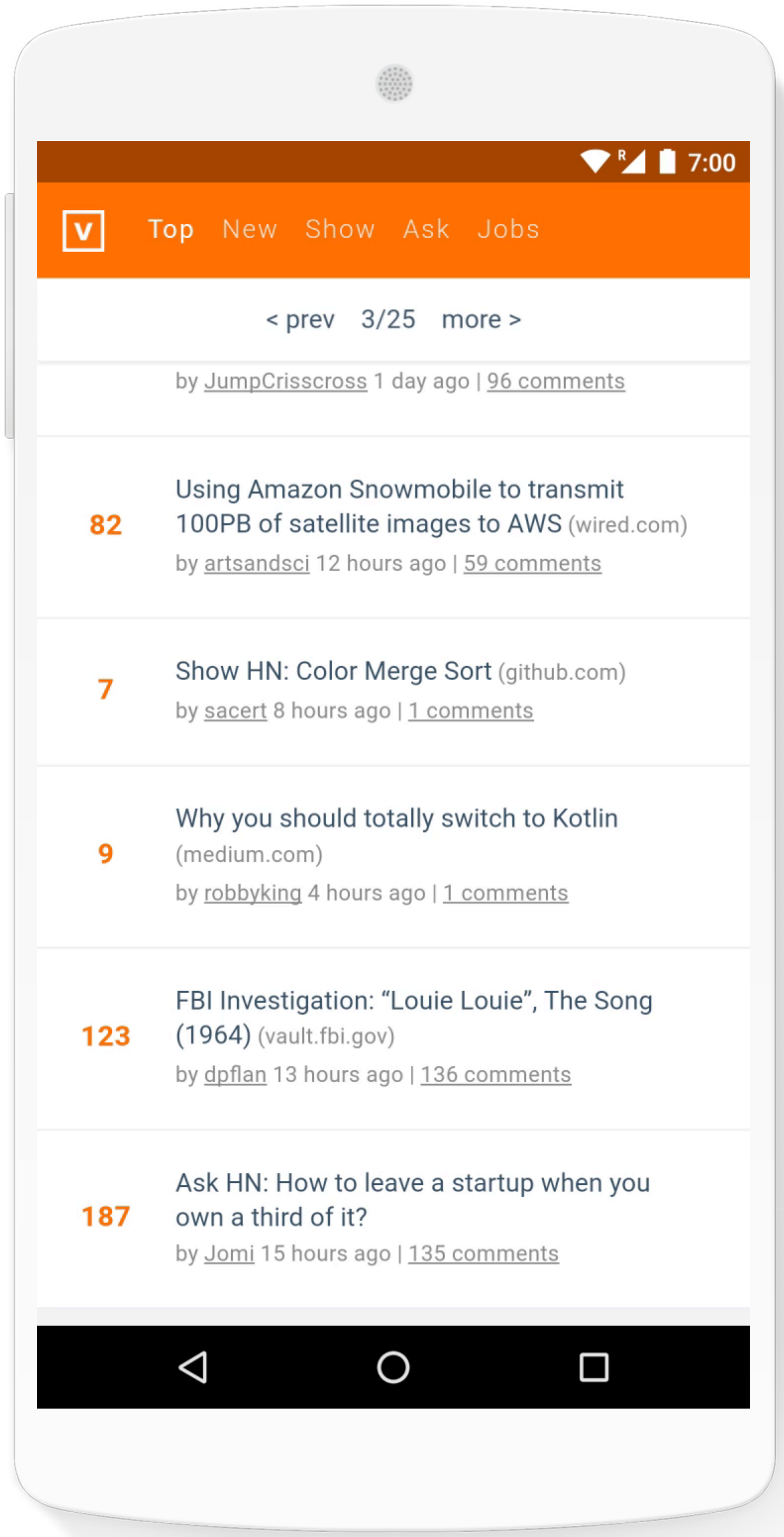
23 points by prismatic 12 hours ago | discuss



< prev 3/25 more >

by JumpCrisscross 1 day ago | 96 comments

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by artsandsci 12 hours ago | 59 comments

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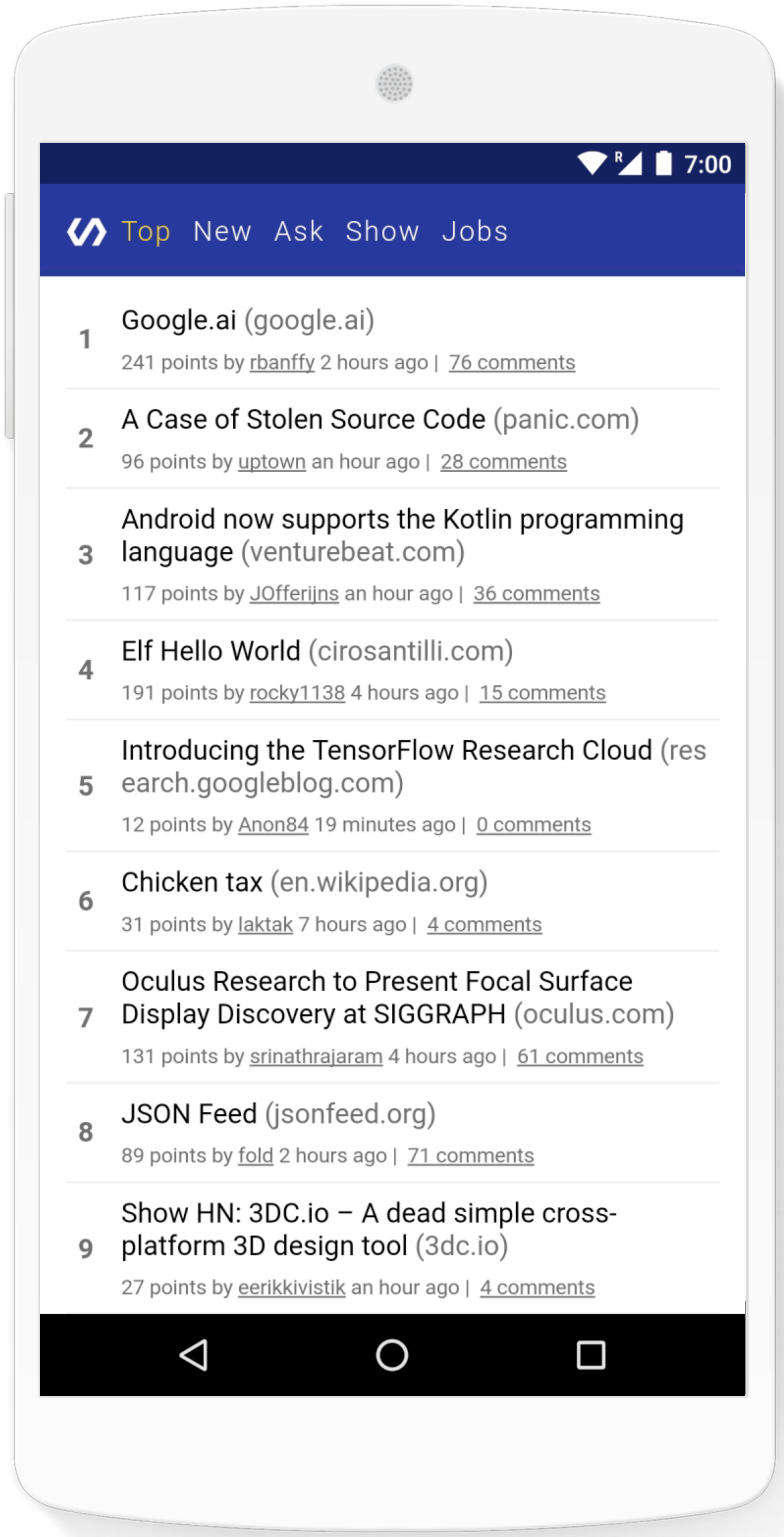
by sacert 8 hours ago | 1 comments

9 Why you should totally switch to Kotlin (medium.com)
by robbyking 4 hours ago | 1 comments

123 FBI Investigation: “Louie Louie”, The Song (1964) (vault.fbi.gov)
by dpflan 13 hours ago | 136 comments

187 Ask HN: How to leave a startup when you own a third of it?
by Jomi 15 hours ago | 135 comments



1 Google.ai (google.ai)
241 points by rbanffy 2 hours ago | 76 comments

2 A Case of Stolen Source Code (panic.com)
96 points by uptown an hour ago | 28 comments

3 Android now supports the Kotlin programming language (venturebeat.com)
117 points by JOfferijns an hour ago | 36 comments

4 Elf Hello World (cirosantilli.com)
191 points by rocky1138 4 hours ago | 15 comments

5 Introducing the TensorFlow Research Cloud (research.googleblog.com)
12 points by Anon84 19 minutes ago | 0 comments

6 Chicken tax (en.wikipedia.org)
31 points by laktak 7 hours ago | 4 comments

7 Oculus Research to Present Focal Surface Display Discovery at SIGGRAPH (oculus.com)
131 points by srinathrajaram 4 hours ago | 61 comments

8 JSON Feed (jsonfeed.org)
89 points by fold 2 hours ago | 71 comments

9 Show HN: 3DC.io – A dead simple cross-platform 3D design tool (3dc.io)
27 points by eerikkivistik an hour ago | 4 comments

HNPWA

Hacker News readers as Progressive Web Apps

Preact HN

kristoferbaxter/preact-hn

Lighthouse: 93/100

Interactive (Emerging Markets): 2.3s

Interactive (Faster 3G): 1.7s

Framework/UI libraries: Preact, Preact Router

Module bundling: Webpack

Service Worker: Application Shell with OfflinePlugin

Performance patterns:
HTTP/2 with Server Push, Brotli and Zopfli static assets

Server-side rendering: Yes

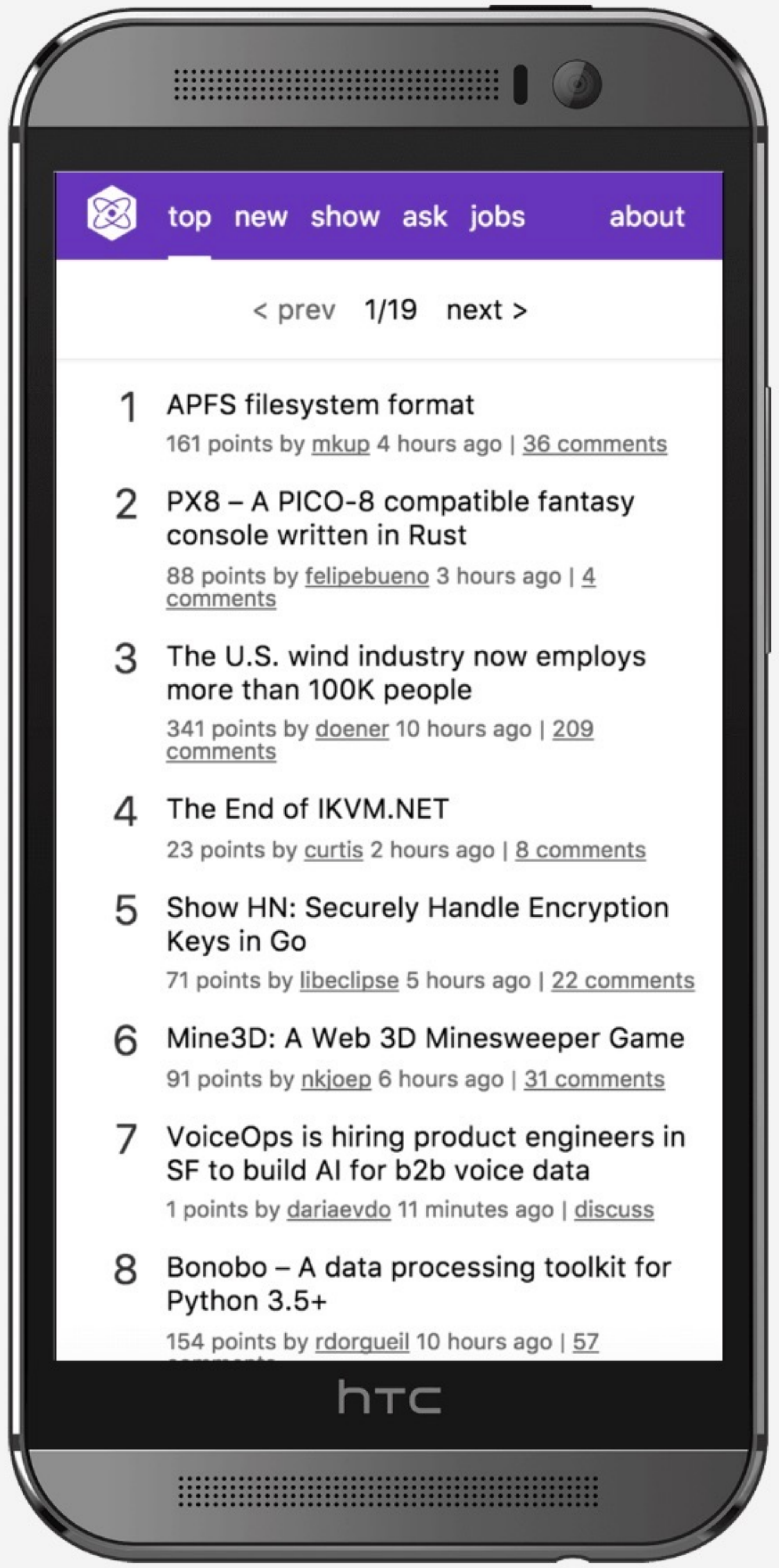
API: In-memory cached Hacker News Firebase API

Hosting: Webfaction + Cloudflare

Author:

VIEW APP

SOURCE CODE



1 APFS filesystem format
161 points by mkup 4 hours ago | 36 comments

2 PX8 – A PICO-8 compatible fantasy console written in Rust
88 points by felipebueno 3 hours ago | 4 comments

3 The U.S. wind industry now employs more than 100K people
341 points by doener 10 hours ago | 209 comments

4 The End of IKVM.NET
23 points by curtis 2 hours ago | 8 comments

5 Show HN: Securely Handle Encryption Keys in Go
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7 VoiceOps is hiring product engineers in SF to build AI for b2b voice data
1 points by dariaevdo 11 minutes ago | discuss

8 Bonobo – A data processing toolkit for Python 3.5+
154 points by rdorgueil 10 hours ago | 57

With Service Workers

Preact Hacker News

Secure https://hn.kristoferbaxter.com

Nexus 5X ▼ 412 × 732 75% ▼

12:29

top new show ask jobs about

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1 Chuck Thacker has died
115 points by mpweiher 4 hours ago | 3 comments

2 Verizon closes $4.5B acquisition of Yahoo, Marissa Mayer resigns
580 points by pyprism 9 hours ago | 305 comments

3 Modifying Microsoft Flight Simulator 4 to run on three immersive monitors
122 points by ywain 4 hours ago | 34 comments

4 Writing a Unix Shell – Part II
22 points by dhanush 1 hour ago | discuss

5 NumPy receives first ever funding, thanks to

With HTTP/2 Server Push

Preact Hacker News

Secure https://hn.kristoferbaxter.com

Nexus 5X ▼ 412 × 732 75% ▼

12:29

top new show ask jobs about

< prev 1/17 next >

1 Chuck Thacker has died
115 points by mpweiher 4 hours ago | 3 comments

2 Verizon closes $4.5B acquisition of Yahoo, Marissa Mayer resigns
580 points by pyprism 9 hours ago | 305 comments

3 Modifying Microsoft Flight Simulator 4 to run on three immersive monitors
122 points by ywain 4 hours ago | 34 comments

4 Writing a Unix Shell – Part II
22 points by dhanush 1 hour ago | discuss

5 NumPy receives first ever funding, thanks to

babel-preset-env + per-browser bundles

Name
×
Headers
Preview
Response
Cookies
Timing

- hn.kristoferbaxter.com
- bundle.application.e61940299d08…
- sw.js
- bundle.ItemHome.aa603a8d1a…
- bundle.AboutHome.77fcdd715…
- bundle.UserHome.79bca5f249…
- bundle.application.e61940299d…
- manifest.json?__uncache=5%2…
- shell?__uncache=5%2F24%2F…

9 requests | 29.1 KB transferred | Finis…

▼ **General**

Request URL: https://hn.kristoferbaxter.com/dist/chrome/bundle.application.e61940299d085eeada9e.js
Request Method: GET
Status Code: ● 200
Remote Address: [2400:cb00:2048:1::681c:797]:443
Referrer Policy: no-referrer-when-downgrade

▼ **Response Headers**

access-control-allow-credentials: true
access-control-allow-origin: *
cache-control: public, max-age=31536000
cf-cache-status: HIT
cf-ray: 36e91[illegible]ce716c4c-SJC
content-encoding: br
content-type: text/javascript
date: Wed, 14 Jun 2017 00:17:08 GMT
expires: Thu, 14 Jun 2018 00:17:08 GMT
server: cloudflare-nginx
set-cookie: __cfduid=ded1a50372cf3d6c807c164a01f4e08cc1497399428; expires=T

29KB

babel-preset-env + per-browser bundles

Ins...
C...
De...
{ } Style...
Perfor...
M...
Ne...
Scra...
All
HTML
CSS
JS
XHR
Fonts
Images
Media
Flash
WS
Other
Filter URLs
Headers
Cookies
Params
Response
Timings
Security
Edit and Resend
Raw headers
Filter headers
51KB

2 requests, 51.77 KB, 0.16 s

Status	Method	File
● 200	GET	/
● 200	GET	bundle.application.472e63e01522c

Request URL: `https://hn.kristoferbaxter.com/dist/firefox/bundle.application.472e015.`

Request method: GET

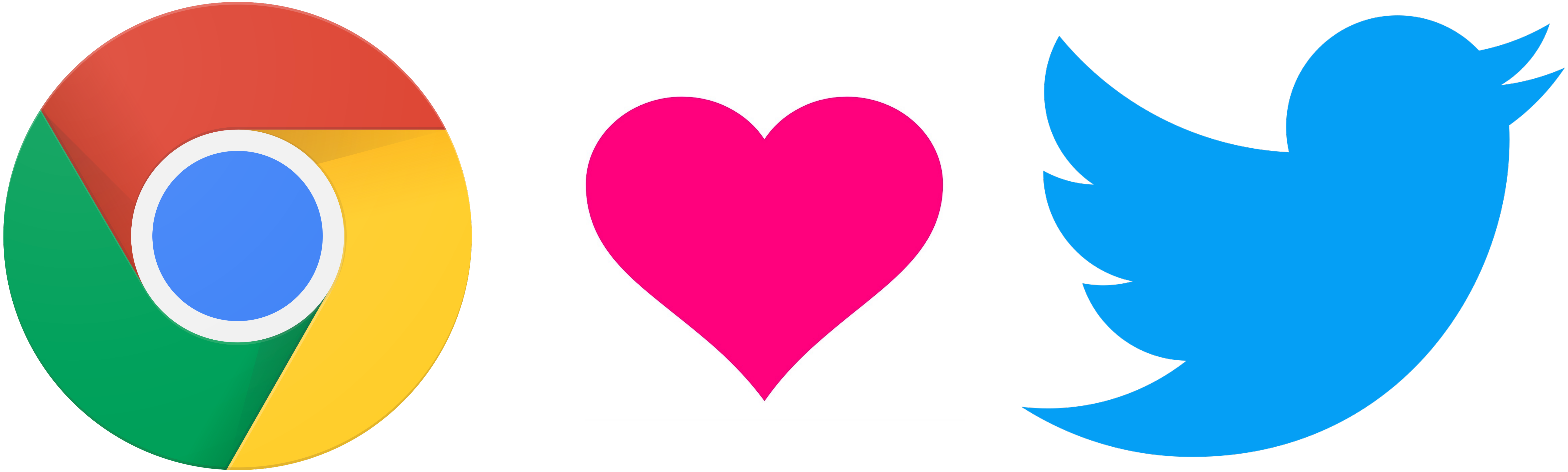
Remote address: 2400:cb00:2048:1::681c:697:443

Status code: ● 200 OK

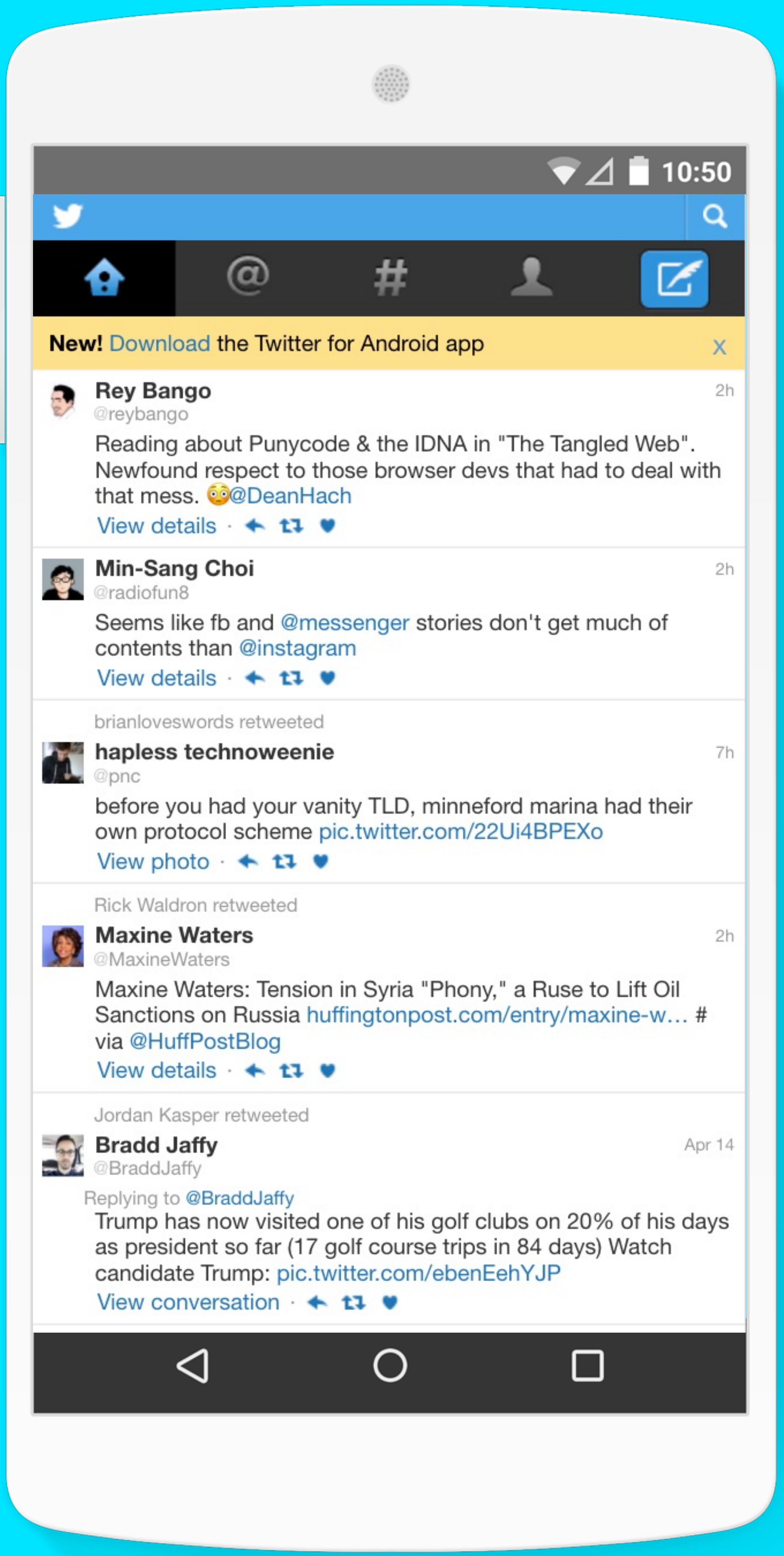
Version: HTTP/2.0

Response headers (407 B)

```
Date: "Wed, 14 Jun 2017 00:16:27 GMT"
Content-Type: "text/javascript"
Cache-Control: "public, max-age=31536000"
Timing-Allow-Origin: "*"
access-control-allow-credentials: "true"
Access-Control-Allow-Origin: "*"
Content-Encoding: "br"
```



Twitter Lite



New! Download the Twitter for Android app

Rey Bango @reybango 2h

Reading about Punycode & the IDNA in "The Tangled Web". Newfound respect to those browser devs that had to deal with that mess. 😳@DeanHach

View details

Min-Sang Choi @radiofun8 2h

Seems like fb and @messenger stories don't get much of contents than @instagram

View details

brianloveswords retweeted

hapless technoweenie @pnc 7h

before you had your vanity TLD, minneford marina had their own protocol scheme pic.twitter.com/22Ui4BPEXo

View photo

Rick Waldron retweeted

Maxine Waters @MaxineWaters 2h

Maxine Waters: Tension in Syria "Phony," a Ruse to Lift Oil Sanctions on Russia huffingtonpost.com/entry/maxine-w… # via @HuffPostBlog

