

# Building fast websites against all odds

DevDay, Berlin 2018



**Who am I?**

**Ryan Townsend**

CTO, SHIFT – @ryantownsend





MATALAN

My Account | Delivery | Returns | Store Finder | Contact | Track My Order

Enter Keyword or Product Code SEARCH

VIEW YOUR BAG (0) CHECKOUT

SALE CHRISTMAS WOMENS LINGERIE MENS GIRLS BOYS LIGHTING HOMEWARE SHOES SOULUXE INSPIR

# PREPARE FOR CHRISTMAS



MATALAN

Enter Keyword or Product Code SEARCH

# PREPARE FOR CHRISTMAS

## DREAMING OF CHRISTMAS



Excited about the most wonderful time of the year? Then

**Performance is pretty important...**



**Traffic x Conversion Rate x AOV**





**Performance = Traffic**



**“The result of rebuilding our pages for performance led to [...] a 15 percent increase in SEO traffic”**  
**– Pinterest**



**"[...] starting in July 2018, page speed will be a ranking factor for mobile searches."**

**– Google**



**Performance = Conversion**



**“For every 100ms decrease in homepage load speed, Mobify's customer base saw a 1.11% lift in session based conversion, amounting to an average annual revenue increase of \$376,789”**

**– Mobify**



**“Similarly, for every 100ms decrease in checkout page load speed, Mobify's customers saw a 1.55% lift in session based conversion, amounting to an average annual revenue increase of \$526,147”**

**– Mobify**



**Performance = AOV**



**+9.6% pages/session**



**+8.7% AOV**

**Performance x Performance x**

**Performance =** 



**But it's not that easy...**

**Selling performance  
can be tricky**



**"Can you implement AMP?"**

- **Replica of your site**
- **Restricted HTML: limited AMP elements**
- **Restricted JS: no custom JS allowed**
- **Restricted CSS: inlined, 50kb max**
- **No repaint: fixed element sizing**
- **No desktop: mobile-only**
- **Shown within Google's branding**
- **Stale-while-revalidate: minimum 15 seconds refresh**
- **Extra QA effort**



**It's gonna get expensive**

**“But the carousel!”**



ALL

Top stories

**VentureBeat**



Apple is 'doing a lot of things' in augmented reality, Tim Cook says

AMP - 3 hours ago

BUSINESS IN



Apple CEO Tim  
calls up Warren  
Lloyd Blankfein

AMP - 5 hours

Apple's US taxes, says



**“[...] we now feel ready to take the next step and work to support more instant-loading content not based on AMP technology in areas of Google Search designed for this, like the Top Stories carousel”**

**– AMP Project @ Google**

**Why don't we just build  
fast sites in the first place?**





**"It's easier to ask forgiveness  
than it is to get permission."**

— Grace Hopper



**You don't need permission  
to build fast websites**

# **The Slowest Site in the World**





This repository

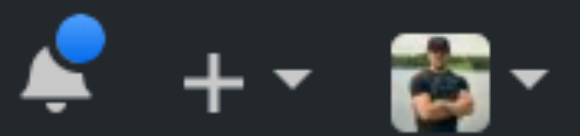
Search

Pull requests

Issues

Marketplace

Explore



ryantownsend / slowest-site-in-the-world

Add Repo

Watch 0

Star 0

Fork 0

Code

Issues 0

Pull requests 0

Projects 0

Wiki

Insights

Settings

An example implementation of a really slow website, can be used to practice web performance optimisation

Edit

Add topics

1 commit

1 branch

0 releases

1 contributor

Branch: master

New pull request

Create new file

Upload files

Find file

Clone or download

ryantownsend Initial public commit

Latest commit 735a3a2 21 seconds ago

public	Initial public commit	21 seconds ago
.gitignore	Initial public commit	21 seconds ago
Procfile	Initial public commit	21 seconds ago
app.json	Initial public commit	21 seconds ago
index.js	Initial public commit	21 seconds ago
logo.png	Initial public commit	21 seconds ago

github.com/ryantownsend/slowest-site-in-the-world

Branch: master ▾

New pull request

Create new file






Upload files


Find file


Clone or download ▾

 **ryantownsend** Initial public commit

Latest commit 735a3a2 21 seconds ago

 <a href="#">public</a>	Initial public commit	21 seconds ago
 <a href="#">.gitignore</a>	Initial public commit	21 seconds ago
 <a href="#">Procfile</a>	Initial public commit	21 seconds ago
 <a href="#">app.json</a>	Initial public commit	21 seconds ago
 <a href="#">index.js</a>	Initial public commit	21 seconds ago
 <a href="#">logo.png</a>	Initial public commit	21 seconds ago
 <a href="#">package.json</a>	Initial public commit	21 seconds ago
 <a href="#">readme.md</a>	Initial public commit	21 seconds ago
 <a href="#">yarn.lock</a>	Initial public commit	21 seconds ago

 **readme.md**

 Deploy to Heroku





# Test a website's performance

[Advanced Testing](#)[Simple Testing](#)[Visual Comparison](#)[Traceroute](#)[START TEST](#)**Test Configuration:**

Mobile - Slow 3G

Chrome 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)

## Recent Industry Blog Posts

[How to exclude WebPageTest traffic from analytics visits](#)[Preparing for GDPR: What you should know](#)[Shifting Performance Testing Left](#)[What Does Medianova's Bad Bot Protection Do?](#)[Accurately Measure Your UX with Chrome](#)

