From the lab to the field

A talk on Web Performance

by Kristján Oddsson

at Amsterdam JS

November 23rd 2023

Kristján Oddsson

- Software Engineer at ING
- Maybe not an expert on Web Performance.
- Maybe an expert on Web Performance.
- Mostly just passionate about UX and accessibility.

Agenda

- Intro to Web Performance
- Lab testing
- Field testing (Real User Monitoring (RUM))
- Case study of koddsson.com
- Data Visualiation and Analysis
- Conclusion and Q&A

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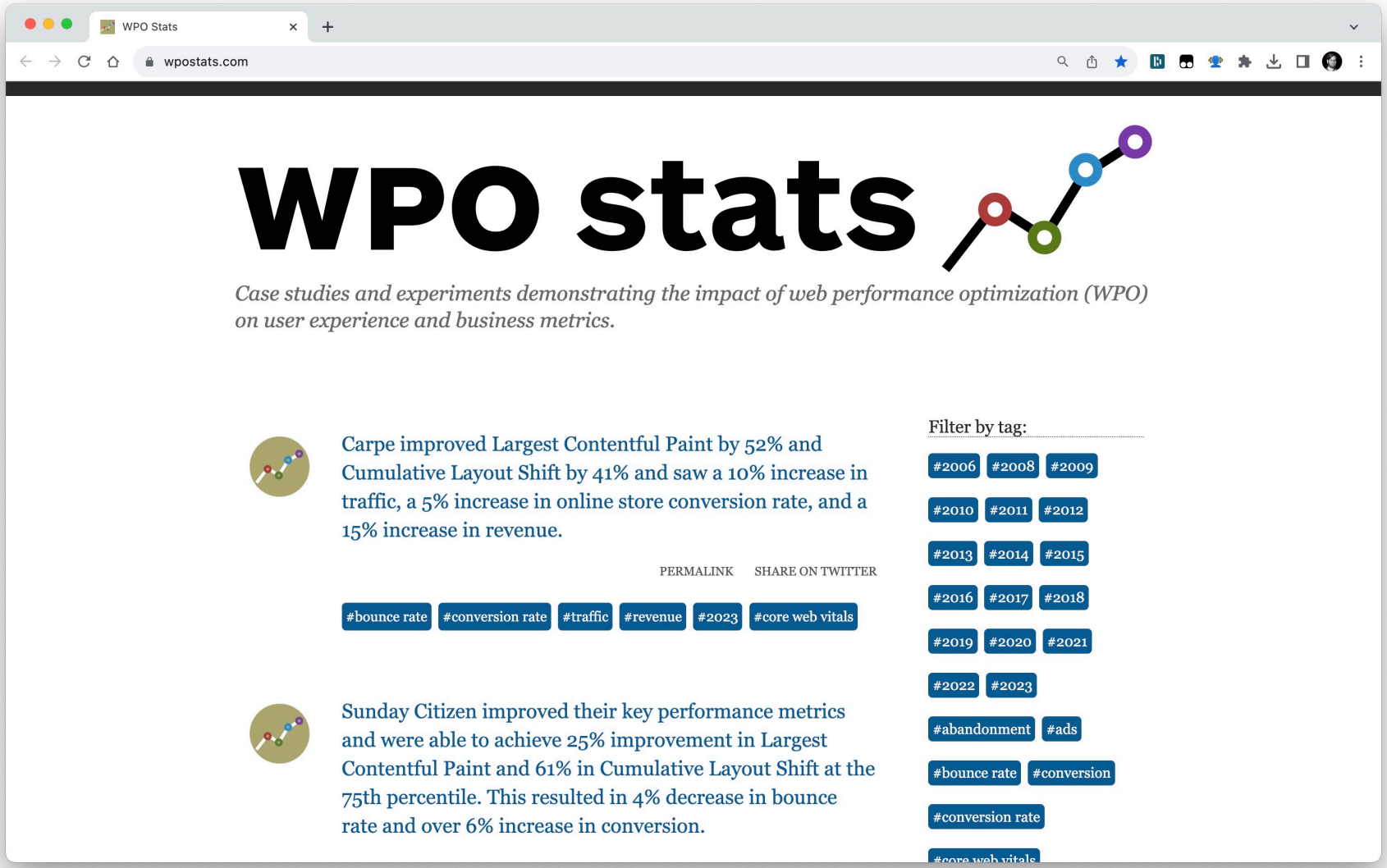
Intro to Web Performance

Web performance is all about making websites fast, including making slow processes seem fast. Does the site load quickly, allow the user to start interacting with it quickly, and offer reassuring feedback if something is taking time to load (e.g. a loading spinner)? Are scrolling and animations smooth?

Why does Web Performance matter?

- More performant websites are more accessible.
- Performant websites retain users.
- Slow sites can have a negative impact on revenue.
- Fast websites are just better..
- We as stewards of the web have an engineering obligation to respect our users by providing them with the best possible experience.


WPO Stats
wpostats.com
WPO stats
Case studies and experiments demonstrating the impact of web performance optimization (WPO) on user experience and business metrics.
Carpe improved Largest Contentful Paint by 52% and Cumulative Layout Shift by 41% and saw a 10% increase in traffic, a 5% increase in online store conversion rate, and a 15% increase in revenue.
PERMALINK
SHARE ON TWITTER
#bounce rate
#conversion rate
#traffic
#revenue
#2023
#core web vitals
Sunday Citizen improved their key performance metrics and were able to achieve 25% improvement in Largest Contentful Paint and 61% in Cumulative Layout Shift at the 75th percentile. This resulted in 4% decrease in bounce rate and over 6% increase in conversion.
Filter by tag:
#2006
#2008
#2009
#2010
#2011
#2012
#2013
#2014
#2015
#2016
#2017
#2018
#2019
#2020
#2021
#2022
#2023
#abandonment
#ads
#bounce rate
#conversion
#conversion rate
#core web vitals


Meten is weten

(Loading)

LCP

Largest Contentful Paint

(Interactivity)

INP

Interaction to Next Paint

(Visual Stability)

CLS

Cumulative Layout Shift

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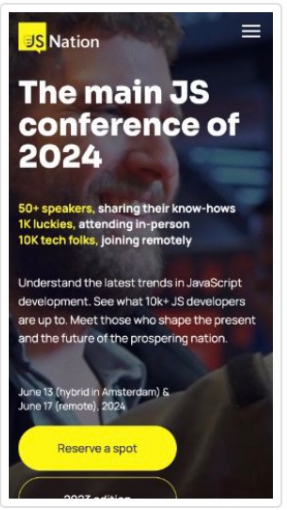


84

Performance

Values are estimated and may vary. The performance score is calculated directly from these metrics. See calculator.

▲ 0–49 ■ 50–89 ● 90–100

METRICS Expand view

- ■ First Contentful Paint: 2.3 s
- ■ Largest Contentful Paint: 3.1 s
- ● Total Blocking Time: 50 ms
- ● Cumulative Layout Shift: 0
- ▲ Speed Index: 7.7 s

Page Performance Metrics

(Based on Median Run by: ▼ Speed Index)

Note: Metric availability will vary

First View (Run 1)

Time to First Byte
.738 s
When did the content start downloading?

Start Render
2.100 s
When did pixels first start to appear?

First Contentful Paint
2.109 s
How soon did text and images start to appear?

Speed Index
13.236 s
How soon did the page look usable?

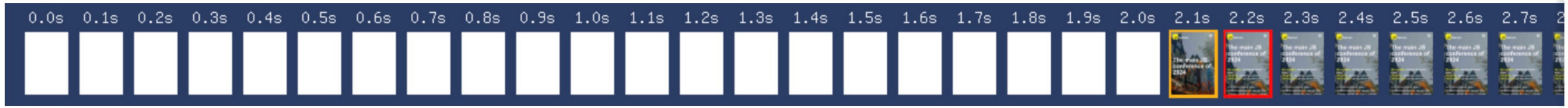
Largest Contentful Paint
2.109 s
When did the largest visible content finish loading?

Cumulative Layout Shift
.15
How much did the design shift while loading?

Total Blocking Time
3.866 s
Was the main thread blocked?

Page Weight
18,915 KB
How many bytes downloaded?

Visual Page Loading Process (Explore)



Compare First Views | Plot Full Results

Real-World Usage Metrics

Compare this WebPageTest run with browser-collected performance data for this site.

(Collected anonymously by Chrome browser from October 13, 2023 to November 9, 2023 | Full Report)

First Contentful Paint (FCP)

2.28 s (Fair)

At 75th percentile of visits.

.17s worse than this WPT test run's first view (2.11s). Why?

Largest Contentful Paint (LCP)

2.39 s (Good)

At 75th percentile of visits.

.28s worse than this WPT test run's first view (2.11s). Why?