View details

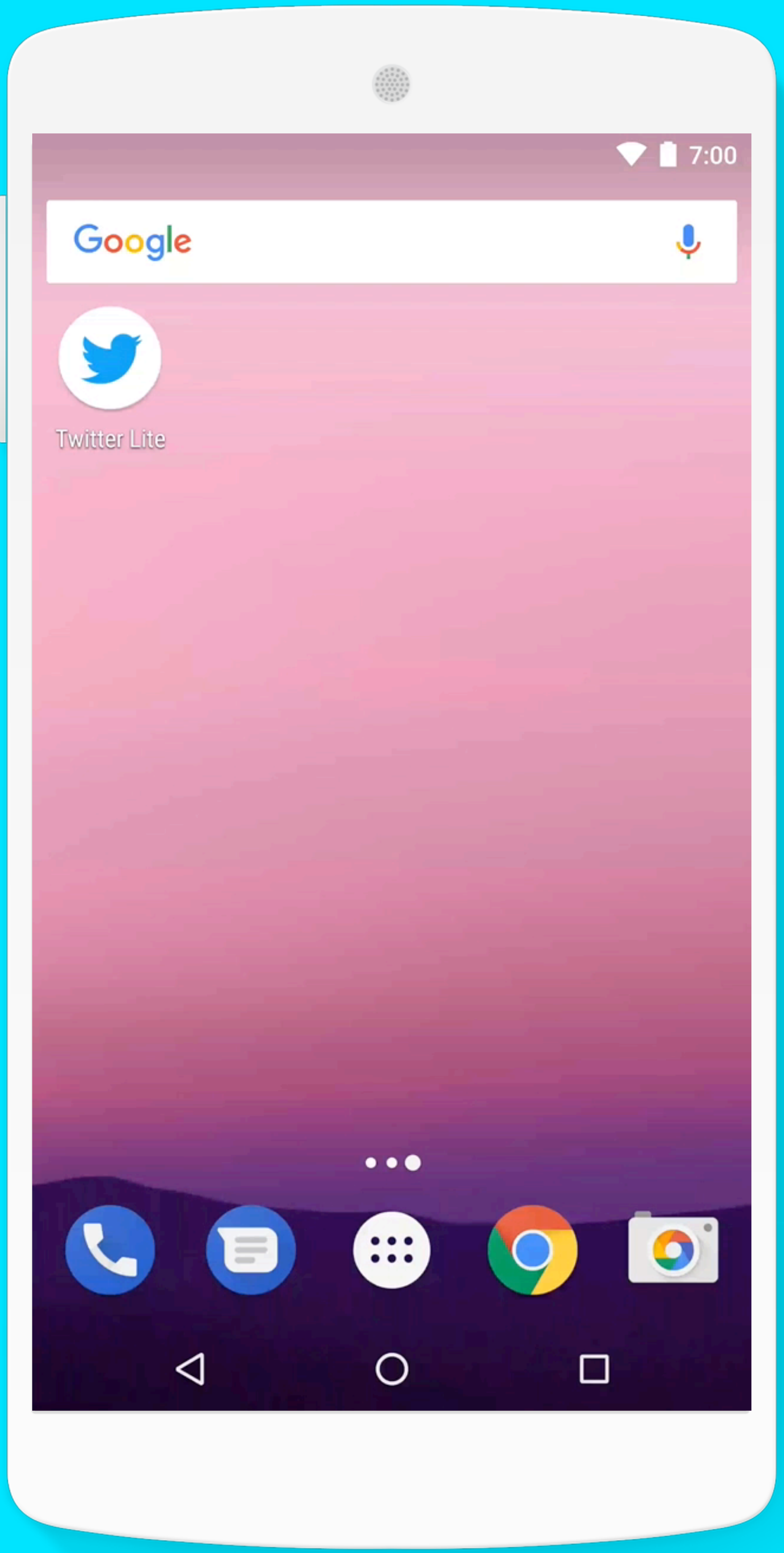
Jordan Kasper retweeted

Bradd Jaffy @BraddJaffy Apr 14

Replying to @BraddJaffy

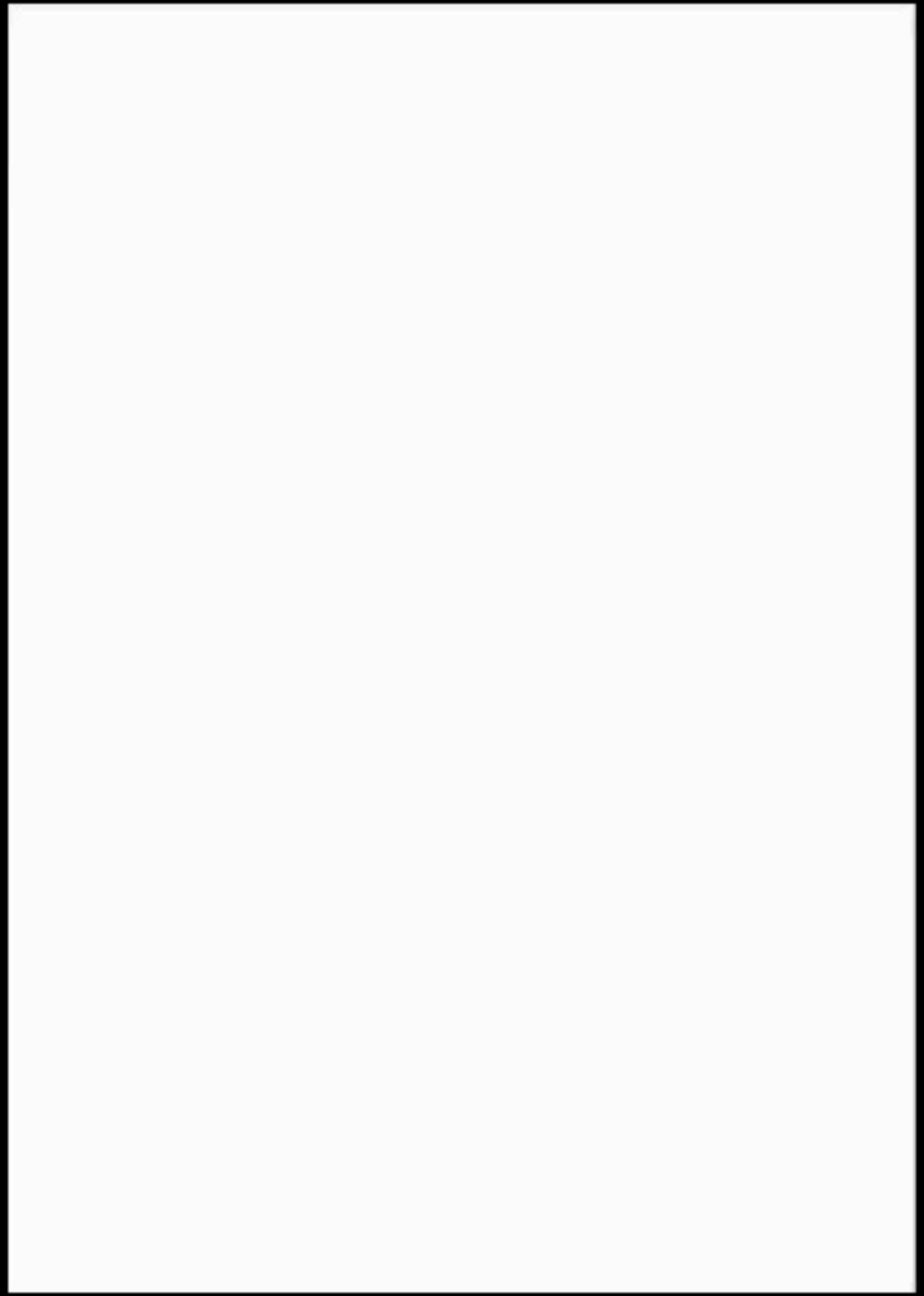
Trump has now visited one of his golf clubs on 20% of his days as president so far (17 golf course trips in 84 days) Watch candidate Trump: pic.twitter.com/ebenEehYJP

View conversation

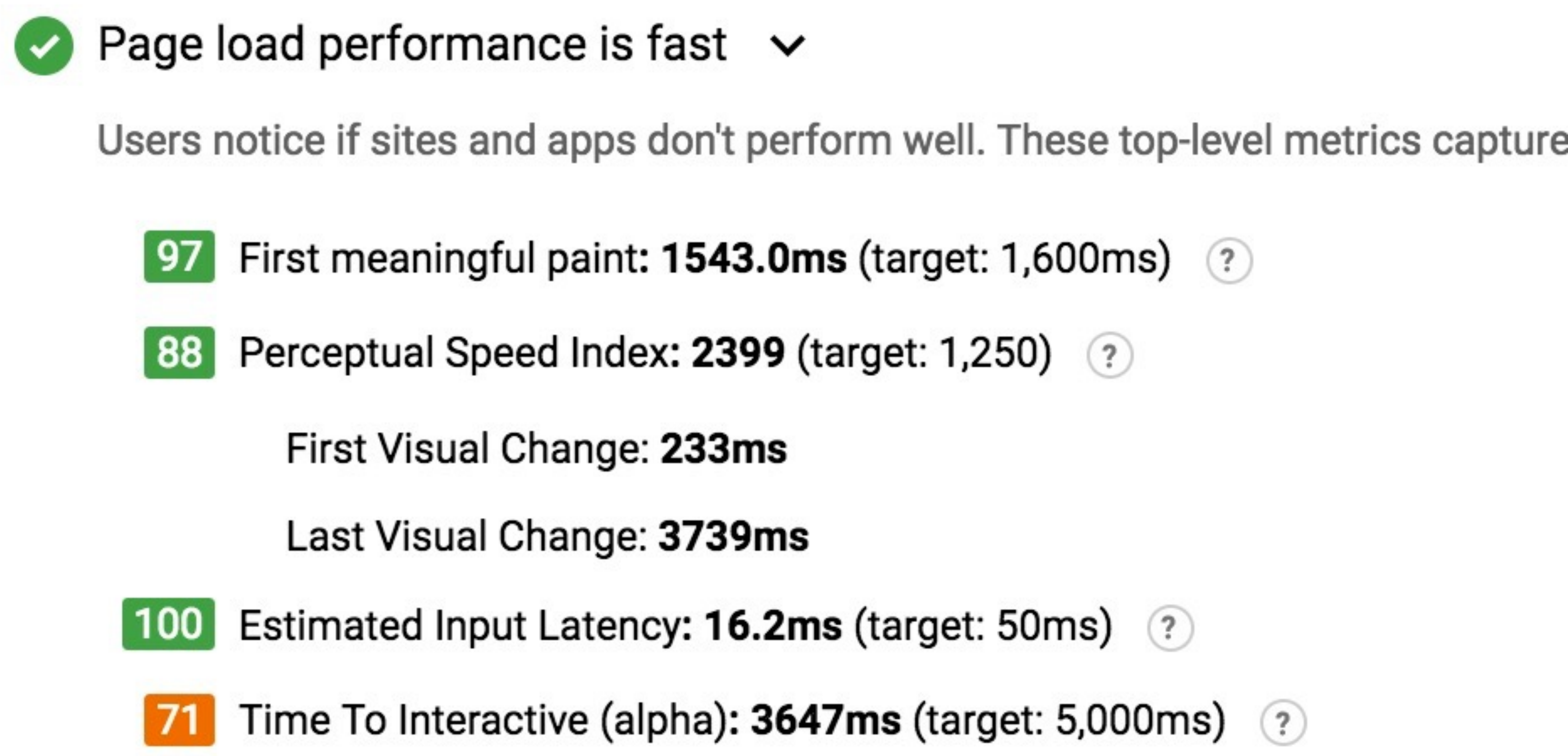


Interactive in <5s on 3G

https://mobile.twitter.com/necolas



0.0



✓ Page load performance is fast ⌄

Users notice if sites and apps don't perform well. These top-level metrics capture

97 First meaningful paint: **1543.0ms** (target: 1,600ms) ?

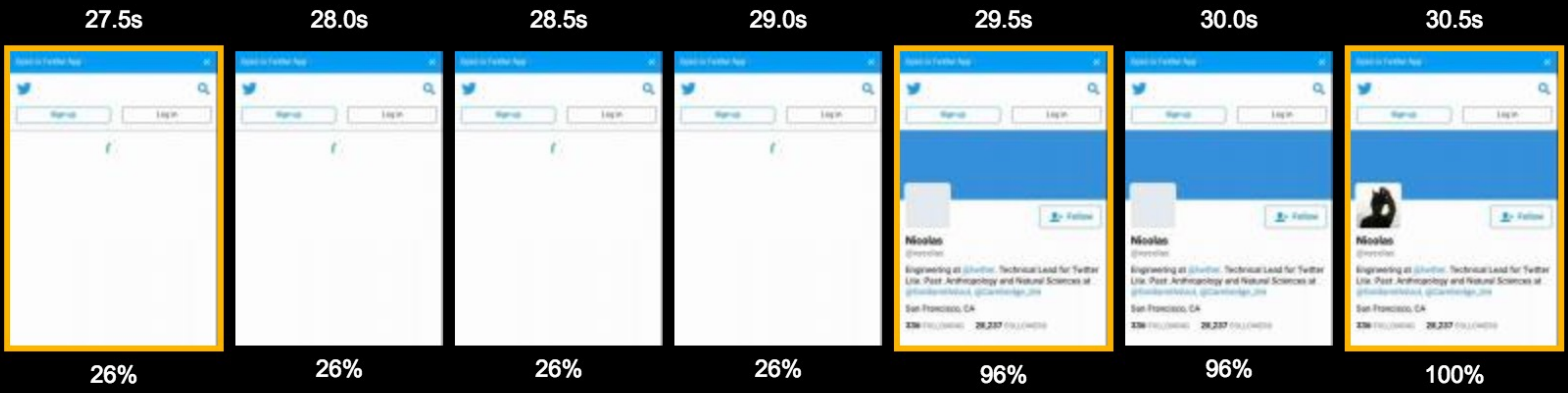
88 Perceptual Speed Index: **2399** (target: 1,250) ?

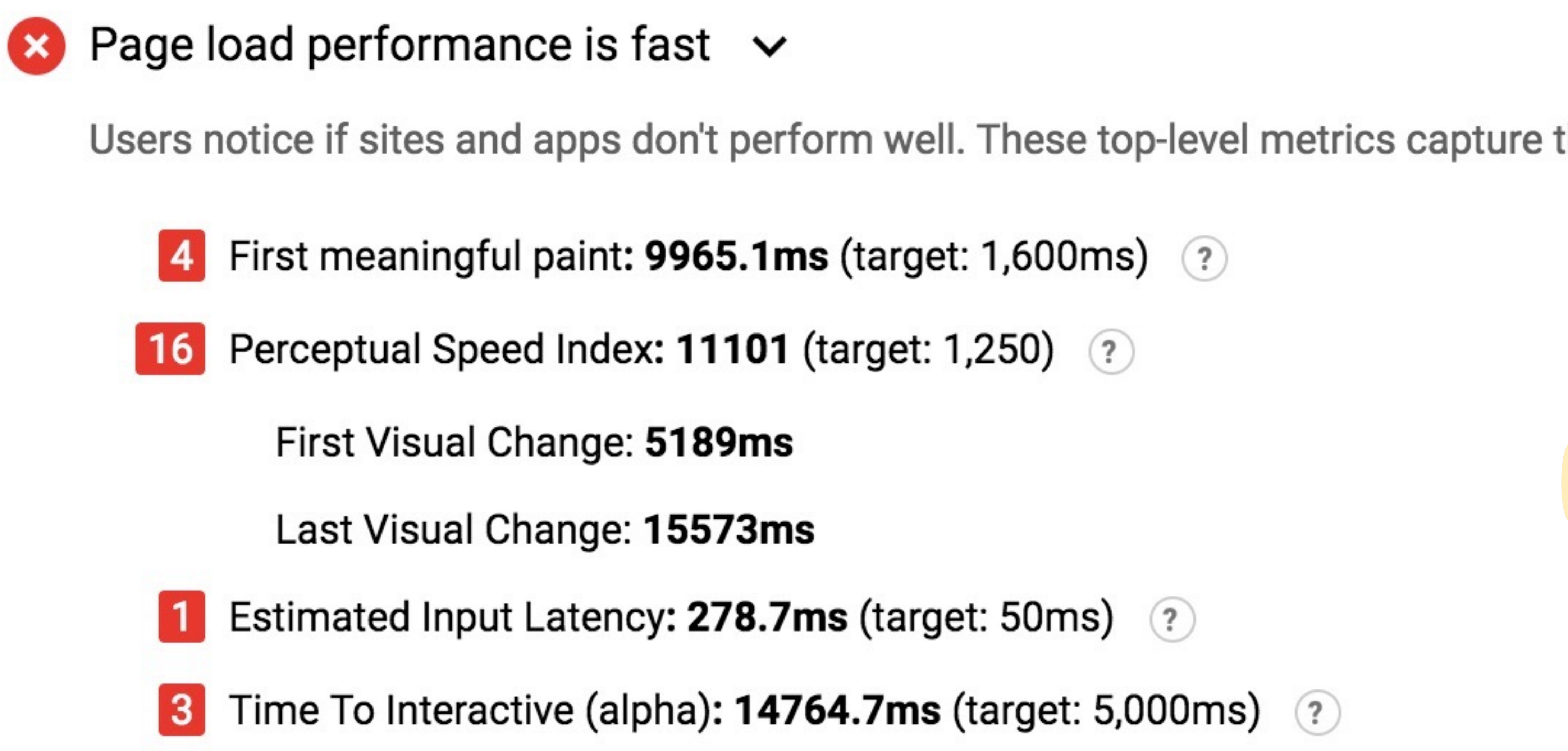
First Visual Change: **233ms**

Last Visual Change: **3739ms**

100 Estimated Input Latency: **16.2ms** (target: 50ms) ?

71 Time To Interactive (alpha): **3647ms** (target: 5,000ms) ?





Page load performance is fast

Users notice if sites and apps don't perform well. These top-level metrics capture the most important perceived performance concerns

4 First meaningful paint: **9965.1ms** (target: 1,600ms) ?

16 Perceptual Speed Index: **11101** (target: 1,250) ?

First Visual Change: **5189ms**

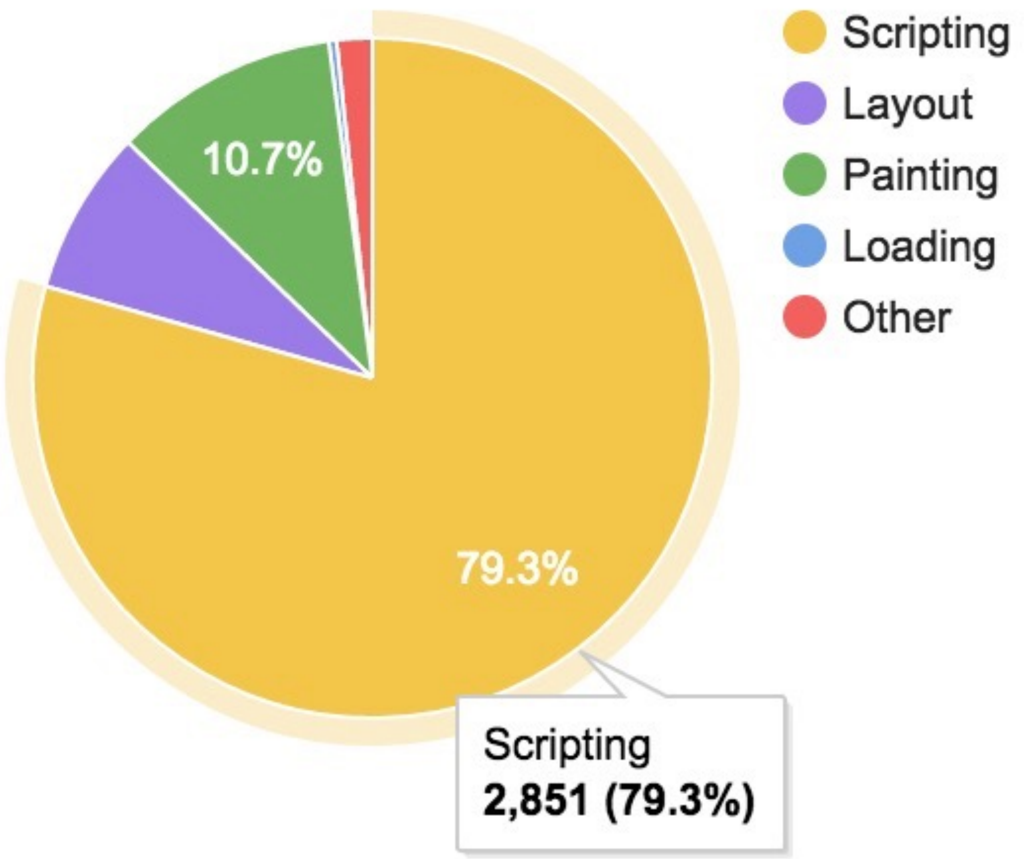
Last Visual Change: **15573ms**

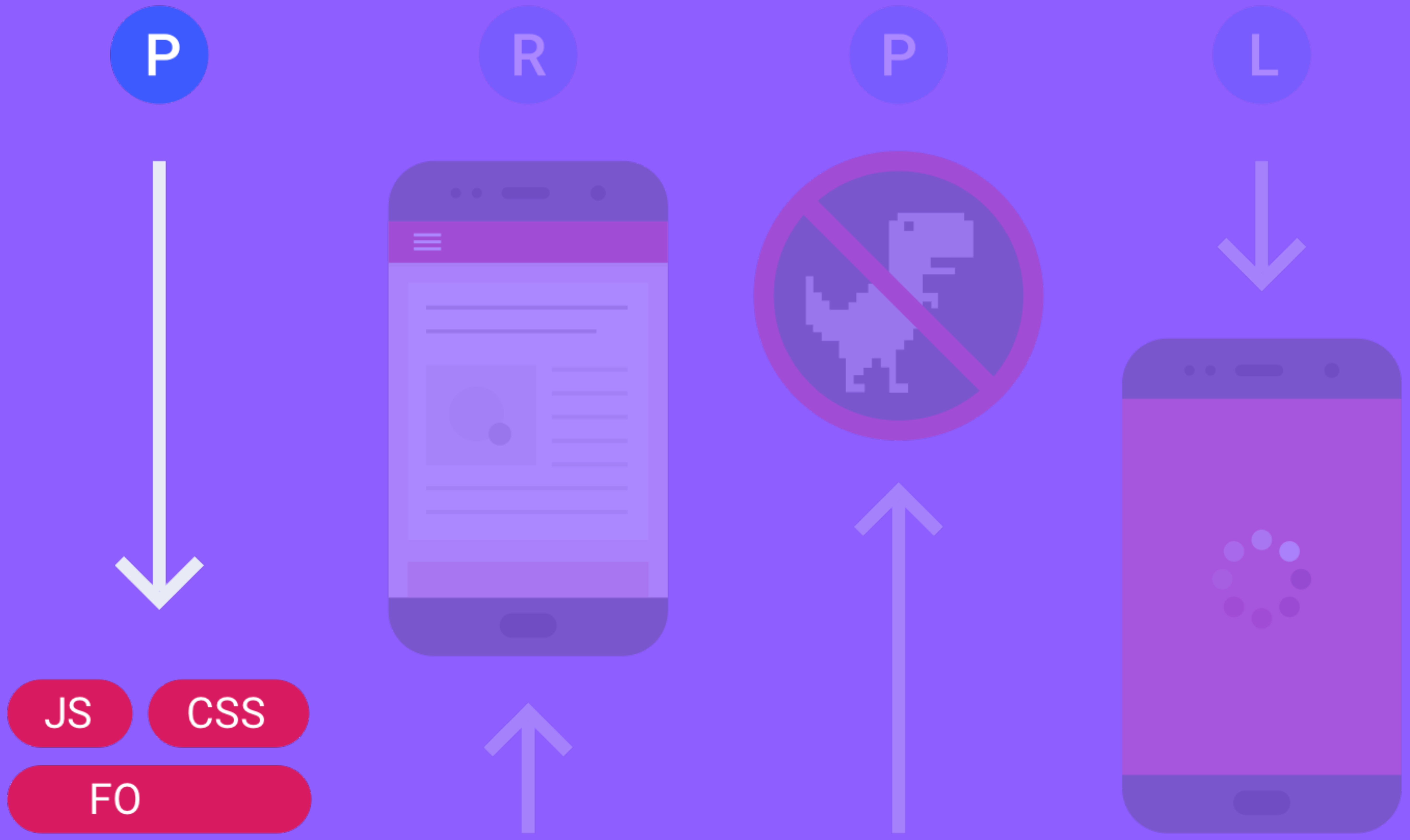
1 Estimated Input Latency: **278.7ms** (target: 50ms) ?

3 Time To Interactive (alpha): **14764.7ms** (target: 5,000ms) ?

Can we get fast
across the boar
3G?

Processing Categories



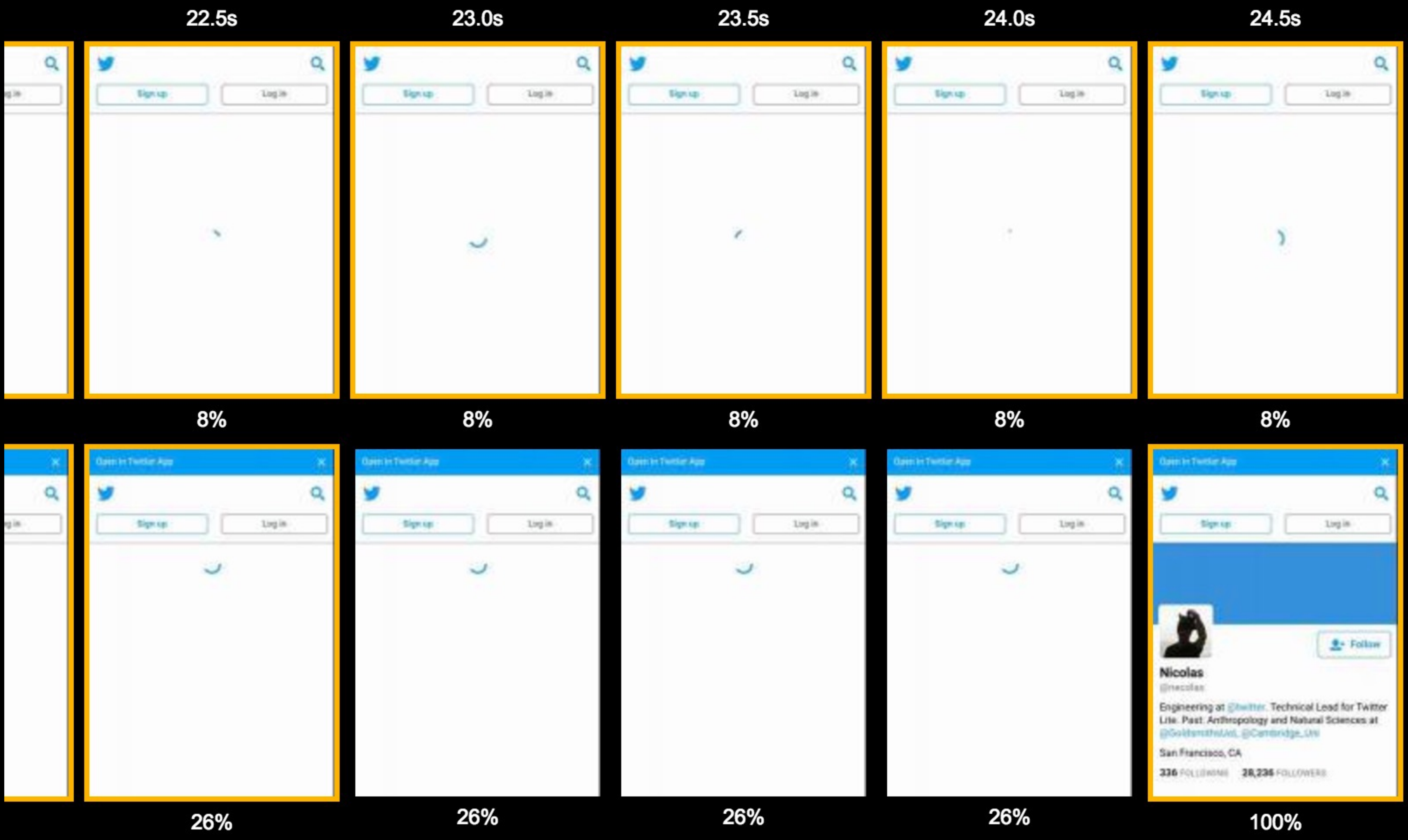


Push / Preload

```
<meta name="viewport" content="width=device-width,initial-scale=1,maximum-scale=1,user-scalable=0">
▶<noscript>…</noscript>
  <link rel="dns-prefetch" href="//ma-0.twimg.com">
  <link rel="dns-prefetch" href="//api.twitter.com">
  <link rel="dns-prefetch" href="//o.twimg.com">
  <link rel="dns-prefetch" href="//pbs.twimg.com">
  <link rel="dns-prefetch" href="//video.twimg.com">
  <link rel="preload" as="script" crossorigin="anonymous" href="https://ma-0.twimg.com/twitter-assets/responsive-web/web/
  ltr/manifest.276ed8680c5220ce.js">
  <link rel="preload" as="script" crossorigin="anonymous" href="https://ma-0.twimg.com/twitter-assets/responsive-web/web/
```