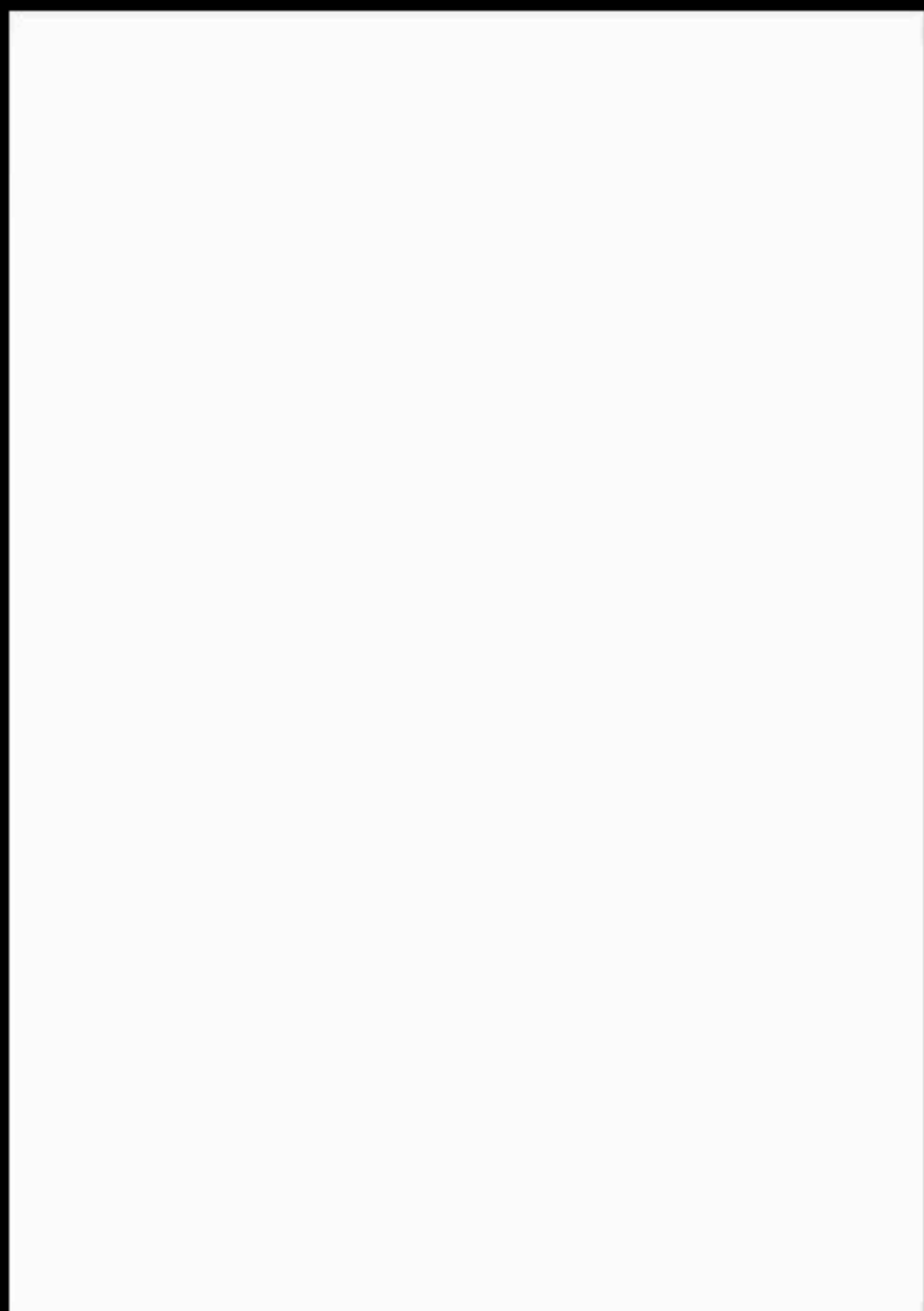
## Recent Discussions

[WPTAgent - iOS devices - inconsistent "bytes in" for objects with GZIP](#)[First Byte and Visually Complete time](#)[Setting up baseline metrics](#)[How to compress SumoMe external images](#)[Video Keeps buffering in Visual Comparison Page](#)



# Initial Results?

- **Start render: 6.4s**
- **SpeedIndex: 12717**
- **Interactive: 4.4s**
- **Bandwidth: 2,594 KB**



0.0

**1. Connection**

**2. <head>**

**3. CSS**

**4. Webfonts**

**5. JavaScript**

**6. Images**



**Connection**

**You can't control your infrastructure without permission, but you can check features are enabled:**

- **GZIP / Brotli**
- **OCSP for SSL**
- **HTTP/2**
- **Connection: keep-alive**



**<head>**

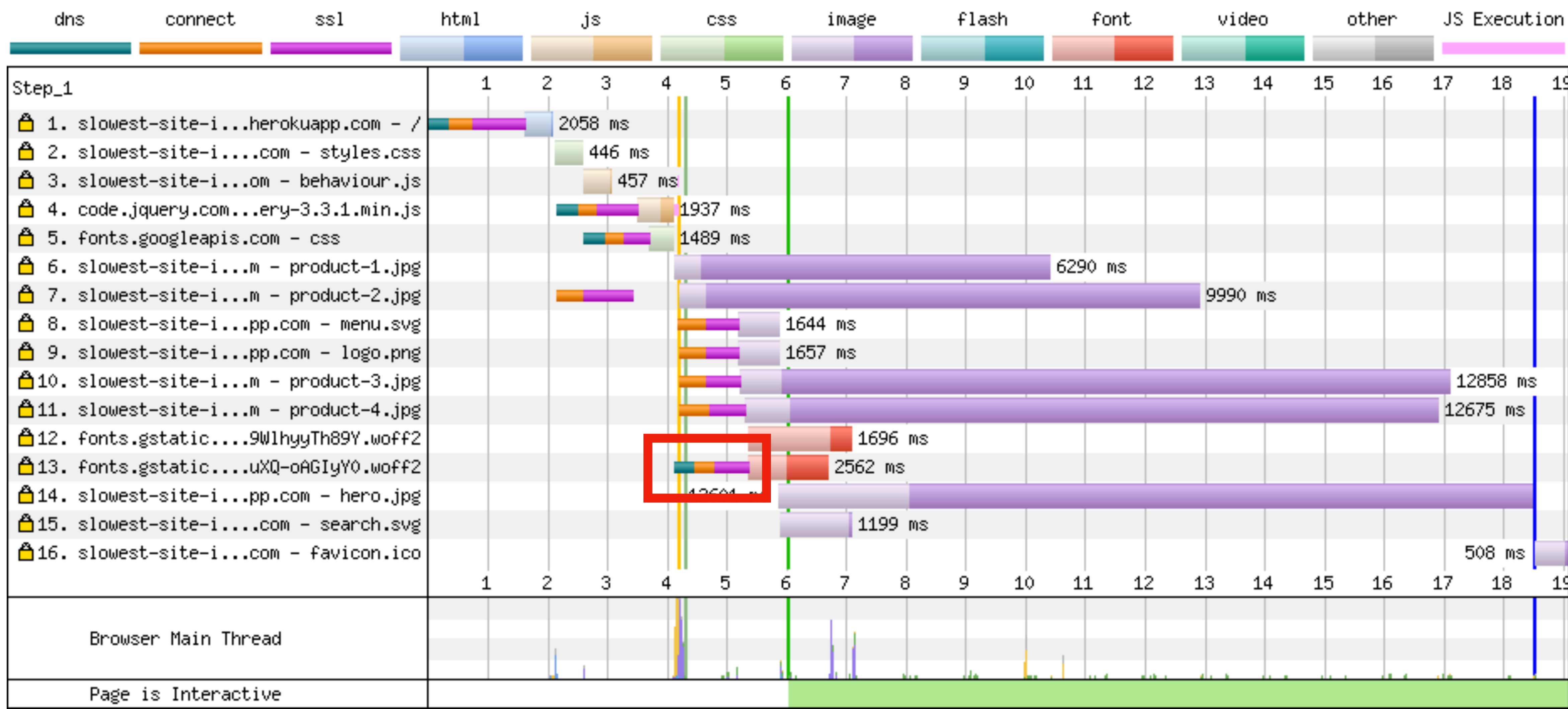
# Correct Order

1. **<meta> character encoding / viewport**
2. **<title>**
3. **Resource hints**
4. **Inline <script>**
5. **External stylesheet**
6. **Inline <style>**
7. **External <script>**
8. **Anything else, e.g. other meta tags**

# Resource Hints

- **DNS Prefetch**
- **Preconnect (CDN, 3rd parties)**
- **Prefetch**
- **Preload (CSS @imports, @font-face etc)**





# Resource Hints: preconnect - WD

Gives a hint to the browser to begin the connection handshake (DNS, TCP, TLS) in the background to improve performance. This is indicated using `<link rel="preconnect" href="https://example-domain.com/">`

Usage	% of all users
Global	65.74% + 1.72% = 67.46%
U.K.	47.25% + 2.58% = 49.83%

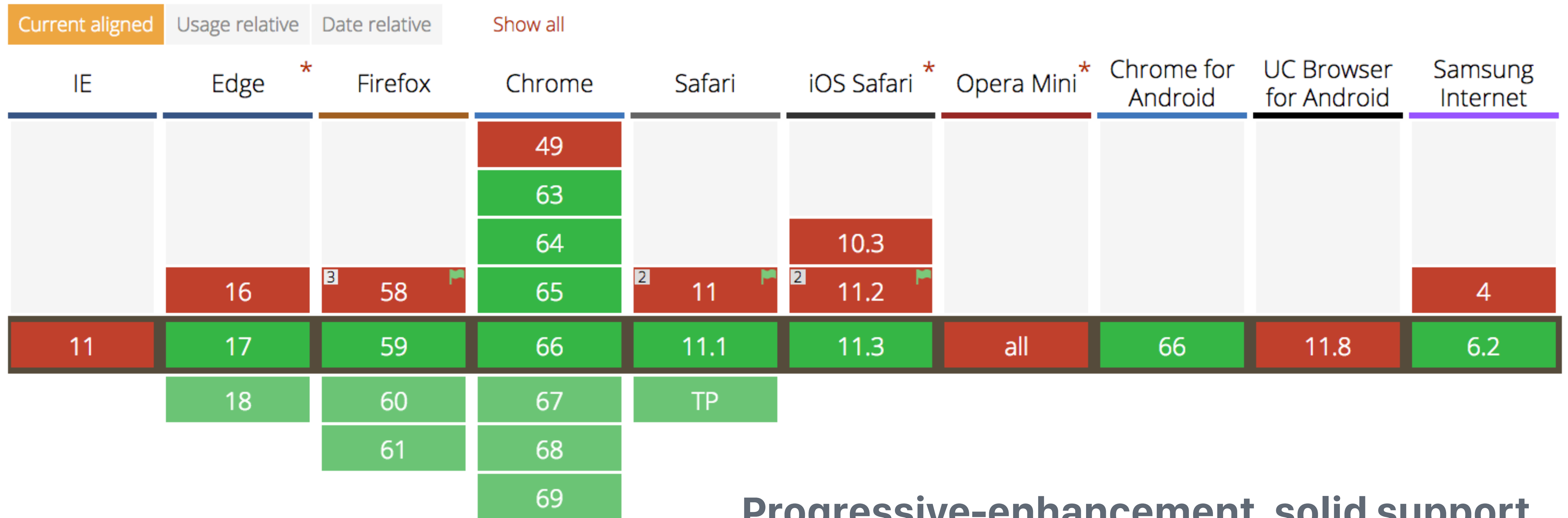
Current aligned	Usage relative	Date relative	Show all						
IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			49						
			63						
			64		10.3				
	<sup>2</sup> 16	58	65	11	11.2				4
11	<sup>2</sup> 17	59	66	11.1	11.3	all	66	11.8	6.2
	<sup>2</sup> 18	60	67	TP					
		61	68						
			69						