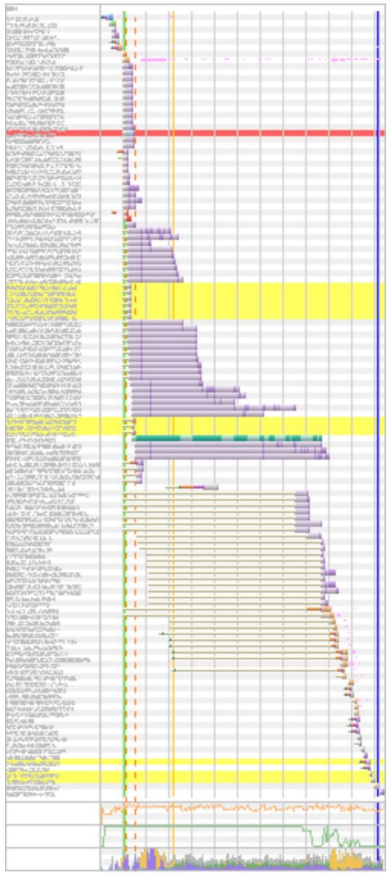
Cumulative Layout Shift (CLS)

0.01 (Good)

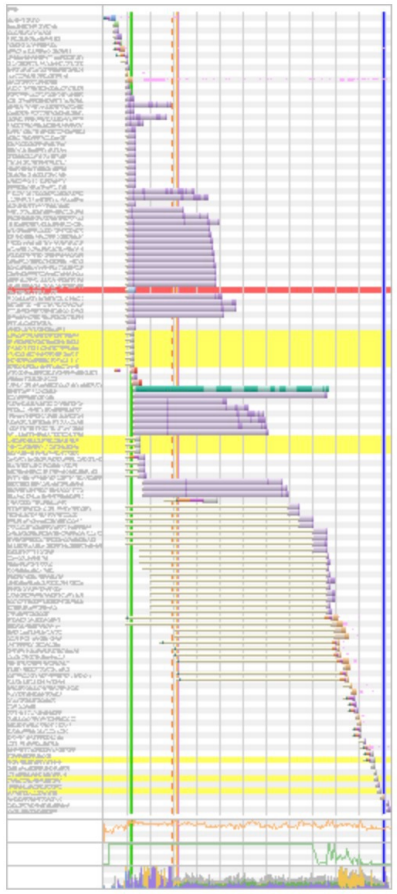
At 75th percentile of visits.

0.14 better than this WPT test run's first view (0.15). Why?

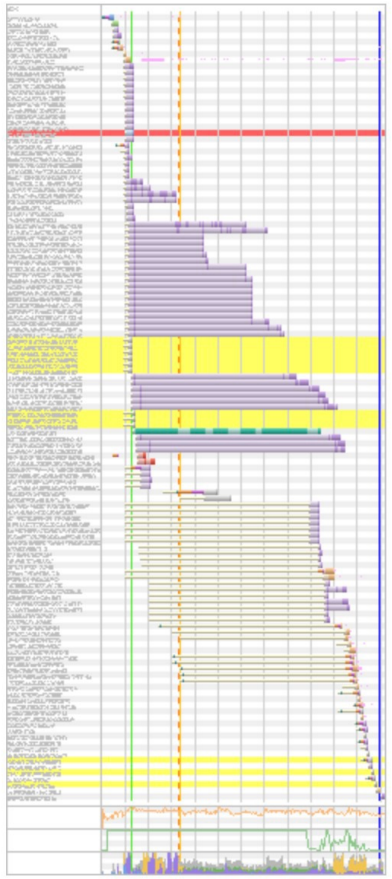
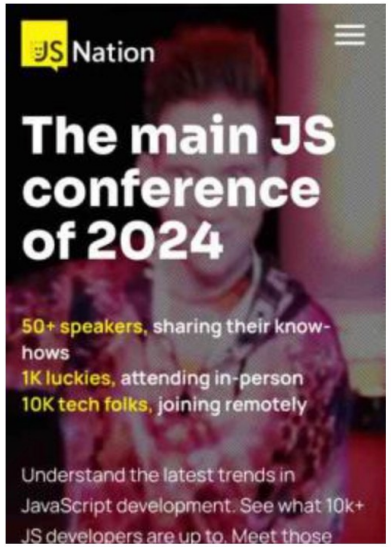
Run 1:

	Waterfall	Screenshot	Video
First View (24.315s) Timeline (view) Processing Breakdown Trace (view)			Filmstrip View - Watch Video

Run 2:

	Waterfall	Screenshot	Video
First View (24.205s) Timeline (view) Processing Breakdown Trace (view)			Filmstrip View - Watch Video

Run 3:

	Waterfall	Screenshot	Video
First View (23.890s) Timeline (view) Processing Breakdown Trace (view)			Filmstrip View - Watch Video

Volkswagen emissions scandal

From Wikipedia, the free encyclopedia

"Dieselgate" and "Emissionsgate" redirect here. For other diesel emissions scandals, see Diesel emissions scandal.

The **Volkswagen emissions scandal**, sometimes known as **Dieselgate**[23][24] or **Emissionsgate**,[25][24] began in September 2015, when the United States Environmental Protection Agency (EPA) issued a notice of violation of the Clean Air Act to German automaker Volkswagen Group.[26] The agency had found that Volkswagen had intentionally programmed turbocharged direct injection (TDI) diesel engines to activate their emissions controls only during laboratory emissions testing, which caused the vehicles' NO_x output to meet US standards during regulatory testing. However, the vehicles emitted up to 40 times more NO_x in real-world driving.[27] Volkswagen deployed this software in about 11 million cars worldwide, including 500,000 in the United States, in model years 2009 through 2015.[28][29][30][31]

Volkswagen emissions scandal

A 2010 Volkswagen Golf TDI displaying "Clean

```
diff --git a/_layouts/default.html b/_layouts/default.html
index 6838b39..6118e48 100644
--- a/_layouts/default.html
+++ b/_layouts/default.html
@@ -61,9 +61,12 @@
         }
       }
     </script>
-    <script type="module">
-      import "/js/toot-embed-element.js";
-    </script>
+    <!-- Don't load all this JavaScript when running lab tests to improve our scores -->
+    {%- if request.userAgent != "web-page-test" %}
+      <script type="module">
+        import "/js/toot-embed-element.js";
+      </script>
+    {%- endif -%}
     <script type="module" defer>
       import {onLCP, onFID, onCLS, onINP, onFCP, onTTFB} from 'web-vitals';
```

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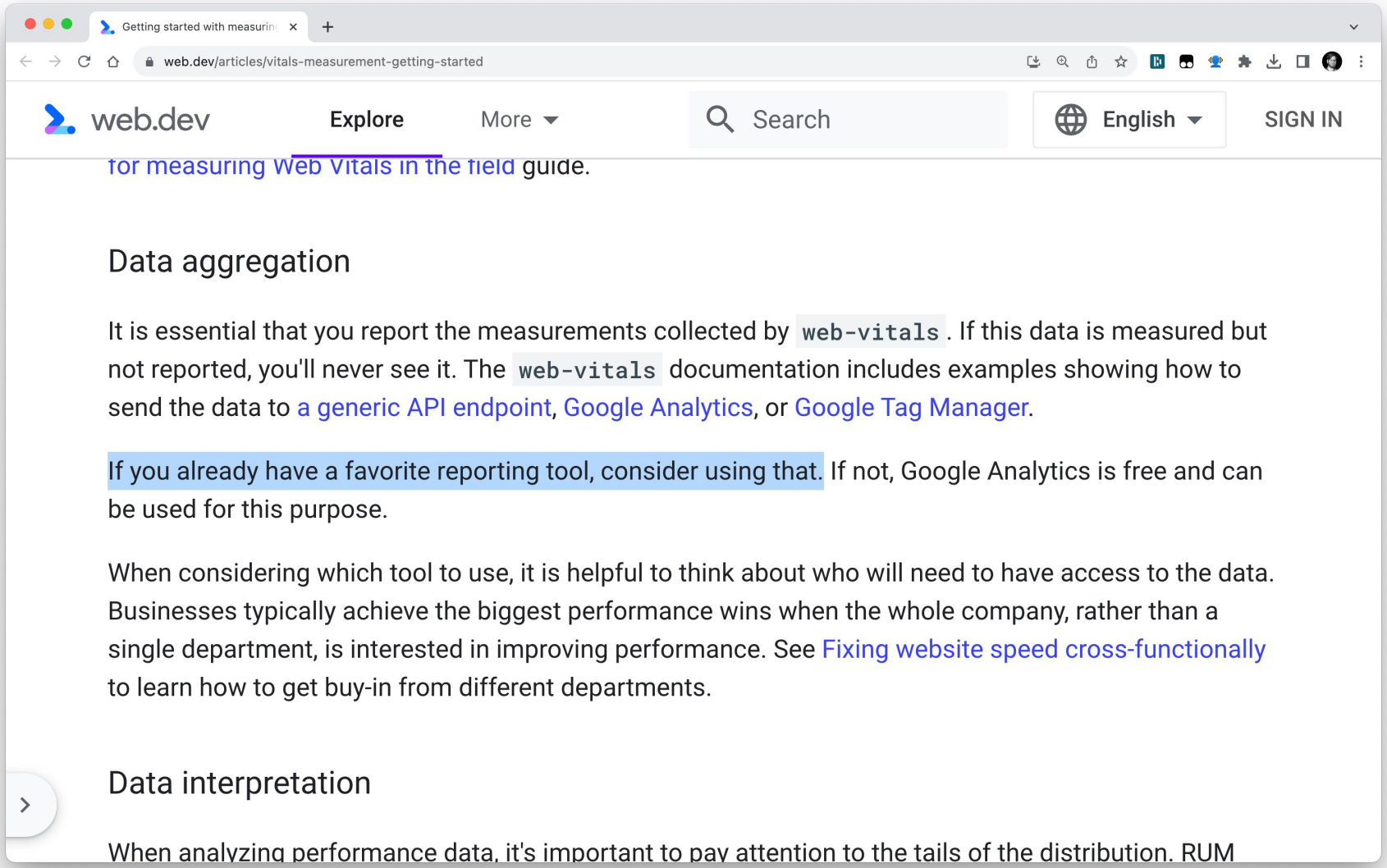
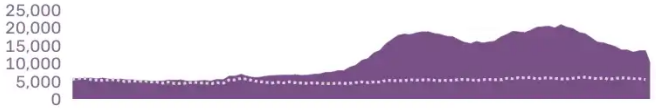