18% improvement

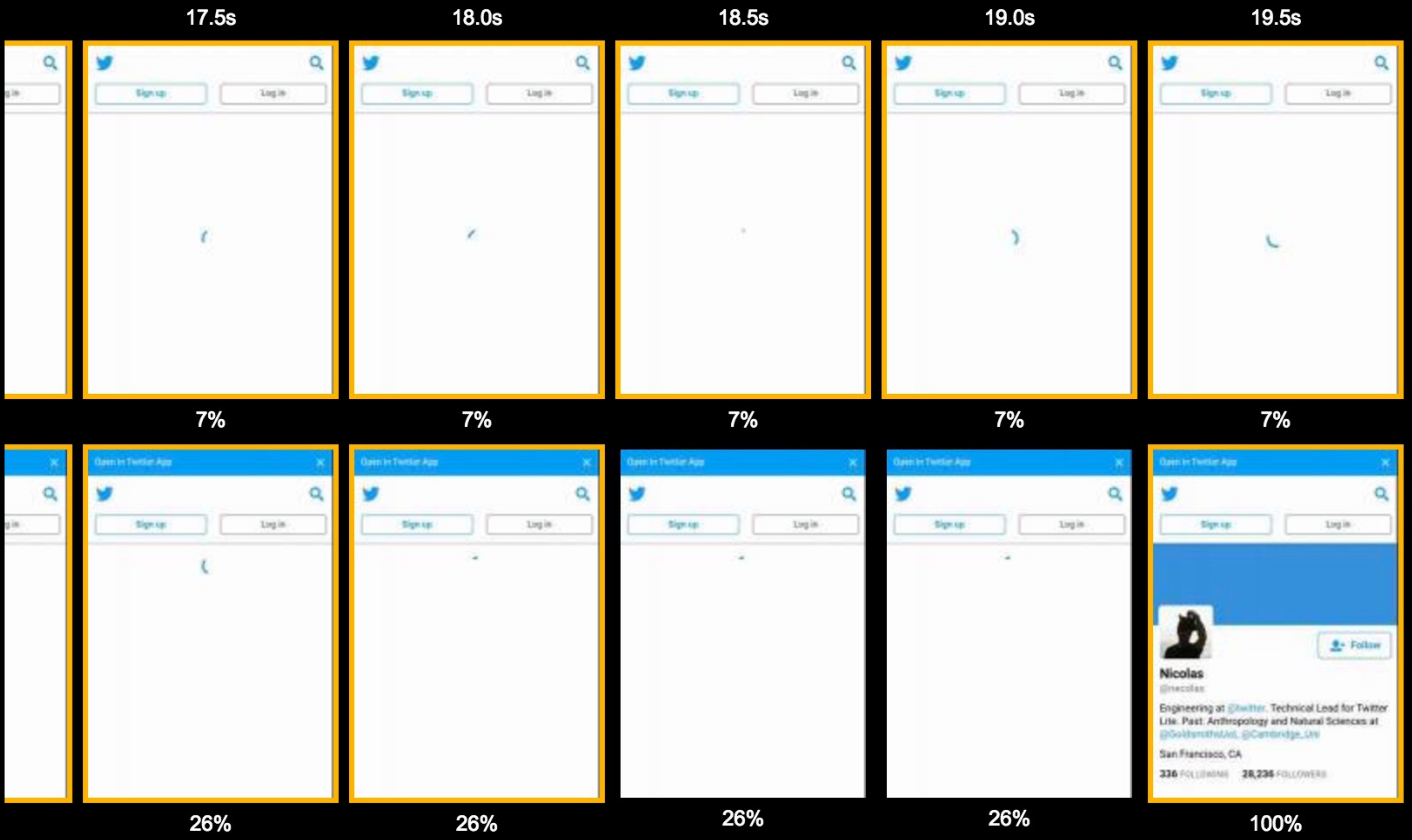
<link rel=dns-prefetch>

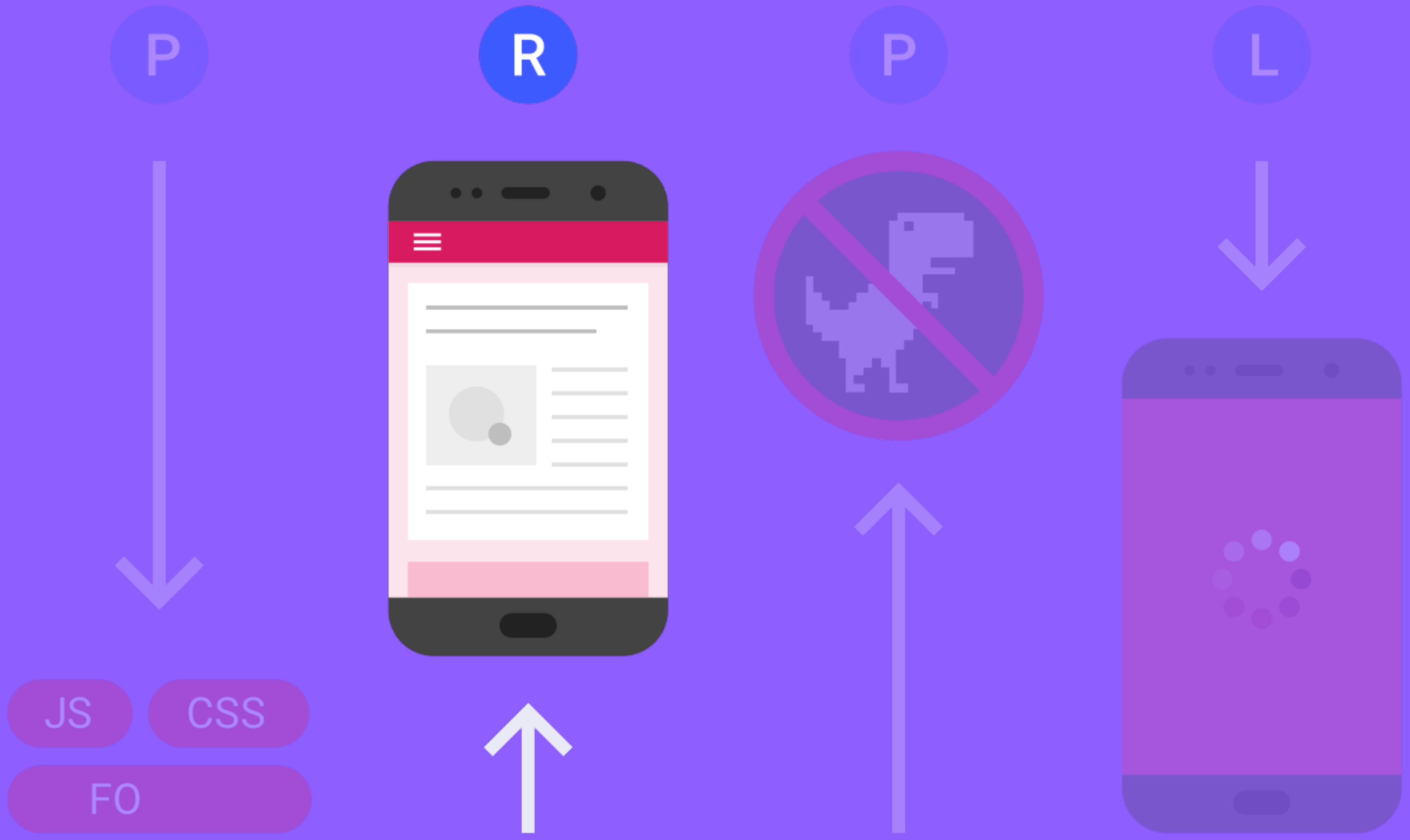


```
<link rel="dns-prefetch" href="//video.twimg.com">
<link rel="preload" as="script" crossorigin="anonymous" href="https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/manifest.276ed8680c5220ce.js">
<link rel="preload" as="script" crossorigin="anonymous" href="https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/vendor.01aa8c5c98c1f889.js">
<link rel="preload" as="script" crossorigin="anonymous" href="https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/i18n/en.fe36e33b4bbfefc0.js">
<link rel="preload" as="script" crossorigin="anonymous" href="https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/main.6b6582a4f8df8d8f.js">
<meta property="fb:app_id" content="2231777543">
```

36% improvement

<link rel=preload>





Render

HTML Streaming reduced TTFB by 30% (200ms), increasing time user's spent in the app.

Nicolas Gallagher, Technical lead for Twitter Lite

Nexus 5X ▼ 412 × 732 75% ▼
Elements
Performance
Network
Application
Console
Sources
Memory
Security
Audits
View:
□ Preserve log
□ Disable cache
□ Offline
No throttling ▼
Filter
□ Regex
□ Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
1000000 ms
2000000 ms
3000000 ms
4000000 ms
5000000 ms
6000000 ms
7000000 ms
8000000 ms
12:29
Home
5

Tracy Lee | ladyleet @ladyleet 19m
@IgorMinar Another potential #newprofilepic. Pic reminds me of one of the reasons #trex exists! #rxjs // @benlesh facebook.com/thisdot/photos...

Igor Minar

😺 matt zabriskie 🤖 Retweeted

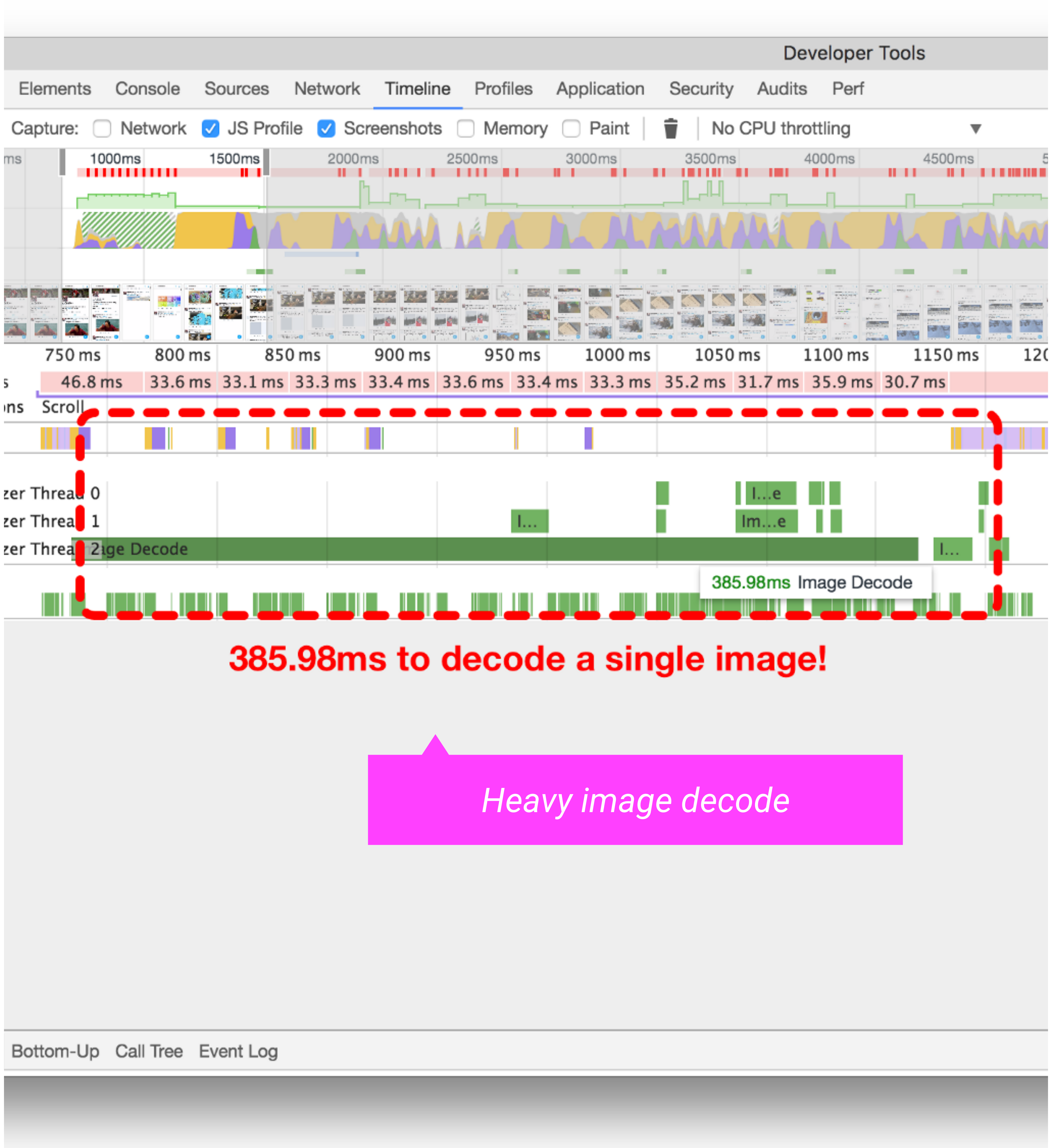
The Practical Dev @ThePracticalDev Oct 29
margin-right: -100px !important;

Name	Type	Size ▼	Time	Priority
C9qFrS8UAAAvQqQ.jpg	jpeg	147 KB	46 ms	Low
Cv-mxS0WEAA9kAU.jpg	jpeg	124 KB	32 ms	Low
C9qGriYV0AEH-Qw.jpg	jpeg	113 KB	34 ms	Low
C9qFfpFUAAAq50h.jpg	jpeg	96.2 KB	19 ms	Low
C9npwAYWsAAiOcy.jpg	jpeg	88.1 KB	20 ms	Low
nyantocat_1__normal.gif	gif	35.2 KB	32 ms	Low
C9pvESTUAAE1Mc0.jpg	jpeg	32.7 KB	28 ms	Low
600x200	jpeg	29.6 KB	14 ms	Low
vauUFZMu?format=jpg&name=386x202	jpeg	21.4 KB	15 ms	Low
HkNSLgk4?format=jpg&name=386x202	jpeg	12.0 KB	18 ms	Low
mikeyyyy_normal.png	png	7.6 KB	19 ms	Low
Picture_24_normal.png	png	7.6 KB	13 ms	Low
me05_normal.jpg	jpeg	7.6 KB	389 ms	Low
horse-js_normal.png	png	7.6 KB	18 ms	Low
squirrelfish_bigger_normal.png	png	7.6 KB	39 ms	Low
player-placeholder.png	png	7.2 KB	22 ms	Low
lT16ds_A_normal.png	png	6.5 KB	17 ms	Low
HbdmXJ1X_normal.png	png	6.0 KB	14 ms	Low

128 / 282 requests | 863 KB / 990 KB transferred | Finish: 1.1 min | DOMContentLoaded: 251 ms | Load: 422 ms

4x improvement to render perf by using requestIdleCallback() to defer JS loading of images.

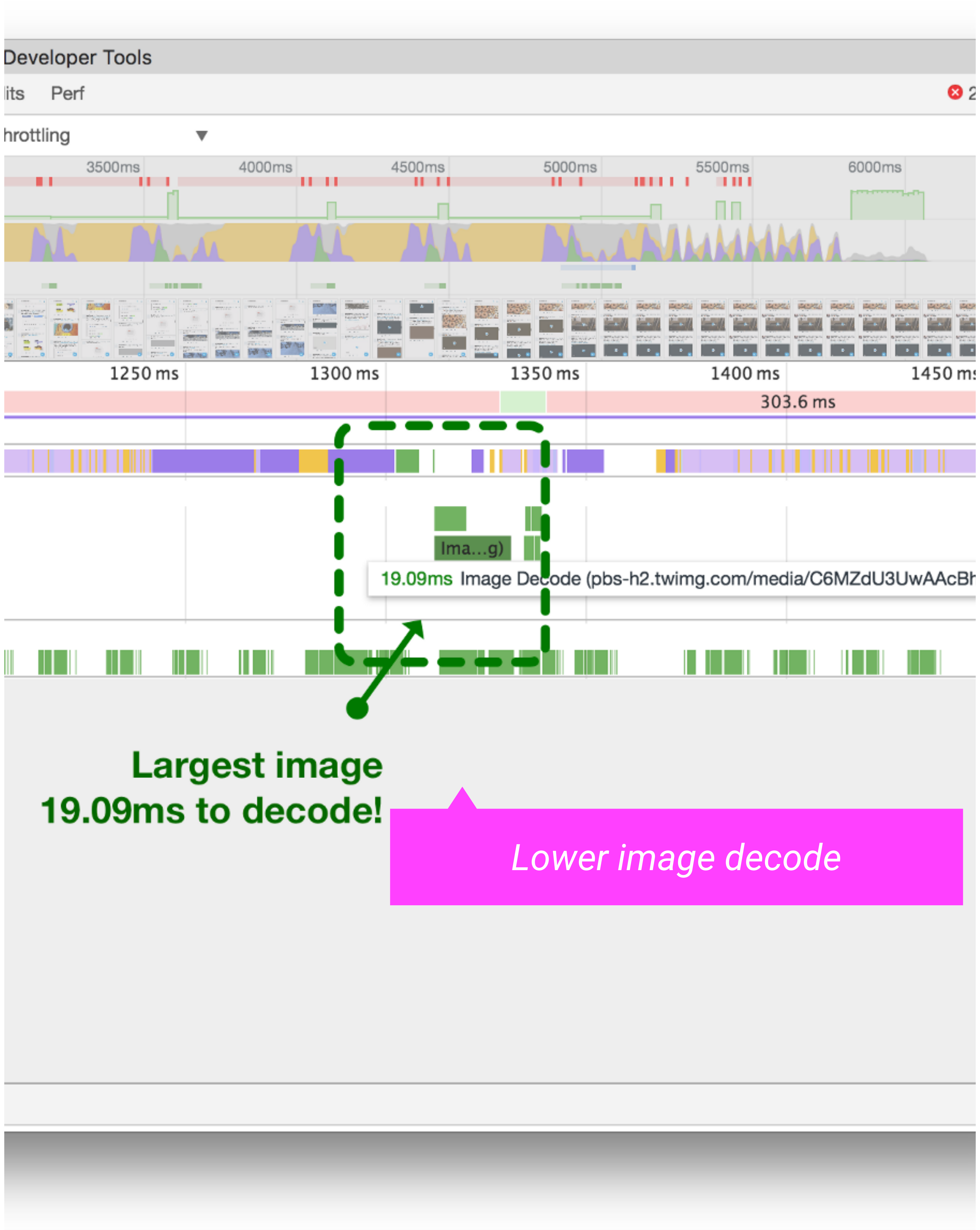
Nicolas Gallagher, Technical lead for Twitter Lite



385.98ms Image Decode

385.98ms to decode a single image!

Heavy image decode



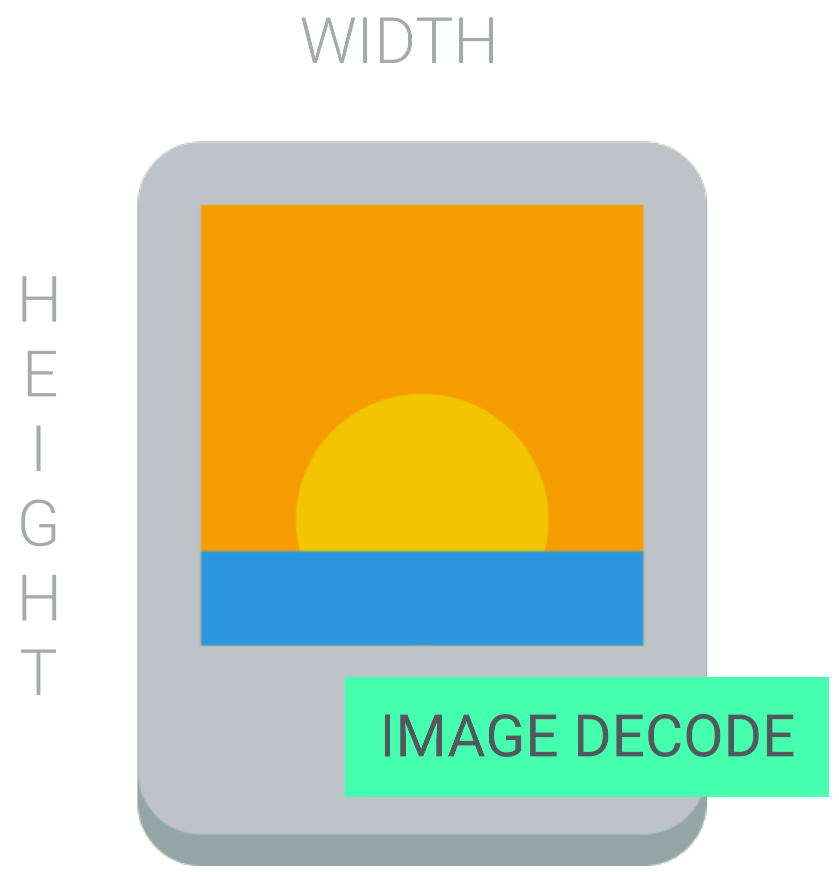
19.09ms Image Decode (pbs-h2.twimg.com/media/C6MZdU3UwAAcBh

Largest image
19.09ms to decode!

