

Why web performance?

Web Performance

A users journey to understand load time

Harry Mumford-Turner

Overview

1. Why are slow sites a problem
2. How fast should sites load
3. Measuring load time
4. Measuring improvement
5. What can we do
 - a. Small Improvements
 - b. Time Consuming Improvements

Why are slow sites a problem?

5 seconds earn 2x ad revenue
than 19 seconds

Google Data from Google Analytics and DoubleClick, 2015-2016

53%

Abandon after
3 seconds



As page load time goes from:

1s to 3s the probability of bounce **increases 32%**

1s to 5s the probability of bounce **increases 90%**

1s to 6s the probability of bounce **increases 106%**

1s to 10s the probability of bounce **increases 123%**

Source: Google/SOASTA Research, 2017.

<https://www.soasta.com/blog/google-mobile-web-performance-study/> 2016

BBC found every additional second a page takes to load, 10% of users leave



<https://www.creativebloq.com/features/how-the-bbc-builds-websites-that-scale>

How fast *should* sites
load?

49% EXPECT
<3 SECONDS

Akamai Technologies, “Consumer Web Performance Expectations Survey”, 2014

22 seconds

The average time it takes to fully load a mobile landing page

2017 Google Research with 900,000 websites

How can we measure load time?



```
$ npx lighthouse https://www.harrymt.com/
```

Harry's Blog

Secure | https://www.harrymt.com/blog/

iPhone 6/7/8 ▾ 375 x 667 93% ▾

The screenshot shows a mobile browser displaying a blog site. The top navigation bar includes 'Home' and 'Blog'. Below, there are two main posts:

- Stubs, Spies and Mocks in JavaScript – 11 April 2018**
Testing with Mocks in JavaScript.
javascript
- Solving Google Interview Questions – 27 November 2017**
Part 2.
interview

To the right of the browser window is the Chrome DevTools Audits tab, titled 'Performance'. It displays various metrics and opportunities for optimization.

Metrics

These metrics encapsulate your web app's performance across a number of dimensions.

Time	Value
997 ms	1
2 s	1
3 s	1
4 s	1
5 s	1
6 s	1
7 s	1
8 s	1
9 s	1
10 s	1

- ▶ First meaningful paint 4,110 ms
- ▶ First Interactive (beta) 8,830 ms
- ▶ Consistently Interactive (beta) 8,830 ms
- ◀ Perceptual Speed Index: 4.936
- ▶ Estimated Input Latency: 36 ms

Opportunities

These are opportunities to speed up your application by optimizing the following resources.

Serve images in next-gen formats	7,390 ms 1,191 KB
Property size images	6,080 ms 980 kB
Offscreen images	6,080 ms 980 kB
Optimize images	2,350 ms 379 kB
Reduce render-blocking stylesheets	1,910 ms

Diagnostics

More information about the performance of your application.

- ▶ Uses inefficient cache policy on static assets: 19 assets found

56 42

The screenshot shows a web browser window displaying the Scott Logic website at <https://www.scottlogic.com>. The page features a large, semi-transparent background image of a woman wearing glasses, looking slightly to the side. Overlaid on this image is the text "Altogether Smarter" in a large, white, sans-serif font, with "Pragmatic solutions to complex software challenges" in a smaller font below it.

At the top of the page, there is a dark navigation bar with the company logo "SCOTT LOGIC / ALTOGETHER SMARTER" on the left. To the right of the logo are links for "Careers", "Events", and "Contact". Below the navigation bar, there are four main menu items: "What we do", "Our work", "Who we are", and "Blog".

On the right side of the page, there is a teal-colored callout box containing the text "Shaping an effective DevOps culture" and "How we coached Rabobank to improve their DevOps practices". Below this text is a link "Read the full case study".

Lighthouse

Version: 2.9.1

Results for: <https://www.scottlogic.com/>

Apr 8, 2018, 6:43 PM GMT+1 • ▶ Runtime settings



45

55

51

81

80

Performance	45
Progressive Web App	55
Accessibility	51
Best Practices	81
SEO	80

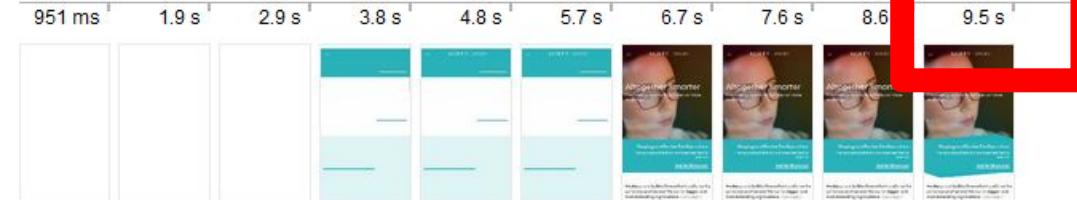
Performance

These encapsulate your web app's current performance and opportunities to improve it.

45

Metrics

These metrics encapsulate your web app's performance across a number of dimensions