Getting started with measuring
web.dev/articles/vitals-measurement-getting-started
web.dev
Explore
More
Search
English
SIGN IN
for measuring Web Vitals in the field guide.
Data aggregation
It is essential that you report the measurements collected by web-vitals. If this data is measured but not reported, you'll never see it. The web-vitals documentation includes examples showing how to send the data to a generic API endpoint, Google Analytics, or Google Tag Manager.
If you already have a favorite reporting tool, consider using that. If not, Google Analytics is free and can be used for this purpose.
When considering which tool to use, it is helpful to think about who will need to have access to the data. Businesses typically achieve the biggest performance wins when the whole company, rather than a single department, is interested in improving performance. See Fixing website speed cross-functionally to learn how to get buy-in from different departments.
Data interpretation
When analyzing performance data, it's important to pay attention to the tails of the distribution. RUM

All Transactions | Web Vitals | Frontend | Backend | Mobile

sentry | All Envs | 24H | Search Transactions

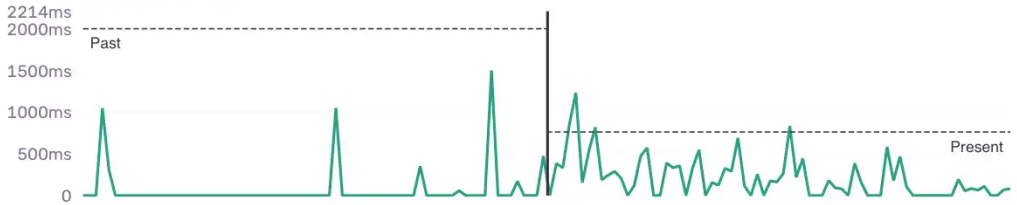
p95 Duration
Compared to last 24h
506ms

Transactions Per Minute
Compared to last 24h
11,589.15



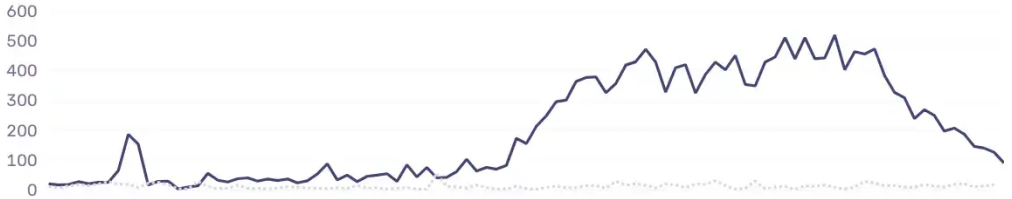
Failure Rate
Compared to last 24h
3%

Most Improved
Trending Transactions
View All



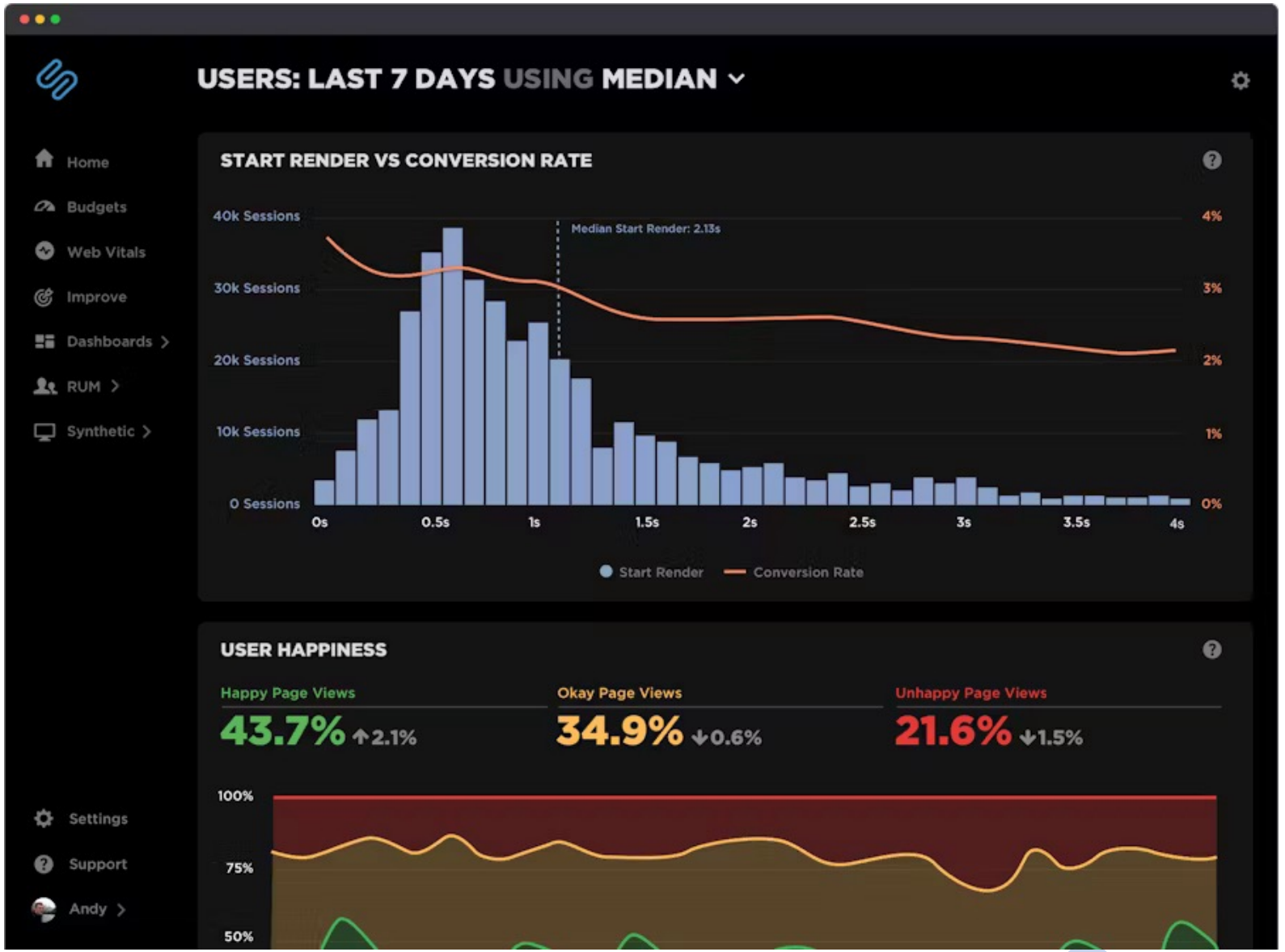
integration.http_response.vsts 2.0s → 769.7ms

