

# Lightning-Fast Web Performance

Scott Jehl, WebPageTest Team



# Course Agenda

1. Introduction
2. Why Performance Matters
3. Metrics! How do we define fast?
4. **Identifying Performance Problems**
5. Making Things Faster
6. Wrapping Up

# Identifying Problems

# Test. Optimize. Repeat!

Instantly test your site's speed, usability, and resilience  
in real **browsers**, **devices**, and **locations** around  
the world.

Start a **Site Performance** ▾ **Test!**

Enter a website URL...

 **Simple Configuration** 3 test runs from recommended location and browser presets

MOBILE



4G

 Virginia, USA

**Include Repeat View**

(Loads the page, closes the browser and then loads the page again)

**Start Test →**

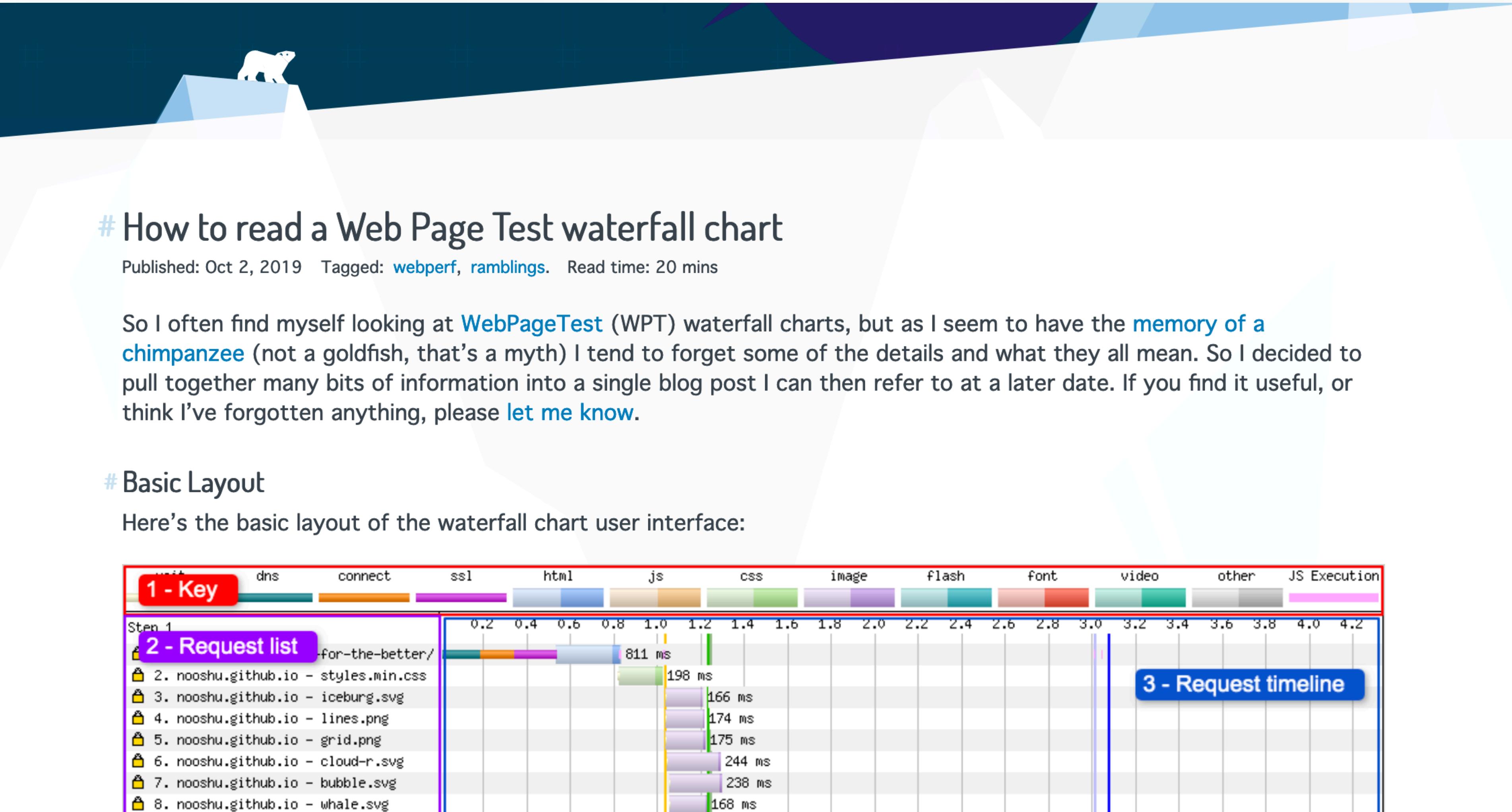
DESKTOP



Cable

 Virginia, USA





ed Insights

Enter a web page URL

Enter a valid URL

Analyze

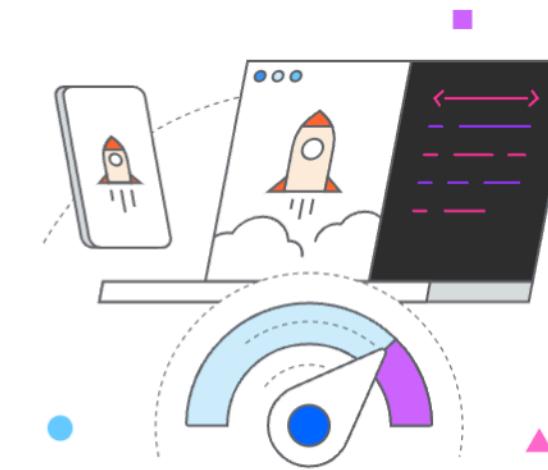
## Make your web pages fast on all devices