▶ First meaningful paint 6,110 ms

▶ First Interactive (beta) 9,350 ms

▶ Consistently Interactive (beta) 9,350 ms

▶ Perceptual Speed Index: 6,304

9 seconds

Load Time

www.scottlogic.com



45

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Performance

Progressive Web App

Accessibility

Best Practices

SEO

Performance

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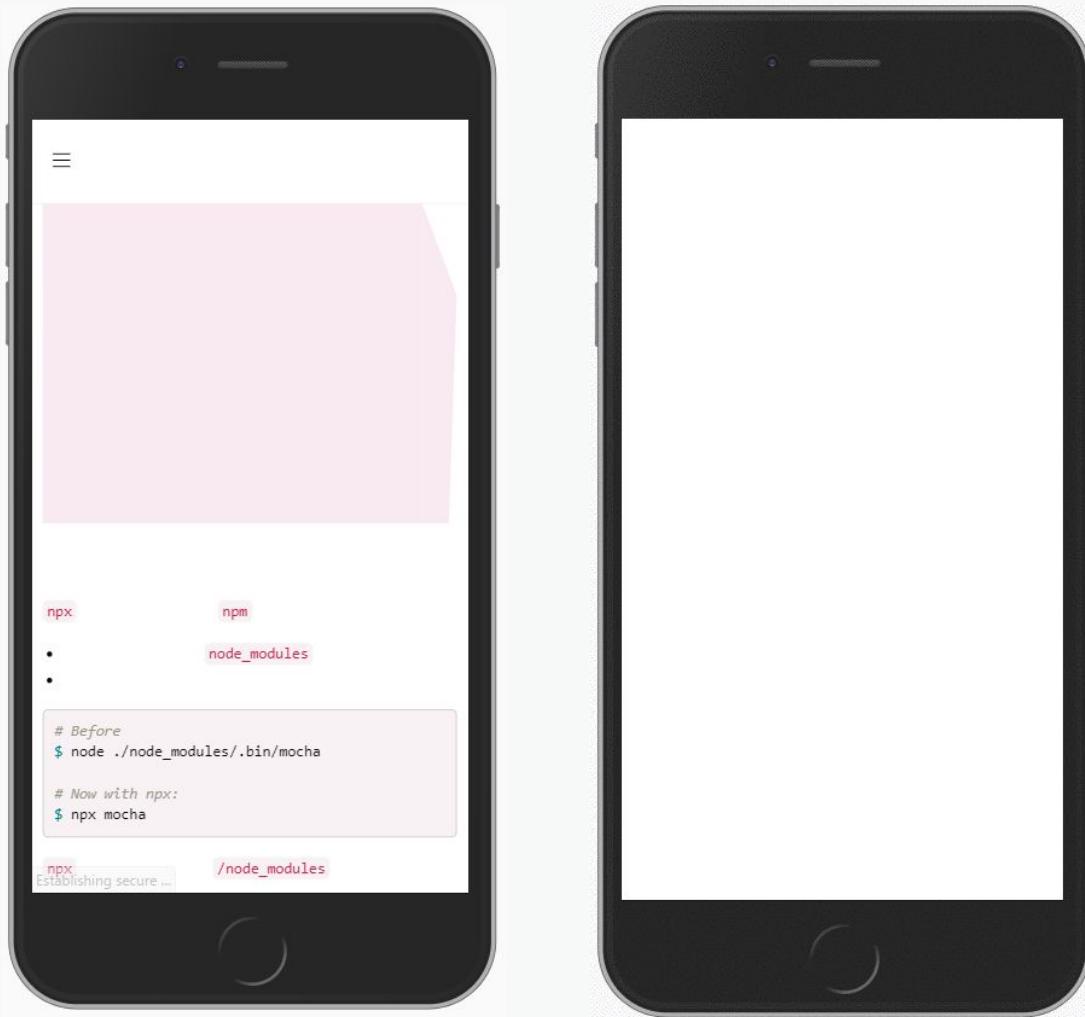
▶ First meaningful paint 6,110 ms

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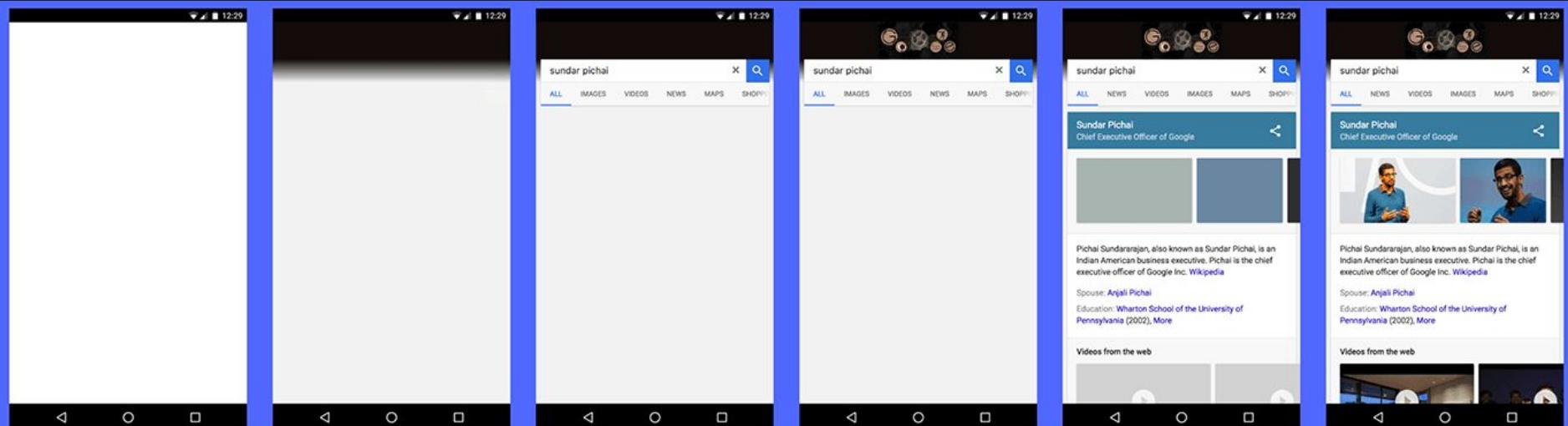
▶ Perceptual Speed Index: 6,304





User-centric performance metrics

The Experience	The Metric
Is it happening?	First Paint (FP)
Is it useful?	First Meaningful Paint (FMP)
Is it usable?	Time to Interactive (TTI)
Is it delightful?	Long Tasks (technically the absence of long tasks)



First Paint
(FP)

First Contentful
Paint (FCP)

First Meaningful
Paint (FMP)

Time to
Interactive (TTI)