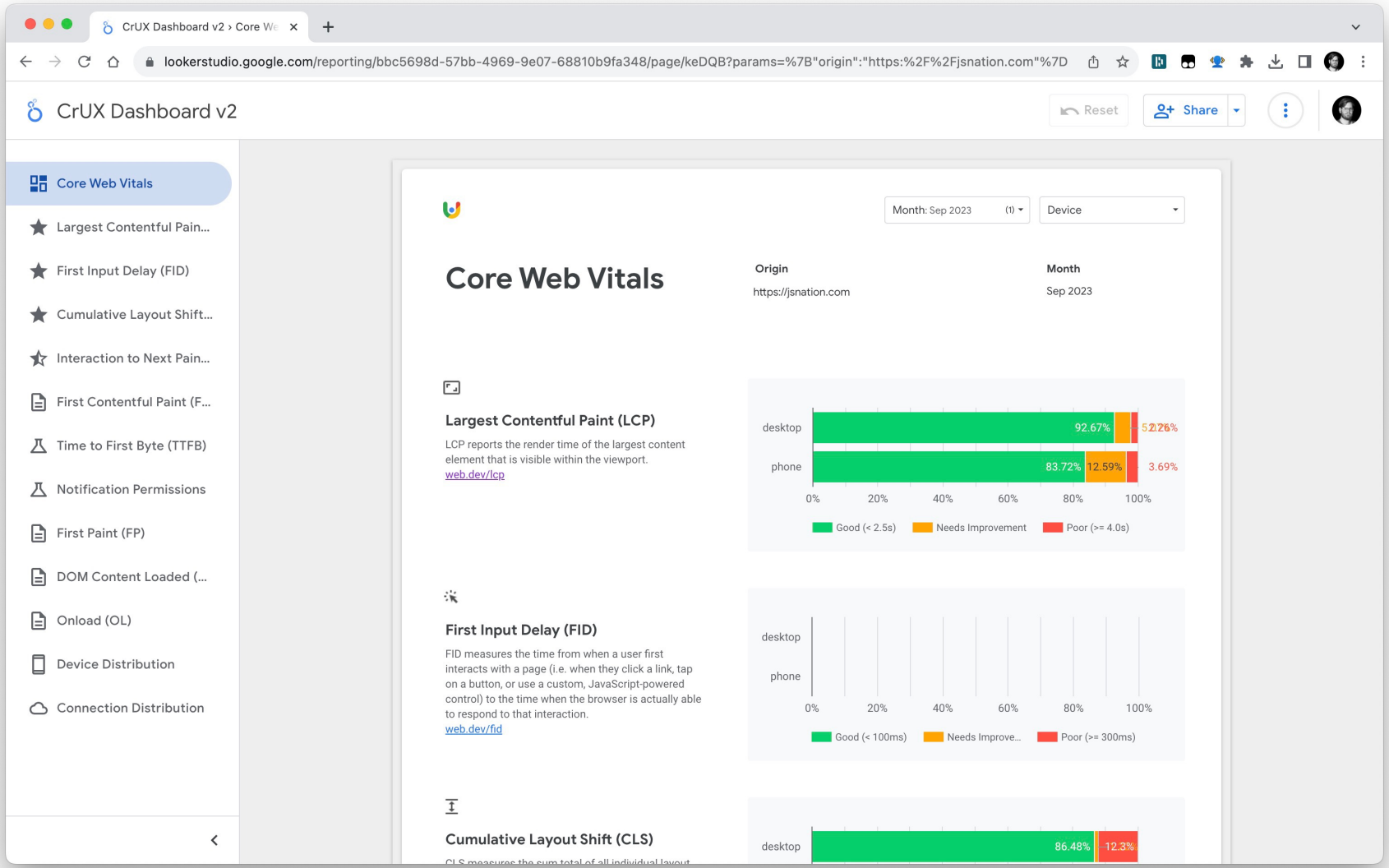
Most Related Issues
Suggested transactions



/extensions/gitlab/webhook/	SENTRY-W3F
sentry.tasks.store.process_event	SENTRY-SFG
sentry.tasks.post_process.post_proce ...	SENTRY-SVA

TRANSACTION	PROJECT	TPM ↓	P50	P95	FAILURE RATE	APDEX	USERS	USER MISERY
sentry.tasks.store.save_event_transaction	sentry	661.8326	34.77ms	194.12ms	0%	0.9968	0	(no value)
sentry.tasks.store.save_event	sentry	660.9604	56.52ms	228.84ms	0%	0.9887	0	(no value)
sentry.tasks.process_buffer.buffer_incr_task	sentry	638.7159	1.29ms	1.82ms	0%	0.9999	0	(no value)

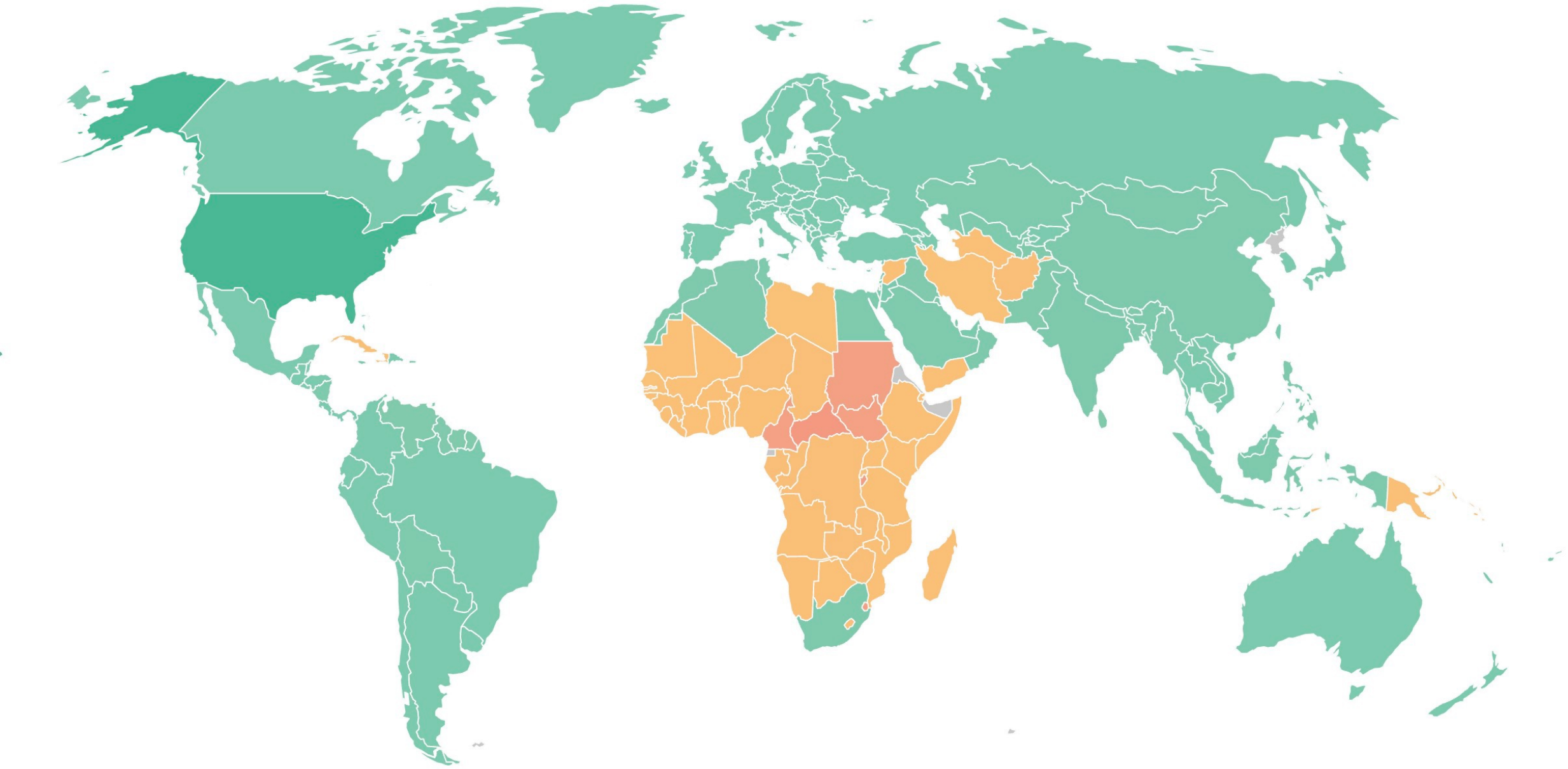

USERS: LAST 7 DAYS USING MEDIAN
Home
Budgets
Web Vitals
Improve
Dashboards
RUM
Synthetic
Settings
Support
Andy
START RENDER VS CONVERSION RATE
40k Sessions
30k Sessions
20k Sessions
10k Sessions
0 Sessions
Median Start Render: 2.13s
4%
3%
2%
1%
0%
0s
0.5s
1s
1.5s
2s
2.5s
3s
3.5s
4s
Start Render
Conversion Rate
USER HAPPINESS
Happy Page Views
43.7% ↑2.1%
Okay Page Views
34.9% ↓0.6%
Unhappy Page Views
21.6% ↓1.5%
100%
75%
50%


CrUX Dashboard v2 › Core We
lookerstudio.google.com/reporting/bbc5698d-57bb-4969-9e07-68810b9fa348/page/keDQB?params=%7B"origin":"https:%2F%2Fjsnation.com"%7D
CrUX Dashboard v2
Reset
Share
Core Web Vitals
Largest Contentful Pain...
First Input Delay (FID)
Cumulative Layout Shift...
Interaction to Next Pain...
First Contentful Paint (F...
Time to First Byte (TTFB)
Notification Permissions
First Paint (FP)
DOM Content Loaded (...
Onload (OL)
Device Distribution
Connection Distribution
Month: Sep 2023
Device
Core Web Vitals
Origin
https://jsnation.com
Month
Sep 2023
Largest Contentful Paint (LCP)
LCP reports the render time of the largest content element that is visible within the viewport.
web.dev/lcp
desktop
phone
92.67%
5.74%
2.26%
83.72%
12.59%
3.69%
0%
20%
40%
60%
80%
100%
Good (< 2.5s)
Needs Improvement
Poor (>= 4.0s)
First Input Delay (FID)
FID measures the time from when a user first interacts with a page (i.e. when they click a link, tap on a button, or use a custom, JavaScript-powered control) to the time when the browser is actually able to respond to that interaction.
web.dev/fid
Good (< 100ms)
Needs Improve...
Poor (>= 300ms)
Cumulative Layout Shift (CLS)
86.48%
12.3%