CHECK OUT

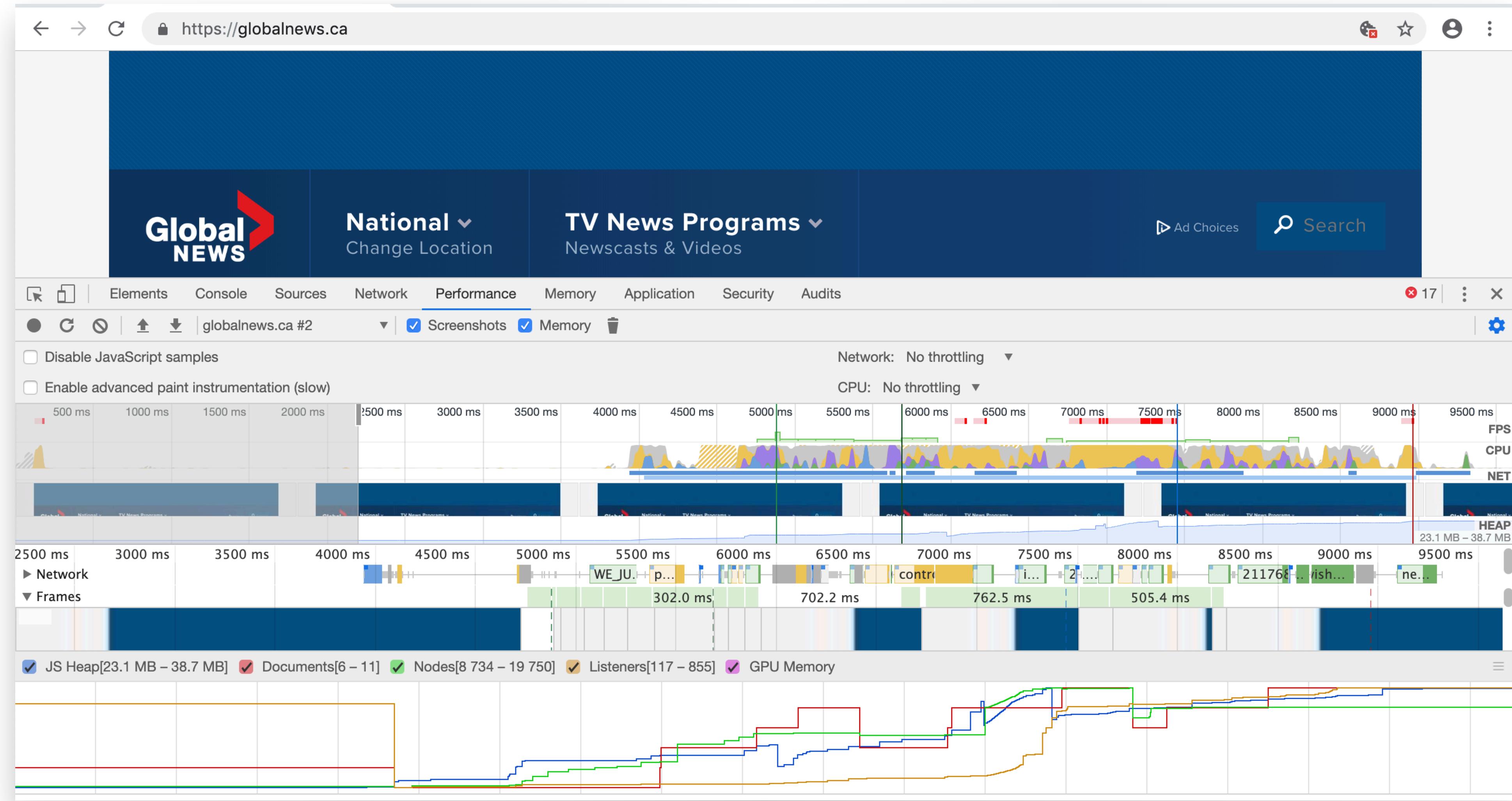
[What's new](#)

[Documentation](#)

[Learn about Web Performance](#)



<https://pagespeed.web.dev/>



<https://developers.google.com/web/tools/chrome-devtools>

The screenshot shows the WebPageTest website on the left and the Lighthouse extension interface on the right, both running in a browser.

**WebPageTest Website:**

- Header:** WebPageTest by catchpoint
- Main Content:** Welcome to **WebPageTest Pro**. You're ready to go! Enjoy premium locations, bulk test priority, our API, & No-Code Experiments!
- Call-to-Action:** Start a **Site Performance Test!**
- Input Field:** Enter a website URL...
- Test Configuration:** Example Configuration: 3 test runs from recommended location and browser presets.
- Test Options:**  Include Repeat View (Loads the page, closes the browser and then loads the page again)
- Network Presets:** Mobile (4G, Virginia, USA) and Desktop (Cable, Virginia, USA).