45

55

51

81

80

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Performance

Progressive Web App

Accessibility

Best Practices

SEO

Performance

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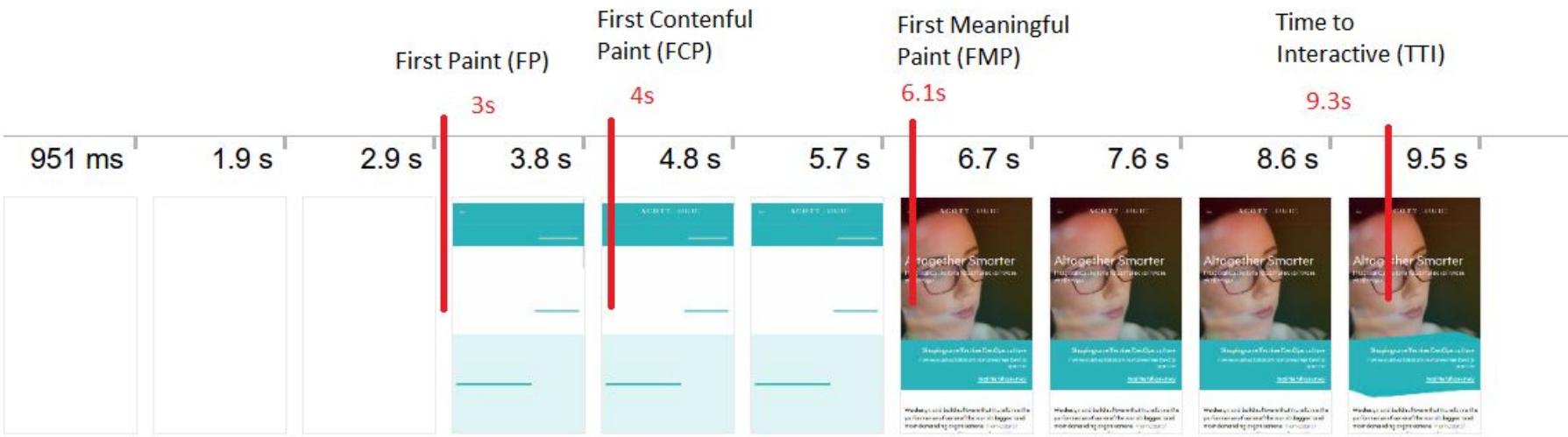


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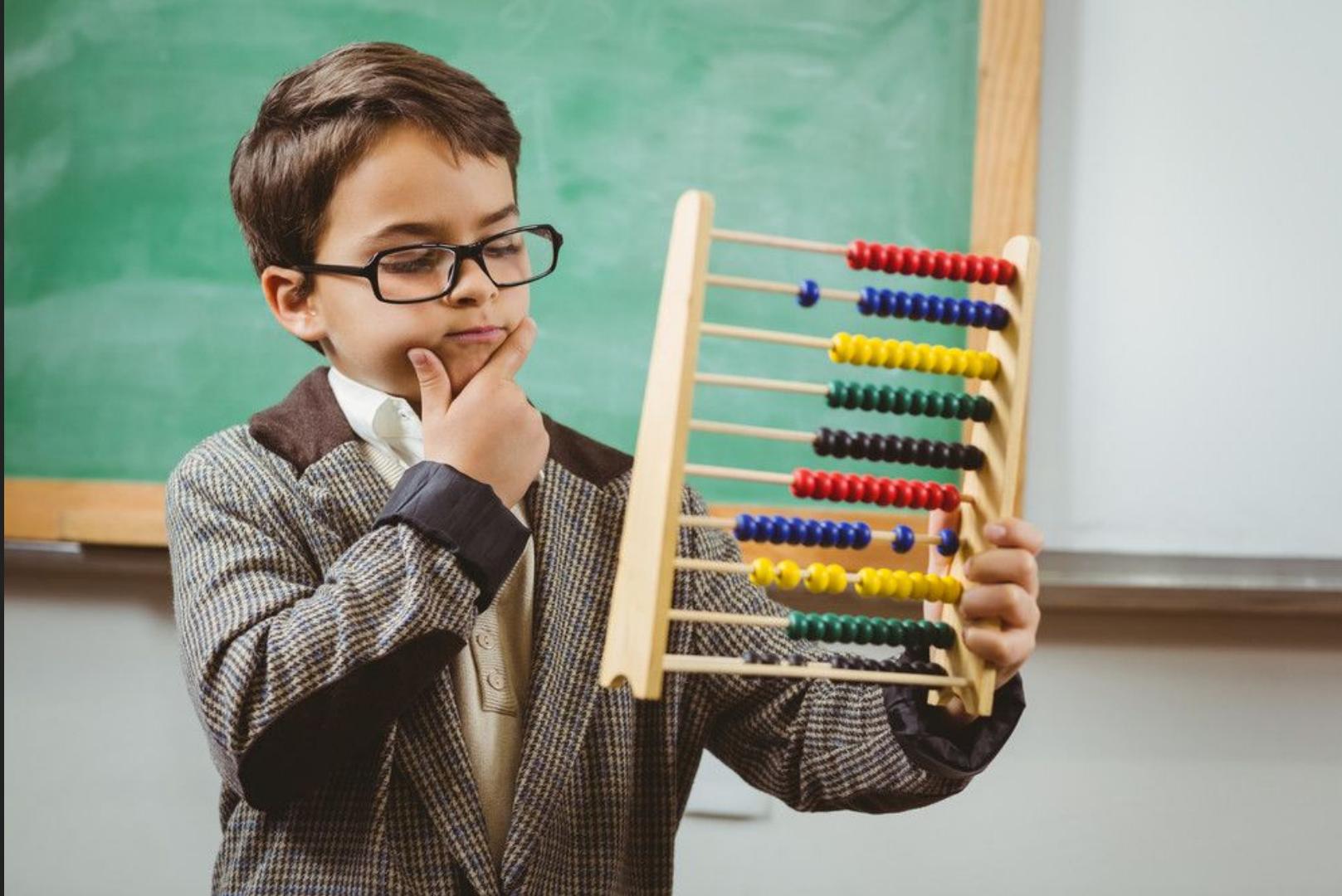


- ▶ First meaningful paint **6,110 ms**
- ▶ First Interactive (beta) **9,350 ms**
- ▶ Consistently Interactive (beta) **9,350 ms**

6 seconds

First Meaningful Paint (FMP)

www.scottlogic.com





6 Sids

Meaningful Paint

www.scottlogic.com

“Our site loads in
X.XX seconds”

How can we measure improvements?