GEOGRAPHY

September 23

Largest Contentful Paint



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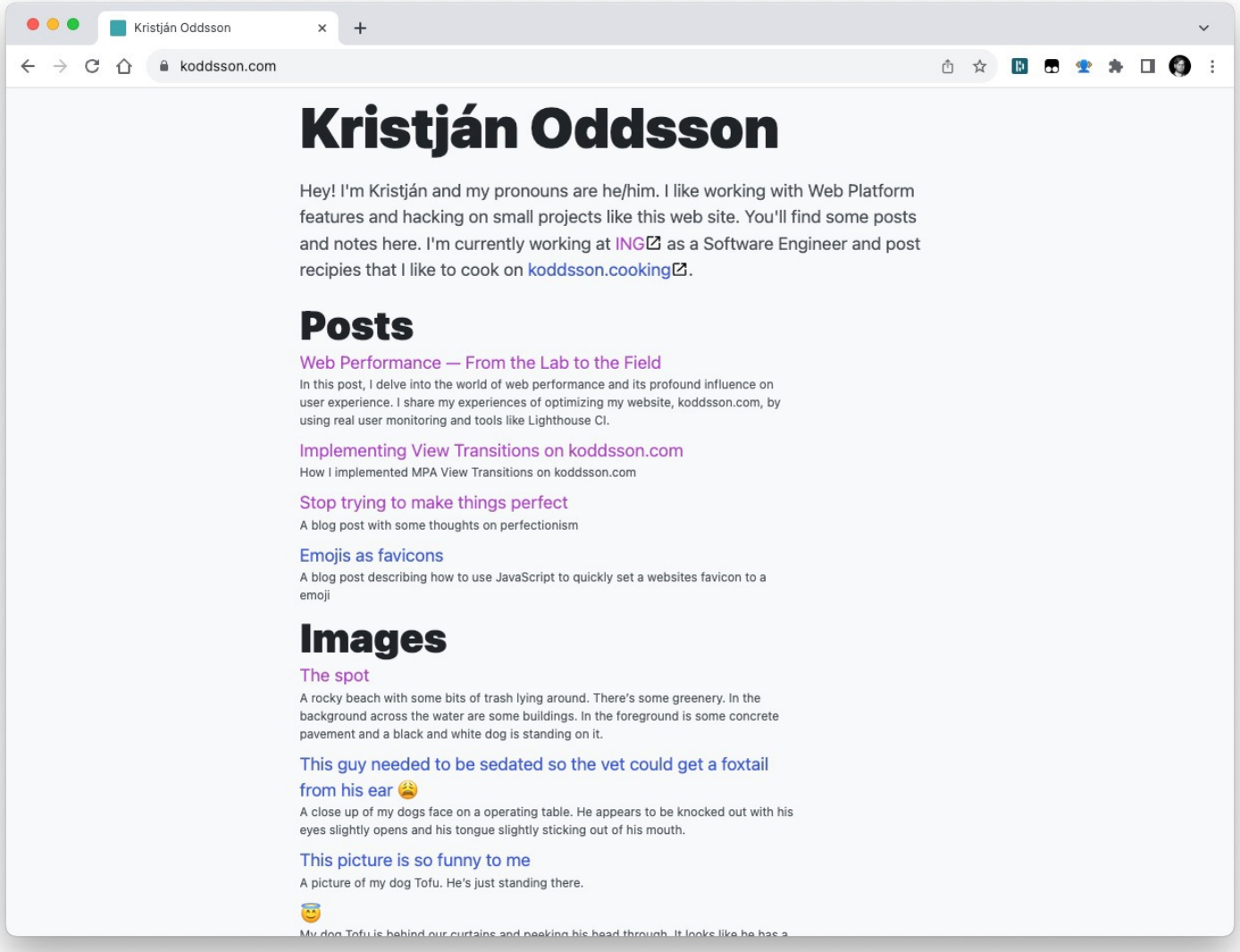
Kristján Oddsson
koddsson.com
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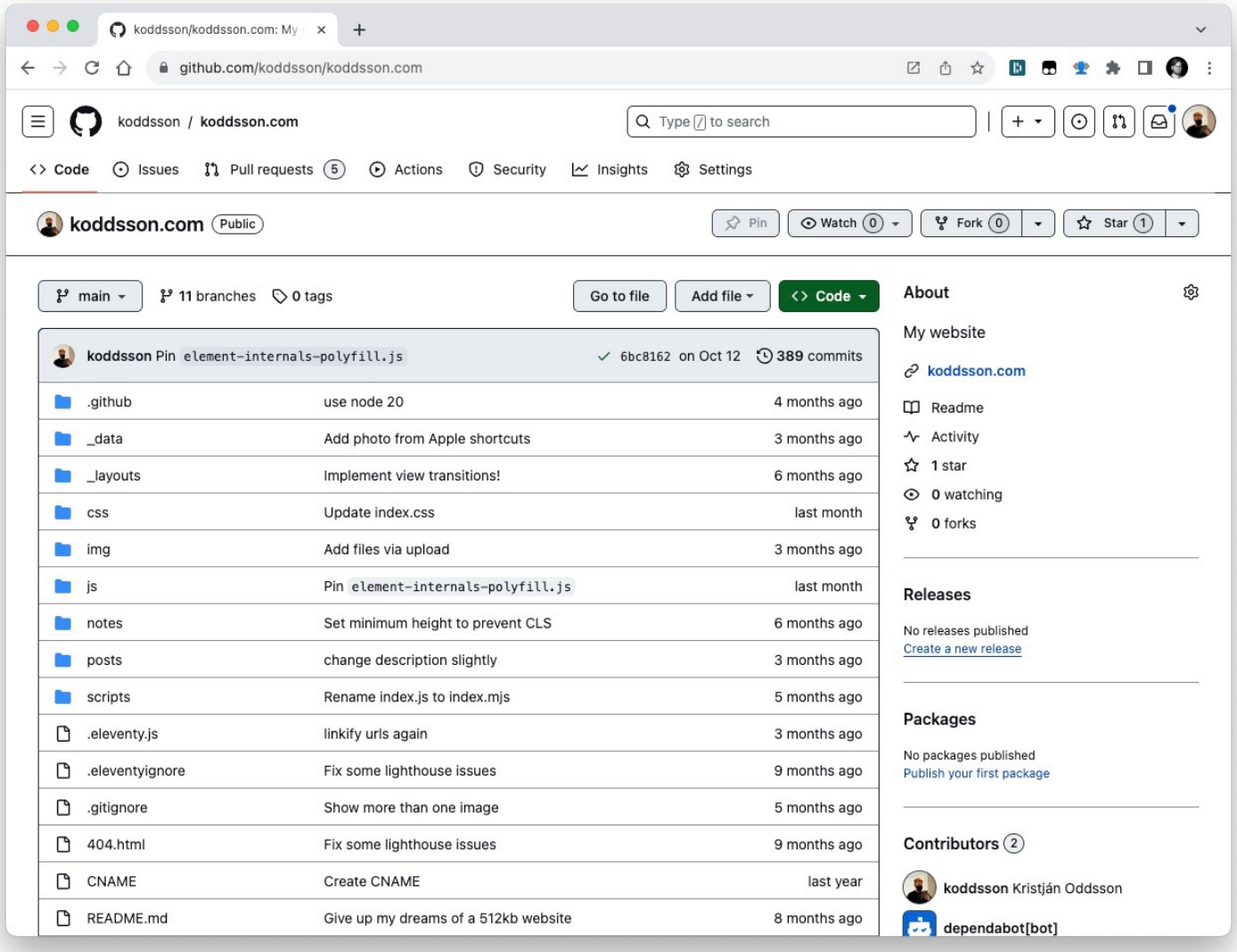
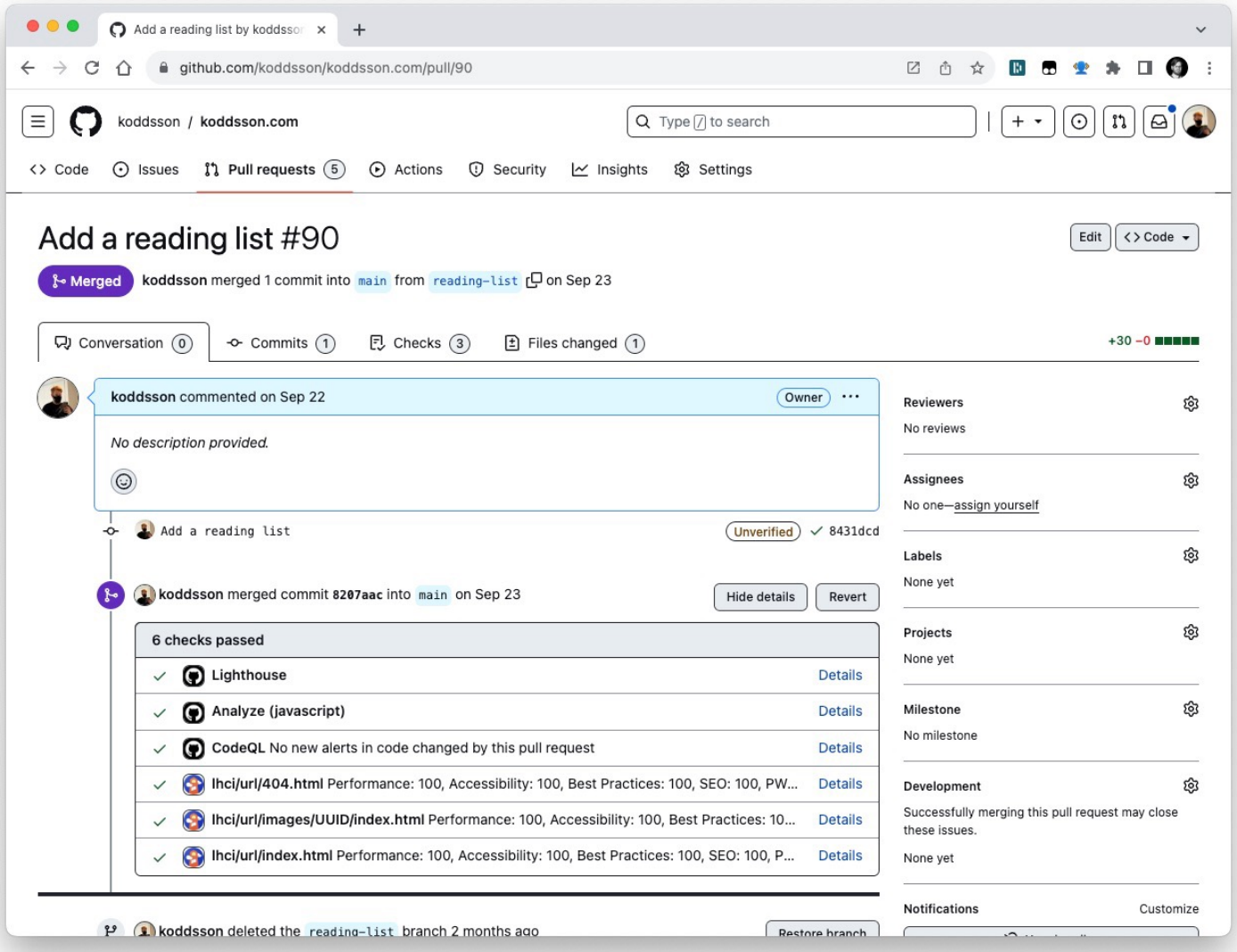
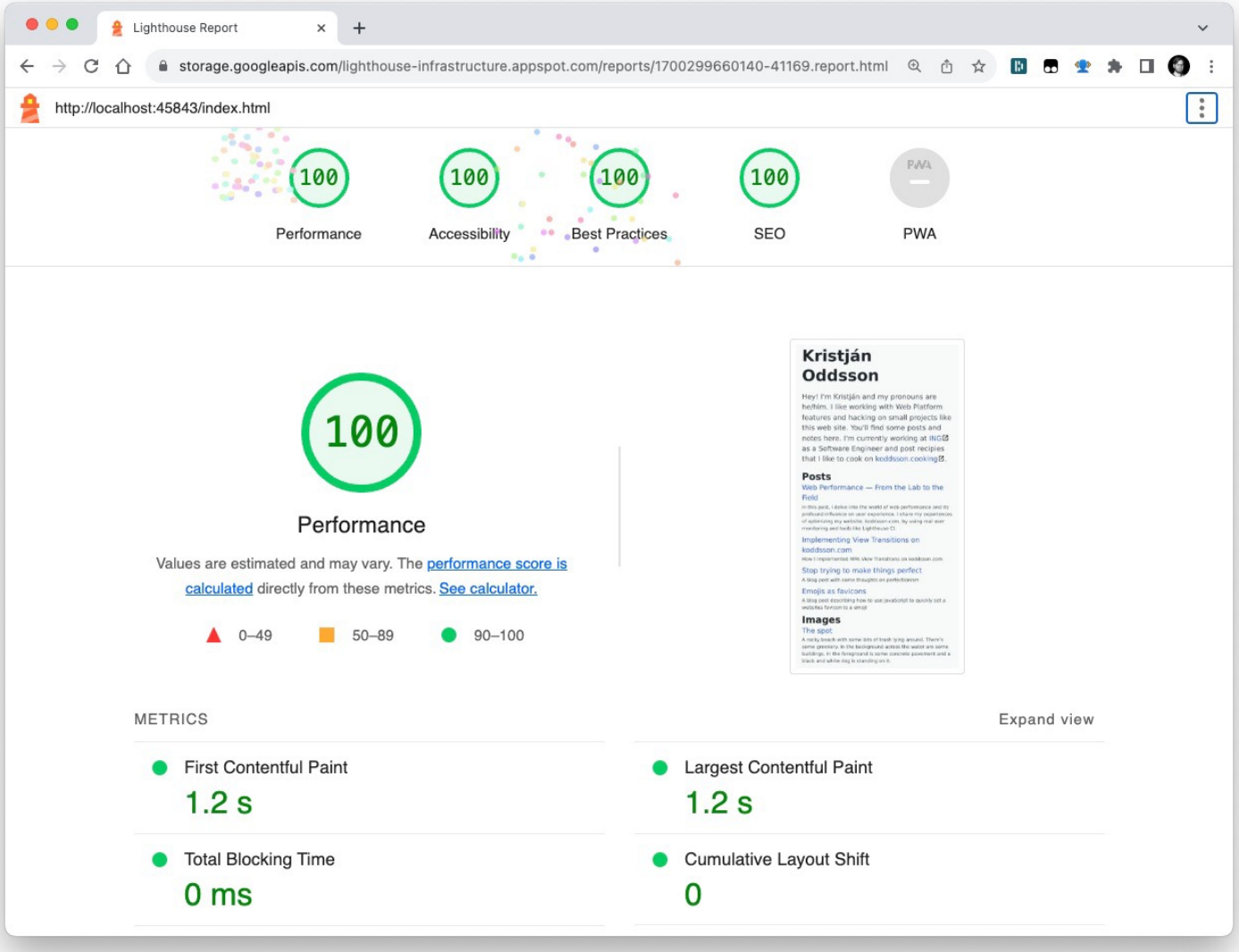
Hey! I'm Kristján and my pronouns are he/him. I like working with Web Platform features and hacking on small projects like this web site. You'll find some posts and notes here. I'm currently working at ING as a Software Engineer and post recipies that I like to cook on koddsson.cooking.
Posts
Web Performance — From the Lab to the Field
In this post, I delve into the world of web performance and its profound influence on user experience. I share my experiences of optimizing my website, koddsson.com, by using real user monitoring and tools like Lighthouse CI.
Implementing View Transitions on koddsson.com
How I implemented MPA View Transitions on koddsson.com
Stop trying to make things perfect
A blog post with some thoughts on perfectionism
Emojis as favicons
A blog post describing how to use JavaScript to quickly set a websites favicon to a emoji
Images
The spot
A rocky beach with some bits of trash lying around. There's some greenery. In the background across the water are some buildings. In the foreground is some concrete pavement and a black and white dog is standing on it.
This guy needed to be sedated so the vet could get a foxtail from his ear 😩
A close up of my dogs face on a operating table. He appears to be knocked out with his eyes slightly opens and his tongue slightly sticking out of his mouth.
This picture is so funny to me
A picture of my dog Tofu. He's just standing there.
😇