**Progressive-enhancement, solid support**

# Resource Hints: preload - CR

Using `<link rel="preload">`, browsers can be informed to prefetch resources without having to execute them, allowing fine-grained control over when and how resources are loaded.

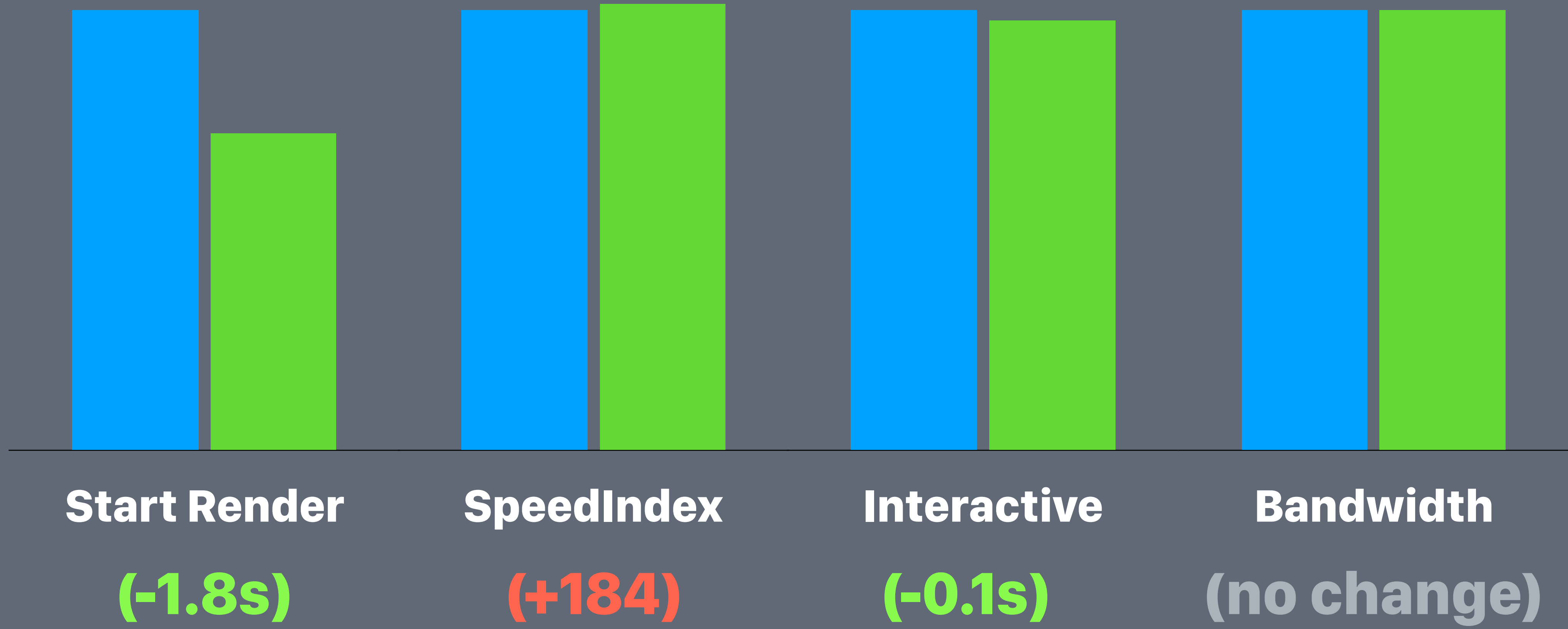
Usage	% of all users
Global	61.43% + 0.37% = 61.8%
U.K.	44.99% + 0.24% = 45.23%



**Progressive-enhancement, solid support**



**Results?**



**Value: \$6,782,202 / year**

Value based on Mobify case study

**CSS**



**Remove @import**

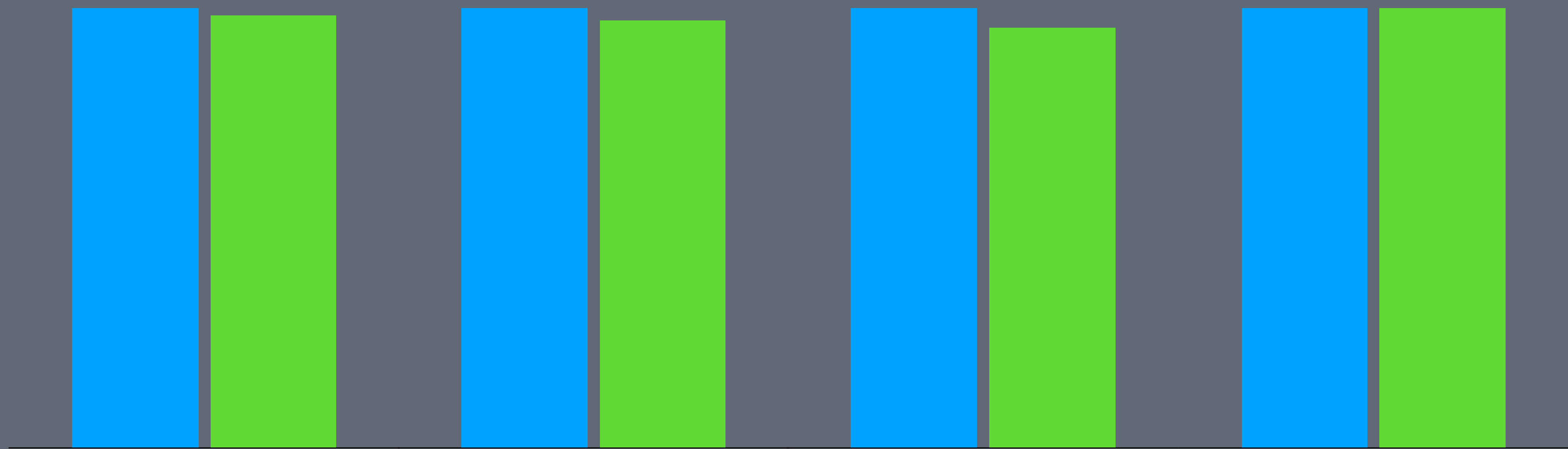
**Inline (Critical) CSS**

**Asynchronous below-the-fold CSS**



**Results?**

(ideal conditions)