There are lots of free tools available

WWW.SPARKREACTION.COM
THIS SITE IS GREAT
You're amazing! Let's all bask in the glow of your amazingness. Ahhh.
PERFORMANCE MOBILE SEO SECURITY
Pagespeed score ▲

Latest Performance Report for:
https://www.keycdn.com/
Report generated: Thu, Sep 3, 2015, 2:37 PM -0700
Test Server Region: London, UK
Using: Chrome (Desktop) 36.0.1985.125, PageSpeed 1.12.16, YSlow 3.1.8

Performance Scores	Page Details
Page Speed Score: (97%) YSlow Score: A (98%)	Page Load Time: 1.7s Total Page Size: 319KB Requests: 22

What do my scores mean? Rules are sorted in order of importance. Optimizing rules at the top of the list will have the most significant impact on page speed. Not every recommendation will be applicable to your site. The recommendations are meant to give you ideas on what you can do to be out of your control (e.g. external resources) or that are ready to go.



Website Speed Test Full Page Speed Test
A page speed test that includes a waterfall breakdown and the website preview. Select any of the 14 test locations. Easily share the website speed test results with others. Do you like this website performance test? Share via: Twitter Learn more about the Website Speed Test Terms

URL: foobar.com Location: New York, US Public: Run

Results for https://tools.keycdn.com/

First Byte Time	Keep-alive Enabled	Compress Transfer	Compress Images	Cache static content	Effective use of CDN
A	A	A	N/A	B	✓

Raw page data - Raw object data
Export HTTP Archive (.har)
See in ShowSlow
View Test Log

Status	Type	Content Size	Time	Timeline
200 OK	text/html	8 KB	37ms	
200 OK	text/css	12 KB	113ms	
200 OK	application/javascript	90 KB	139ms	
200 OK	text/javascript	7 KB	40ms	
200 OK	image/png	16 KB	51ms	
200 OK	image/png	186 B	35ms	
200 OK	application/octet-stream	15 KB	69ms	
200 OK	image/gif	35 B	20ms	

PageSpeed Insights 84

ANALYZE

Mobile Desktop

99 / 100 Speed

! Consider Fixing:

Minify JavaScript
[Show how to fix](#)

✓ 9 Passed Rules

[Show details](#)

Download optimized image, JavaScript, and CSS resources for this page.

100 / 100 User Experience

✓ Congratulations! No issues found.

Avoid plugins
Your page does not appear to use plugins, which would prevent content from being usable on many platforms. Learn more about the importance of avoiding plugins.

Configure the viewport
Your page specifies a viewport matching the device's size, which allows it to render properly on all devices. Learn more about configuring viewports.

[View detailed results](#)



PageSpeed Insights

<https://scottlogic.com/>

ANALYZE



Mobile



Desktop

Speed

Fast

0.8s FCP 0.9s DCL

Optimization

Low

57 / 100

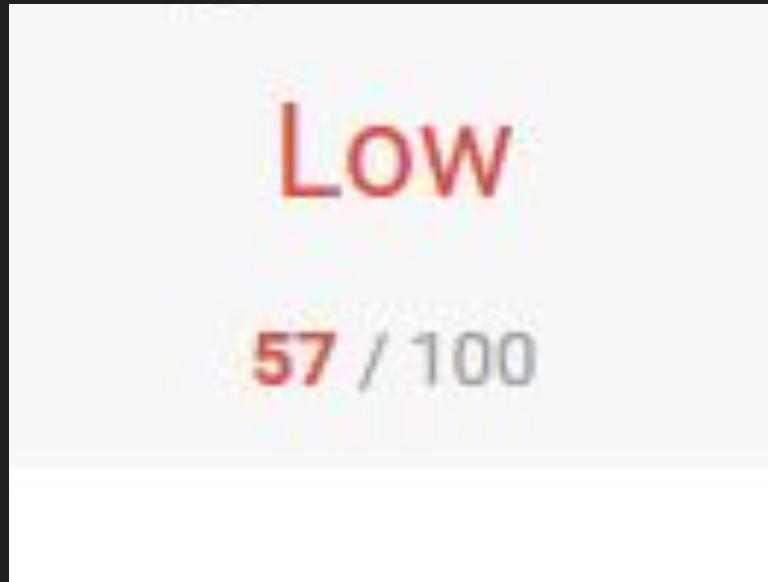
Data from the Chrome User Experience report indicates this page's median **FCP** (0.8s) and **DCL** (0.9s) ranks it in the fastest third of all pages. Although the page could be more optimized it is probably unnecessary. [Learn more.](#)

Report for: <https://www.scottlogic.com/>

Page Load Distributions



Desktop



PageSpeed Insights

<https://scottlogic.com/>

ANALYZE



Mobile



Desktop

Speed

Unavailable

Optimization

Low

47 / 100

Data about the real-world performance of this page was [unavailable](#). PageSpeed Insights was still able to analyze this page to find potential optimizations. Applying these optimizations may improve the speed of this page. Please [investigate the recommendations below](#). [Learn more](#).

Report for: <https://www.scottlogic.com/>

Page Stats

PSI estimates this page requires 8 additional round trips to load render blocking resources and 1.5 MB to fully render. The median page requires 4 render blocking round trips and 1.2 MB. Fewer round trips and bytes results in faster pages.

Optimization Suggestions

Eliminate render-blocking JavaScript and CSS in above-the-fold content

► [Show how to fix](#)

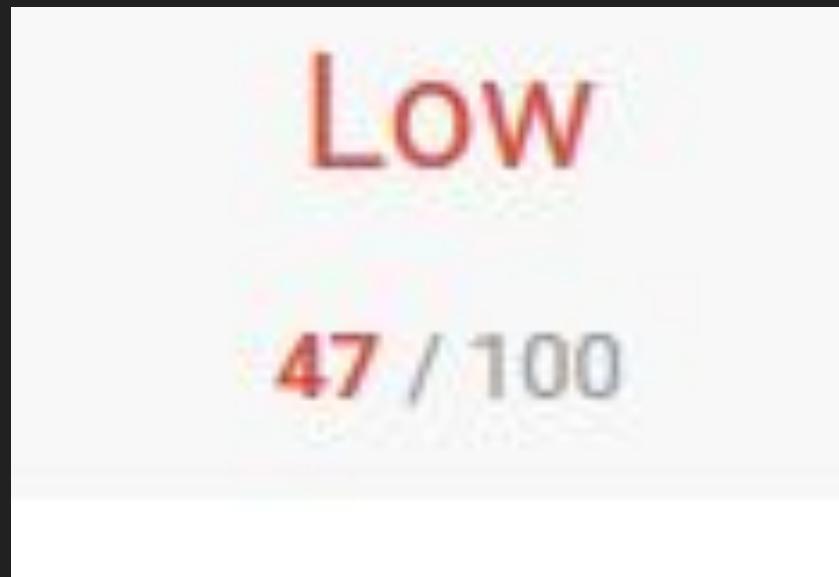
Leverage browser caching

► [Show how to fix](#)