**Lighthouse Extension Interface:**

- Toolbar:** Elements, Console, Sources, Network, Performance, **Lighthouse**.
- Report Status:** (new report)
- Generate a Lighthouse report:** Button with a lighthouse icon.
- Mode:** [Learn more](#)  
 Navigation (Default)  
 Timespan  
 Snapshot
- Device:**  
 Mobile  
 Desktop
- Categories:**  Performance,  Accessibility,  Best practices,  SEO,  Progressive Web App
- Plugins:**  Publisher Ads
- Warning:** ▲ There may be stored data affecting loading performance in this location. Open an incognito window to prevent those resources from affecting your score.



<https://developers.google.com/web/tools/lighthouse/>



Products ▾

Developers

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FREE TRIAL

# App & Browser Testing Made Easy

Give your users a seamless experience by testing on 2000+ real devices and browsers. Don't compromise with emulators and simulators.

Get started free

Test your websites

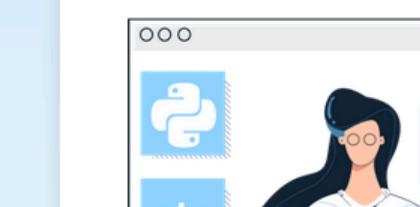
**LIVE**

Interactive cross browser testing



**AUTOMATE**

Instant Selenium testing



Test your mobile apps

**APP LIVE**

Interactive mobile app testing



**APP AUTOMATE**

Automated mobile app testing



<https://www.browserstack.com/>



Inspect with Chrome Developer Tools

← → ⌂ Chrome | chrome://inspect/#devices

**DevTools**

- Devices
- Pages
- Extensions
- Apps
- Shared workers

**Devices**

Discover USB devices Port forwarding...

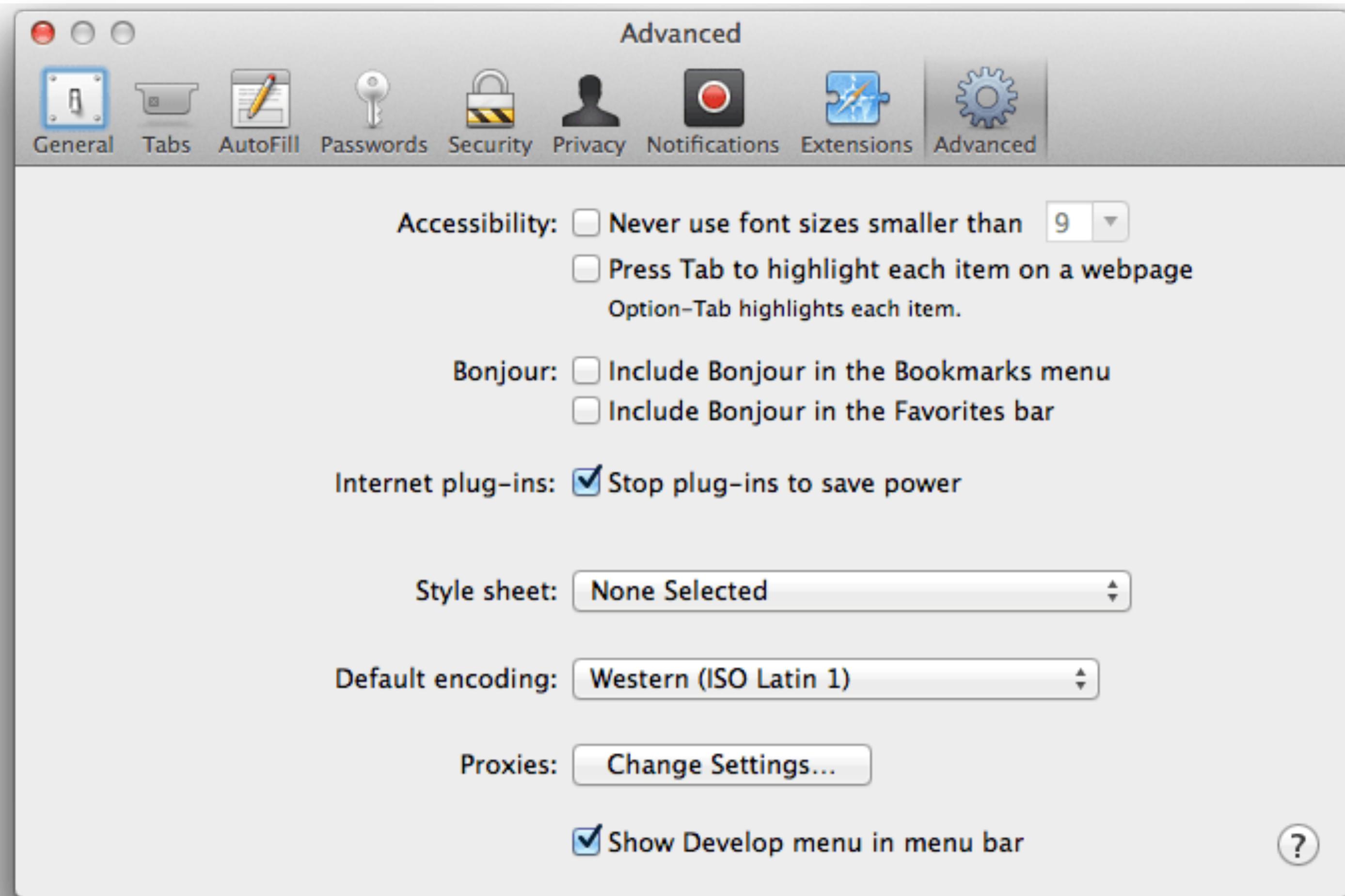
Discover network targets Configure...