**Start Render**

**(-0.1s)**

**SpeedIndex**

**(-348)**

**Interactive**

**(-0.2s)**

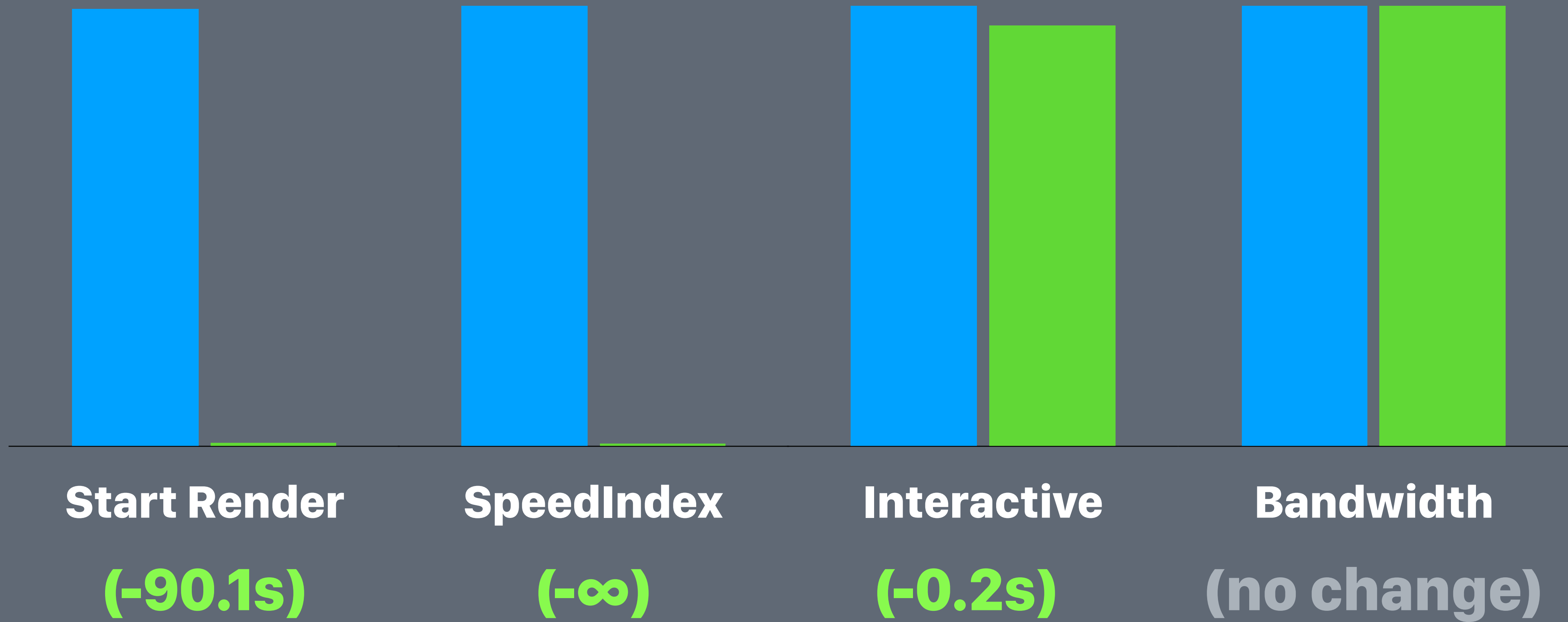
**Bandwidth**

**(no change)**

**Value: \$376,789 / year**

Value based on Mobify case study

(Google Fonts offline)

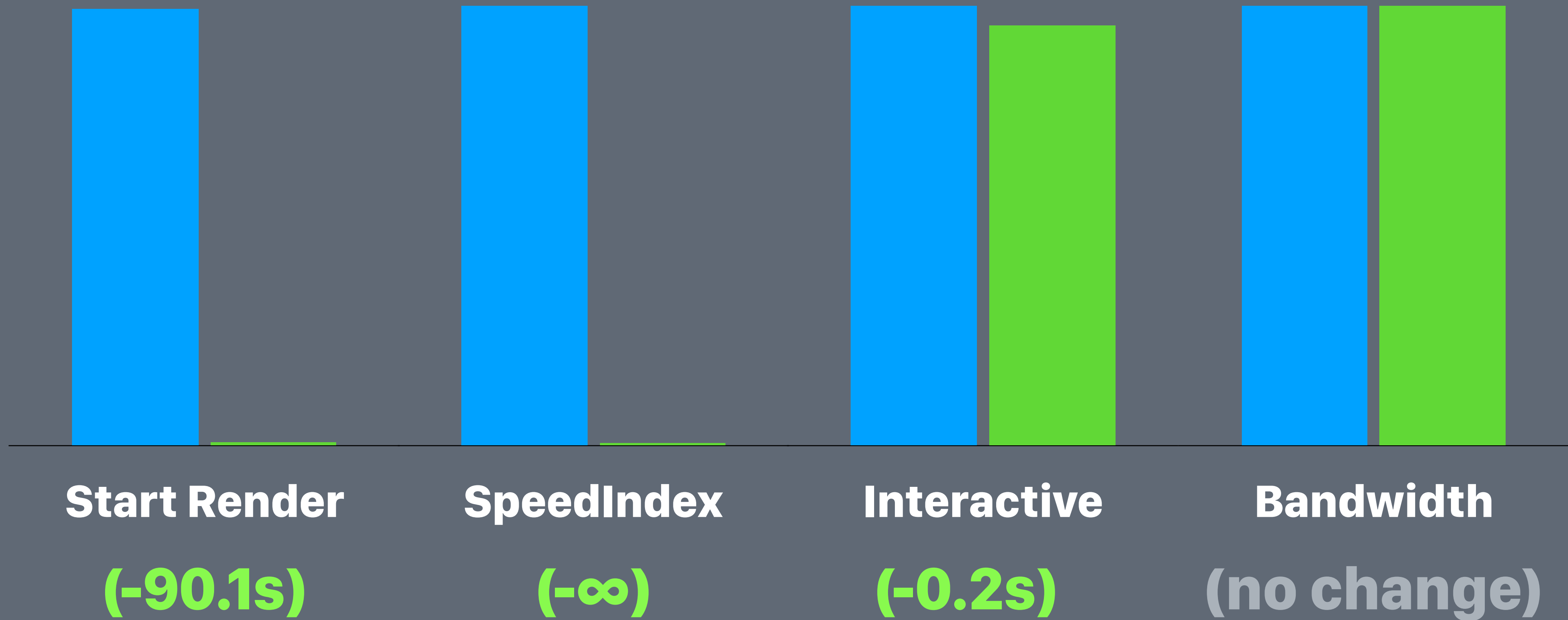


**Value: \$339,486,889 / year**

Value based on Mobify case study



(Google Fonts offline)



**Value: \$38,754 / hour**

Value based on Mobify case study


# Webfonts

**Self-host**



**font-display: swap / optional**

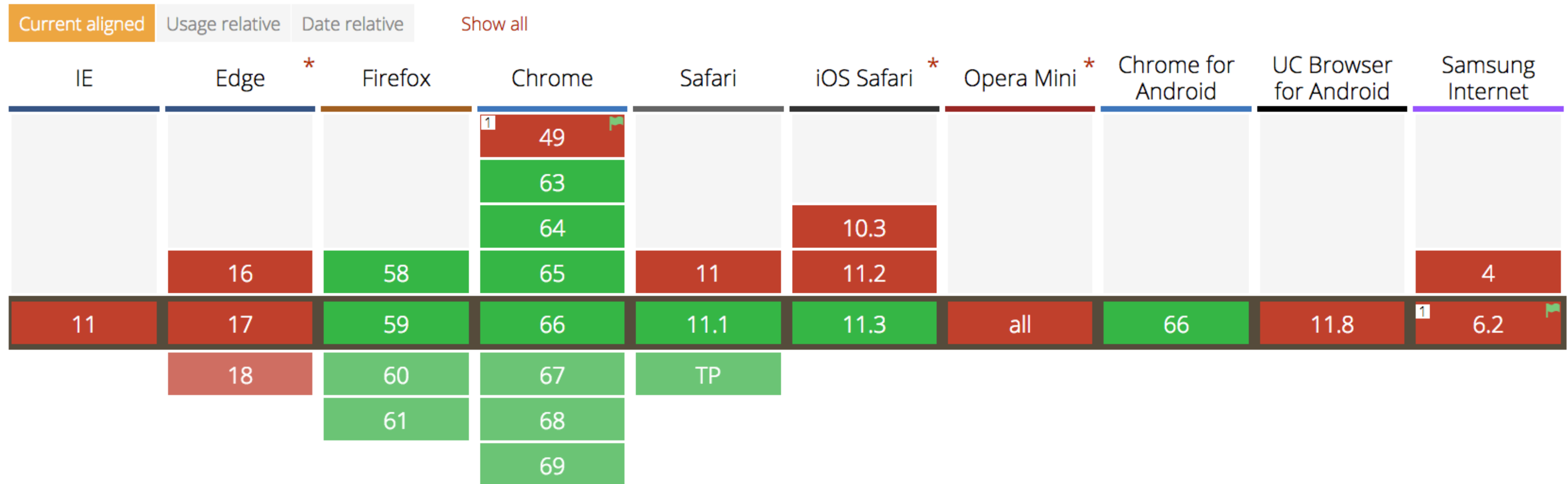
# CSS font-rendering controls - WD

Usage % of all users 

Global 60.29%

U.K. 42.95%

@font-face descriptor (currently defined as font-display) that allows control over how a downloadable font renders before it is fully loaded.