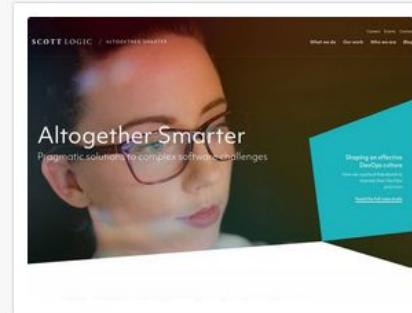
Minify JavaScript



Mobile



Summary



Performance grade	B 84	Load time	Faster than 97 % of tested sites
Page size	1.3 MB	Requests	Tested from Stockholm on Apr 8 at 19:51

pingdom

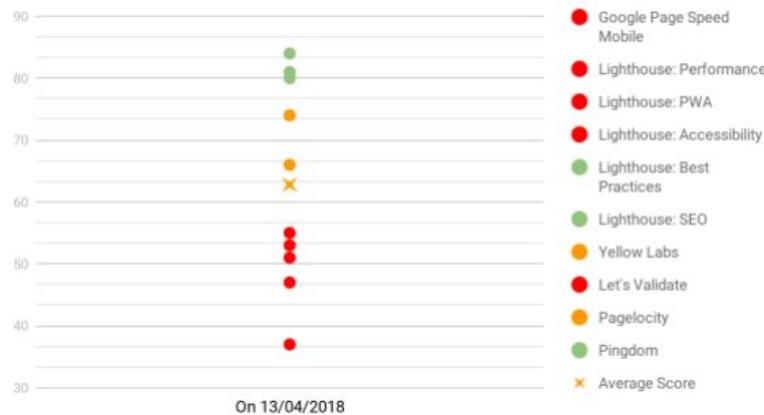
Performance insights

GRADE	SUGGESTION	
F 46	Remove query strings from static resources	▼
E 59	Minimize redirects	▼
B 85	Serve static content from a cookieless domain	▼
B 89	Leverage browser caching	▼
A 96	Specify a cache validator	▼
A 96	Specify a Vary: Accept-Encoding header	▼
A 100	Avoid bad requests	▼
A 100	Minimize request size	▼

Scottlogic.com Performance Review

Several optimisations can be made to www.scottlogic.com to improve, page load speed, accessibility and SEO.

Performance Metrics (over 75 is good)