koddsson/koddsson.com: My
github.com/koddsson/koddsson.com
koddsson / koddsson.com
Type / to search
Code
Issues
Pull requests 5
Actions
Security
Insights
Settings
koddsson.com Public
Pin
Watch 0
Fork 0
Star 1
main
11 branches
0 tags
Go to file
Add file
Code
koddsson Pin element-internals-polyfill.js
6bc8162 on Oct 12
389 commits
.github use node 20 4 months ago
_data Add photo from Apple shortcuts 3 months ago
_layouts Implement view transitions! 6 months ago
css Update index.css last month
img Add files via upload 3 months ago
js Pin element-internals-polyfill.js last month
notes Set minimum height to prevent CLS 6 months ago
posts change description slightly 3 months ago
scripts Rename index.js to index.mjs 5 months ago
.eleventy.js linkify urls again 3 months ago
.eleventyignore Fix some lighthouse issues 9 months ago
.gitignore Show more than one image 5 months ago
404.html Fix some lighthouse issues 9 months ago
CNAME Create CNAME last year
README.md Give up my dreams of a 512kb website 8 months ago
About
My website
koddsson.com
Readme
Activity
1 star
0 watching
0 forks
Releases
No releases published
Create a new release
Packages
No packages published
Publish your first package
Contributors 2
koddsson Kristján Oddsson
dependabot[bot]


Add a reading list by koddsso
github.com/koddsson/koddsson.com/pull/90
koddsson / koddsson.com
Type / to search
Code
Issues
Pull requests 5
Actions
Security
Insights
Settings
Add a reading list #90
Edit
Code
Merged
koddsson merged 1 commit into main from reading-list on Sep 23
Conversation 0
Commits 1
Checks 3
Files changed 1
+30 −0
koddsson commented on Sep 22
Owner
No description provided.
Add a reading list
Unverified
8431dcd
koddsson merged commit 8207aac into main on Sep 23
Hide details
Revert
6 checks passed
Lighthouse
Details
Analyze (javascript)
Details
CodeQL No new alerts in code changed by this pull request
Details
lhci/url/404.html Performance: 100, Accessibility: 100, Best Practices: 100, SEO: 100, PW...
Details
lhci/url/images/UUID/index.html Performance: 100, Accessibility: 100, Best Practices: 10...
Details
lhci/url/index.html Performance: 100, Accessibility: 100, Best Practices: 100, SEO: 100, P...
Details
koddsson deleted the reading-list branch 2 months ago
Restore branch
Reviewers
No reviews
Assignees
No one—assign yourself
Labels
None yet
Projects
None yet
Milestone
No milestone
Development
Successfully merging this pull request may close these issues.
None yet
Notifications
Customize