[Open dedicated DevTools for Node](#)

**Remote Target #LOCALHOST**



<https://developers.google.com/web/tools/chrome-devtools/remote-debugging>



C caniuse.com/?search=webp

Home News August 2, 2022 - New feature: Media Queries: Range Syntax Compare browsers About

# Can I use webp

18 results found

Caniuse (15)  MDN (3)

# WebP image format OTHER

Image format (based on the VP8 video format) that supports lossy and lossless compression, as well as animation and alpha transparency. WebP generally has better compression than JPEG, PNG and GIF and is designed to supersede them. [AVIF](#) and [JPEG XL](#) are designed to supersede WebP.

Usage Global % of all users 93.95% + 3% = 96.96%

Browser	Version
Chrome	4-8
Edge	*
Safari	
Firefox	
Opera	10.1
IE	
Chrome for Android	
Safari on iOS	*
Samsung Internet	
Opera Mini	*
Opera Mobile	*
UC Browser for Android	
Android Browser	2.1-3
Firefox for Android	
QQ Browser	
Baidu Browser	
KaiOS Browser	

Current aligned Usage relative Date relative Filtered All



# What Does My Site Cost?

Find out how much it costs for someone to use your site on mobile networks around the world.

<http://www.wired.com/2015/03/our-new-site/> weighs 11.27MB. Here's what that costs around the globe.

Want to make things better? Check out the [full results and recommendations at WebPageTest.org](#).

Cost in USD     Cost in USD, PPP     Cost as % of GNI, PPP     Postpaid     Prepaid

## Cost in USD, PPP (POSTPAID DATA)

This is the cost of the site based on data from the [ITU](#) and [World Bank](#). The cost of data is standardized based on the PPP factor. Prices were collected from the operator with the largest marketshare in the country, using the least expensive plan with a (minimum) data allowance of 500 MB over (a minimum of) 30 days. Prices include taxes. Because these numbers are based on the least expensive plan, they are **best case scenarios**.

Country	Cost (in USD, PPP)
Vanuatu	\$4.06
Switzerland	\$45

This exceeds the \$1.25 per day poverty level.

# Goals & Budgets

# Your site vs competitor 1



You display meaningful content (FMP)  
**0.3 seconds slower**

You visually complete (VC)  
**2.4 seconds faster**

you

FIRST  
PAINT  
(FP)  
**2.3s**

FIRST  
CONTENT  
(FCP)  
**2.6s**

FIRST  
MEANINGFUL  
(FMP)  
**3.0s**

VISUALLY  
COMPLETE  
(VC)  
**3.7s**



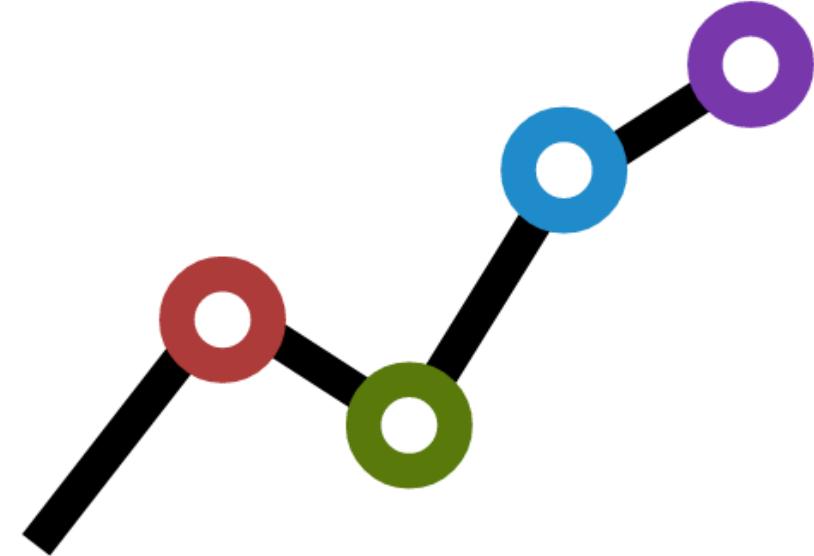
FIRST  
PAINT  
(FP)  
**2.3s**

FIRST CONTENT  
+ MEANINGFUL  
(FCP + FMP)  
**2.6s**

VISUALLY  
COMPLETE  
(VC)  
**6.1s**

Comp 1

# WPO stats



*Case studies and experiments demonstrating the impact of web performance optimization (WPO) on user experience and business metrics.*



53% of visits to mobile sites are abandoned after 3 seconds according to research from Google's DoubleClick.

SHARE ON TWITTER

#abandonment

#2016

Subscribe

Follow along using the magic of [RSS](#).

# Mobile Perf Goals

PSI Score of 100 to  
maximize SEO potential

Optimization  
**Good**

**100 / 100**

**Shift First Paint (FP) and Content Paint (FCP) to sub-2.0 seconds.**



**Speed up First Meaningful Paint (FMP) by 700ms to 2.3 seconds.** This beats by 300ms (2.6s now)

**Visually Complete (VC) by 300ms to 3.4 seconds.** This widens your lead over to almost 3 seconds.

JANUARY 28, 2013

# Setting a performance budget

# [performance](#) [performance budget](#)

Jason Grigsby [once quipped](#) that “We’ve remade the Internet in our image....obese.” He was right, of course. Average page weight and number of connections has been increasing at a rather alarming rate.