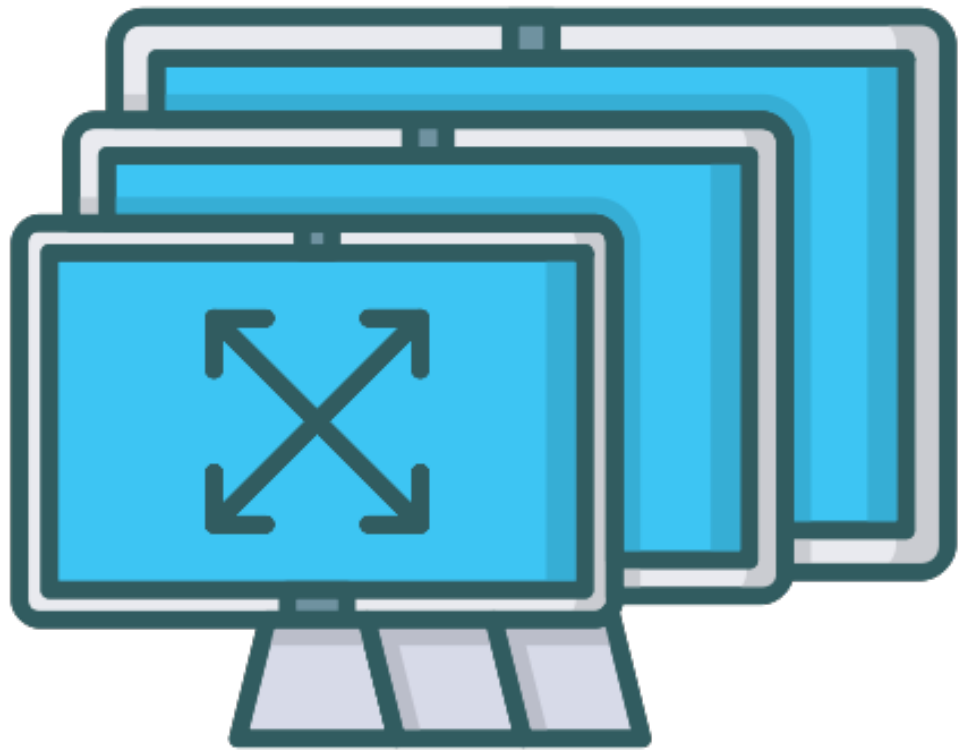
Lower image decode

High-perf Images

Choose the right format



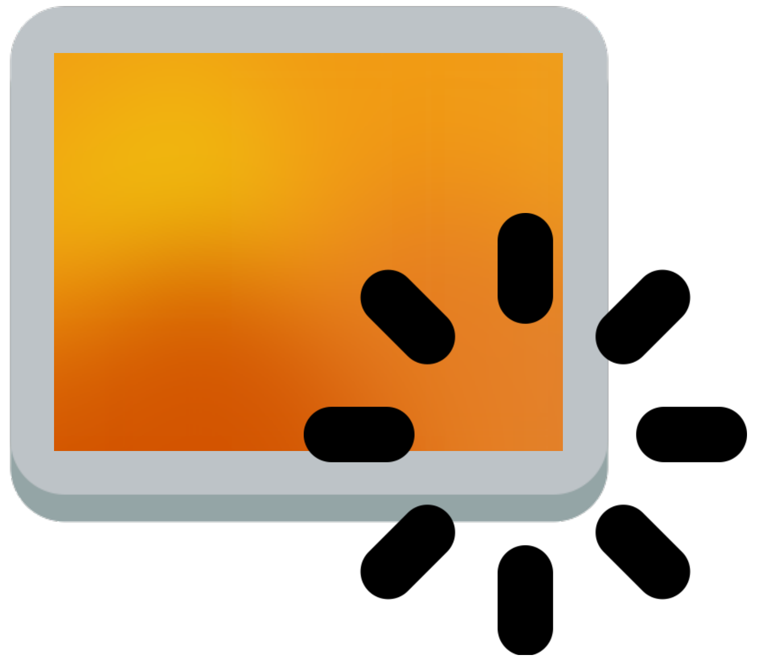
Size appropriately



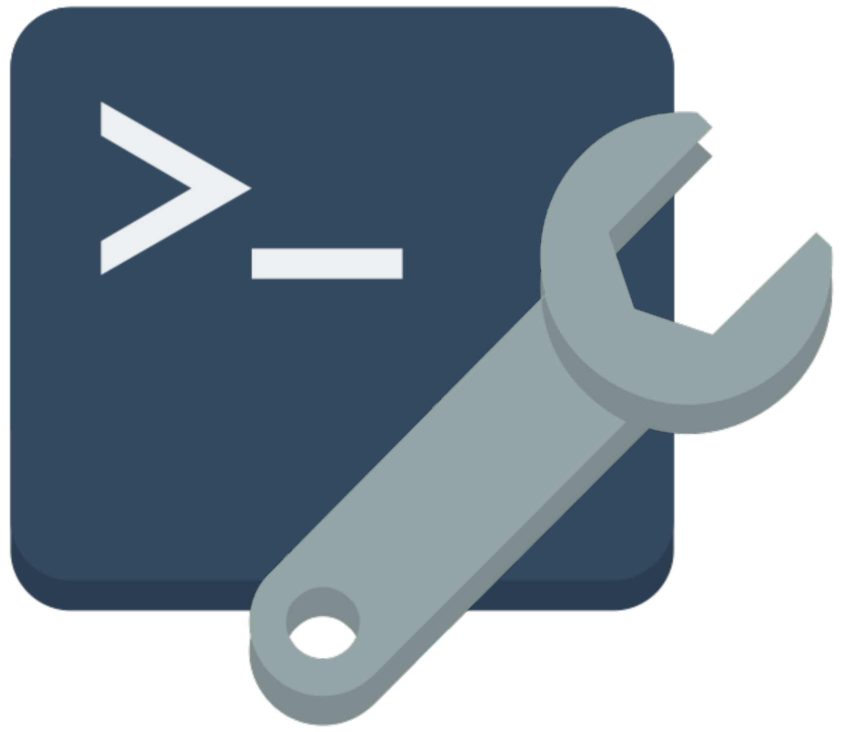
Adapt intelligently

Compress carefully

Prioritize critical images

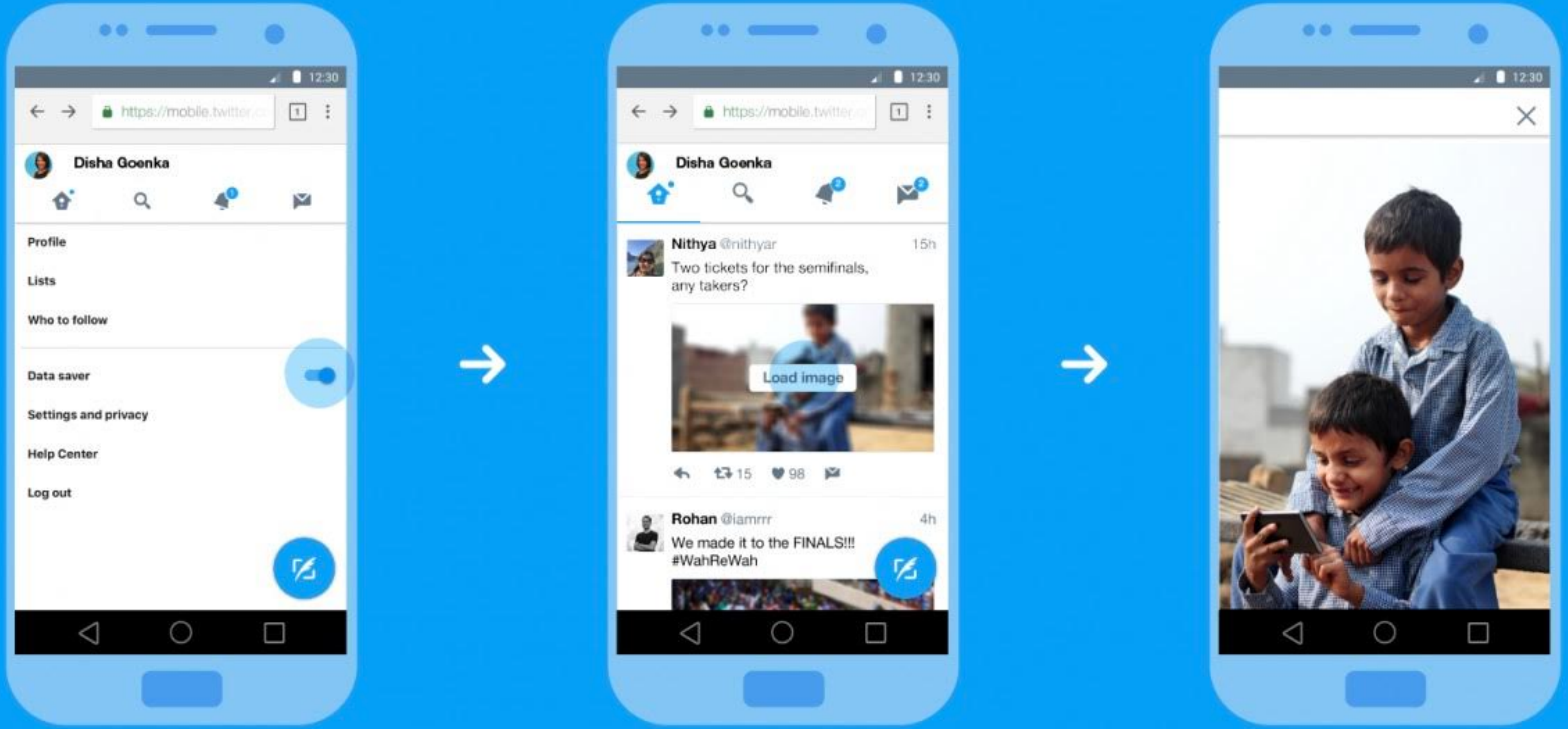


Lazy-load the rest



Take care with tools

Data Saver Mode introduced up to 70% savings



Profile

Lists

Who to follow

Data saver

Settings and privacy

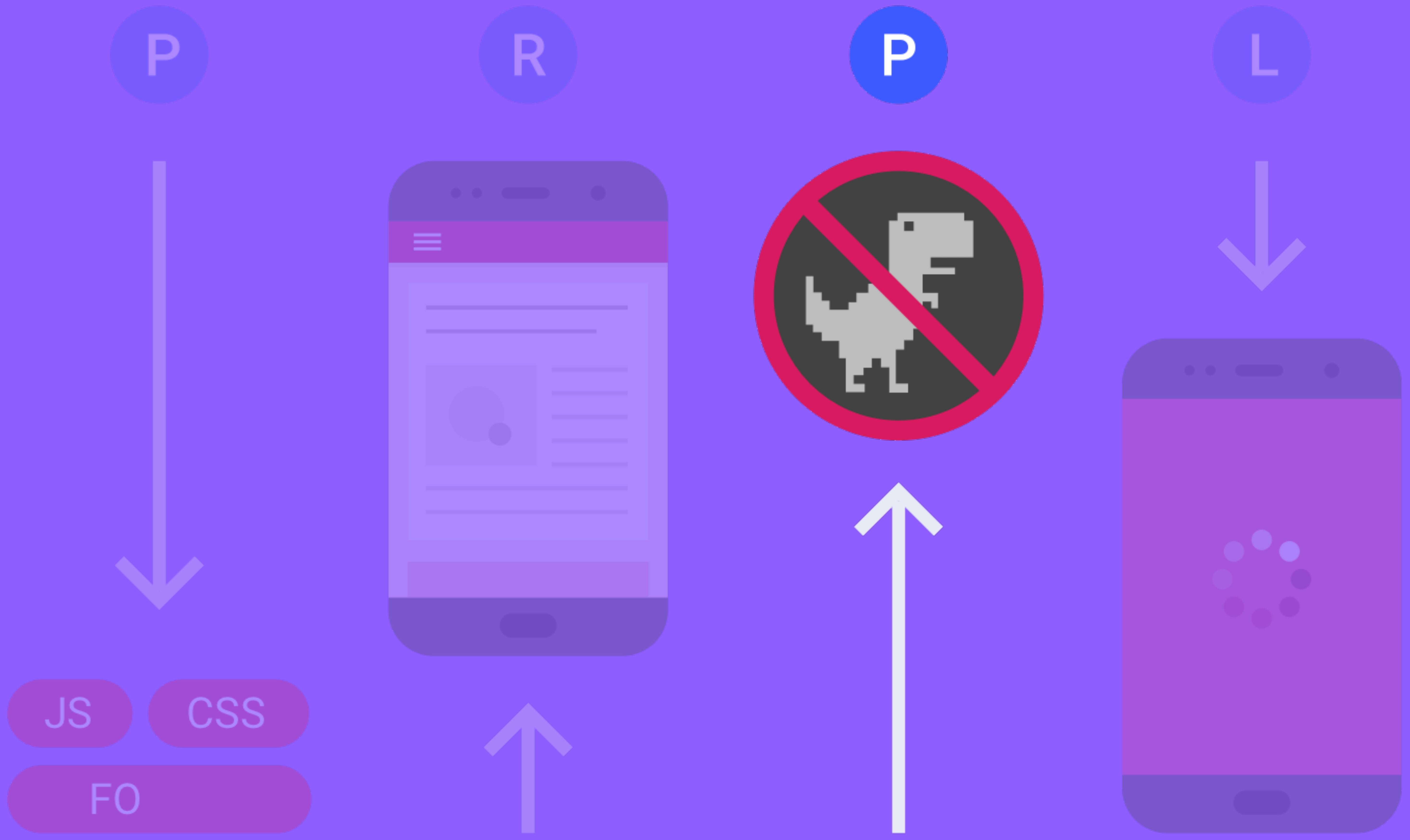
Help Center

Log out

Nithya @nithyar 15h
Two tickets for the semifinals, any takers?

Rohan @iamrrr 4h
We made it to the FINALS!!! #WahReWah

Next up: Save-Data client hint



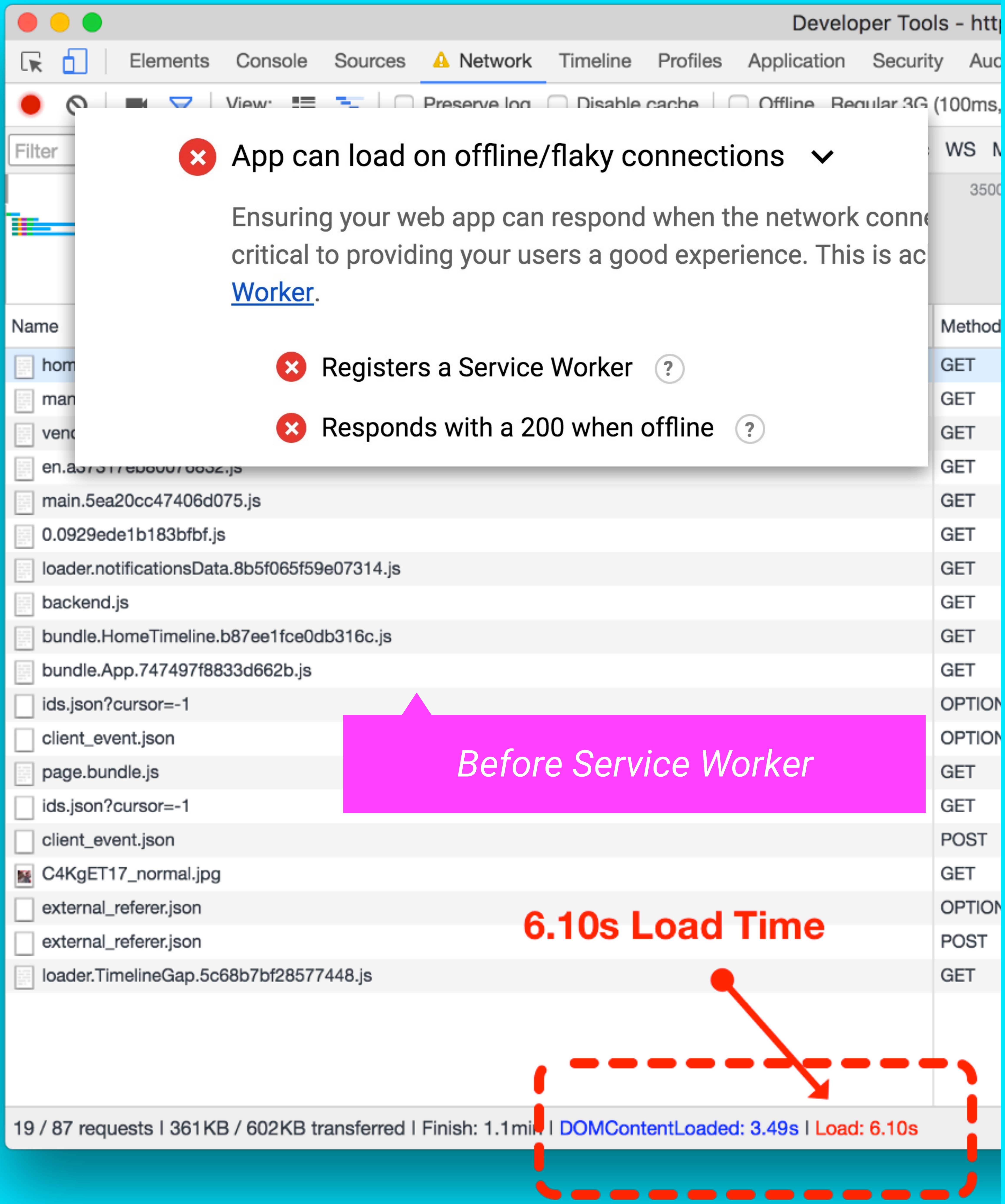
Precache

Elements
Performance
Network
Application
Console
Sources
Memory
Security
Audits
6
Application
Manifest
Service Workers
Clear storage
Storage
Local Storage
Session Storage
IndexedDB
Web SQL
Cookies
Cache
Cache Storage
assets - https://mobile.twitter.c
twemoji - https://mobile.twitter.
Application Cache
Frames
top
Home

#	Request	...
0	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/0.4a3f78855dc4d0f1.js	OK
1	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bundle.AccessInterstitial.73ad7aad62ce3b06.js	OK
2	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bundle.Account.584a62e0feff6256.js	OK
3	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bundle.App.991ac1a0530e5a54.js	OK
4	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bun	OK
5	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
6	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
7	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
8	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
9	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
10	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
11	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
12	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
13	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
14	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
15	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
16	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
17	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
18	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
19	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
20	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
21	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
22	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
23	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK
24	https://ma-0.twimg.com/twitter-assets/responsive-web/web/ltr/bu	OK

Application Shell

A skeleton representing the user interface that can be offline cached & instantly rendered on repeat visits.



App can load on offline/flaky connections

Ensuring your web app can respond when the network conne critical to providing your users a good experience. This is ac Worker.

Registers a Service Worker ?

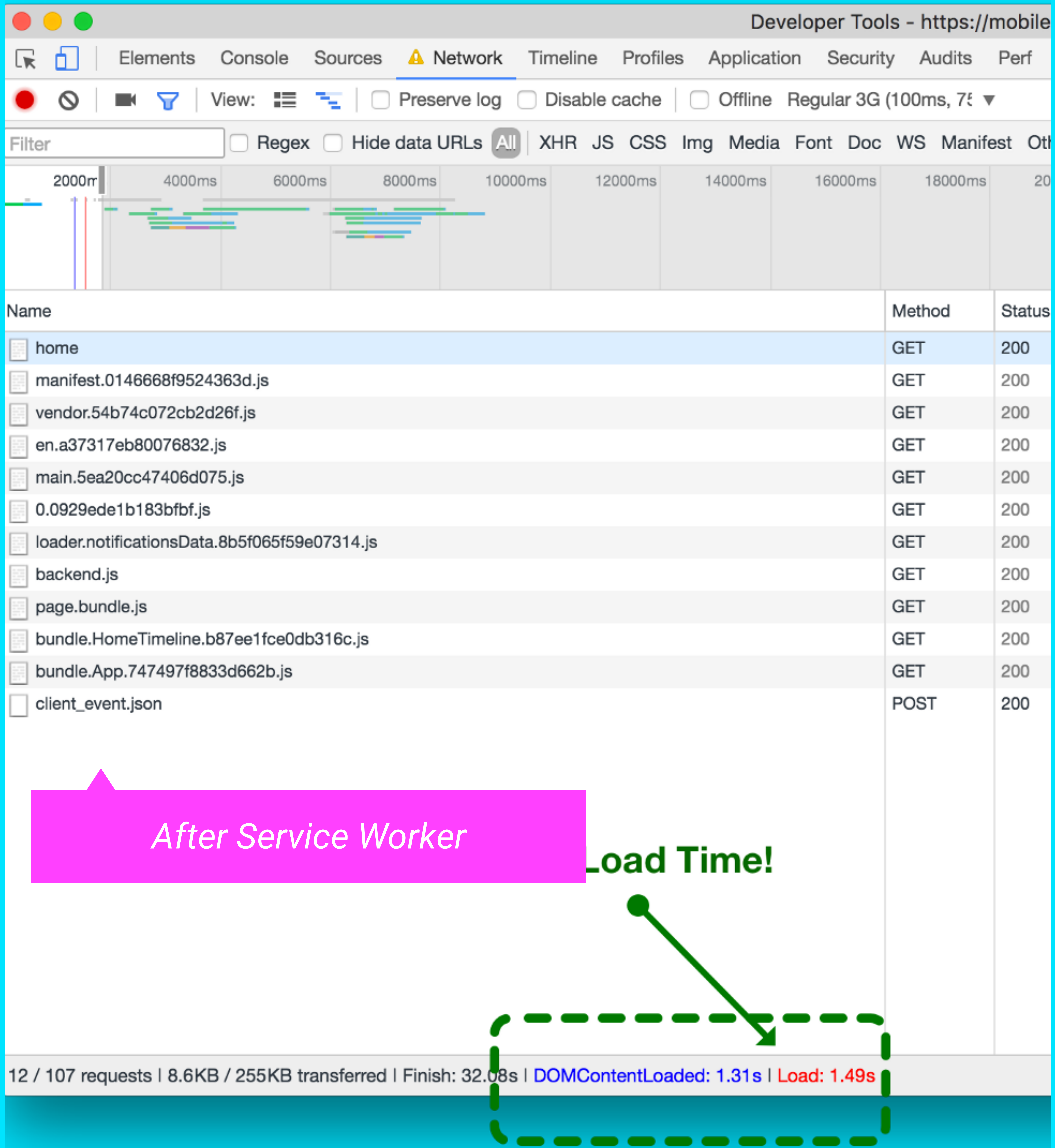
Responds with a 200 when offline ?

Name	Method
hom	GET
man	GET
venc	GET
en.a37317eb80076832.js	GET
main.5ea20cc47406d075.js	GET
0.0929ede1b183bfbf.js	GET
loader.notificationsData.8b5f065f59e07314.js	GET
backend.js	GET
bundle.HomeTimeline.b87ee1fce0db316c.js	GET
bundle.App.747497f8833d662b.js	GET
ids.json?cursor=-1	OPTION
client_event.json	OPTION
page.bundle.js	GET
ids.json?cursor=-1	GET
client_event.json	POST
C4KgET17_normal.jpg	GET
external_referer.json	OPTION
external_referer.json	POST
loader.TimelineGap.5c68b7bf28577448.js	GET

19 / 87 requests | 361KB / 602KB transferred | Finish: 1.1min | DOMContentLoaded: 3.49s | Load: 6.10s

Before Service Worker

6.10s Load Time

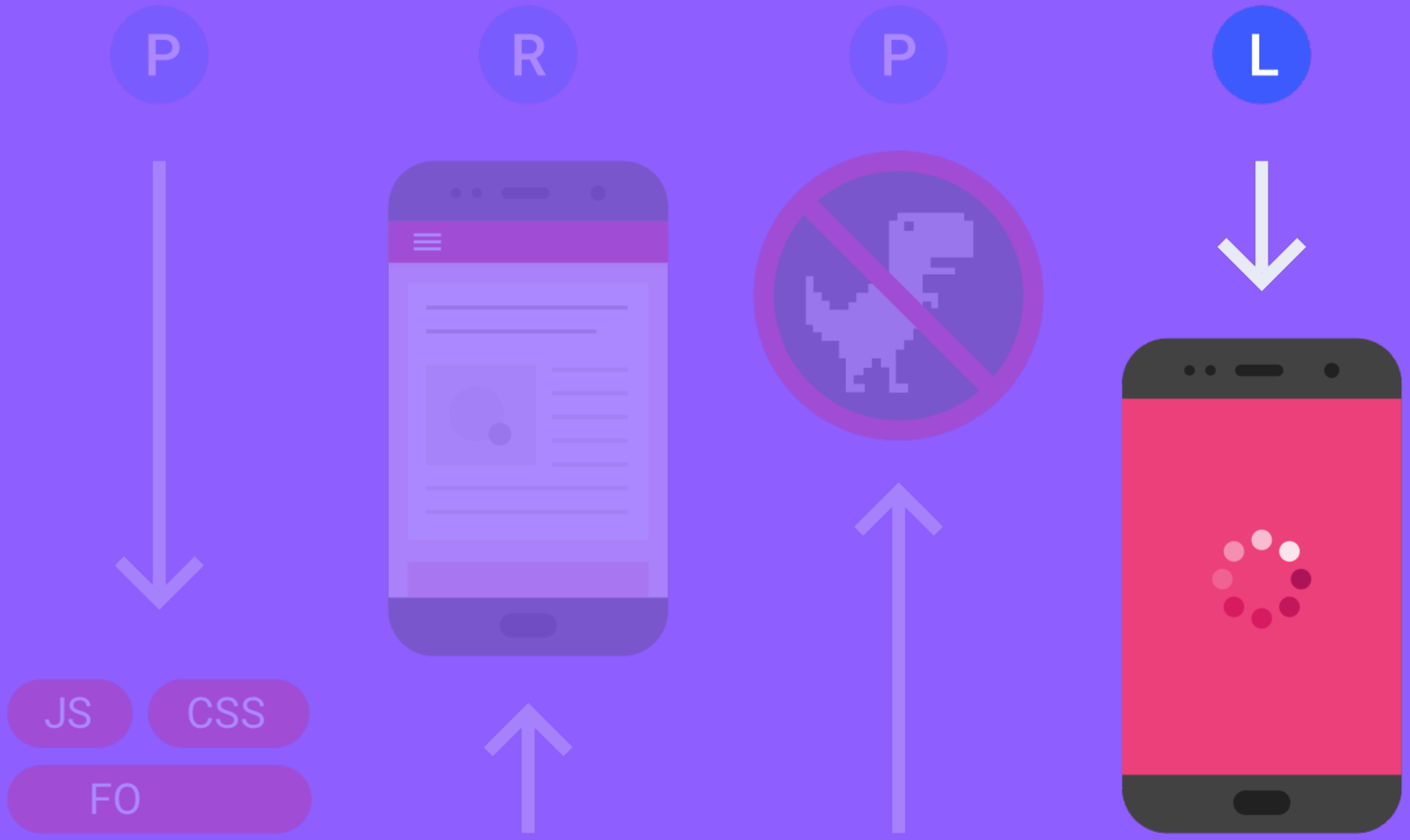


Name	Method	Status
home	GET	200
manifest.0146668f9524363d.js	GET	200
vendor.54b74c072cb2d26f.js	GET	200
en.a37317eb80076832.js	GET	200
main.5ea20cc47406d075.js	GET	200
0.0929ede1b183bfbf.js	GET	200
loader.notificationsData.8b5f065f59e07314.js	GET	200
backend.js	GET	200
page.bundle.js	GET	200
bundle.HomeTimeline.b87ee1fce0db316c.js	GET	200
bundle.App.747497f8833d662b.js	GET	200
client_event.json	POST	200

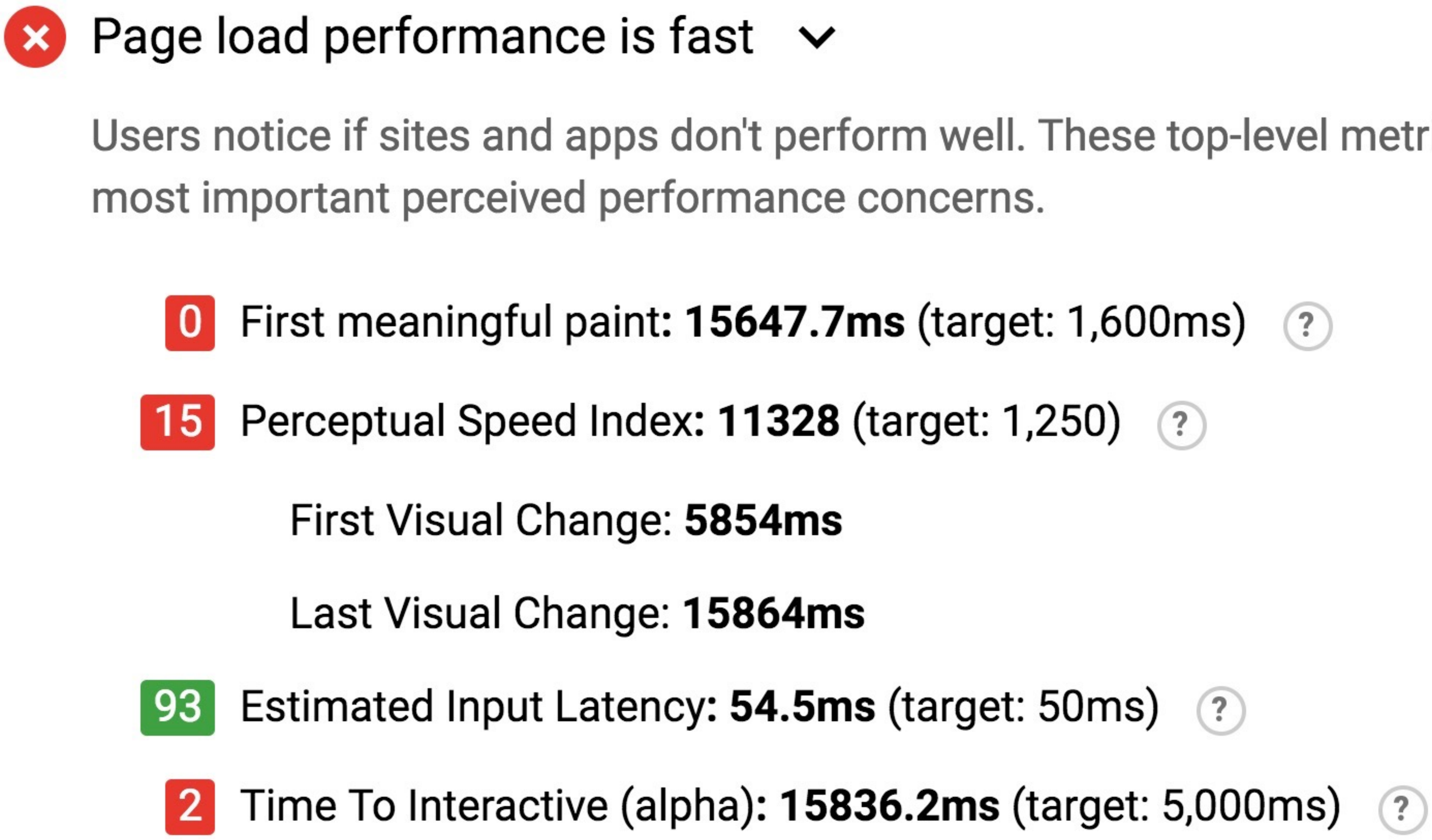
12 / 107 requests | 8.6KB / 255KB transferred | Finish: 32.08s | DOMContentLoaded: 1.31s | Load: 1.49s

After Service Worker

Load Time!



Lazy-load



✗ Page load performance is fast

Users notice if sites and apps don't perform well. These top-level metrics capture the most important perceived performance concerns.

0 First meaningful paint: **15647.7ms** (target: 1,600ms) ?

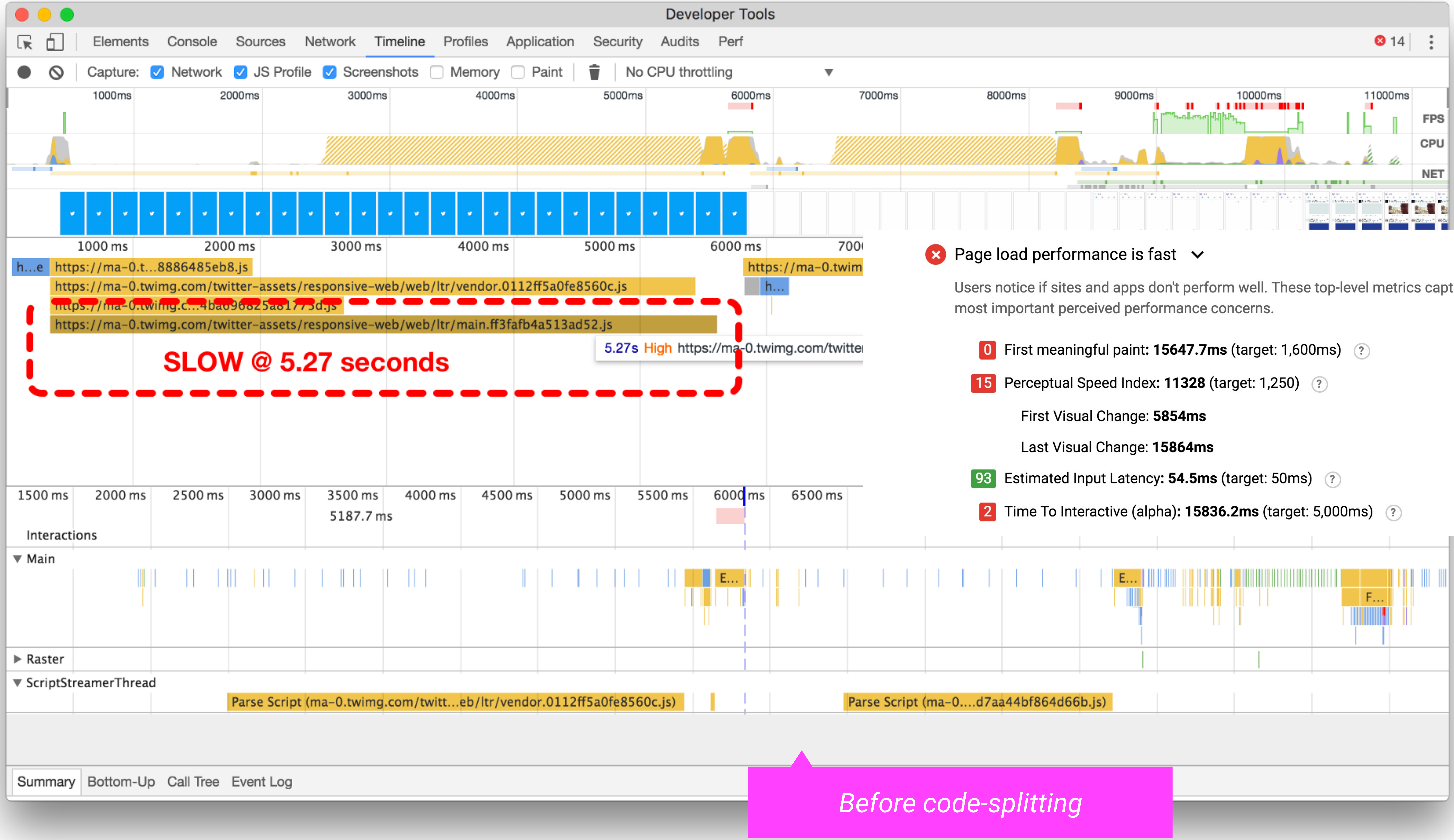
15 Perceptual Speed Index: **11328** (target: 1,250) ?