**Progressive-enhancement, average support**

**WOFF2**

# WOFF 2.0 - Web Open Font Format - CR

TrueType/OpenType font that provides better compression than WOFF 1.0.

Usage	% of all users	
Global	79.1%	+ 2.01% = 81.11%
U.K.	85.76%	+ 2.49% = 88.25%

Current aligned	Usage relative	Date relative	Show all							
IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet	
			49							
			63							
			64		10.3					
	16	58	65	<sup>1</sup> 11	11.2				4	
11	17	59	66	<sup>1</sup> 11.1	11.3	all	66	11.8	6.2	
	18	60	67	<sup>1</sup> TP						
		61	68							
			69							

**Solid support, WOFF1 for IE9-IE11**



# unicode-range

(bundling for web fonts)

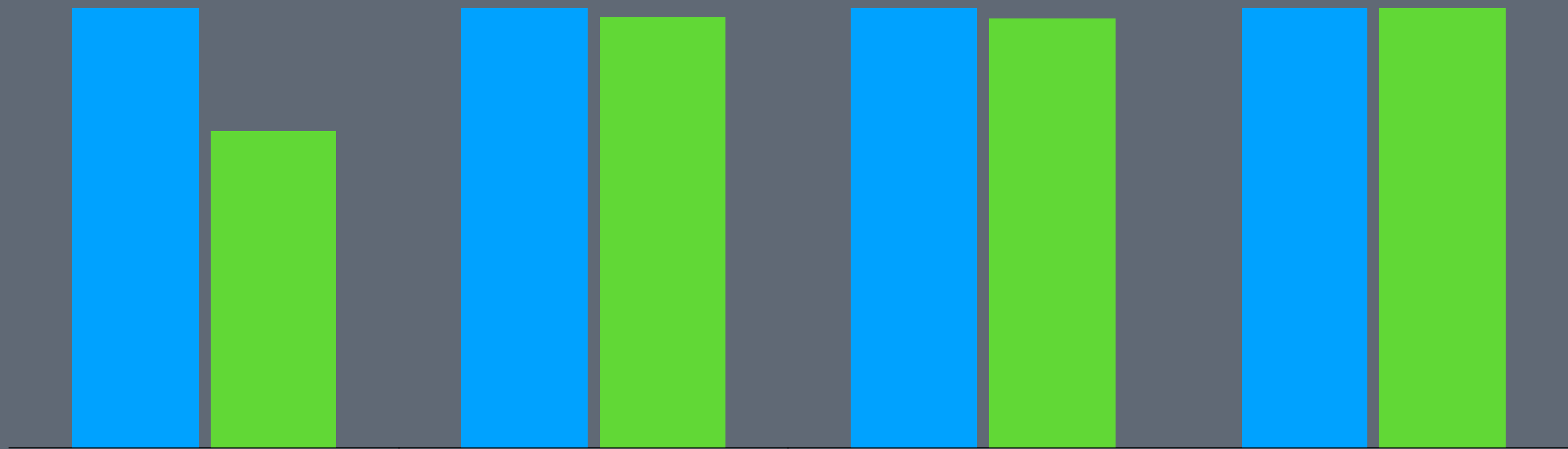
```
/* latin */
@font-face {
  font-family: 'Montserrat';
  font-style: normal;
  font-weight: 400;

  src: local('Montserrat Regular'), local('Montserrat-Regular'),
       url(/fonts/montserrat.woff2) format('woff2');

  unicode-range: U+0000-00FF, U+0131, U+0152-0153, U+02BB-02BC, U+02C6,
                U+02DA, U+02DC, U+2000-206F, U+2074, U+20AC, U+2122, U+2191,
                U+2193, U+2212, U+2215, U+FEFF, U+FFFD;

  font-display: swap;
}
```

**Results?**



**Start Render**

**(-1.8s)**

**SpeedIndex**

**(-258)**

**Interactive**

**(-0.1s)**

**Bandwidth**

**(no change)**

**Value: \$6,782,202 / year**

Value based on Mobify case study



# JavaScript

# Sync vs Async vs Defer

to be avoided!

A red arrow with a hand-drawn style, pointing from the text 'to be avoided!' towards the word 'Sync' in the main title.

still valuable!

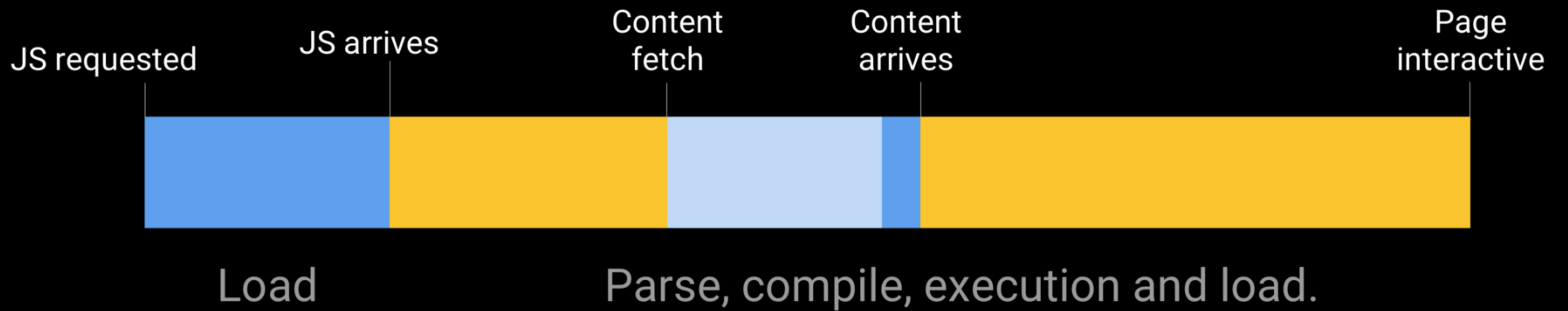
A green arrow with a hand-drawn style, pointing from the text 'still valuable!' towards the word 'Defer' in the main title.

**Don't let third parties control  
your performance or uptime**

**[https://cdnjs.cloudflare.com/ajax/  
libs/jquery/3.3.1/jquery.min.js](https://cdnjs.cloudflare.com/ajax/libs/jquery/3.3.1/jquery.min.js)**