Lighthouse Report
storage.googleapis.com/lighthouse-infrastructure.appspot.com/reports/1700299660140-41169.report.html
http://localhost:45843/index.html
100
Performance
100
Accessibility
100
Best Practices
100
SEO
PWA
PWA
100
Performance
Values are estimated and may vary. The performance score is calculated directly from these metrics. See calculator.
0–49
50–89
90–100
Kristján Oddsson
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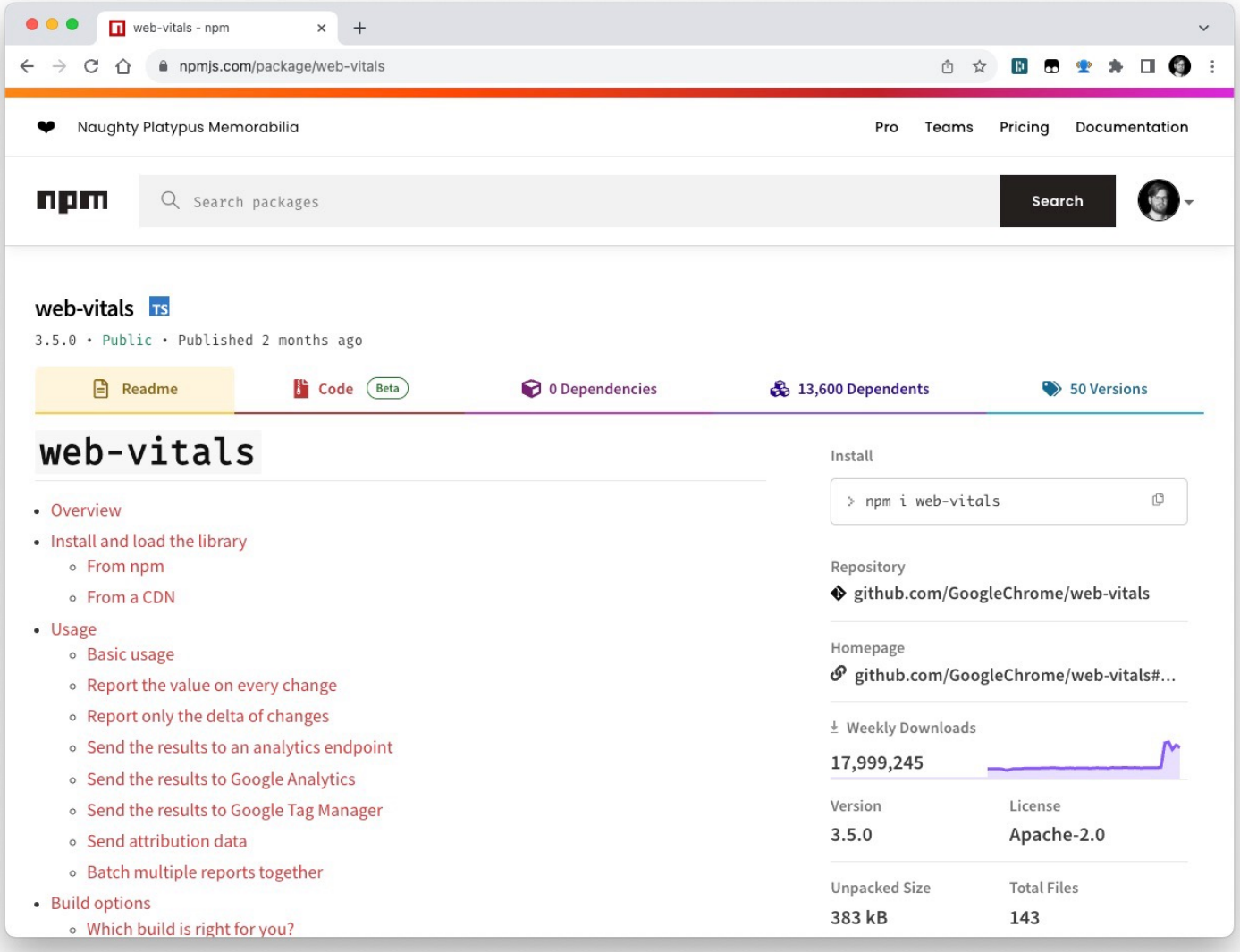
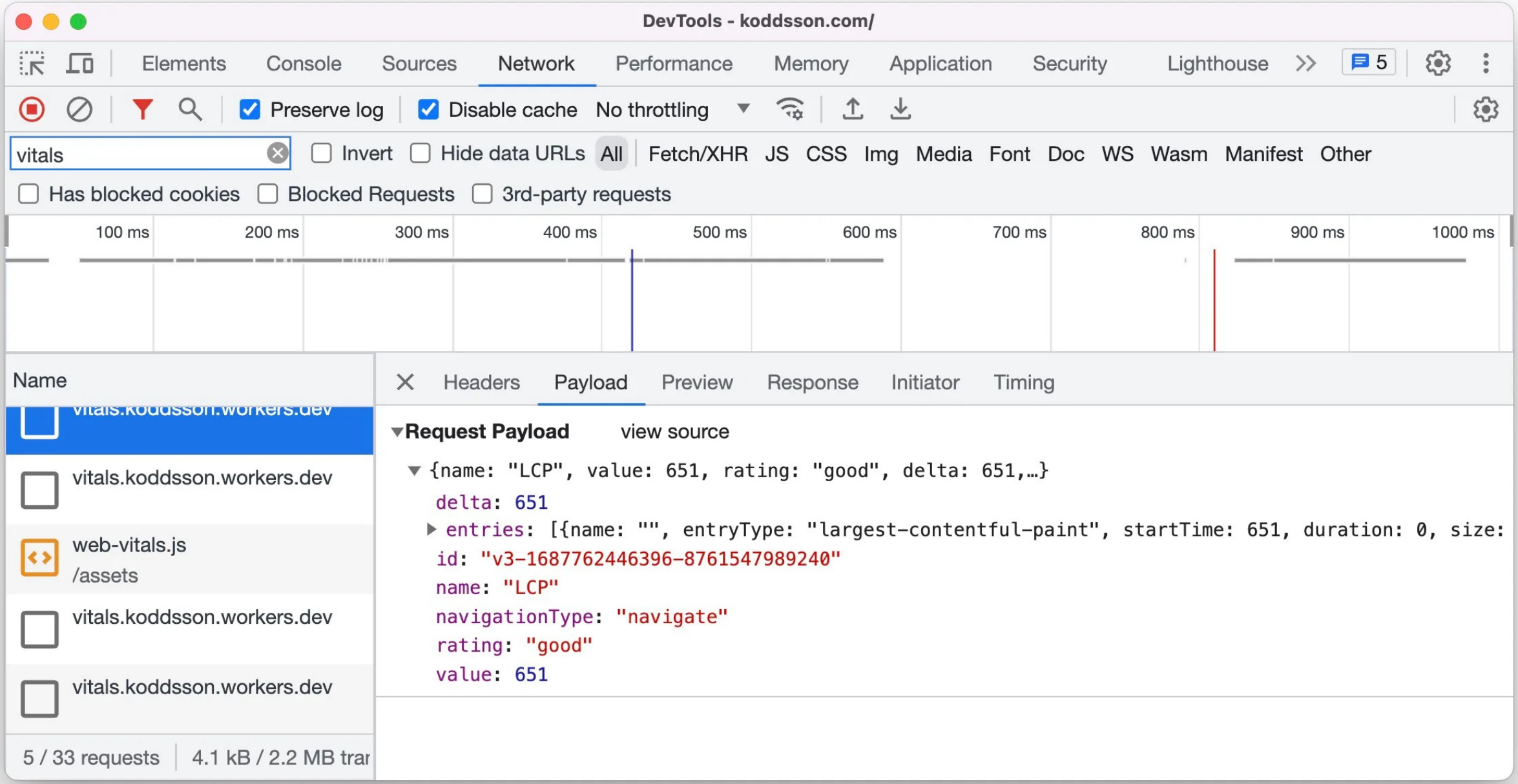
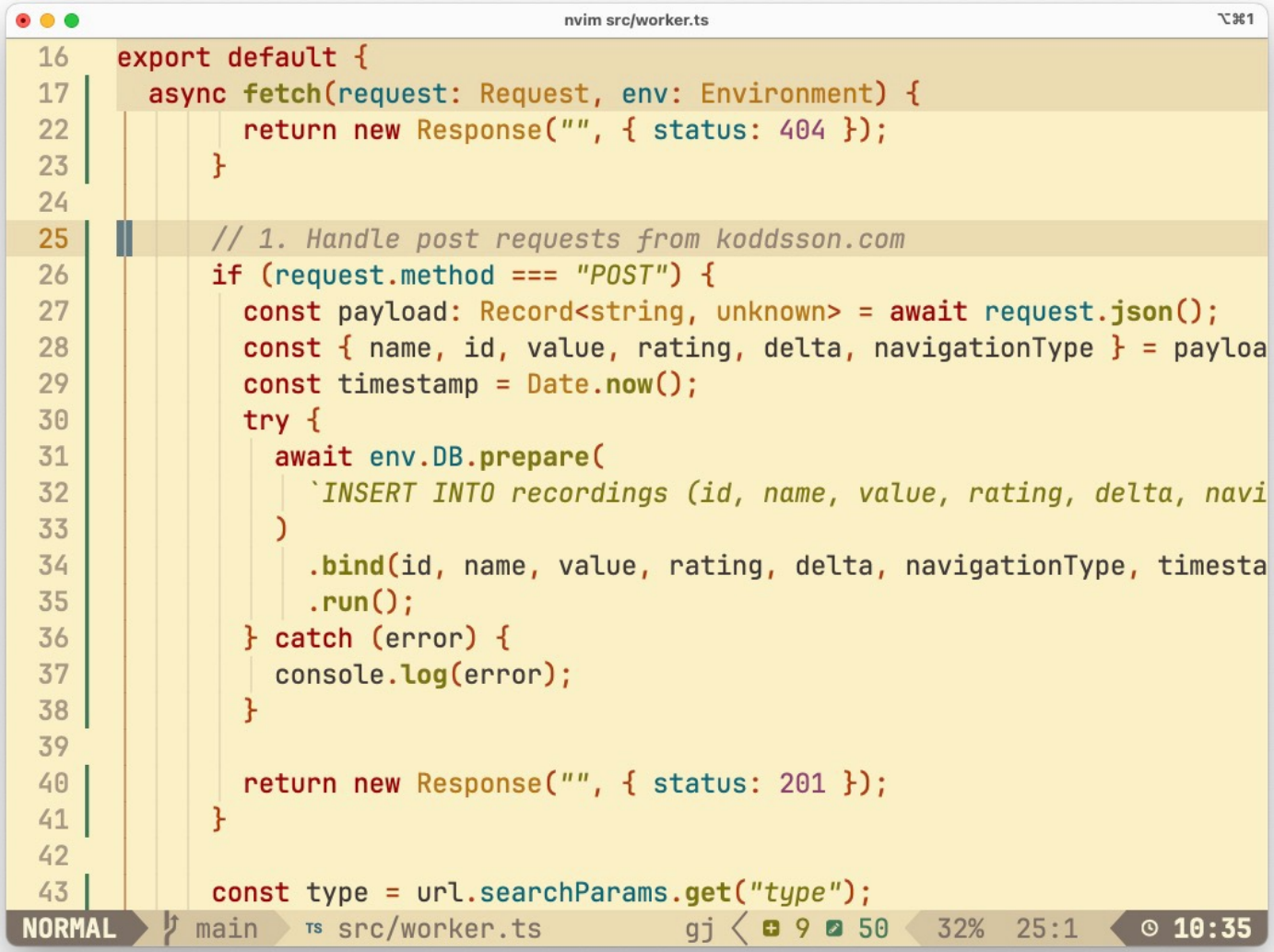
METRICS
Expand view
First Contentful Paint
1.2 s
Largest Contentful Paint
1.2 s
Total Blocking Time
0 ms
Cumulative Layout Shift
0