First Visual Change: **5854ms**

Last Visual Change: **15864ms**

93 Estimated Input Latency: **54.5ms** (target: 50ms) ?

2 Time To Interactive (alpha): **15836.2ms** (target: 5,000ms) ?



Page load performance is fast

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15 Perceptual Speed Index: **11328** (target: 1,250) ?

First Visual Change: **5854ms**

Last Visual Change: **15864ms**

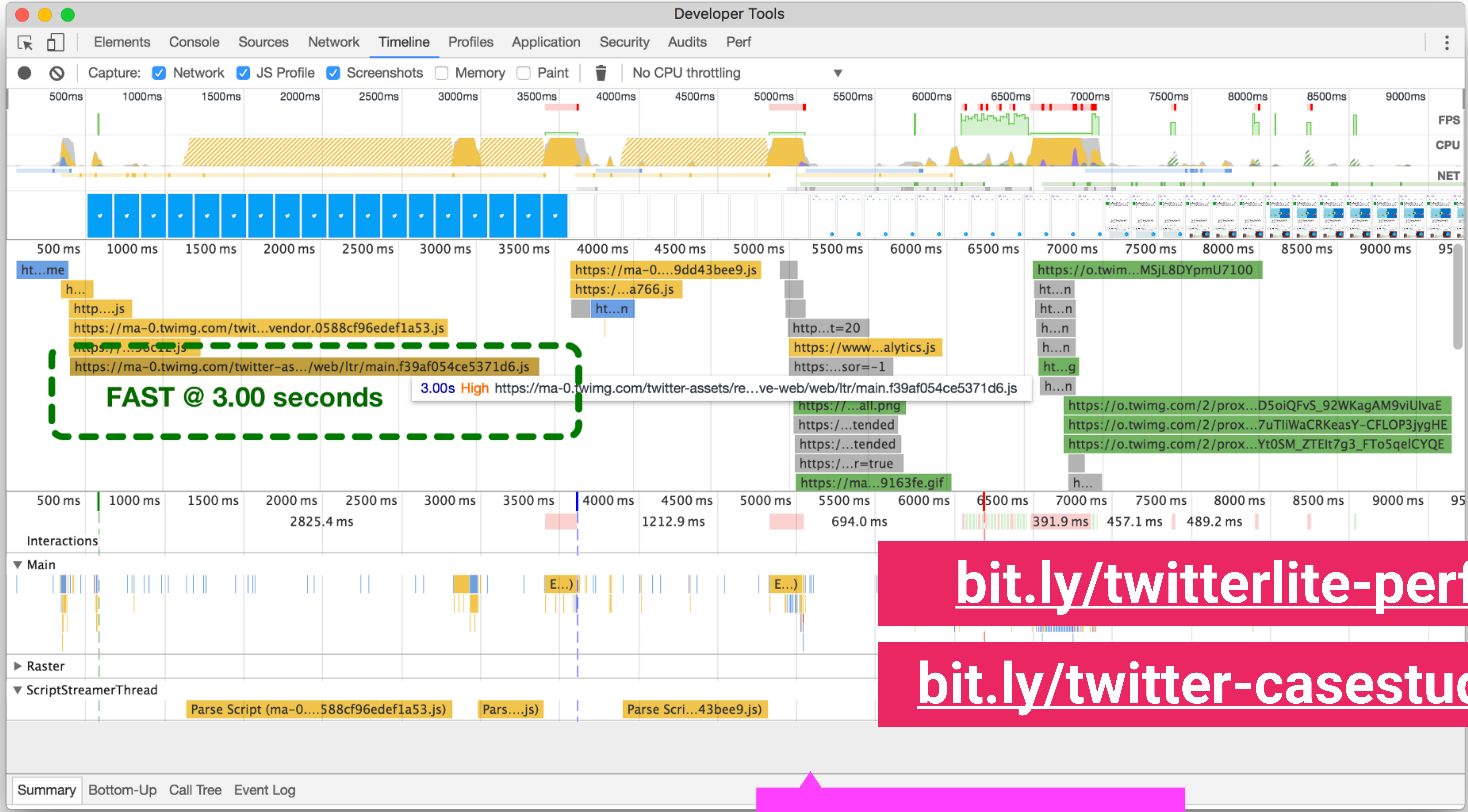
93 Estimated Input Latency: **54.5ms** (target: 50ms) ?

2 Time To Interactive (alpha): **15836.2ms** (target: 5,000ms) ?

Before code-splitting

webpack-web.config.js

```
const plugins = [
  // extract vendor and webpack's module manifest
  new webpack.optimize.CommonsChunkPlugin({
    names: [ 'vendor', 'manifest' ],
    minChunks: Infinity
  }),
  // extract common modules from all the chunks (requires no
'name' property)
  new webpack.optimize.CommonsChunkPlugin({
    async: true,
    children: true,
    minChunks: 4
  })
];
```


Developer Tools
Elements Console Sources Network Timeline Profiles Application Security Audits Perf
Capture: ☑ Network ☑ JS Profile ☑ Screenshots □ Memory □ Paint
No CPU throttling
500ms 1000ms 1500ms 2000ms 2500ms 3000ms 3500ms 4000ms 4500ms 5000ms 5500ms 6000ms 6500ms 7000ms 7500ms 8000ms 8500ms 9000ms
FPS
CPU
NET
ht…me
http….js
https://ma-0.twimg.com/twit…vendor.0588cf96edef1a53.js
https://ma-0.twimg.com/twitter-as…/web/ltr/main.f39af054ce5371d6.js
https://ma-0….9dd43bee9.js
https:/…a766.js
http…t=20
https://www…alytics.js
https:…sor=-1
https://…all.png
https:/…tended
https:/…r=true
https://ma…9163fe.gif
https://o.twim…MSjL8DYpmU7100
https://o.twimg.com/2/prox…D5oiQFvS_92WKagAM9viUlvaE
https://o.twimg.com/2/prox…7uTliWaCRKeasY-CFLOP3jygHE
https://o.twimg.com/2/prox…Yt0SM_ZTElt7g3_FTo5qelCYQE
2825.4 ms
1212.9 ms
694.0 ms
391.9 ms
457.1 ms
489.2 ms
Interactions
Main
Raster
ScriptStreamerThread
Parse Script (ma-0….588cf96edef1a53.js)
Pars….js)
Parse Scri…43bee9.js)
Summary Bottom-Up Call Tree Event Log

3.00s High https://ma-0.twimg.com/twitter-assets/re…ve-web/web/ltr/main.f39af054ce5371d6.js

FAST @ 3.00 seconds

bit.ly/twitterlite-perf

bit.ly/twitter-casestudy

After code-splitting

ARIAL

HELVETICA

GEORGIA

TIMES NEW ROMAN

GOTHAM BOLD

FIRA MONO

ROBOTO MONO

OCTOBER STORM

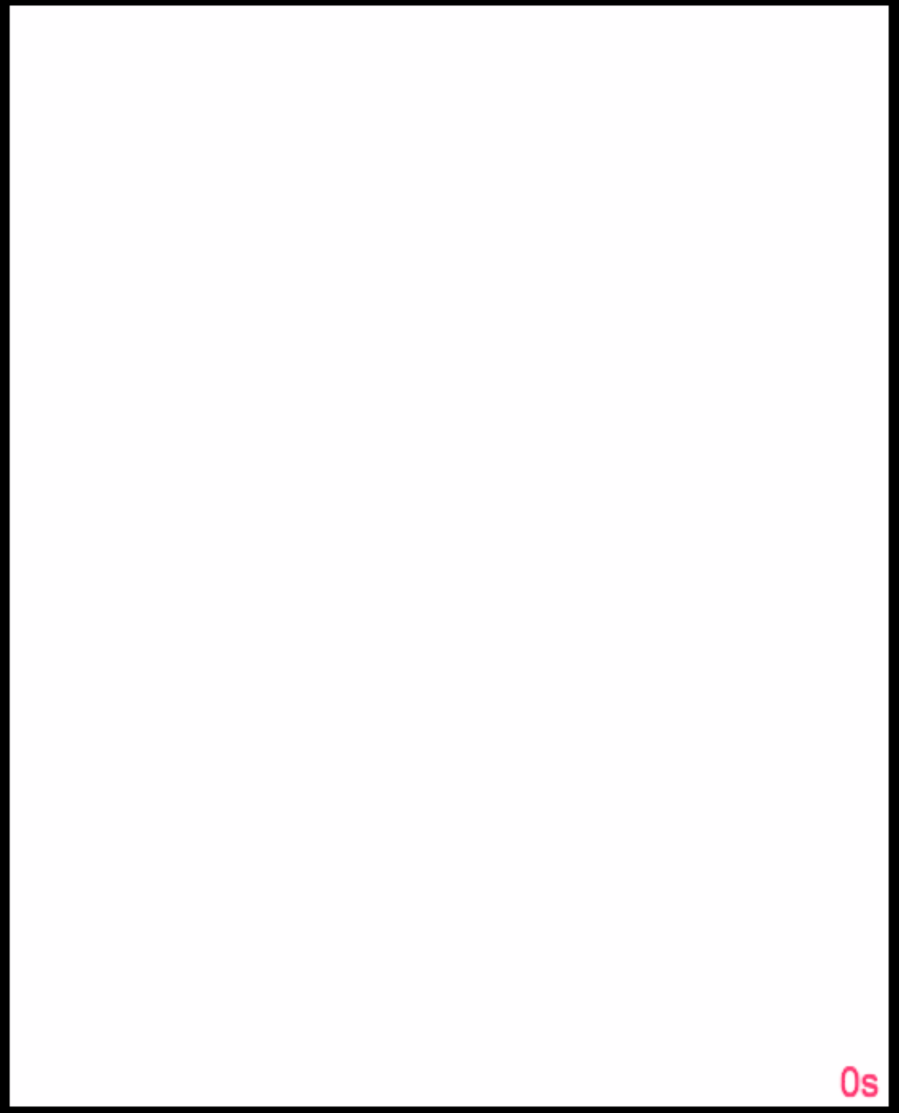
MONTSERRAT

ARCADE CLASSIC

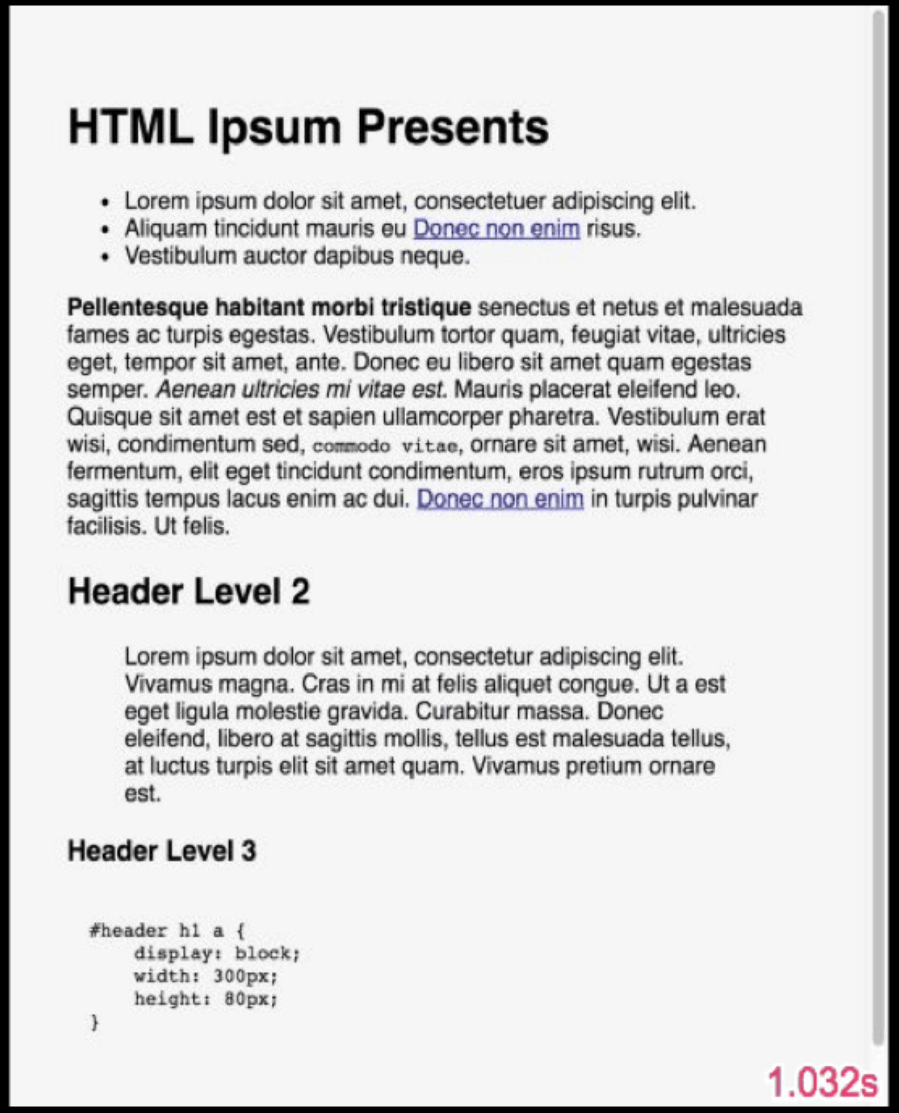
Have a Web Font Loading Strategy

FOUT

FLASH OF UNSTYLED TEXT



REQUEST CONTENT



HTML Ipsum Presents

- Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
- Aliquam tincidunt mauris eu Donec non enim risus.
- Vestibulum auctor dapibus neque.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. *Aenean ultricies mi vitae est.* Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, `commodo vitae`, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis.

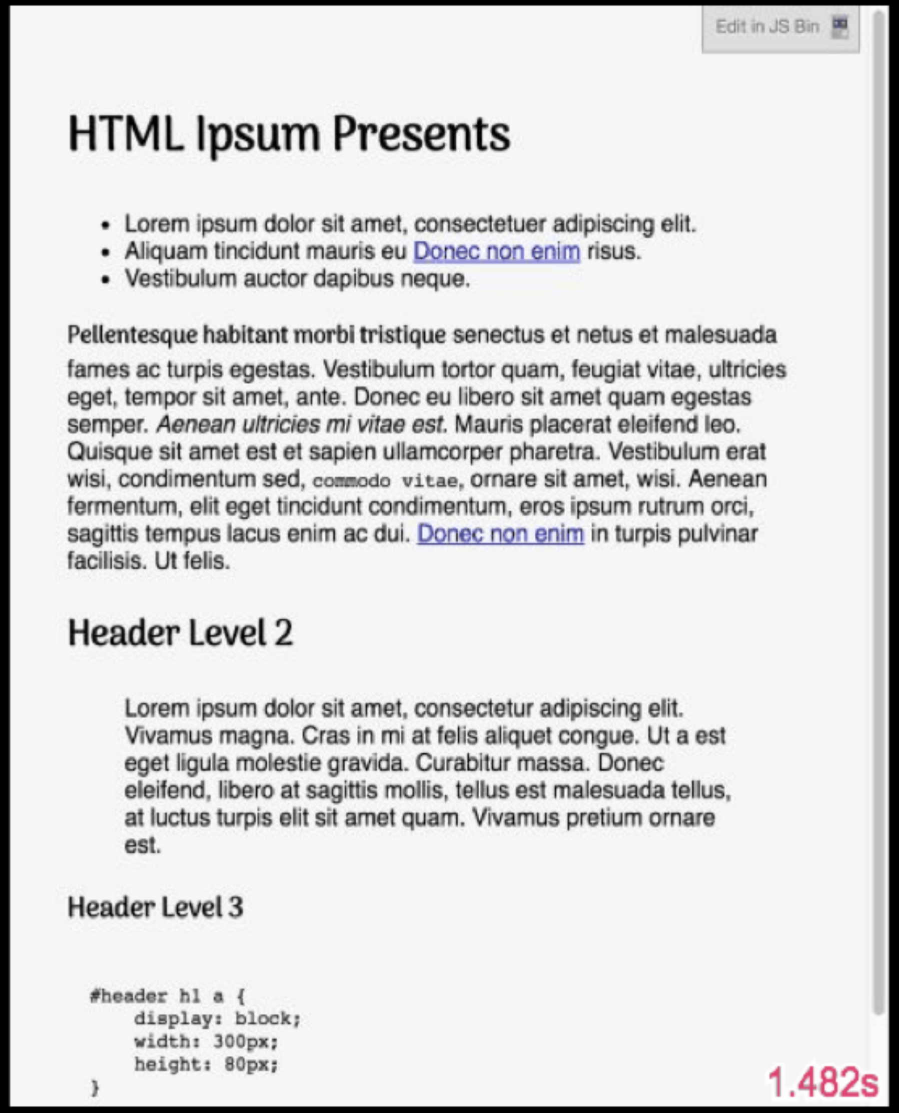
Header Level 2

> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.

Header Level 3

```
#header h1 a {
    display: block;
    width: 300px;
    height: 80px;
}
```

CONTENT LOADS



HTML Ipsum Presents

- Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
- Aliquam tincidunt mauris eu Donec non enim risus.
- Vestibulum auctor dapibus neque.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. *Aenean ultricies mi vitae est.* Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, `commodo vitae`, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis.

Header Level 2

> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.

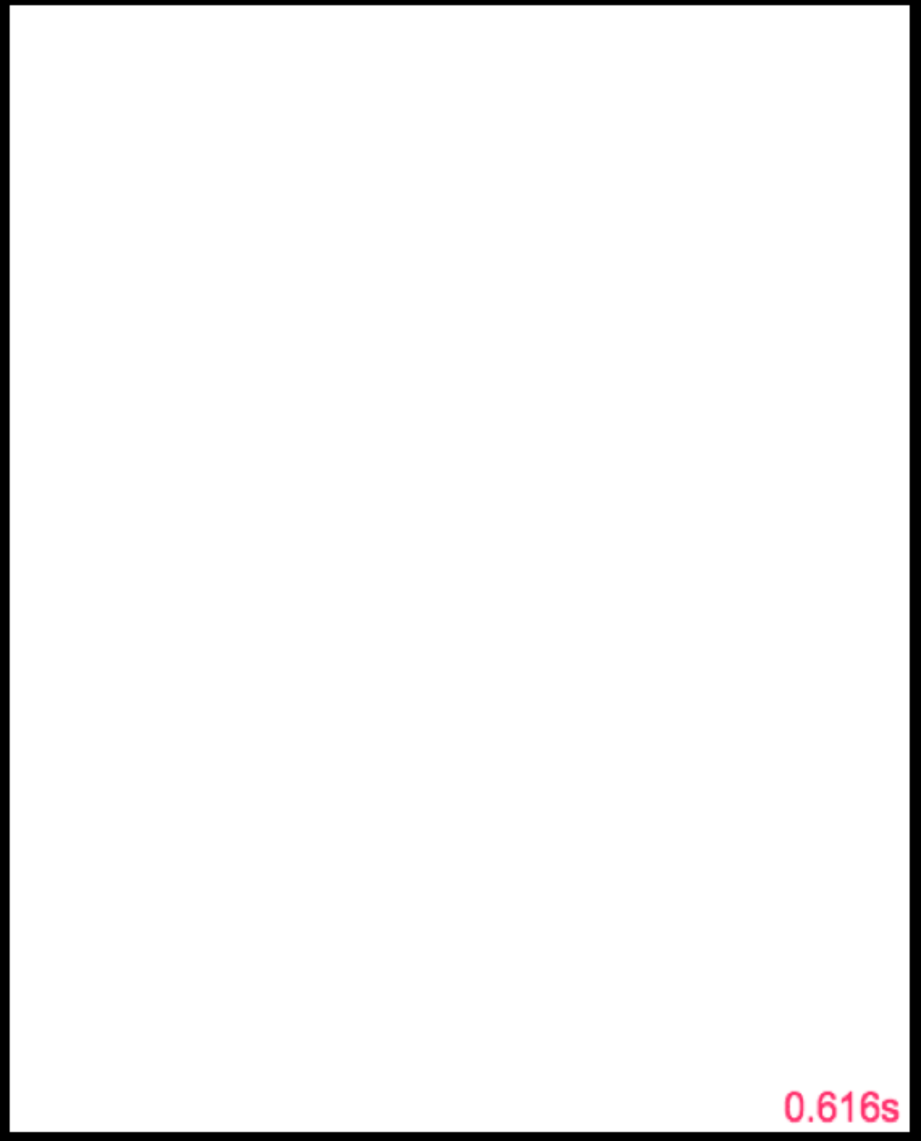
Header Level 3

```
#header h1 a {
    display: block;
    width: 300px;
    height: 80px;
}
```