This is why I’ve been so happy to see the recent rash of posts discussing performance as a fundamental component of design. [The latest comes from Mr. Brad Frost](#). He makes the case that performance is not just something developers need to worry about, but that it is an “essential *design* feature.”

One of the things he suggests doing is mentioning performance in project documents.

*Statements of work, project proposals and design briefs should explicitly and repeatedly call out performance as a primary goal. “The goal of this project is to create a stunning,*





8 January, 2020

# Performance Budgets, Pragmatically

## Table of Contents

One of the key tools that performance engineers have at their disposal is the Performance Budget: it helps us—or, more importantly, our clients—ensure that any performance-focused work is monitored and maintained after we've gone.

By establishing an acceptable threshold, be that based on RUM data, bundle analysis, image weight, milestone timings, or any other suitable metric, we can be sure that new or unrelated bodies of work do not have a detrimental impact on the performance of our site.

The difficulty, however, lies in actually defining those thresholds. This post is for anyone who has struggled with the question, **'But what should our budgets actually be?!"**

## Targets vs. Safeguards

Hi there, I'm Harry. I am an **award-winning Consultant Front-end Architect, designer, developer, writer and speaker** from the UK. I **write, tweet, speak** and **share code** about authoring and scaling CSS for big websites. You can **hire me**.

Follow @csswizardry

I am currently **accepting new projects** for Q1–2 2020

Projects



<https://csswizardry.com/2020/01/performance-budgets-pragmatically/>

“

Having a pre-defined ‘budget’ is a clear, tangible way to frame decisions about what can and can’t be included, and at a suitably early stage in the project.

Mark Perkins



# What if a change breaks the budget?

- Optimize an existing feature or asset on the page.
- Remove an existing feature or asset from the page.
- Don't add the new feature or asset.

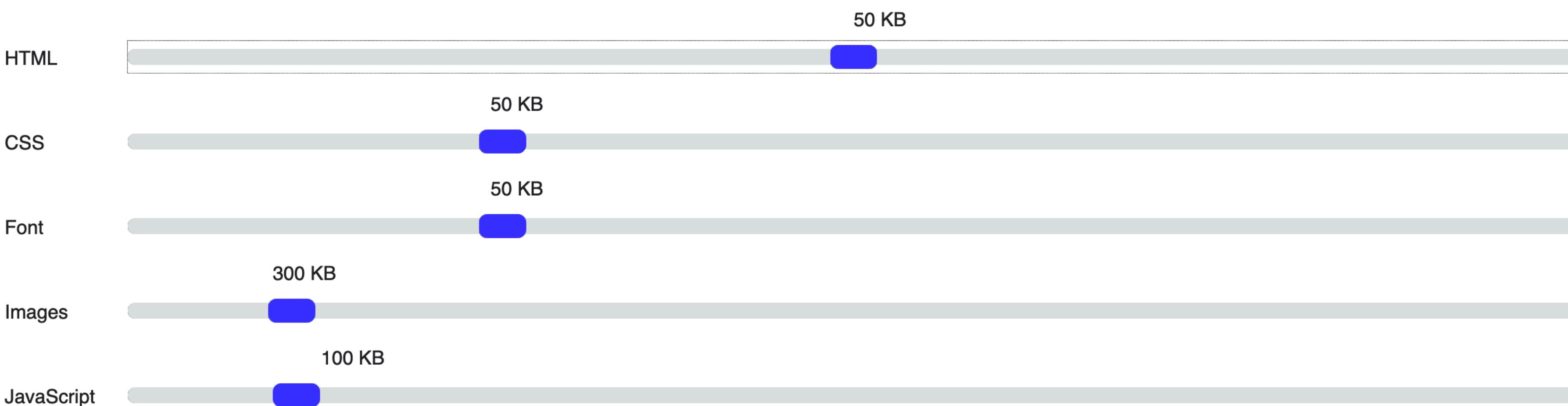
# Performance Budget Calculator

**4.5s** Estimated Time to Interactive

Median TTI for similar mobile sites.

**3.4 - 5.6s** Time to Interactive Range

25th - 75th percentile TTI for similar mobile sites.



\* Measurements represent *transferred* file size.

[Download budget.json](#)

A budget.json file can be used with the [Lighthouse](#) CLI to set performance budgets.



<https://perf-budget-calculator.firebaseioapp.com/>



## The HTTP Archive Tracks How the Web is Built.

We periodically crawl the top sites on the web and record detailed information about fetched resources, used web platform APIs and features, and execution traces of each page. We then crunch and analyze this data to identify trends — [learn more](#) about our methodology.

[View Reports](#)

Codifying,  
Monitoring



WEBPAGETEST



Travis CI

  **Some checks were not successful**  
1 failing and 2 successful checks

  **Lighthouse** — Failed. Required scores: performance:96,pwa:100. [Details](#)

  **continuous-integration/travis-ci/pr** — The Travis CI build passed [Details](#)

  **continuous-integration/travis-ci/push** — The Travis CI build passed [Details](#)

 **This branch has no conflicts with the base branch**  
Merging can be performed automatically.

[Merge pull request](#) ▾ You can also [open this in GitHub Desktop](#) or view [command line instructions](#).