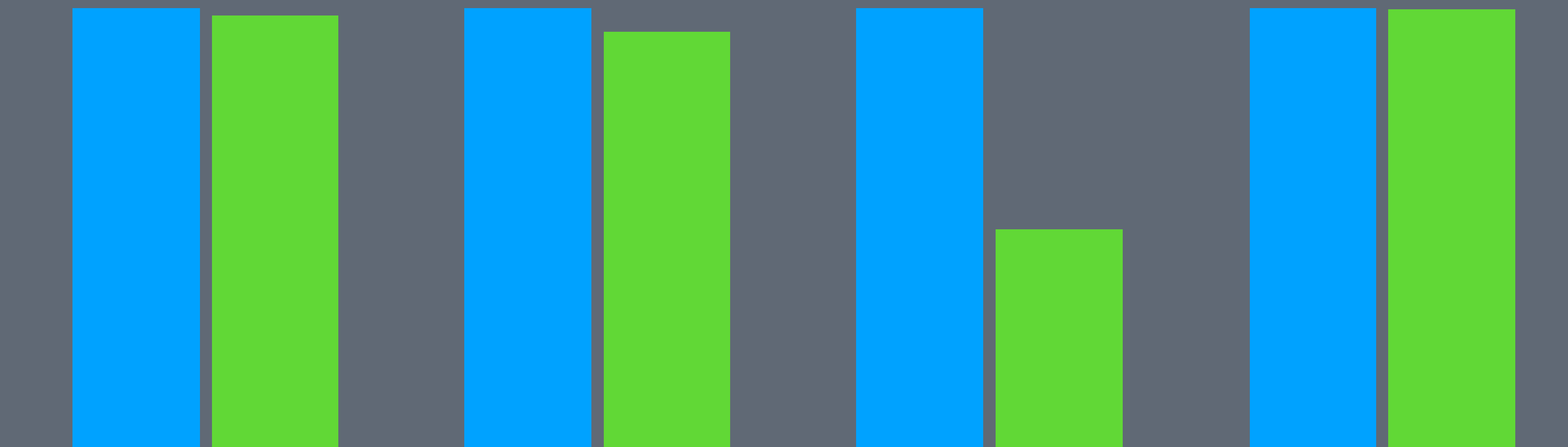
*(to be avoided!)*





# **Bundling & Tree-shaking**

**Results?**



**Start Render**

**(-0.1s)**

**SpeedIndex**

**(-691)**

**Interactive**

**(-2.2s)**

**Bandwidth**

**(-5KB)**

**Value: \$376,789 / year**

Value based on Mobify case study



**Images**

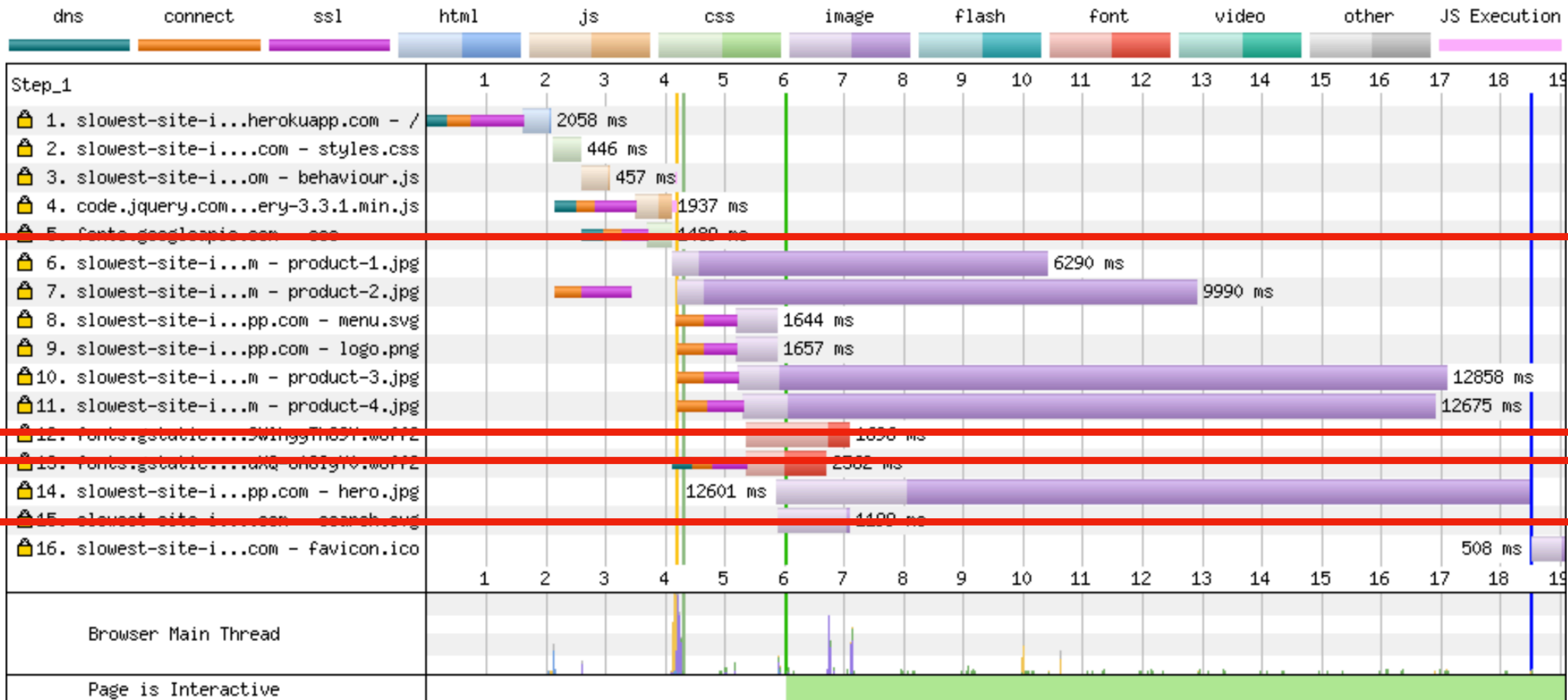
# Foreground vs Background

```

```

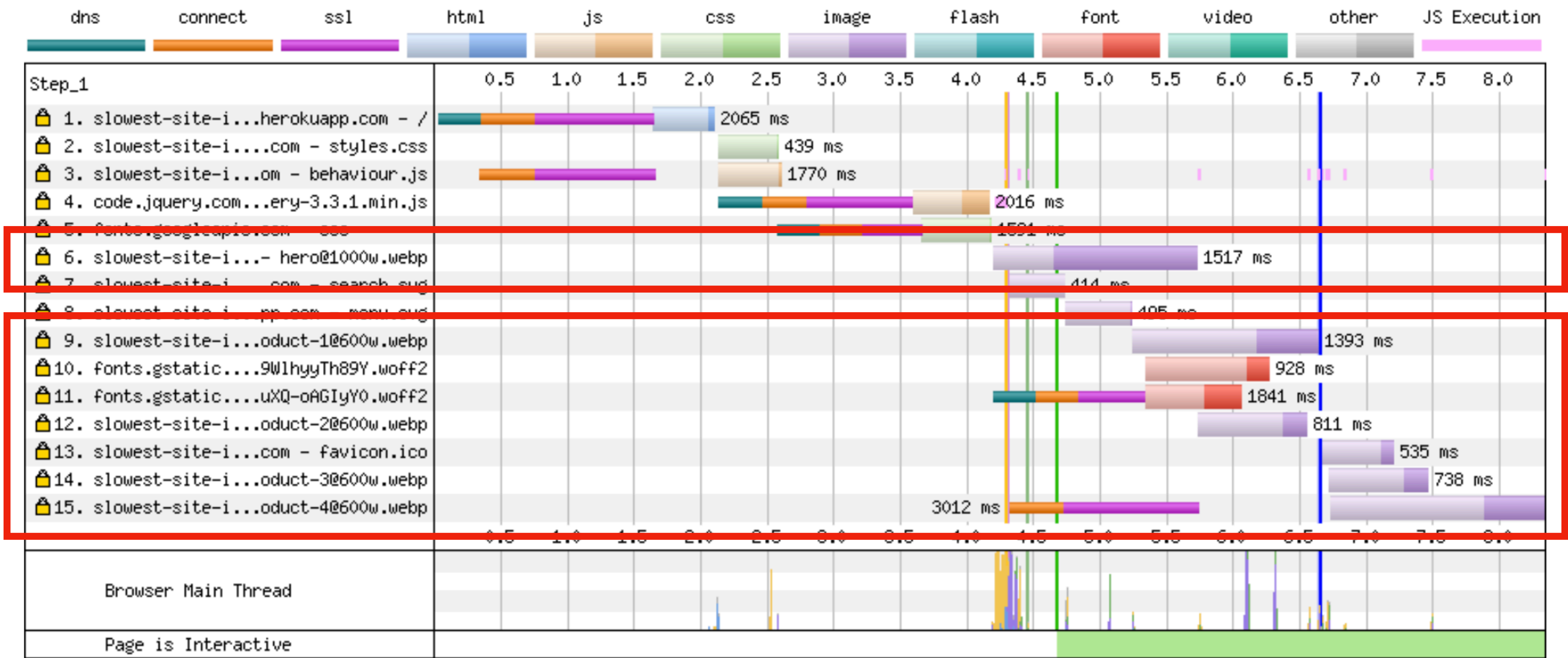
vs

```
background-image: url(image.jpg)
```



Hero loaded after lower-priority product images






Corrected by using a foreground <img>

# Lazy-load Beneath the Fold



☰ Slow Site 🔍



**The slowest site in the world!**


Okay, so it's not **the** slowest... you can probably find worse, but it's supposed to be a good representation of what a common slow site could look like.