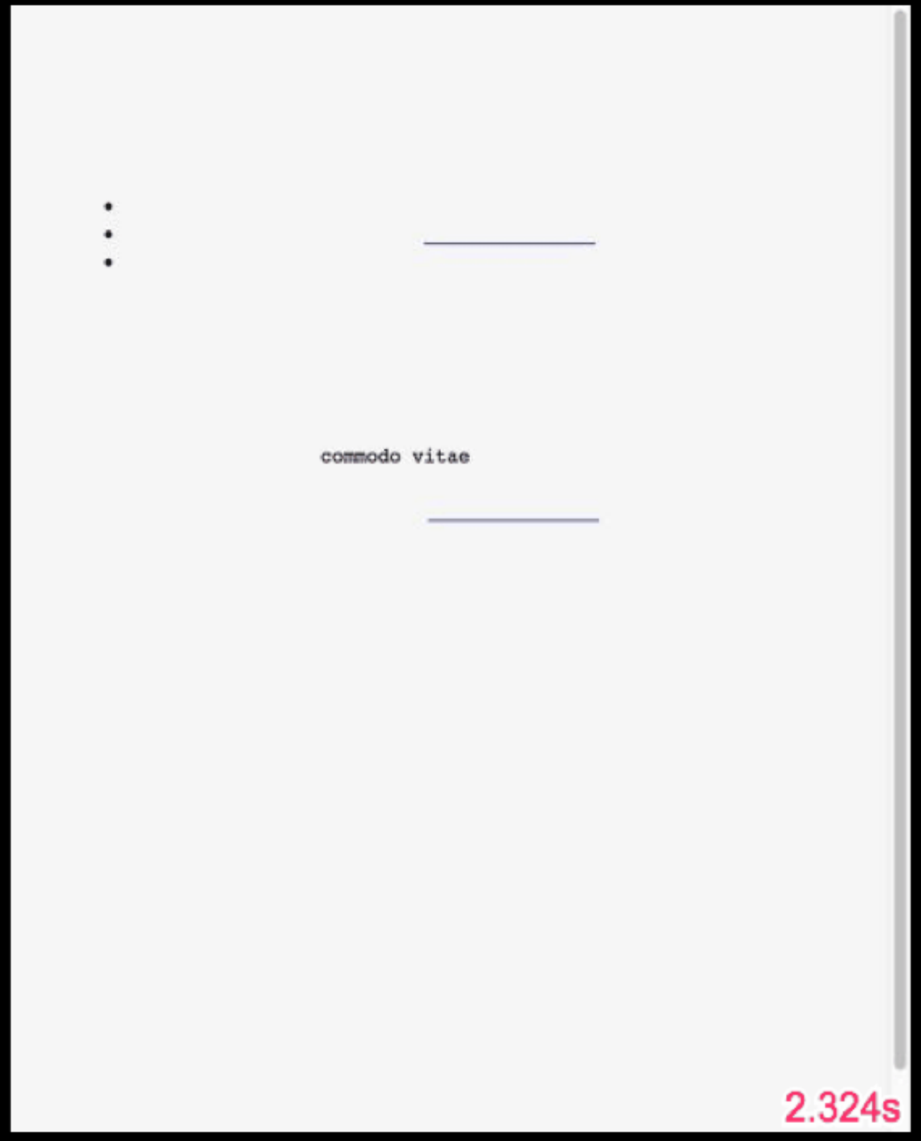
WEB FONT LOADS

FOIT

FLASH OF INVISIBLE TEXT

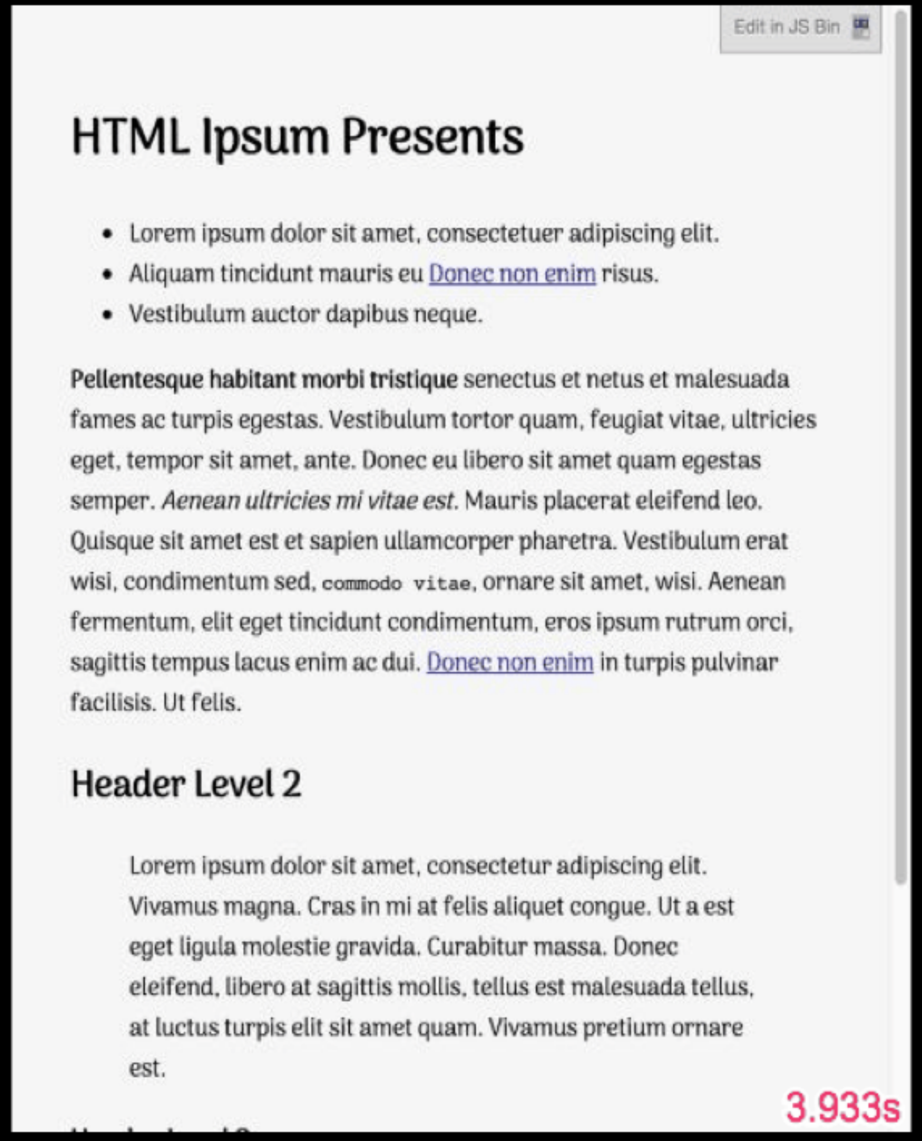


REQUEST CONTENT



`commodo vitae`

CONTENT LOADS



HTML Ipsum Presents

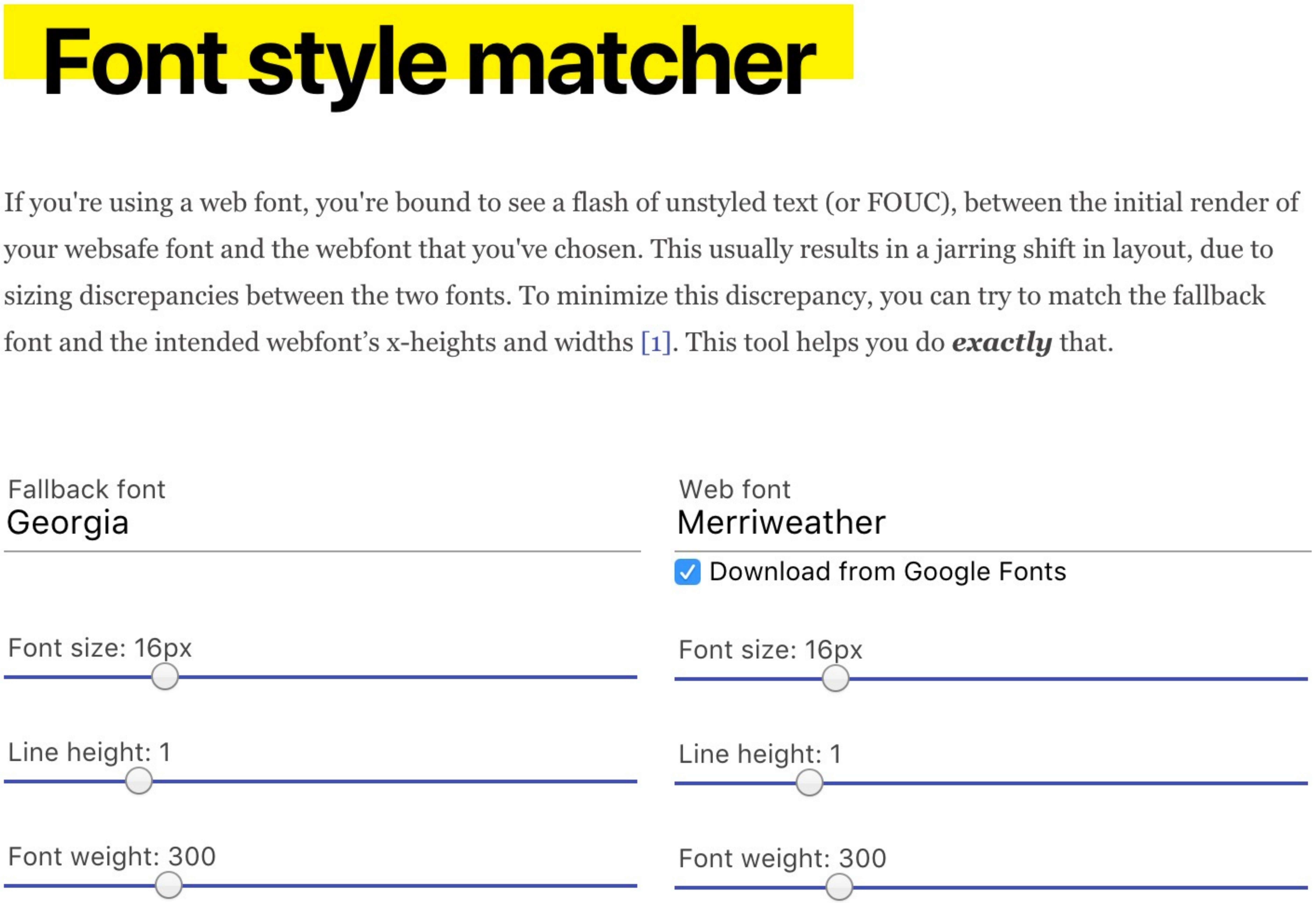
- Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
- Aliquam tincidunt mauris eu Donec non enim risus.
- Vestibulum auctor dapibus neque.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. *Aenean ultricies mi vitae est.* Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, `commodo vitae`, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis.

Header Level 2

> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.

WEB FONT LOADS



Font style matcher

If you're using a web font, you're bound to see a flash of unstyled text (or FOUC), between the initial render of your websafe font and the webfont that you've chosen. This usually results in a jarring shift in layout, due to sizing discrepancies between the two fonts. To minimize this discrepancy, you can try to match the fallback font and the intended webfont's x-heights and widths [1]. This tool helps you do ***exactly*** that.

Fallback font
Georgia

Web font
Merriweather
☑ Download from Google Fonts

Font size: 16px

Font size: 16px

Line height: 1

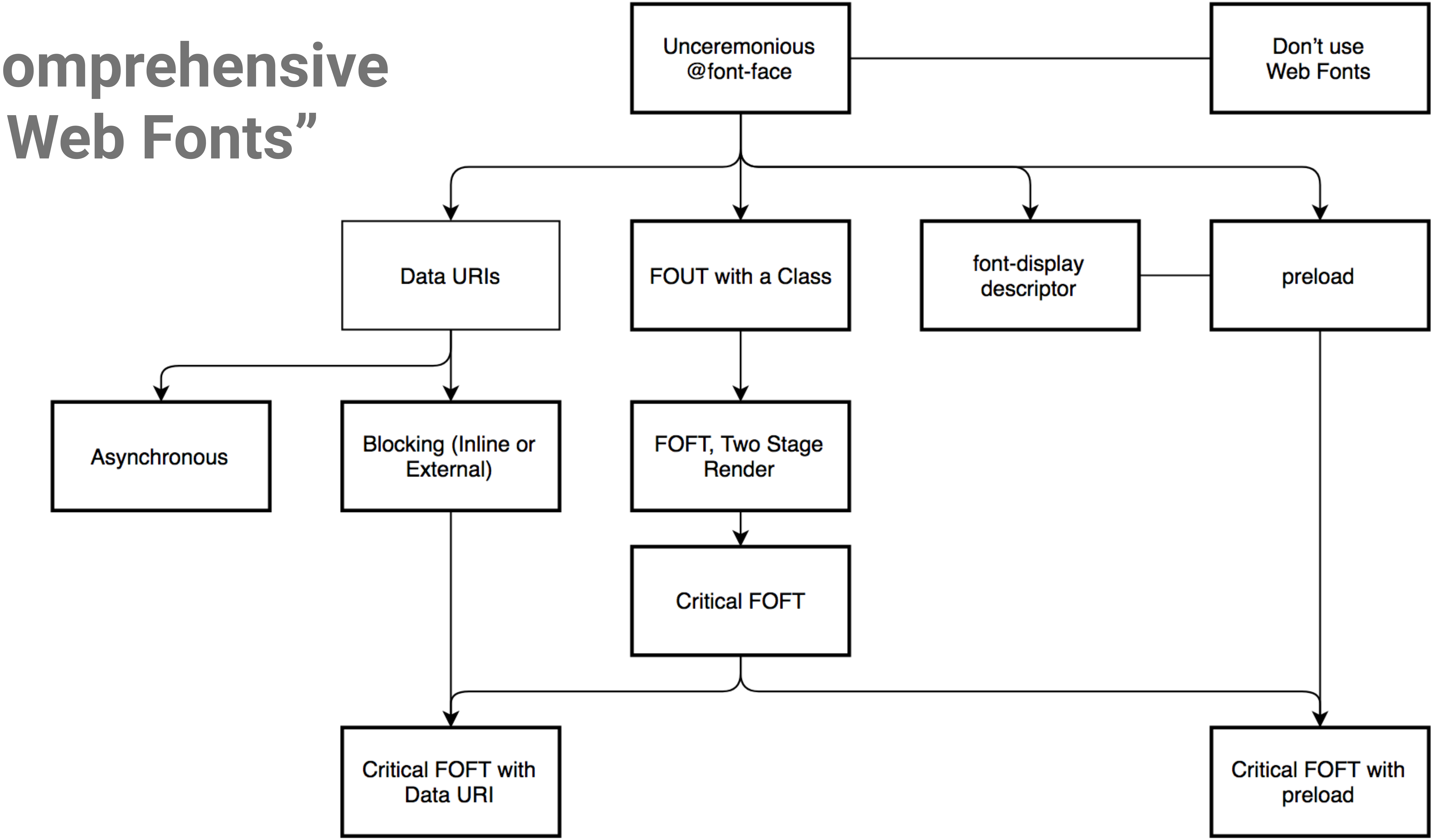
Line height: 1

Font weight: 300

Font weight: 300

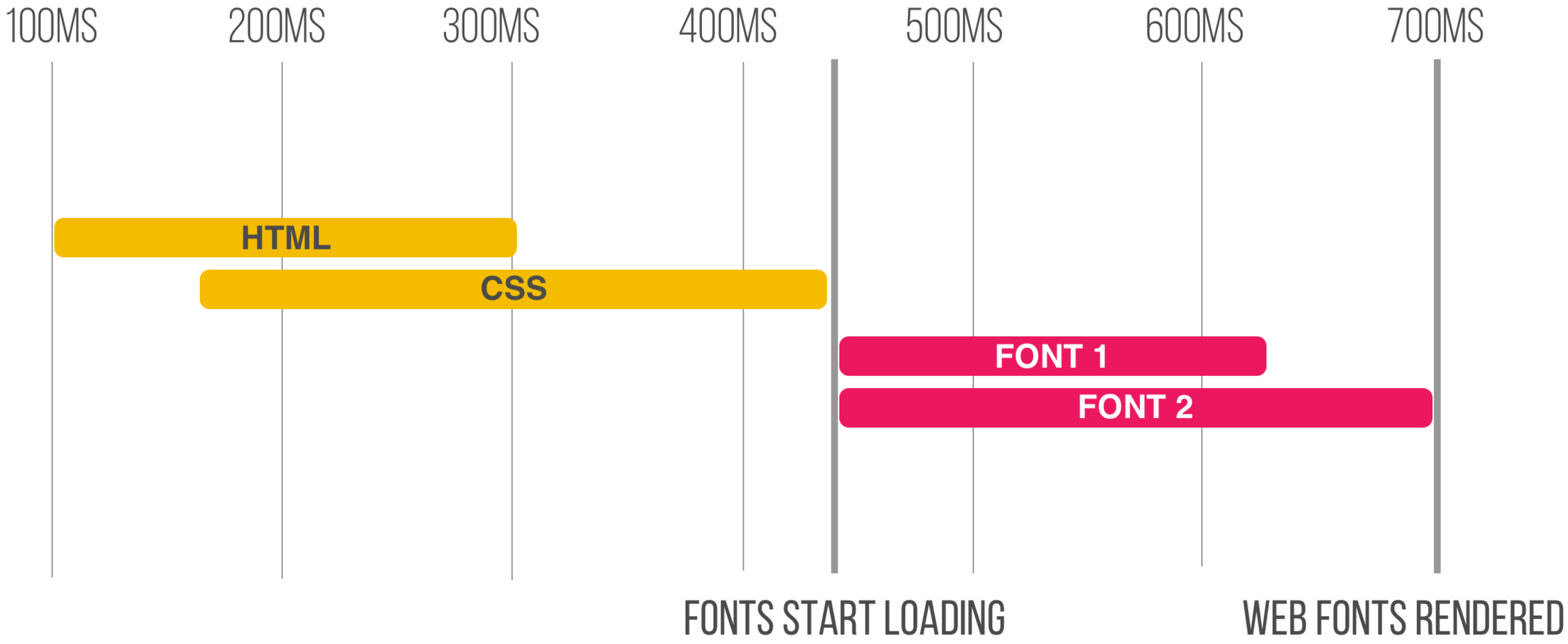
https://meowni.ca/font-style-matcher/

“Comprehensive Web Fonts”

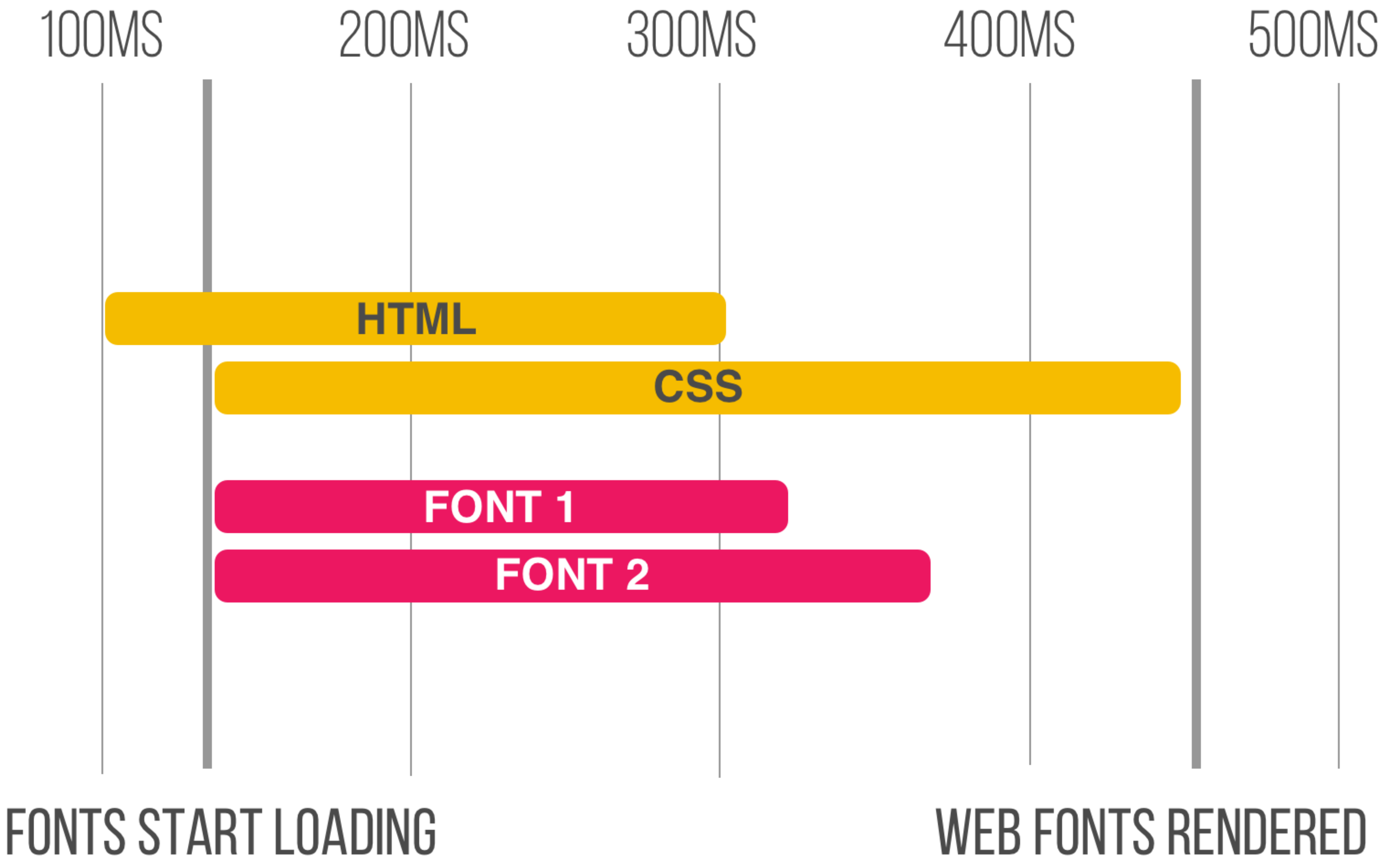


https://www.zachleat.com/web/comprehensive-webfonts/

Without Preload



With Preload



With Preload

```
<link rel="preload" as="font" href="font.woff"
type="font/woff">
```

```
Link: <font.woff>; rel=preload; as=font;
type='font/woff'
```

Heaviest use of rel=preload is for Web Fonts

HTTPArchive

Nexus 5X ▼
412 × 732
75% ▼
12:29
teenVOGUE
Like
Use Shopify to create your online store
It only takes 60 seconds
shopify
No design skills needed
Unlimited bandwidth and produ
Accept payments instantly
Application
Elements
Console
Network
Timeline
Sources
Profiles
Security
Styles
Computed
Filter
Inherited from html

```
fashion, beauty, celebrity style, entertainment, teen issues,
videos and more from TeenVogue magazine on TeenVogue.com.
Fashion starts here.">
<meta property="og:image" content>
<meta name="twitter:card" content="summary_large_image">
<meta name="twitter:site" content="@teenvogue">
<meta name="twitter:title" content="Teen Vogue: Fashion,
Beauty, Entertainment News for Teens">
<meta name="twitter:description" content="The latest on
fashion, beauty, celebrity style, entertainment, teen issues,
videos and more from TeenVogue magazine on TeenVogue.com.
Fashion starts here.">
<meta name="twitter:image:src" content="?mbid=social_retweet">
<meta name="twitter:domain" content="teenvogue.com">
<meta name="version" content="4.1.0">
<link rel="preload" href="/fonts/VogueAvantGarde-Bold.woff"
as="font" type="font/woff" crossorigin>
<link rel="preload" href="/fonts/VogueDisplay.woff" as="font"
type="font/woff" crossorigin> == $0
<link rel="preload" href="/fonts/VogueDisplay-
SemiBoldItalic.woff" as="font" type="font/woff" crossorigin>
<link rel="preload" href="/fonts/VogueAvantGarde-
ExtraLight.woff" as="font" type="font/woff" crossorigin>
▶<script type="application/ld+json">…</script>
▶<script>…</script>
<script async src="//www.teenvogue.com/cns/
```

```
element.style {
}
*, :after, :before
  box-sizing: bor
}
link {
  display: none;
}
html {
  -moz-osx-font-s
  -webkit-font-sm
  height: 100%;
}
html {
  font-size: 10px
  -webkit-tap-hig
}
html {
```

Preloading Web Fonts = 50% (1.2s) improvement in time-to-text-paint

https://www.shopify.com/

shopify
WAYS TO SELL
PRICING
BLOG
MORE
Log in
Get started

Every great business starts with an idea

Shopify is the one platform you need to build the business you've always dreamed of

Start your free trial

Build your brand with your very own online store

Sell your products everywhere, from websites to mobile apps

See how people just like you succeed with Shopify

1.5

https://www.shopify.com/

shopify

1.5

Control font performance with font-display

Chrome 60

auto: uses whatever font display strategy the user-agent uses

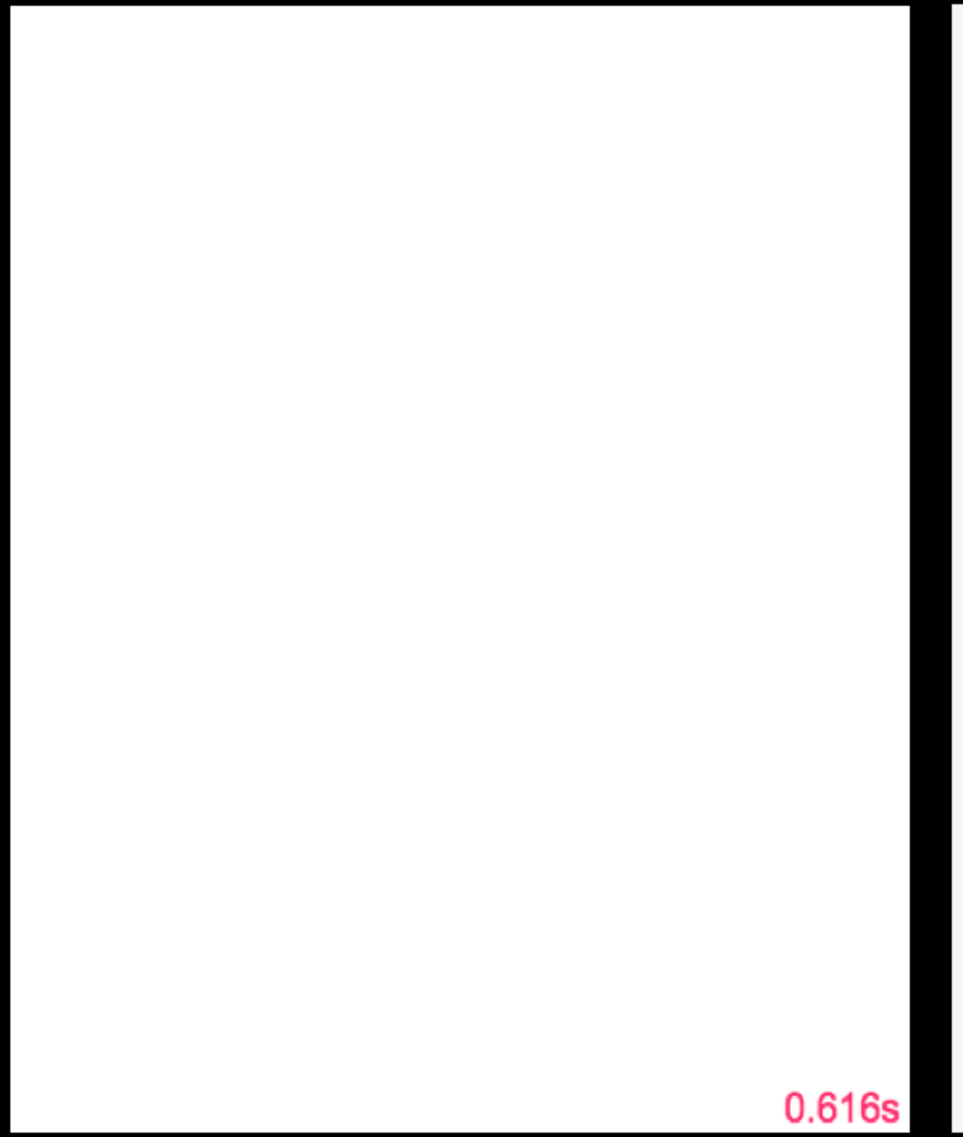
block: draws "invisible" text at first if the font is not loaded, but swaps the font face in as soon as it loads

swap: draws text immediately with a fallback if the font face isn’t loaded, but swaps the font face in as soon as it loads

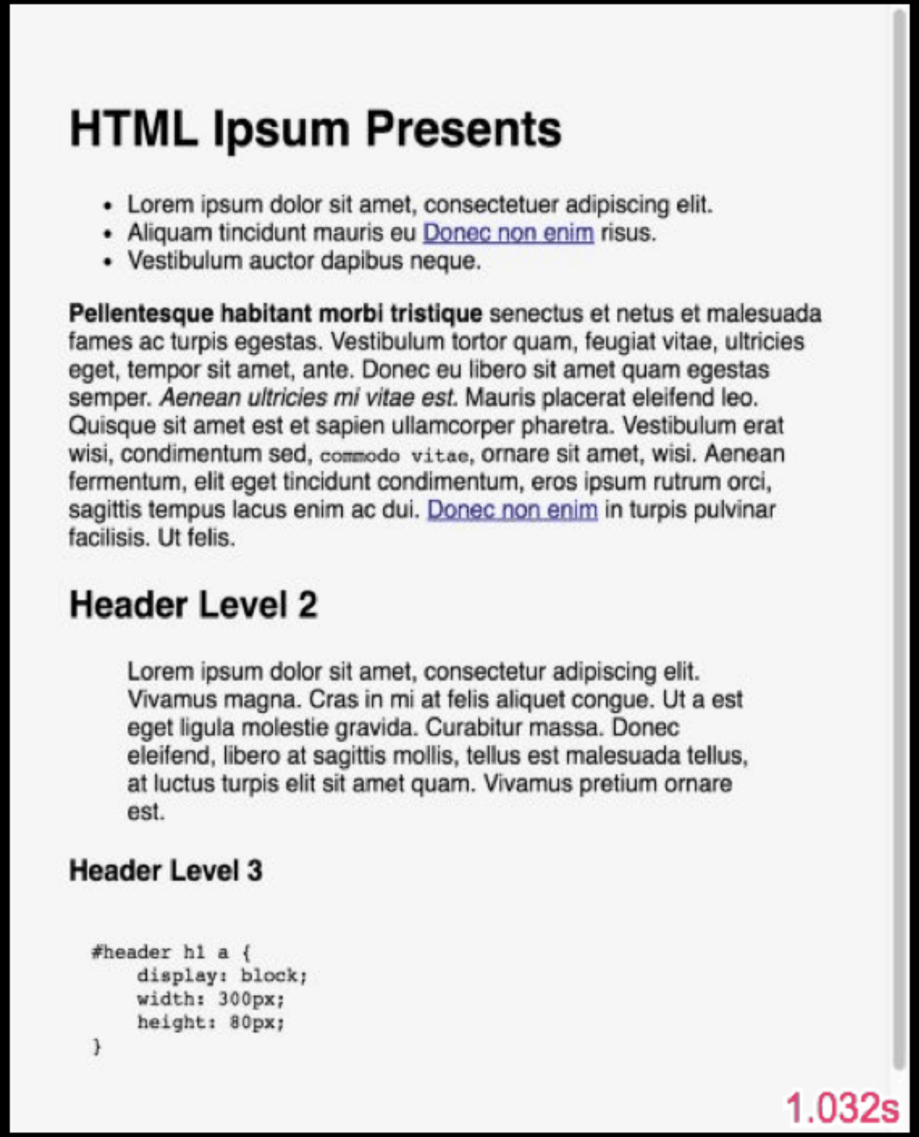
fallback: font face is rendered with a fallback at first if it’s not loaded, but the font is swapped as soon as it loads

optional: if the font face can’t be loaded quickly, just use the fallback `font-display: optional`

Fonts not in the cache


0.616s

REQUEST CONTENT


HTML Ipsum Presents

- Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
- Aliquam tincidunt mauris eu Donec non enim risus.
- Vestibulum auctor dapibus neque.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. *Aenean ultricies mi vitae est.* Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, `commodo vitae`, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis.