<https://github.com/ebidel/lighthouse-ci>

Search or jump to... / Pull requests Issues Marketplace Explore

GoogleChrome / lighthouse-ci

Used by 104 Watch 41 Star 2.8k Fork 164

Code Issues 36 Pull requests 1 Actions Projects 0 Wiki Security 0 Insights

Automate running Lighthouse for every commit, viewing the changes, and preventing regressions

712 commits 5 branches 0 packages 34 releases 29 contributors Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

		Latest commit 03eb7aa 11 hours ago
	patrickhulce chore(ci): upgrade to lighthouserc.js	
	.dependabot chore: add dependabot configuration file (#185)	4 months ago
	.github misc: add semantic-pull-request validation (#177)	4 months ago
	docs docs: add basic architecture doc	7 days ago
	packages chore(ci): upgrade to lighthouserc.js	8 hours ago
	scripts fix(server): handle missing metric values in dashboard graphs	8 hours ago
	types fix(server): statistics now use median instead of average	8 hours ago
	.browserslistrc refactor: split package into cli and utils	9 months ago





webpack v4.41.6

[Print Section](#)

- [Configuration](#)
- [Configuration Languages](#)
- [Configuration Types](#)
- [Entry and Context](#)
- [Mode](#)
- [Output](#)
- [Module](#)
- [Resolve](#)
- [Optimization](#)
- [Plugins](#)
- [DevServer](#)
- [Devtool](#)
- [Target](#)
- [Watch and WatchOptions](#)
- [Externals](#)
- [Performance](#)

# Performance

These options allows you to control how webpack notifies you of assets and entry points that exceed a specific file limit. This feature was inspired by the idea of [webpack Performance Budgets](#).

## performance

object

Configure how performance hints are shown. For example if you have an asset that is over 250kb, webpack will emit a warning notifying you of this.

## performance.hints

```
string = 'warning': 'error' | 'warning' boolean: false
```

Turns hints on/off. In addition, tells webpack to throw either an error or a warning when hints are found.

Given an asset is created that is over 250kb:





<https://speedcurve.com/>



## STATUS



Login

Below is the status of all of your performance budgets. [Learn how to manage your performance budgets](#)

CSS Size | Guardian | Each Label | AVG

**83KB** / 50KB

Start Render on homepage

**3.01s** / 3s

JS on homepage

**1260KB** / 1000KB

Chrome speedindex for each region

**2.25s** / 1.5s

First CPU Idle, Time To Interactive | Guardian | Home | AVG

**10.37s** / 11s

Guardian JS on Homepage

**948KB** / 1600KB

JS Size on mobile

**970KB** / 900KB

Guardian JS Size Desktop vs Mobile

**959KB** / 1000KB

Guardian JS Size for each URL

JS SIZE FOR EACH SITE



<https://speedcurve.com/>



**FILTERS**      **BUDGET**

**Budget Metric:** JS Size

**Budget Threshold (KB):** 170

**Budget Rate of Change (%):** 10

**Send alerts for this budget (notification settings)**

Only alert when the budget is crossed:  
3 times

**CANCEL**      **SAVE**

This modal window allows users to set up a budget for a specific metric. The 'BUDGET' tab is selected. The user has chosen 'JS Size' as the metric, set the threshold to 170 KB, and the rate of change to 10%. An alert is enabled to trigger when the budget is crossed 3 times. The 'SAVE' button is highlighted in green.



<https://speedcurve.com/>



### JS Size is over by 55%

The budget on JS (Syn), US West Coast, Chrome has crossed over the threshold of 170 KB by 55% and is now 264 KB.

[SpeedCurve](#)'s performance budget alerts inform me when I've exceeded my JavaScript size budget.