This sample site is built by [@ryantownsend](#).

It's here to provide an educational resource, where you can practice optimising performance.



☰ Slow Site 🔍

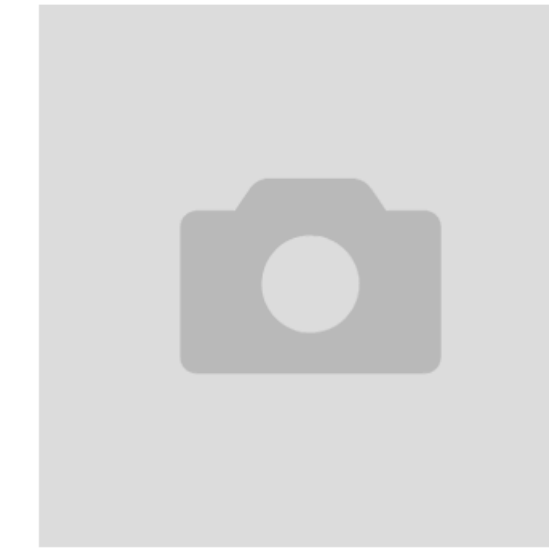


**The slowest site in the world!**

Okay, so it's not **the** slowest... you can probably find worse, but it's supposed to be a good representation of what a common slow site could look like.

This sample site is built by [@ryantownsend](#).

It's here to provide an educational resource, where you can practice optimising performance.





DEV  
DAY  
2018

Berlin, Faro

**Experience**  
**DEV DAY on May 26,**  
**2018**  
**in Berlin and Faro**

Celebrating software  
craftsmanship

Meet fellow developers of all  
experience levels. Exchange  
your knowledge and learn  
about the most exciting



**Elena Kolevska**

Software Engineer  
InvisibleCity



**Julia Krüger**

Full Stack Developer  
Neighbourhood

# Low-Quality Image Preview (LQIP)



Low-Quality Image Preview (LQIP)





**Serve Appropriate Sizes**

# Srcset and sizes attributes - LS

The `srcset` and `sizes` attributes on `img` (or `source`) elements allow authors to define various image resources and "hints" that assist a user agent to determine the most appropriate image source to display (e.g. high-resolution displays, small monitors, etc).

Usage	% of all users
Global	89.06% + 0.26% = 89.32%
U.K.	90.51% + 0.42% = 90.93%

Current aligned	Usage relative	Date relative	Show all						
IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			49						
			63						
			64		10.3				
	16	58	65	11	11.2				4
11	17	59	66	11.1	11.3	all	66	11.8	6.2
	18	60	67	TP					
		61	68						
			69						

**Latest version of all the major browsers**

**Serve Appropriate Formats**



# WebP image format - UNOFF

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

Usage	% of all users
Global	74.03% + 0.17% = 74.2%
U.K.	47.14% + 0.09% = 47.23%

Current aligned
Usage relative
Date relative
Show all

IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			49						
			63						
			64		10.3				
	16	58	65	11	11.2				4
11	17	59	66	11.1	11.3	all	66	11.8	6.2
	18	60	67	TP					
		61	68						
			69						

**Blink-based browsers only** 🙄

# JPEG 2000 image format - OTHER

Usage	% of all users
Global	13.06%
U.K.	40.32%

JPEG 2000 (JP2) was created by the Joint Photographic Experts Group committee in 2000 with the intention of superseding their original discrete cosine transform-based JPEG standard (created in 1992) with a newly designed, wavelet-based method. It offers some advantages in image fidelity over standard JPEG.

Current aligned	Usage relative	Date relative	Show all						
IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			49						
			63						
			64		10.3				
	16	58	65	11	11.2				4
11	17	59	66	11.1	11.3	all	66	11.8	6.2
	18	60	67	TP					
		61	68						
			69						

Safari only 🙄

# JPEG XR image format - OTHER

Usage % of all users

Global 5.09%

U.K. 6%

The latest JPEG image format of Joint Photographic Experts Group which boasts better compression and supports lossless compression, alpha channel, and 48-bit deep color over normal jpg format.

Current aligned Usage relative Date relative Show all

IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			49						
			63						
			64		10.3				
	16	58	65	11	11.2				4
11	17	59	66	11.1	11.3	all	66	11.8	6.2
	18	60	67	TP					
		61	68						
			69						

IE/Edge only 🙄

```
<picture>
  <!--[if IE 9]><video style="display: none;"><![endif]-->
  <source srcset='hero@1600w.jxr 1600w, ...' type='image/vnd.ms-photo' />
  <source srcset='hero@1600w.jp2 1600w, ...' type='image/jp2' />
  <source srcset='hero@1600w.webp 1600w, ...' type='image/webp' />
  <!--[if IE 9]></video><![endif]-->

  <img srcset='
    hero@1600w.jpg 1600w,
    hero@1400w.jpg 1400w,
    hero@1200w.jpg 1200w,
    ...'
    src='hero@400w.jpg'
    alt='Hero Image'
  />
</picture>
```

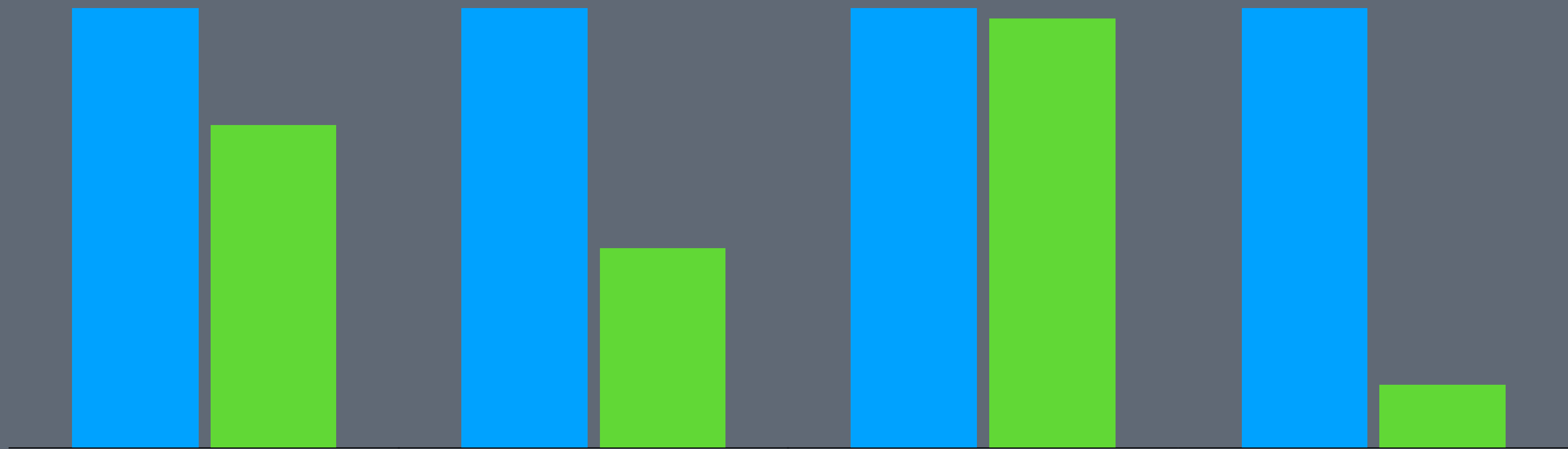
our different sizes

our different formats

fallback to JPEG with an old-school <img> 'src'