Header Level 2

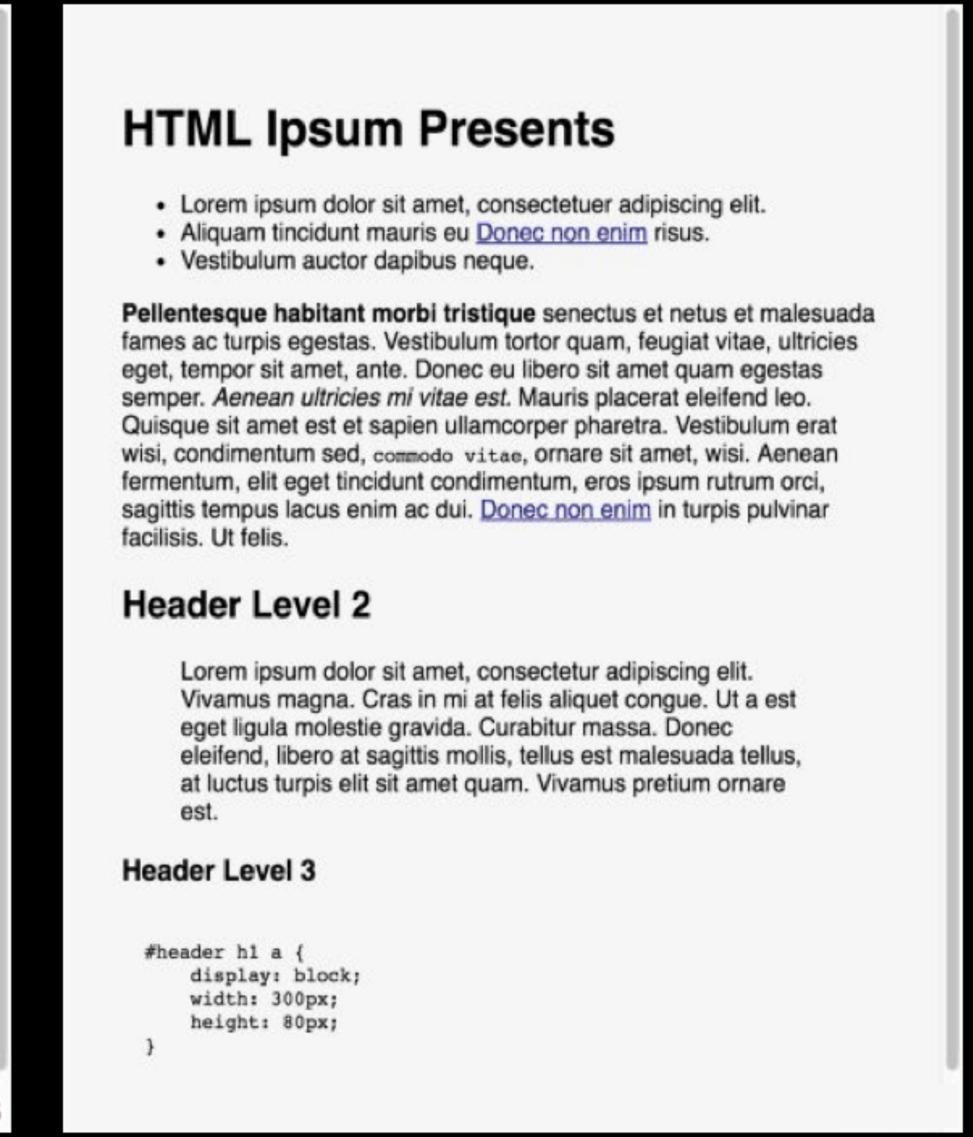
> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.

Header Level 3

```
#header h1 a {
    display: block;
    width: 300px;
    height: 80px;
}
```

1.032s

CONTENT LOADS


HTML Ipsum Presents

- Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
- Aliquam tincidunt mauris eu Donec non enim risus.
- Vestibulum auctor dapibus neque.

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Header Level 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.

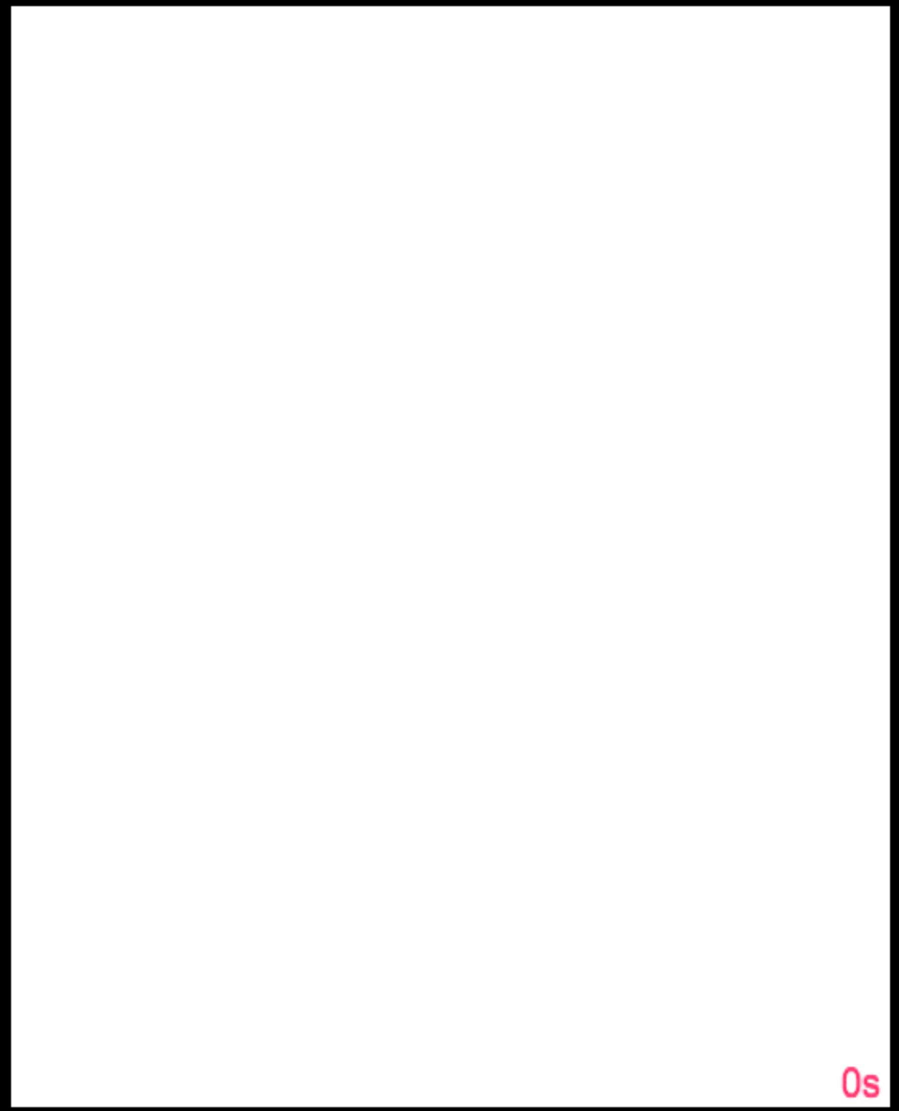
Header Level 3

#header h1 a {
    display: block;
    width: 300px;
    height: 80px;
}

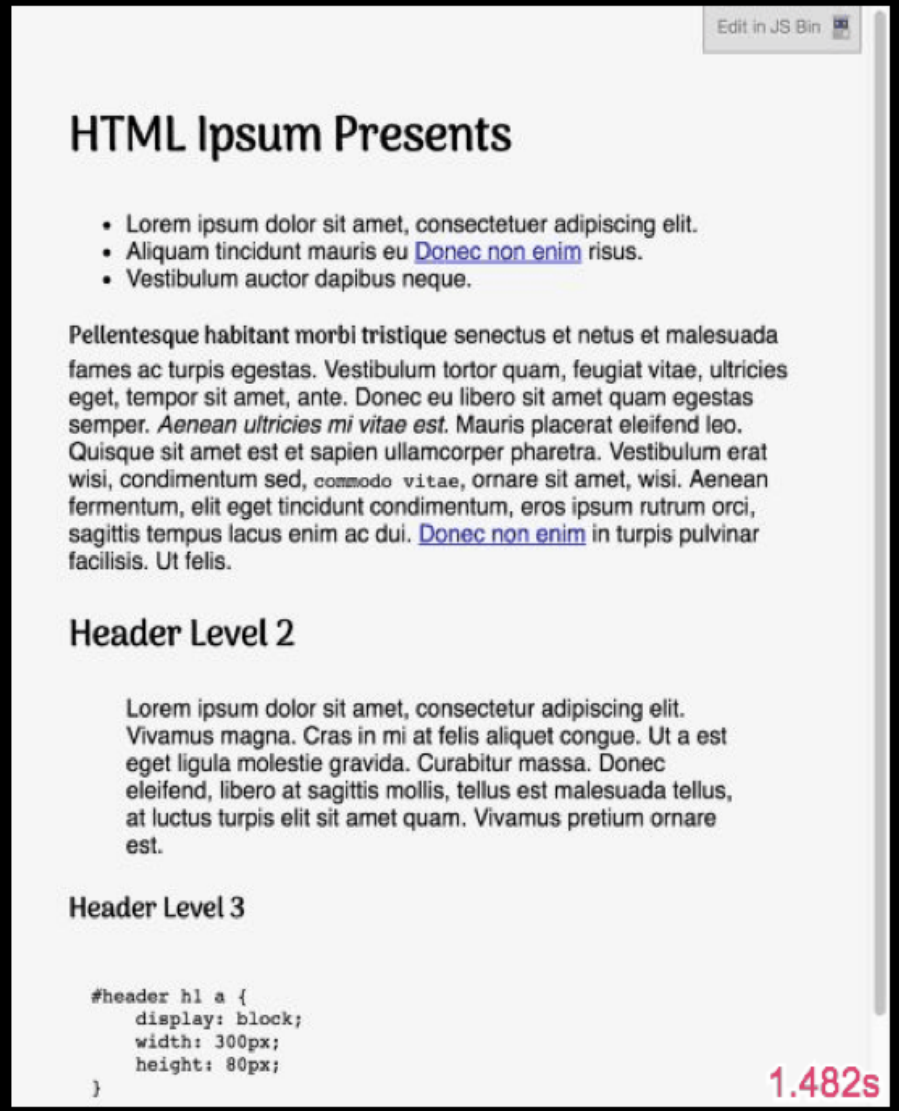
WEB FONT LOADS

`font-display: optional`

Fonts in the cache


0s

REQUEST CONTENT



HTML Ipsum Presents

- Lorem ipsum dolor sit amet, consectetuer adipiscing elit.
- Aliquam tincidunt mauris eu Donec non enim risus.
- Vestibulum auctor dapibus neque.

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Vestibulum tortor quam, feugiat vitae, ultricies eget, tempor sit amet, ante. Donec eu libero sit amet quam egestas semper. *Aenean ultricies mi vitae est.* Mauris placerat eleifend leo. Quisque sit amet est et sapien ullamcorper pharetra. Vestibulum erat wisi, condimentum sed, `commodo vitae`, ornare sit amet, wisi. Aenean fermentum, elit eget tincidunt condimentum, eros ipsum rutrum orci, sagittis tempus lacus enim ac dui. Donec non enim in turpis pulvinar facilisis. Ut felis.

Header Level 2

> Lorem ipsum dolor sit amet, consectetur adipiscing elit. Vivamus magna. Cras in mi at felis aliquet congue. Ut a est eget ligula molestie gravida. Curabitur massa. Donec eleifend, libero at sagittis mollis, tellus est malesuada tellus, at luctus turpis elit sit amet quam. Vivamus pretium ornare est.

Header Level 3

```
#header h1 a {
    display: block;
    width: 300px;
    height: 80px;
}
```

1.482s

CONTENT LOADS

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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Ę	Ĝ	Ğ	Ġ	Ģ	Ĥ	Ħ	Ì	Í	Î	Ĩ	Ï	Ī	Ĭ	İ	Į	Ĳ	Ĵ	Ķ	Ĺ	Ľ	Ļ	Ŀ	Ł	Ń	Ň	Ñ
Ņ	Ò	Ó	Ô	Õ	Ö	Ō	Ŏ	Ő	Ø	Ǿ	Œ	Ŕ	Ř	Ŗ	Ś	Ŝ	Š	Ş	Ș	Ť	Ţ	Ŧ	Ù	Ú	Û	Ũ
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h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	à	á	â	ã	ä	ā	ă	å
ǻ	ą	æ	ǽ	ć	ĉ	č	ċ	ç	ď	đ	è	é	ê	ĕ	ë	ē	ě	ė	ę	ĝ	ğ	ġ	ģ	ĥ	ħ	ì
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©	®	™	¤	€	$	¢	£	ƒ	¥	ª	º	°	#	0	1	2	3	4	5	6	7	8	9	¹	²	³
⁄	¼	½	¾	%	‰	+	−	±	×	÷	=	≠	≈	<	>	≤	≥	µ	¬	∆	Ω	π	∞	∂	∫	√

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
À	Á	Â	Ã	Ä	Ā	Ă	Å	Ǻ	Ą	Æ	Ǽ	Ć	Ĉ	Č	Ċ	Ç	Ď	Đ	È	É	Ê	Ě	Ë	Ē	Ĕ	Ė
Ę	Ĝ	Ğ	Ġ	Ģ	Ĥ	Ħ	Ì	Í	Î	Ĩ	Ï	Ī	Ĭ	İ	Į	Ĳ	Ĵ	Ķ	Ĺ	Ľ	Ļ	Ŀ	Ł	Ń	Ň	Ñ
Ņ	Ò	Ó	Ô	Õ	Ö	Ō	Ŏ	Ő	Ø	Ǿ	Œ	Ŕ	Ř	Ŗ	Ś	Ŝ	Š	Ş	Ș	Ť	Ţ	Ŧ	Ù	Ú	Û	Ũ
Ü	Ū	Ŭ	Ů	Ű	Ų	Ẁ	Ẃ	Ŵ	Ẅ	Ỳ	Ý	Ŷ	Ÿ	Ź	Ž	Ż	Ŋ	Ð	Þ	a	b	c	d	e	f	g
h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z	à	á	â	ã	ä	ā	ă	å
ǻ	ą	æ	ǽ	ć	ĉ	č	ċ	ç	ď	đ	è	é	ê	ě	ë	ē	ĕ	ė	ę	ĝ	ğ	ġ	ģ	ĥ	ħ	ì
í	î	ĩ	ï	ī	ĭ	į	ĳ	ı	ȷ	ĵ	ķ	ĸ	ĺ	ľ	ļ	ŀ	ł	ń	ň	ñ	ņ	ŉ	ò	ó	ô	õ
ö	ō	ŏ	ő	ø	ǿ	œ	ŕ	ŗ	ř	ś	ŝ	š	ş	ș	ß	ſ	ť	ţ	ŧ	ù	ú	û	ũ	ü	ū	ŭ
ů	ű	ų	ẁ	ẃ	ŵ	ẅ	ỳ	ý	ŷ	ÿ	ź	ž	ż	ŋ	ð	þ	ﬀ	ﬁ	ﬃ	ﬂ	ﬄ	&	`	´	ˆ	ˇ
˜	¨	¯	˘	˚	˝	˙	¸	˛	,	;	:	0	…	!	¡	?	¿				“	”		„	‹	
›	«	»	/	|	-	–	—	•	·	(	)	[	]	{	}	*	†	‡	§	¶	^	~	¦	\	_	@
©	®	™	¤	€	$	¢	£	ƒ	¥	ª	º	°	#	0	1											
⁄	¼	½	¾	%	‰	+	−	±	×	÷	=	≠	≈	<	>	≤	≥	µ	¬	∆	Ω	π	∞	∂	∫	√

bit.ly/font-subsetting

Web Font Subsetting

Supported by Google Fonts

```
https://fonts.googleapis.com/css?family=Inconsolata
```

~3KB

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
abcdefghijklm
nopqrstuvwxyz
1234567890

```
https://fonts.googleapis.com/css?family=Inconsolata&text=Hello
```

~880 bytes

H
W
del
or

The browser can also handle subsetting!

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
abcdefghijklm
nopqrstuvwxyz
1234567890

```
/* Large subset, normal weight */
@font-face {
  font-family: whatever;
  src: url('reg-extended.woff')
  format('woff');
  unicode-range: U+A0-FFFF;
  font-weight: normal;
}
```

Firefox 44

Chrome 36

https://jakearchibald.com/2014/minimising-font-downloads/

CSS Font Loading API

Firefox 41

Chrome 35

```
const font = new FontFace("Awesome Font", "url(/fonts/awesome.woff2)", {
  style: 'normal', unicodeRange: 'U+000-5FF', weight: '400'
});

// don't wait for the render tree, initiate an immediate fetch!
font.load().then(function() {
  // apply the font (which may re-render text and cause a page reflow)
  // after the font has finished downloading
  document.fonts.add(font);
  document.body.style.fontFamily = "Awesome Font, serif";
  // OR... apply your own render strategy here...
});
```

https://developers.google.com/web/fundamentals/performance/optimizing-content-efficiency/webfont-optimization

Web Font Loading Tips

https://meowni.ca/posts/web-fonts/

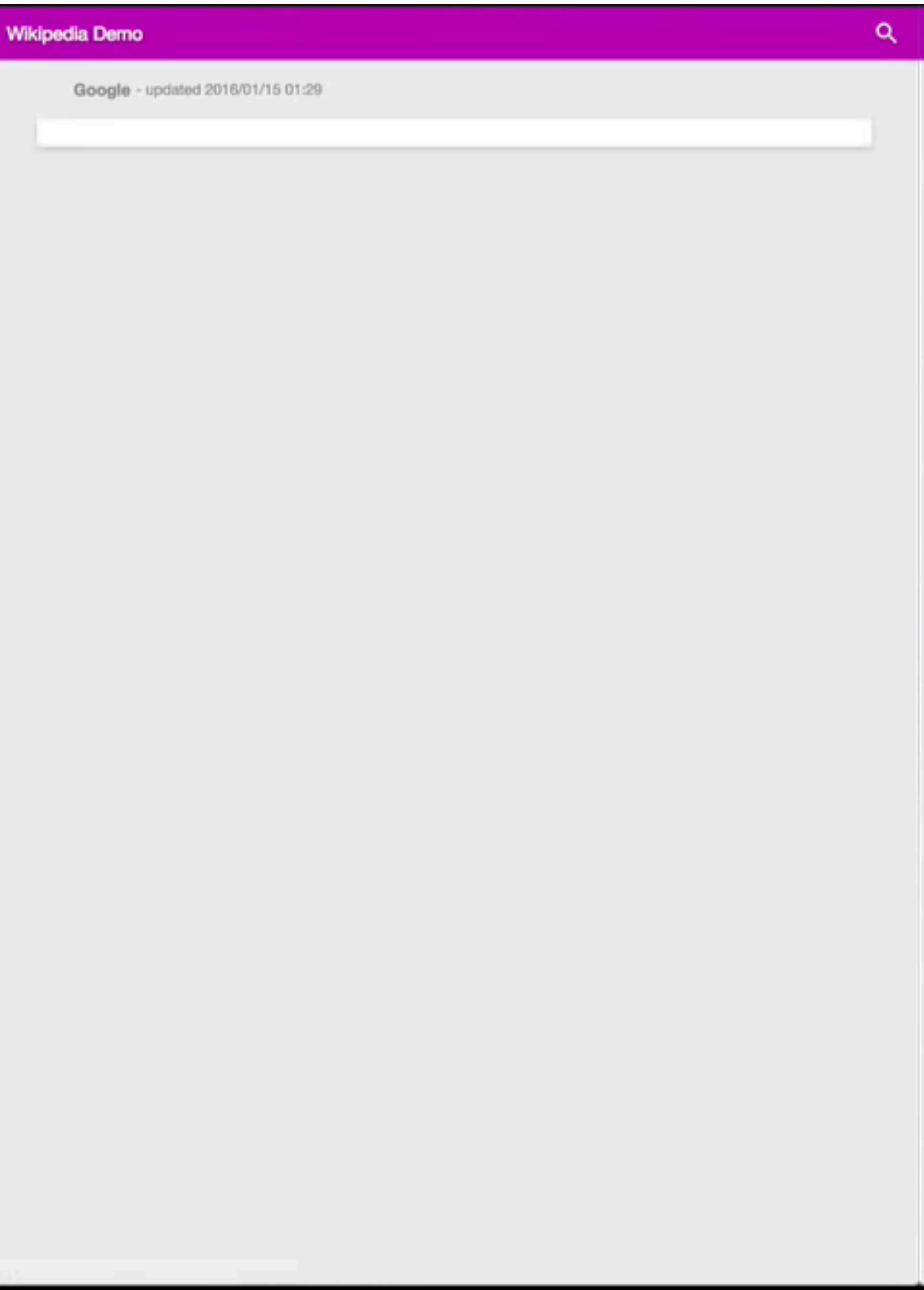
1. Understand the anatomy of a web font and how browsers load
2. font-display: optional (i.e if you can’t do it fast, load a fallback)
3. Minimize font downloads by limiting range of characters you’re loading
4. Minimize FOIT by using <link rel=“preload”>
5. If you need more control try out the Font Loading API

THE FUTURE?

PROGRESSIVE LOADING . . . .