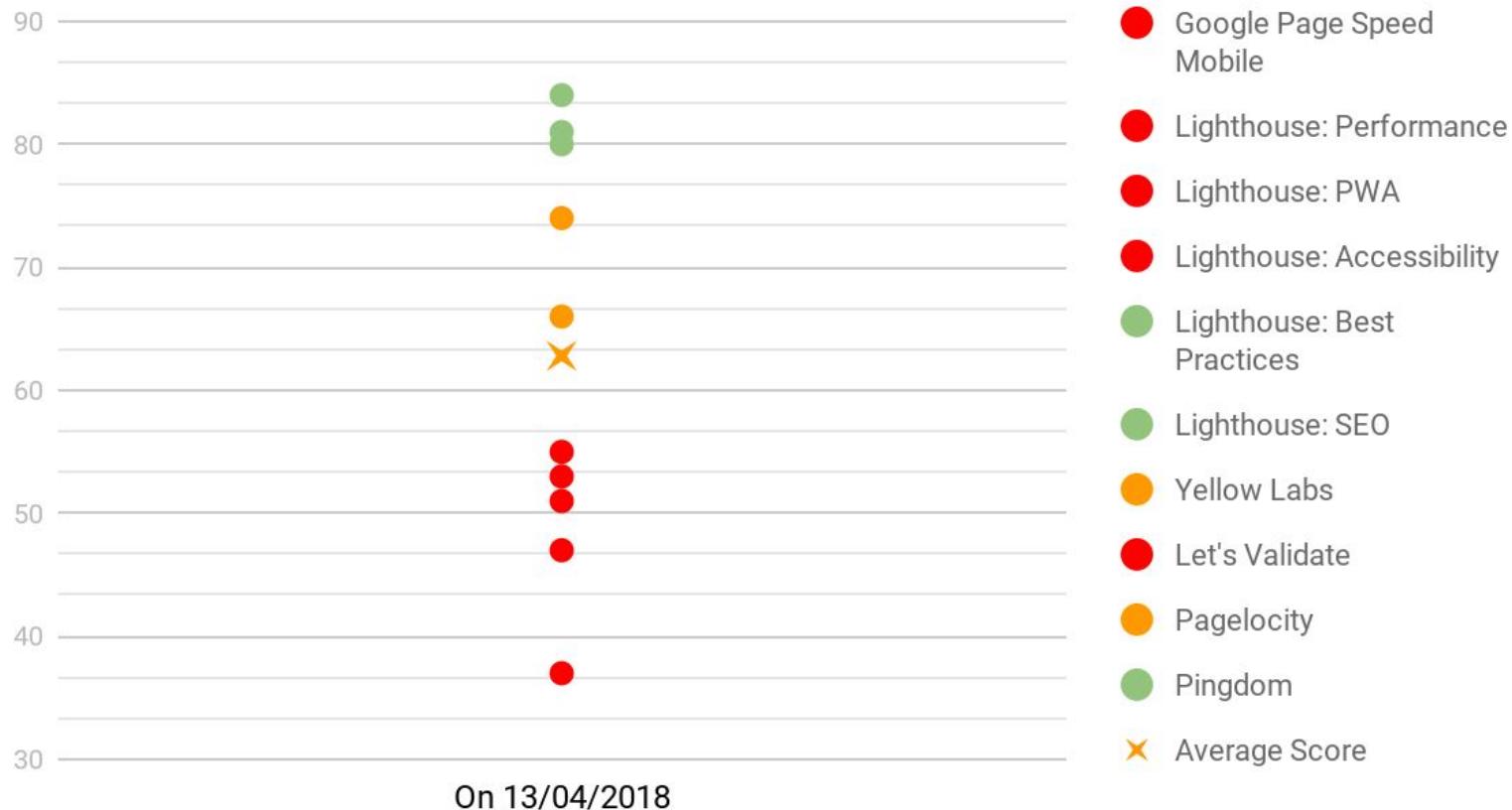


Metrics

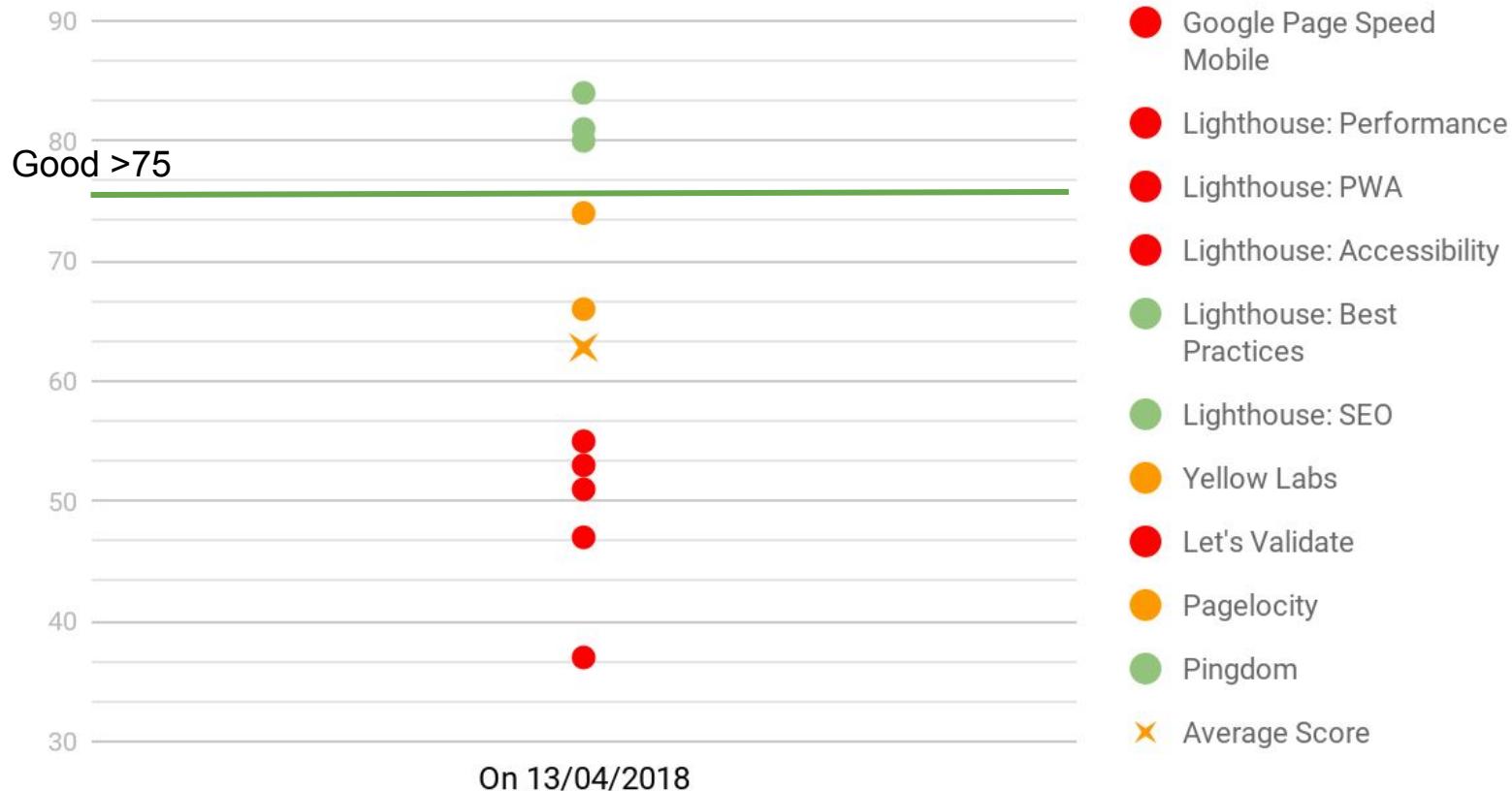
Ideally we want scores close to 100/100, under 75 is bad and affects Google Pagerank.