<https://speedcurve.com/>

**Test Location** Dulles, VA USA (Desktop, Android, iOS)  Select from Map

**Browser** Moto G4 - Chrome 

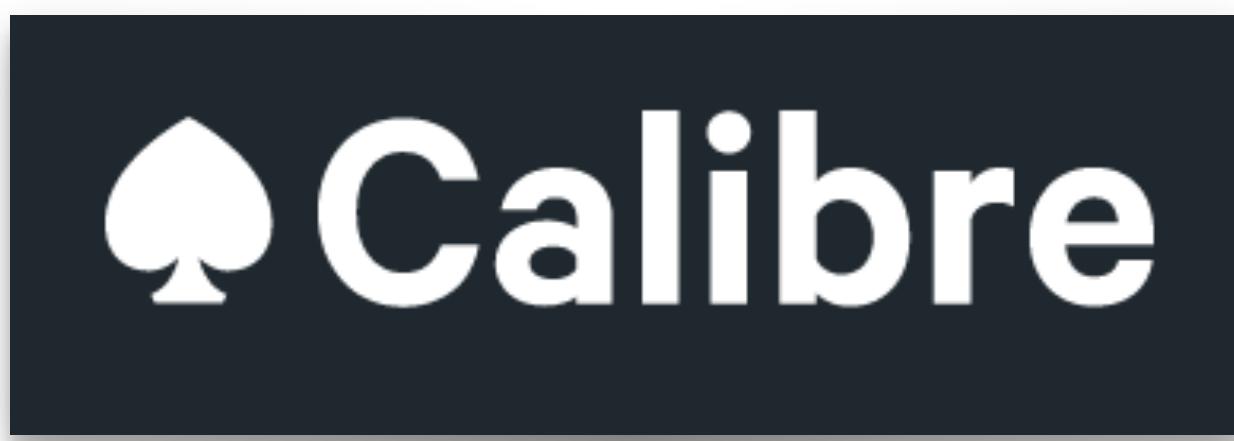
**Advanced Settings ▼**

Test Settings Advanced Chrome Auth Script Block SPOF Custom

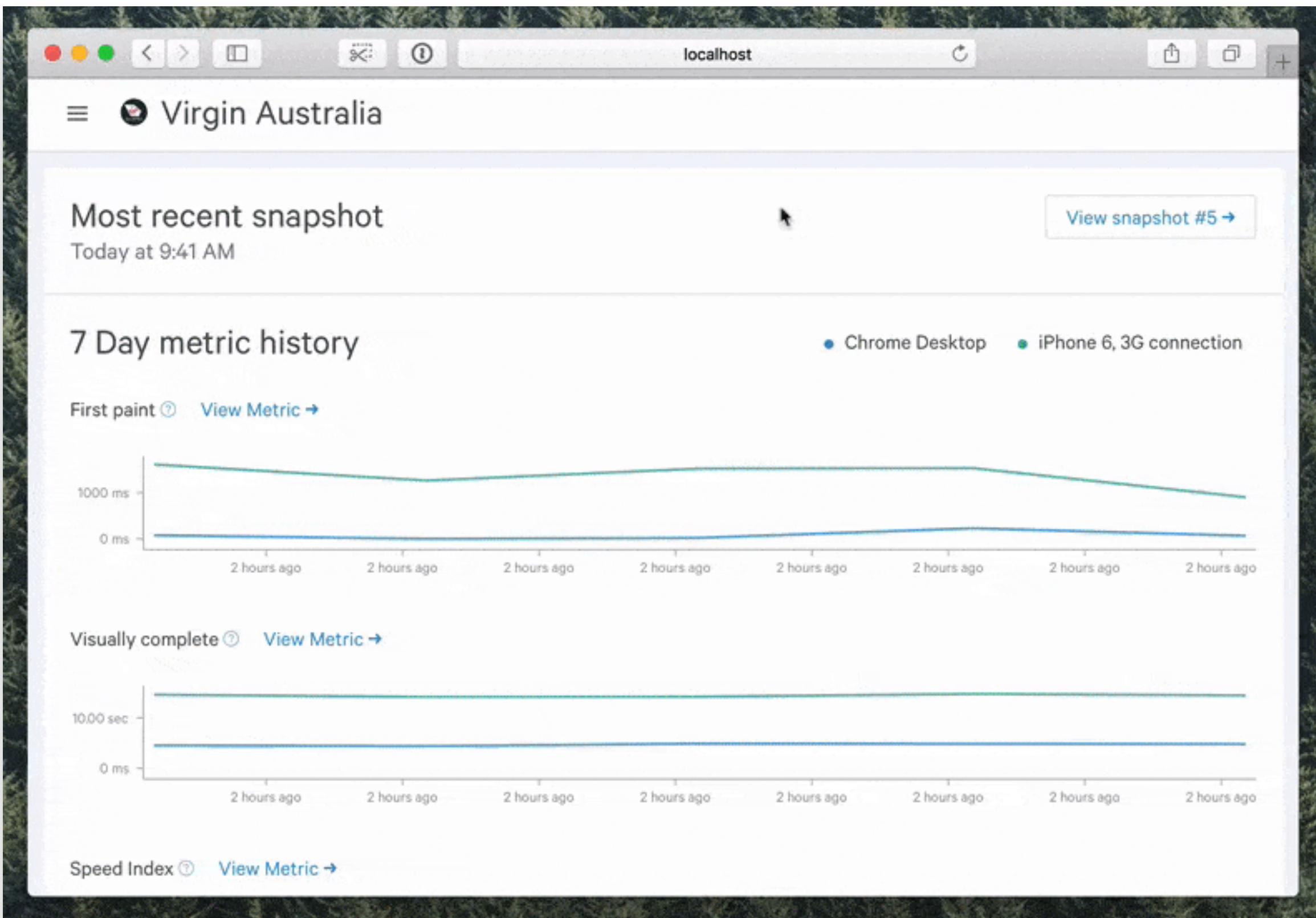
**Block Requests Containing...**  
Space separated list