Progressive Loading: HTML

bit.ly/streams-ftw / Streams API

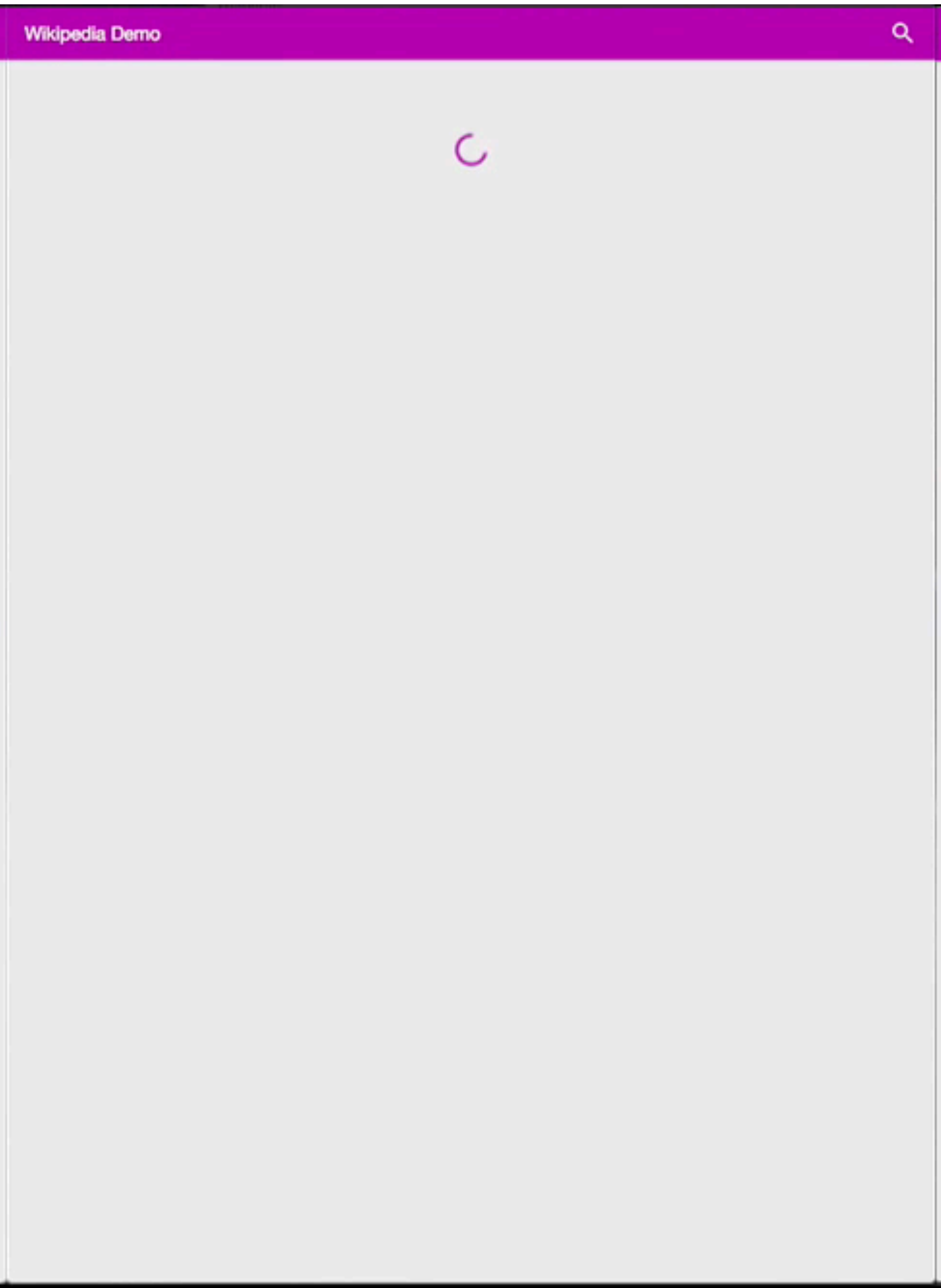


Wikipedia Demo

Google - updated 2016/01/15 01:29

Server render

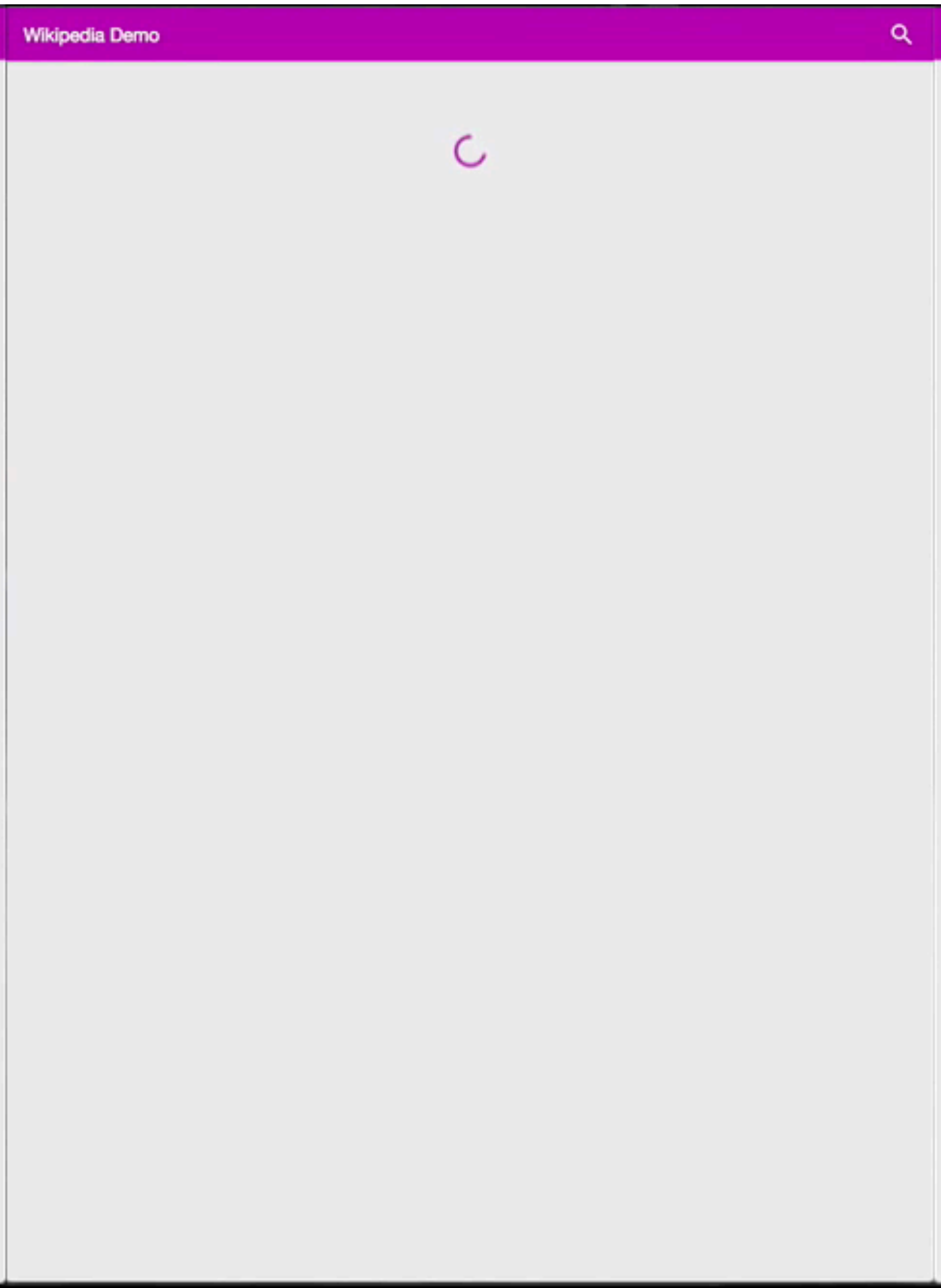
0.73s /



Wikipedia Demo

Service worker client render

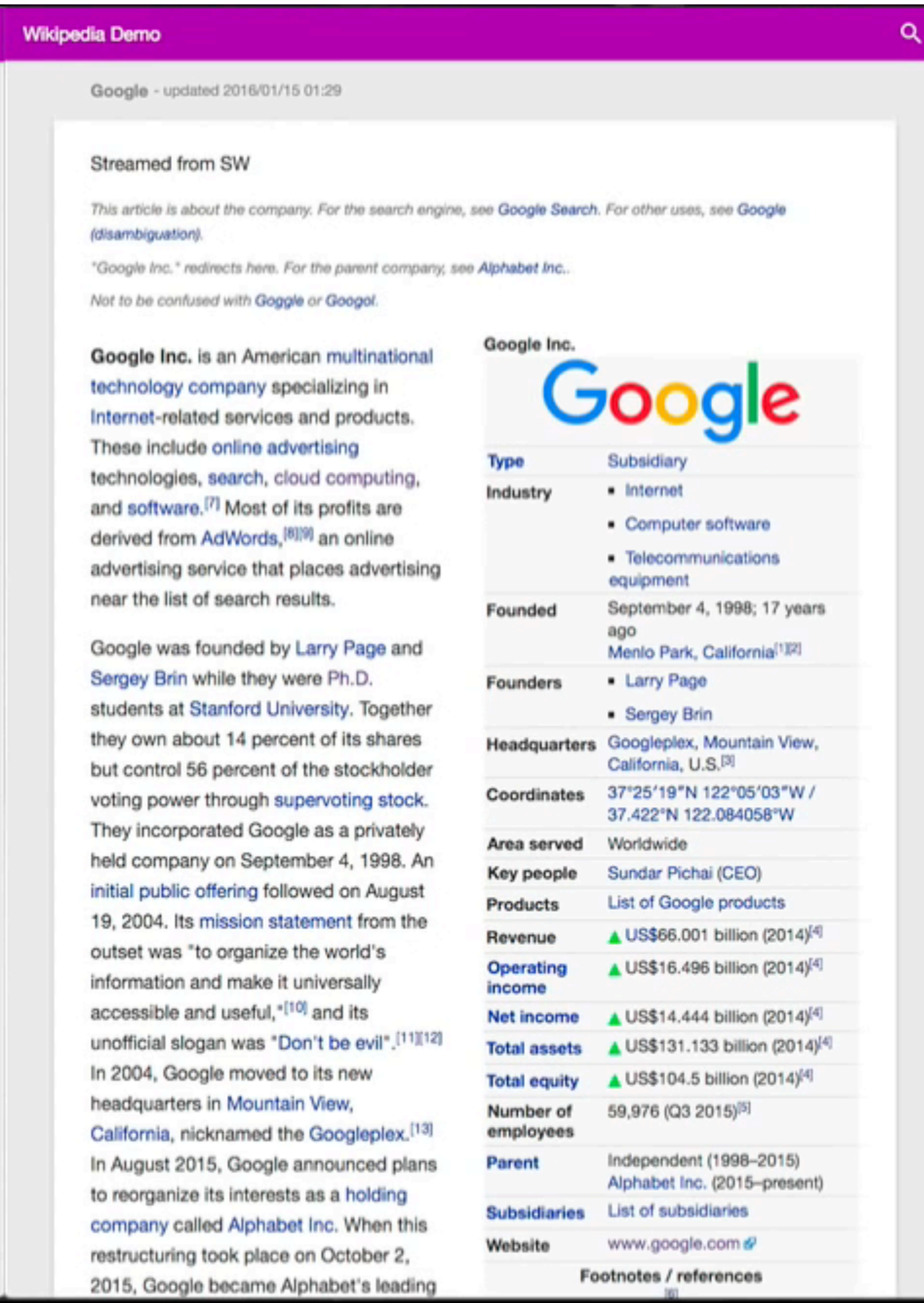
0.10s /



Wikipedia Demo

Service worker client render + hacks

0.10s /



Wikipedia Demo

Google - updated 2016/01/15 01:29

Streamed from SW

This article is about the company. For the search engine, see Google Search. For other uses, see Google (disambiguation).

"Google Inc." redirects here. For the parent company, see Alphabet Inc..

Not to be confused with Goggle or Googol.

Google Inc. is an American multinational technology company specializing in Internet-related services and products. These include online advertising technologies, search, cloud computing, and software.[7] Most of its profits are derived from AdWords,[8][9] an online advertising service that places advertising near the list of search results.

Google was founded by Larry Page and Sergey Brin while they were Ph.D. students at Stanford University. Together they own about 14 percent of its shares but control 56 percent of the stockholder voting power through supervoting stock. They incorporated Google as a privately held company on September 4, 1998. An initial public offering followed on August 19, 2004. Its mission statement from the outset was "to organize the world's information and make it universally accessible and useful,"[10] and its unofficial slogan was "Don't be evil".[11][12] In 2004, Google moved to its new headquarters in Mountain View, California, nicknamed the Googleplex.[13] In August 2015, Google announced plans to reorganize its interests as a holding company called Alphabet Inc. When this restructuring took place on October 2, 2015, Google became Alphabet's leading

Google Inc.

Type	Subsidiary
Industry	• Internet • Computer software • Telecommunications equipment
Founded	September 4, 1998; 17 years ago Menlo Park, California[1][2]
Founders	• Larry Page • Sergey Brin
Headquarters	Googleplex, Mountain View, California, U.S.[3]
Coordinates	37°25′19″N 122°05′03″W / 37.422°N 122.084058°W
Area served	Worldwide
Key people	Sundar Pichai (CEO)
Products	List of Google products
Revenue	▲ US$66.001 billion (2014)[4]
Operating income	▲ US$16.496 billion (2014)[4]
Net income	▲ US$14.444 billion (2014)[4]
Total assets	▲ US$131.133 billion (2014)[4]
Total equity	▲ US$104.5 billion (2014)[4]
Number of employees	59,976 (Q3 2015)[5]
Parent	Independent (1998–2015) Alphabet Inc. (2015–present)
Subsidiaries	List of subsidiaries
Website	www.google.com

Footnotes / references

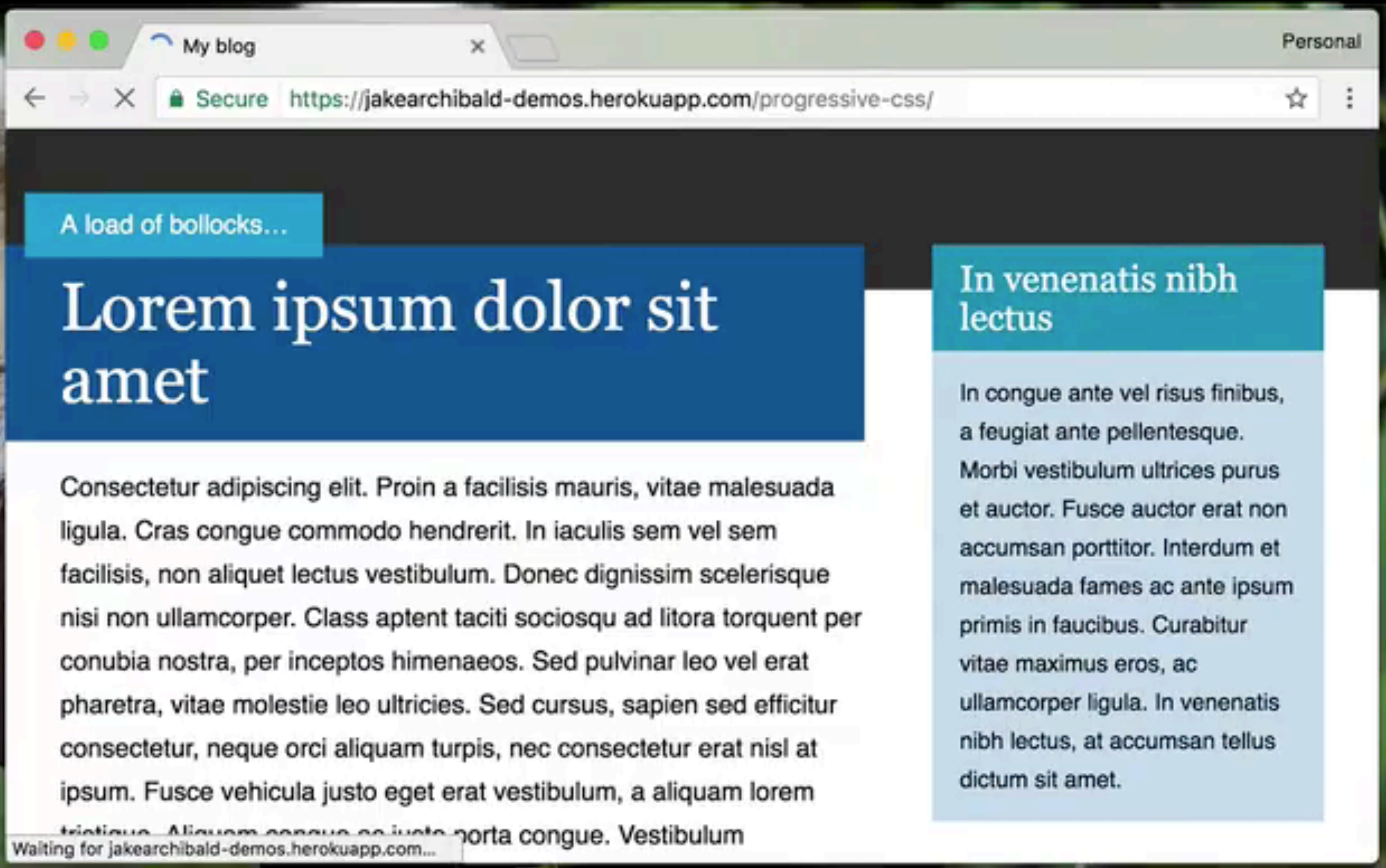
Service worker streamed response

0.10s / 1.00s

Progressive Loading: CSS

bit.ly/progressive-css

<link> in body


My blog
Personal
Secure
https://jakearchibald-demos.herokuapp.com/progressive-css/
Waiting for jakearchibald-demos.herokuapp.com...

A load of bollocks...

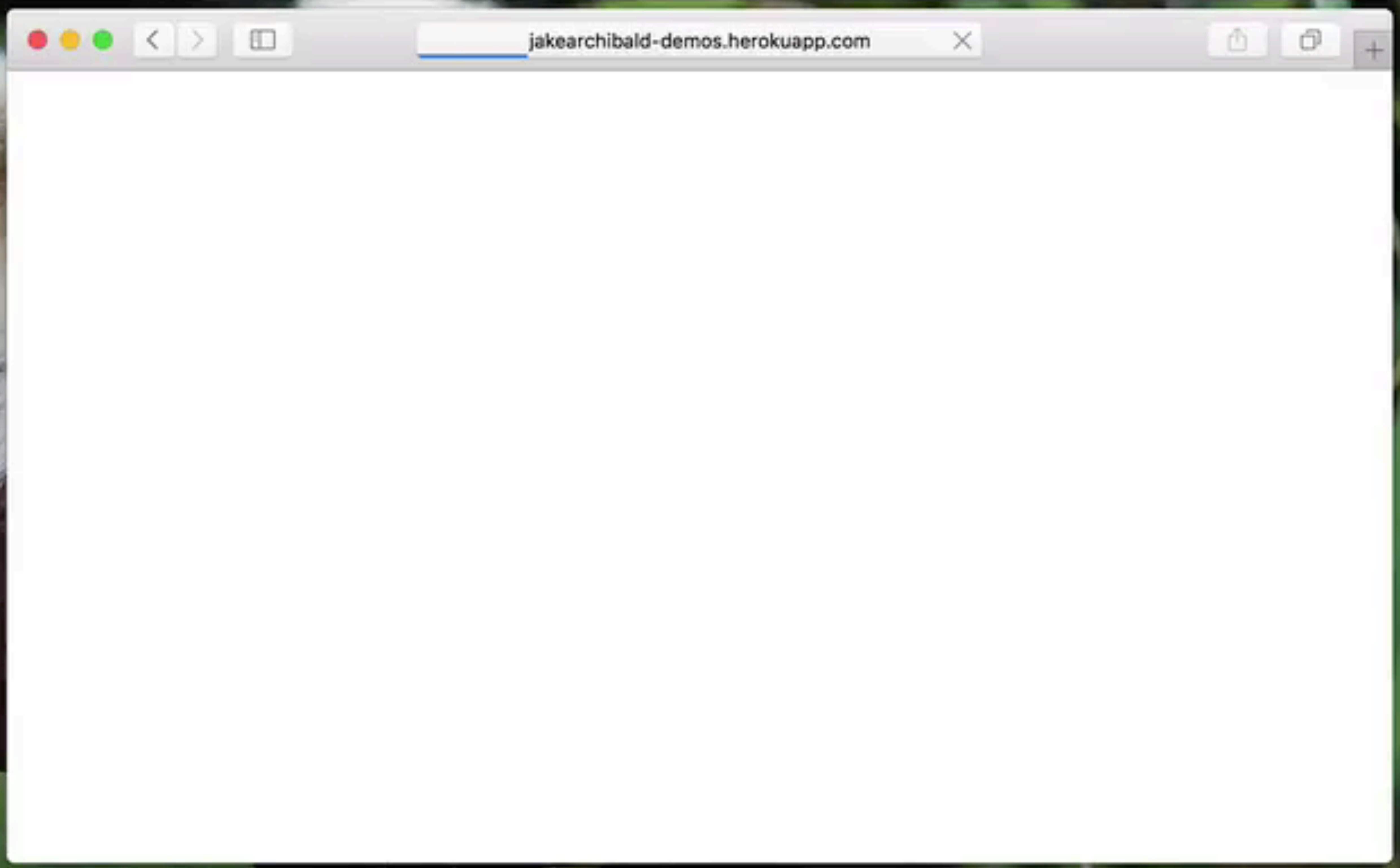
Lorem ipsum dolor sit amet

Consectetur adipiscing elit. Proin a facilisis mauris, vitae malesuada ligula. Cras congue commodo hendrerit. In iaculis sem vel sem facilisis, non aliquet lectus vestibulum. Donec dignissim scelerisque nisi non ullamcorper. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos himenaeos. Sed pulvinar leo vel erat pharetra, vitae molestie leo ultricies. Sed cursus, sapien sed efficitur consectetur, neque orci aliquam turpis, nec consectetur erat nisl at ipsum. Fusce vehicula justo eget erat vestibulum, a aliquam lorem tristique. Aliquam congue ac justo porta congue. Vestibulum

In venenatis nibh lectus

In congue ante vel risus finibus, a feugiat ante pellentesque. Morbi vestibulum ultrices purus et auctor. Fusce auctor erat non accumsan porttitor. Interdum et malesuada fames ac ante ipsum primis in faucibus. Curabitur vitae maximus eros, ac ullamcorper ligula. In venenatis nibh lectus, at accumsan tellus dictum sit amet.

With progressive CSS



Without

Progressive Loading: CSS

bit.ly/progressive-css

<link> in body

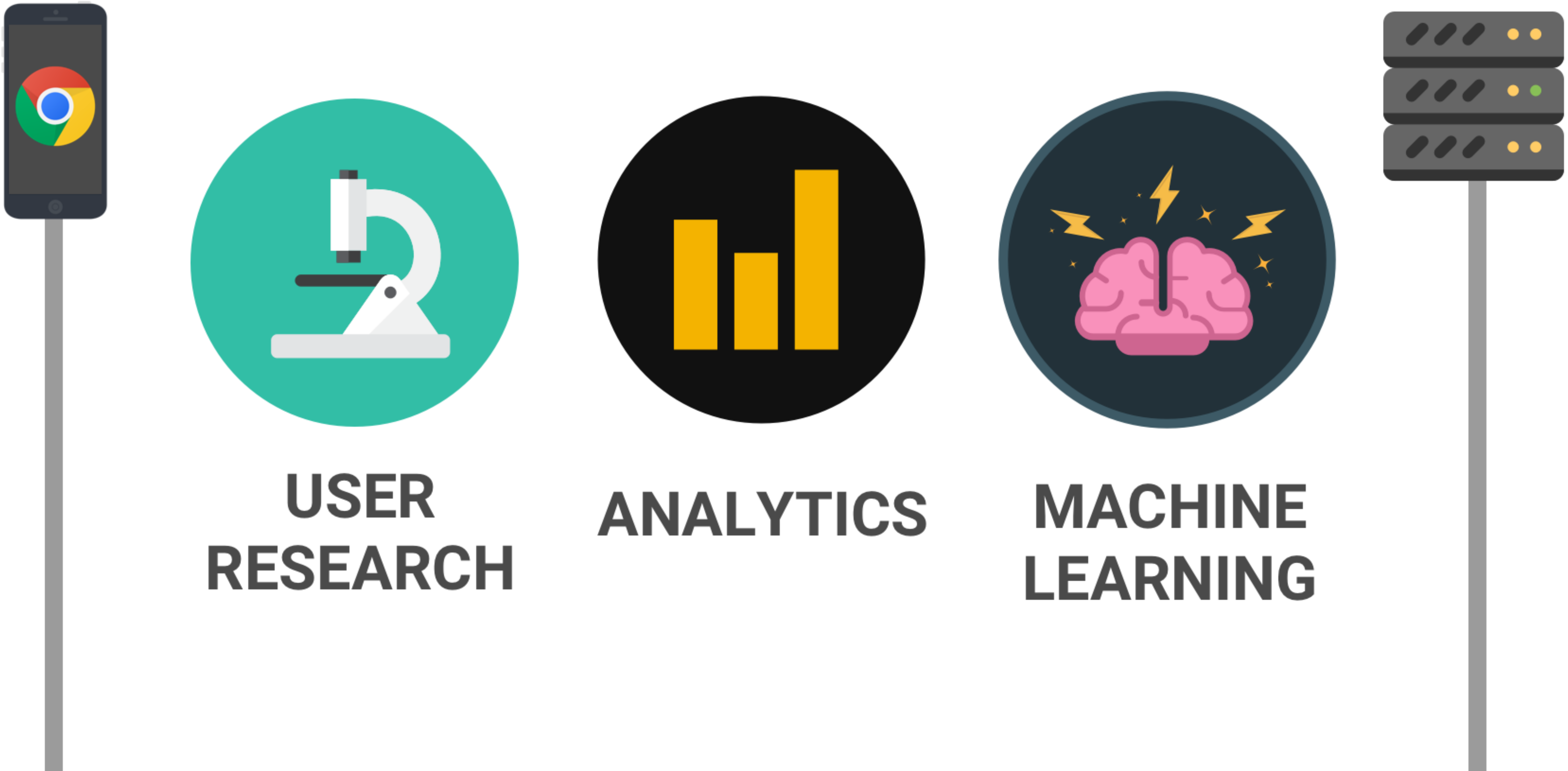
```
<body>
  <!-- HTTP/2 push this resource, or inline it, whichever's faster -->
  <link rel="stylesheet" href="/site-header.css">
  <header>…</header>

  <link rel="stylesheet" href="/article.css">
  <main>…</main>

  <link rel="stylesheet" href="/comment.css">
  <section class="comments">…</section>

  <link rel="stylesheet" href="/about-me.css">
  <section class="about-me">…</section>
</body>
```

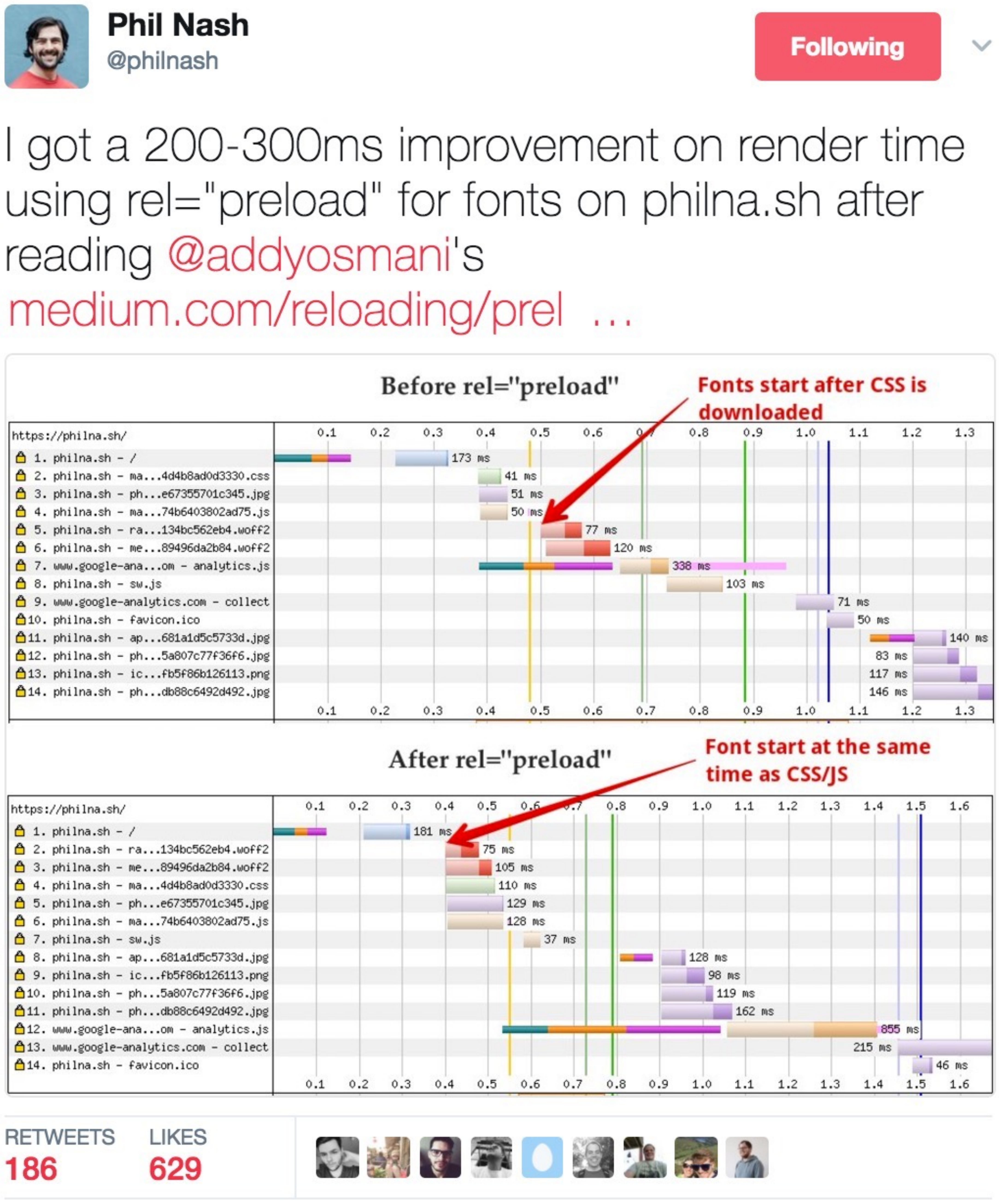
DATA-DRIVEN LOADING



USER RESEARCH

ANALYTICS

MACHINE LEARNING



Phil Nash
@philnash

Following

I got a 200-300ms improvement on render time using rel="preload" for fonts on philna.sh after reading @addyosmani's medium.com/reloading/prel …

Before rel="preload"
Fonts start after CSS is downloaded
https://philna.sh/
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3
1. philna.sh - /
2. philna.sh - ma...4d4b8ad0d3330.css
3. philna.sh - ph...e67355701c345.jpg
4. philna.sh - ma...74b6403802ad75.js
5. philna.sh - ra...134bc562eb4.woff2
6. philna.sh - me...89496da2b84.woff2
7. www.google-ana...om - analytics.js
8. philna.sh - sw.js
9. www.google-analytics.com - collect
10. philna.sh - favicon.ico
11. philna.sh - ap...681a1d5c5733d.jpg
12. philna.sh - ph...5a807c77f36f6.jpg
13. philna.sh - ic...fb5f86b126113.png
14. philna.sh - ph...db88c6492d492.jpg
173 ms
41 ms
51 ms
50 ms
77 ms
120 ms
338 ms
103 ms
71 ms
50 ms
140 ms
83 ms
117 ms
146 ms
After rel="preload"
Font start at the same time as CSS/JS
https://philna.sh/
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6
1. philna.sh - /
2. philna.sh - ra...134bc562eb4.woff2
3. philna.sh - me...89496da2b84.woff2
4. philna.sh - ma...4d4b8ad0d3330.css
5. philna.sh - ph...e67355701c345.jpg
6. philna.sh - ma...74b6403802ad75.js
7. philna.sh - sw.js
8. philna.sh - ap...681a1d5c5733d.jpg
9. philna.sh - ic...fb5f86b126113.png
10. philna.sh - ph...5a807c77f36f6.jpg
11. philna.sh - ph...db88c6492d492.jpg
12. www.google-ana...om - analytics.js
13. www.google-analytics.com - collect
14. philna.sh - favicon.ico
181 ms
75 ms
105 ms
110 ms
129 ms
128 ms
37 ms
128 ms
98 ms
119 ms
162 ms
855 ms
215 ms
46 ms

RETWEETS 186 LIKES 629

re:loading

Ideas for efficient loading on the web

medium.com/reloading

PERF MATTERS

@ADDYOSMANI