**Results?**



**Start Render**

**(-1.7s)**

**SpeedIndex**

**(-6948)**

**Interactive**

**(-0.1s)**

**Bandwidth**

**(-2,224KB)**

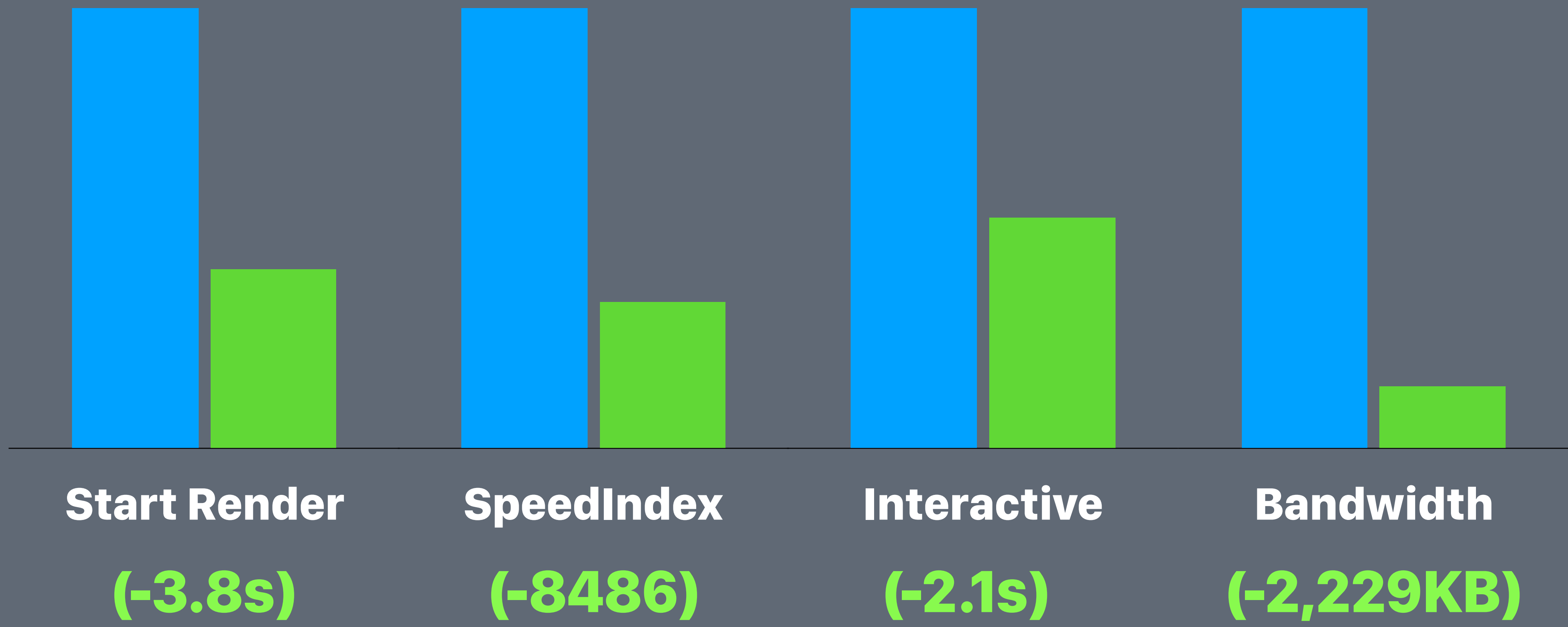
**Value: \$6,405,413 / year**

Value based on Mobify case study

**<https://images.guide/>**

**Show me the money...**





**Value: \$14,317,982 / year**

Value based on Mobify case study

**Original**



**0.0**

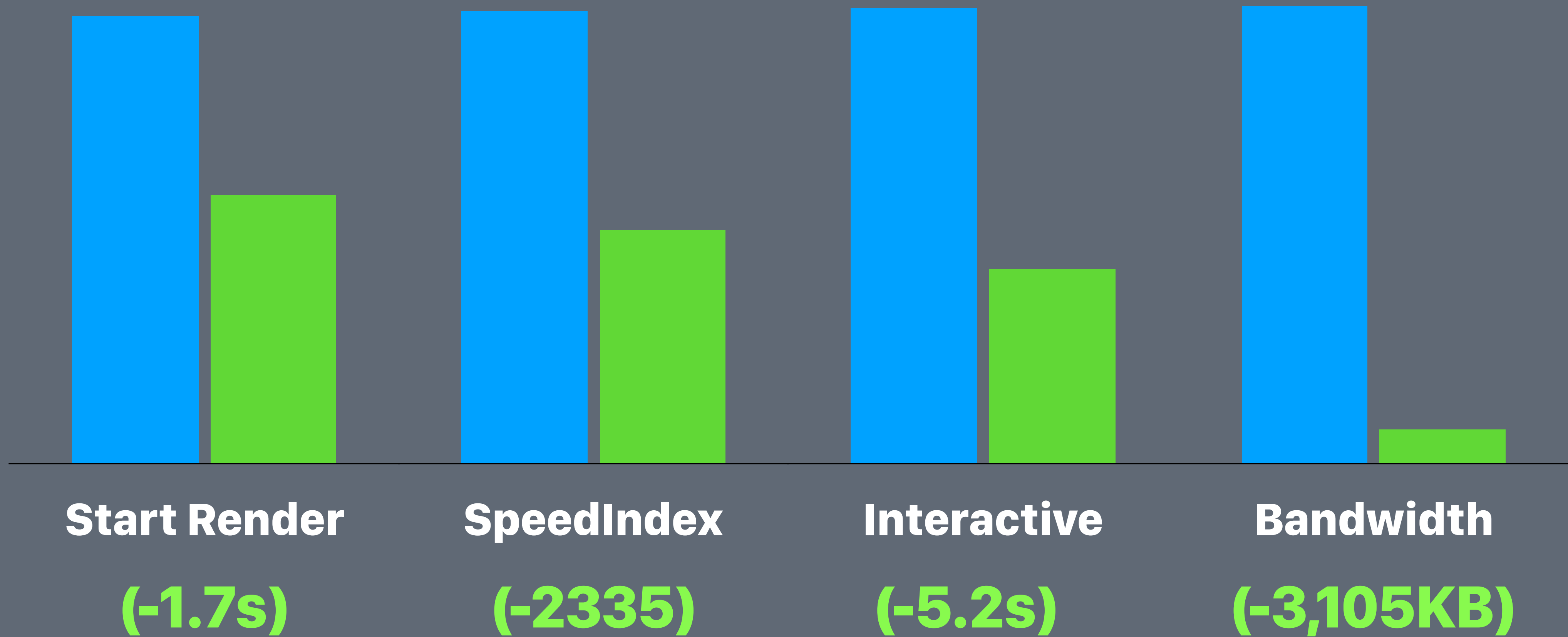
**Optimised**



**0.0**

**<https://bit.ly/2IViWzf>**

**What about Dev Day 2018?**



**Value: \$6,405,413 / year**

Value based on Mobify case study



**323,000 tickets** 😂

Original



0.0

Optimised



0.0

<https://bit.ly/2L6LW3T>

**Low-hanging fruit can have  
immense impact on performance**

**Bonus Point!**



# **Service Workers**

# Service Workers - WD

Method that enables applications to take advantage of persistent background processing, including hooks to enable bootstrapping of web applications while offline.

Usage	% of all users
Global	74.42% + 0.18% = 74.59%
U.K.	48.5% + 0.06% = 48.56%

Current aligned
Usage relative
Date relative
Show all

IE	Edge *	Firefox	Chrome	Safari	iOS Safari *	Opera Mini *	Chrome for Android	UC Browser for Android	Samsung Internet
			49						
			63						
			64		10.3				
	2 16	58	65	11	11.2				4
11	17	59	66	11.1	11.3	all	66	11.8	6.2
	18	60	67	TP					
		61	68						
			69						

**Latest version of all the major browsers**

- **Progressive enhancement**
- **Network control**
- **Offline support**
- **Progressive Web Apps (PWAs)**
- **stale-while-revalidate / stale-while-error**
- **Protect against 3rd party slow-downs**

```
function timeout(delay){
  return new Promise(function(resolve, reject) {
    setTimeout(function(){
      resolve(new Response('', {
        status: 408,
        statusText: 'Request timed out.'
      }));
    }, delay);
  });
}
```

```
self.addEventListener('fetch', function(event {
  event.respondWith(Promise.race([
    fetch(event.request),
    timeout(2000)
  ]));
});
```

*attempt the request*

*force a 2-second timeout*





**Thank you!**

**Ryan Townsend**

CTO, SHIFT – @ryantownsend