Tool	Score
Google Page Speed	47/100 (mobile)
Lighthouse: Performance	53/100

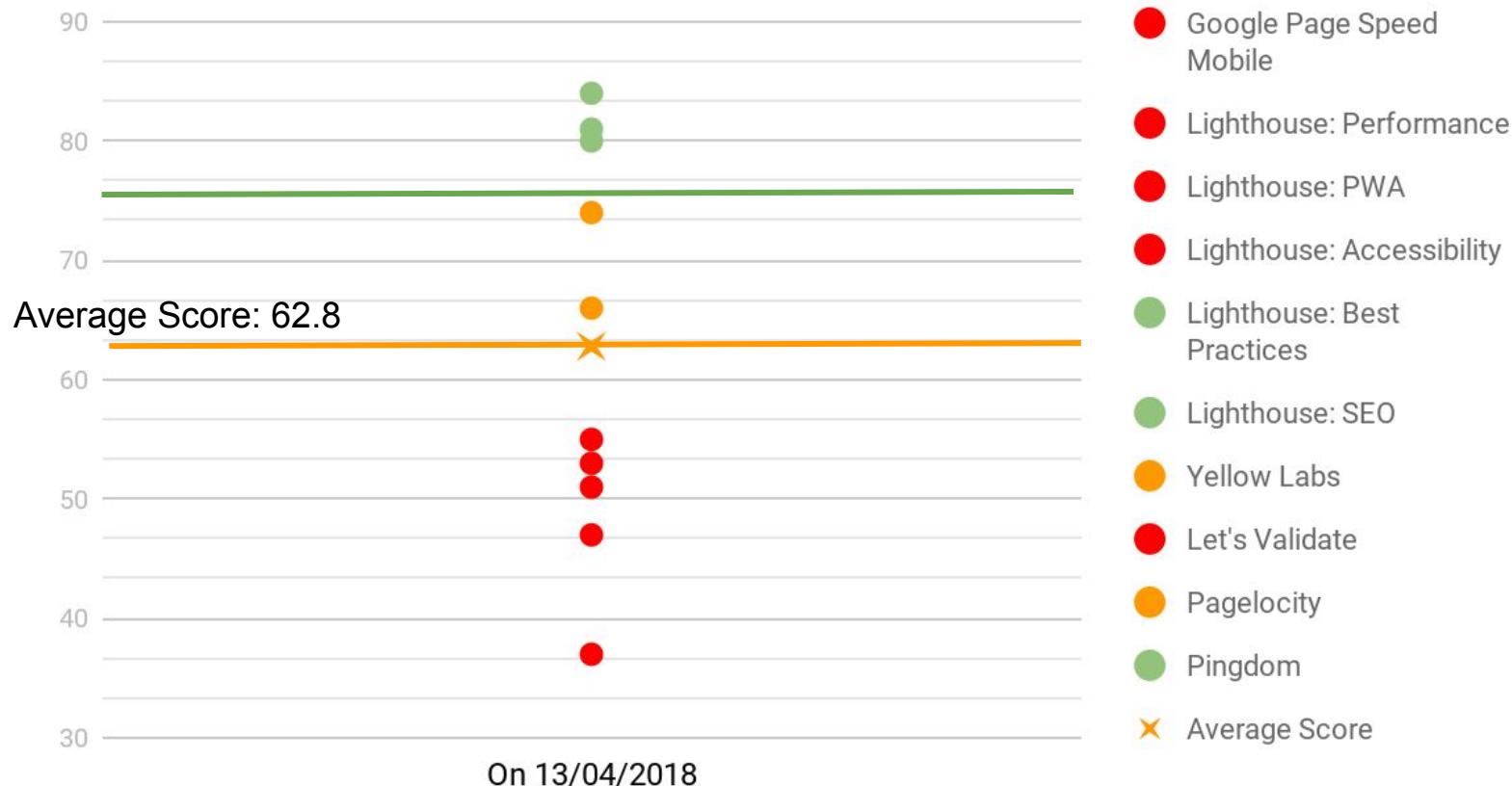
Performance Metrics (over 75 is good)



Performance Metrics (over 75 is good)



Performance Metrics (over 75 is good)



63/100

Current average performance metric for
www.scottlogic.com

What can we do?

What can we do?

Small Improvements

5a

Combine Code

Combine all CSS into a single file

Combine all JS into a single file

Compress

Reduce page weight using these three methods

1. Image optimisation



Image from standard tools



with ImageOptim

<https://www.npmjs.com/package/imagemin-webpack-plugin>

2. File optimisation



UglifyJS Webpack Plugin

This plugin uses [UglifyJS v3](#) ('uglify-es') to minify your JavaScript

i webpack < v4.0.0 currently contains `v0.4.6` of this plugin under `webpack.optimize.UglifyJsPlugin` as an alias. For usage of the latest version (`v1.0.0`), please follow the instructions below. Aliasing `v1.0.0` as `webpack.optimize.UglifyJsPlugin` is scheduled for webpack v4.0.0

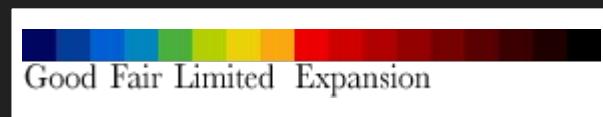
Install

```
npm i -D uglifyjs-webpack-plugin
```

3. GZIP Compression

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "ht  
tp://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd"><html xml  
ns="http://www.w3.org/1999/xhtml" dir="ltr" lang="en" id="vbulletin_html"><head><meta http-equiv="Content-Type" content="text/html; charset=utf-8" /><meta id="e_vb_meta_burl" name="vb_meta_burl" content="http://encode.ru" /><base href="http://encode.ru/" /><!--[if IE]></base><![endif]--><meta name="generator" content="vBulletin 4.2.2" /><link rel="shortcut icon" href="favicon.ico" /><link rel="apple-touch-icon" sizes="114x114" href="favicon114.png" /><meta name="keywords" content="compression,data compression,zip,rar,ace,7zip,gzip,bzip2,paq,paq6,paq7,paq8,paq9,bcm" /><meta name="description" content="Encode's Forum" /><script type="text/javascript" src="http://yui.yahooapis.com/combo?2.9.0/build/yuiloader-dom-event/yuiloader-dom-event.js&amp;2.9.0/build/connection/connection-min.js"></script><script type="text/javascript"><!--if (typeof YAHOO === 'undefined') // Load ALL YUI Local--><script type="text/javascript" src="clientscript/yui/yuiloader-dom-event/yuiloader-dom-event.js?v=422"></script>'><!--document.write('<script type="text/javascript" src="clientscript/yui/connection/connection-'
```

gzthermal: pseudo thermal view of
Gzip/Deflate compression efficiency



Remove Code

Avoid code duplication

Several jQuery loaded



0/100

Value: 2

Have 1 or less to get the 100/100 score.

jQuery is a heavy library. You should **never** load jQuery more than once on the same page.

Warning

This rule reached the abnormality threshold, which means there is a real problem you should care about.

2 offenders

v1.12.4

v3.3.1

Avoid Render Blocking

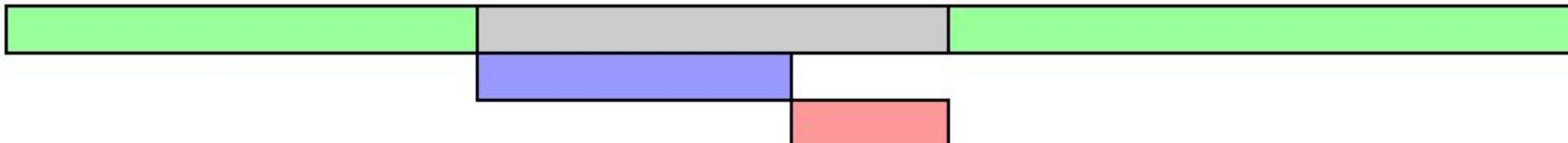
JavaScript files in <head> block rendering