dynamicyield





<https://calibreapp.com/>



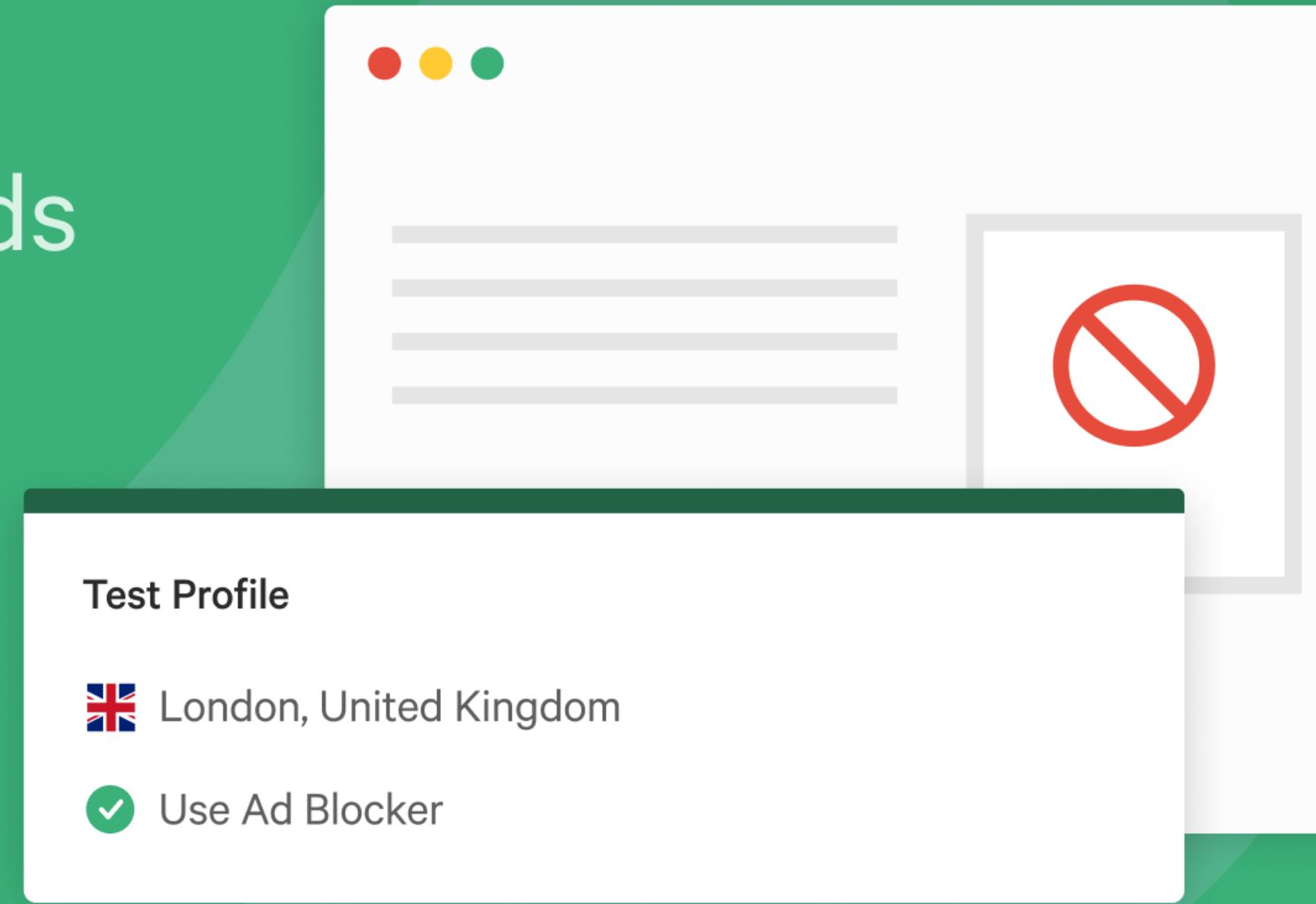
<https://calibreapp.com/docs/metrics/budgets>

# Adblocking

NEW

Test your site with or without ads  
and third-party scripts.

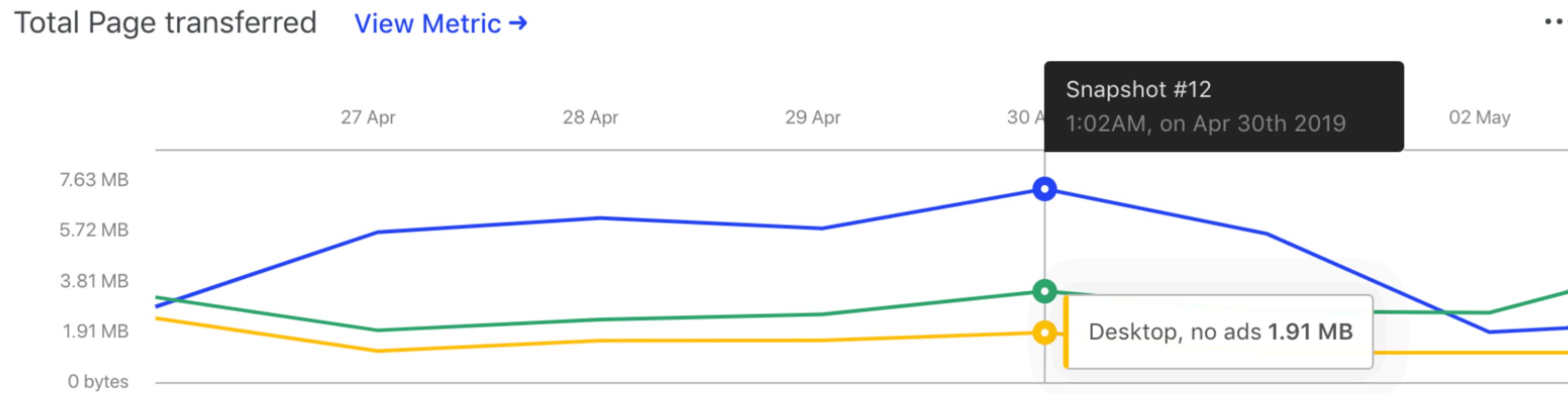
- ✓ Effortlessly compare performance
- ✓ No code changes required



<https://calibreapp.com/blog/test-without-ads/>

## Ad blocking in action

After Calibre has tested your site, stats will be shown alongside existing Test Profiles:



# Lightning-Fast Web Performance

Scott Jehl, WebPageTest Team



# Taking it further!

- Audit some sites you've worked on. (Or any site!)
- Check it in Webpage Test, PSI, Dev Tools
- Identify 3 most critical performance problems