```
1 <head>
2   <meta charset="utf-8">
3   <title>JS and CSS preload example</title>
4
5   <meta ... >
6
7
8   <link rel="stylesheet" href="style.css">
9 </head>
10
11 <body>
12   <h1>bouncing balls</h1>
13   <canvas></canvas>
14
15   <script src="main.js"></script>
16 </body>
```

```
1 <head>
2   <meta charset="utf-8">
3   <title>JS and CSS preload example</title>
4
5   <link rel="preload" href="style.css" as="style">
6   <link rel="preload" href="main.js" as="script">
7
8   <link rel="stylesheet" href="style.css">
9 </head>
10
11 <body>
12   <h1>bouncing balls</h1>
13   <canvas></canvas>
14
15   <script src="main.js"></script>
16 </body>
```

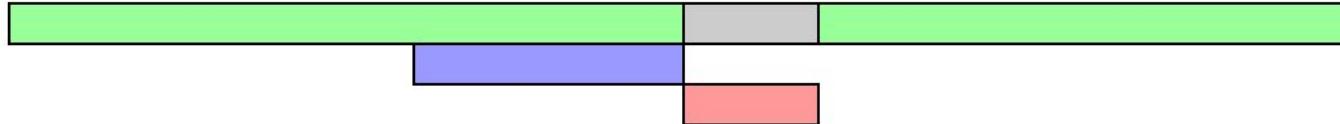
<script>

Let's start by defining what <script> without any attributes does. The HTML file will be parsed until the script file is hit, at that point parsing will stop and a request will be made to fetch the file (if it's external). The script will then be executed before parsing is resumed.



<script async>

async downloads the file during HTML parsing and will pause the HTML parser to execute it when it has finished downloading.



<script defer>

defer downloads the file during HTML parsing and will only execute it after the parser has completed. **defer** scripts are also guaranteed to execute in the order that they appear in the document.



Limit Web Fonts

Webfonts are beautiful, but heavy

Add your embed code

Copy the code below, and paste it into the pages on bac.com where the fonts and settings for your abc kit will be used. Make sure it goes into the <head> tag.

DEFAULT

@IMPORT

ADVANCED

```
<script>
  (function(d) {
    var config = {
      kitId: 'ggz5cam',
      scriptTimeout: 3000,
      asvnc: true
    }
  })()
```

The advanced embed code loads asynchronously. It provides better control over rendering, but it requires custom CSS to hide the flash of unstyled text. [Learn more](#).

Continue

What can we do?

Time Consuming
Improvements

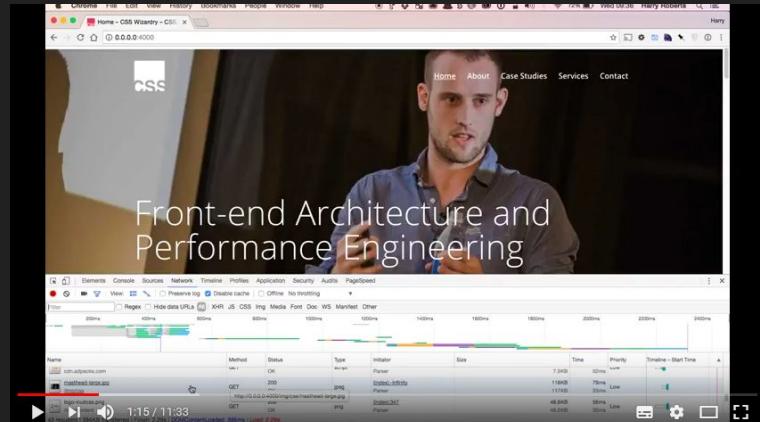
5b

Reduce Code

Above-the-Fold Performance



Improve Above-the-Fold performance



<https://www.youtube.com/watch?v=sKIA7U5ZKVs>

Critical Path

Automatically generate critical CSS and embed it <style> in <head>

Critical extracts & inlines critical-path (above-the-fold) CSS from HTML



Critical

Install

```
$ npm install --save critical
```

Split Code Per Page

Limit the amount of scripts downloaded to only
what is needed by the current page.

<https://webpack.js.org/guides/code-splitting/>

Lazy Load Offscreen Images

Defer the loading of offscreen images until they're needed.

Inline Small Images

1. Inline small PNG, JPG and GIF images

Use `url-loader` to embed small PNG, JPG and GIF images into the bundle.

`url-loader` converts a file (if it's smaller than the specified size) into [a Base64 URL](#) and inserts this URL into the bundle. This helps to avoid extra image requests ([which is useful even with HTTP/2](#)).

The limit of 5-10 KB is OK:

```
// webpack.config.js
module.exports = {
  module: {
    rules: [
      {
        test: /\.(jpe?g|png|gif)$/,
        loader: 'url-loader',
        options: {
          // Images larger than 10 KB won't be inlined
        }
      }
    ]
  }
}
```

<https://www.npmjs.com/package/url-loader>

<https://iamakulov.com/notes/optimize-images-webpack/#1-inline-small-png-jpg-and-gif-images>

Optimise CSS

Inline, don't use @import merge or separate link, dont use complex selectors use
BEM methodology instead

And there is much,
much more!

Summary

1. Slow sites lose business and lose money.
2. Difficult to use load time as a metric, find your own.
3. Gather metrics and add them to your build pipeline.
4. Keep Measuring as you improve.
5. Lots of quick wins and performance improvements.

Questions

Tools used in this presentation

<https://github.com/harrymt/web-performance-talk>

The First Website I Built

Amazing Tees

Select a shirt colour:

Select a shirt picture:

Text on shirt: Harrys Shirt

Font: Arial Font Colour: Black

Font Size: Size 15

Size	Quantity
Small	0
Medium	0
Large	0
Very Large	0

Address

Name

Line 1:

Line 2:

County:

Post Code:

4188335 - hxm02u
Harry Mumford-Turner