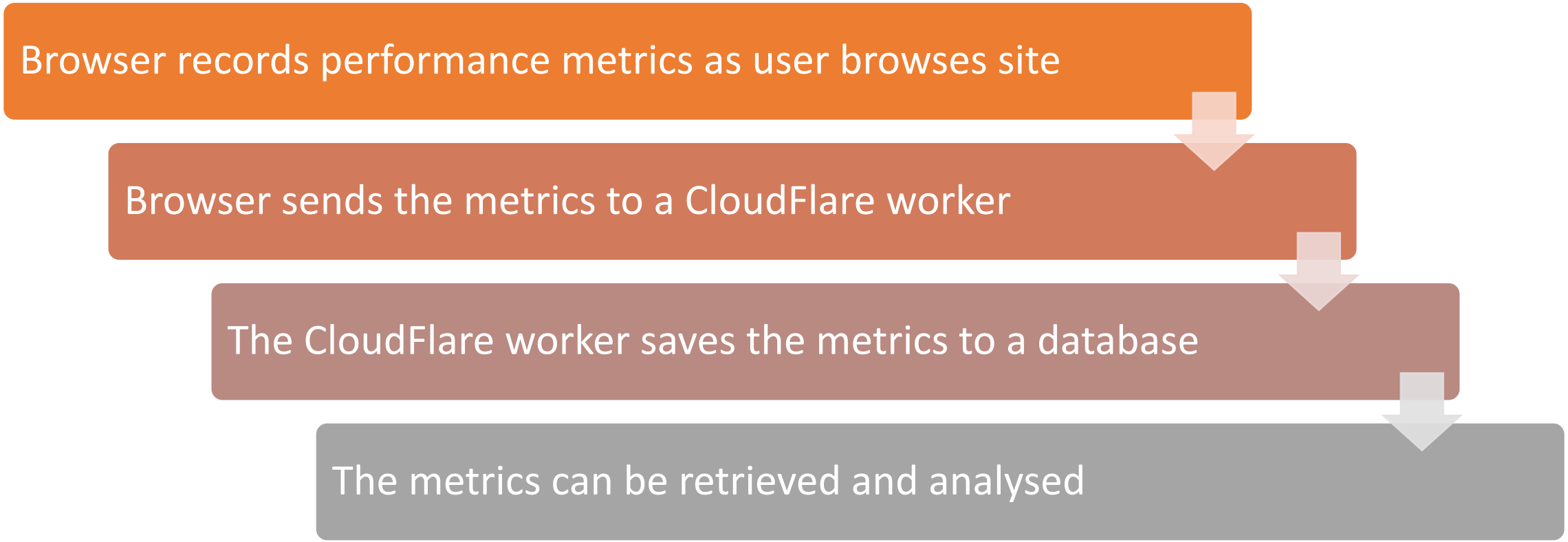

web-vitals - npm
npmjs.com/package/web-vitals
Naughty Platypus Memorabilia
Pro
Teams
Pricing
Documentation
npm
Search packages
Search
web-vitals
TS
3.5.0 • Public • Published 2 months ago
Readme
Code
Beta
0 Dependencies
13,600 Dependents
50 Versions
web-vitals
Overview
Install and load the library
From npm
From a CDN
Usage
Basic usage
Report the value on every change
Report only the delta of changes
Send the results to an analytics endpoint
Send the results to Google Analytics
Send the results to Google Tag Manager
Send attribution data
Batch multiple reports together
Build options
Which build is right for you?
Install
npm i web-vitals
Repository
github.com/GoogleChrome/web-vitals
Homepage
github.com/GoogleChrome/web-vitals#...
Weekly Downloads
17,999,245
Version
3.5.0
License
Apache-2.0
Unpacked Size
383 kB
Total Files
143

```
import {onLCP, onFID, onCLS, onINP, onFCP, onTTFB} from 'web-vitals';

const endpoint = 'https://vitals.koddsson.workers.dev/';

function sendToAnalytics(metric) {
    const body = JSON.stringify(metric);

    // Use `navigator.sendBeacon()` if available, falling back to `fetch()`.
    (navigator.sendBeacon && navigator.sendBeacon(endpoint, body)) ||
        fetch(endpoint, {body, method: 'POST', keepalive: true});
}

onCLS(sendToAnalytics);
onFID(sendToAnalytics);
onLCP(sendToAnalytics);
onINP(sendToAnalytics);
onFCP(sendToAnalytics);
onTTFB(sendToAnalytics);
```


DevTools - koddsson.com/
Elements
Console
Sources
Network
Performance
Memory
Application
Security
Lighthouse
5
Preserve log
Disable cache
No throttling
vitals
Invert
Hide data URLs
All
Fetch/XHR
JS
CSS
Img
Media
Font
Doc
WS
Wasm
Manifest
Other
Has blocked cookies
Blocked Requests
3rd-party requests
100 ms
200 ms
300 ms
400 ms
500 ms
600 ms
700 ms
800 ms
900 ms
1000 ms
Name
vitals.koddsson.workers.dev
vitals.koddsson.workers.dev
web-vitals.js
/assets
vitals.koddsson.workers.dev
vitals.koddsson.workers.dev
5 / 33 requests
4.1 kB / 2.2 MB trar
Headers
Payload
Preview
Response
Initiator
Timing
Request Payload
view source
{name: "LCP", value: 651, rating: "good", delta: 651,…}
delta: 651
entries: [{name: "", entryType: "largest-contentful-paint", startTime: 651, duration: 0, size:
id: "v3-1687762446396-8761547989240"
name: "LCP"
navigationType: "navigate"
rating: "good"
value: 651


nvim src/worker.ts
⌥⌘1
export default {
async fetch(request: Request, env: Environment) {
return new Response("", { status: 404 });
}
// 1. Handle post requests from koddsson.com
if (request.method === "POST") {
const payload: Record<string, unknown> = await request.json();
const { name, id, value, rating, delta, navigationType } = payloa
const timestamp = Date.now();
try {
await env.DB.prepare(
`INSERT INTO recordings (id, name, value, rating, delta, navi
)
.bind(id, name, value, rating, delta, navigationType, timesta
.run();
} catch (error) {
console.log(error);
}
return new Response("", { status: 201 });
}
const type = url.searchParams.get("type");
NORMAL
main
src/worker.ts
gj
9
50
32%
25:1
10:35

The flow broken down by steps



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- Lab testing
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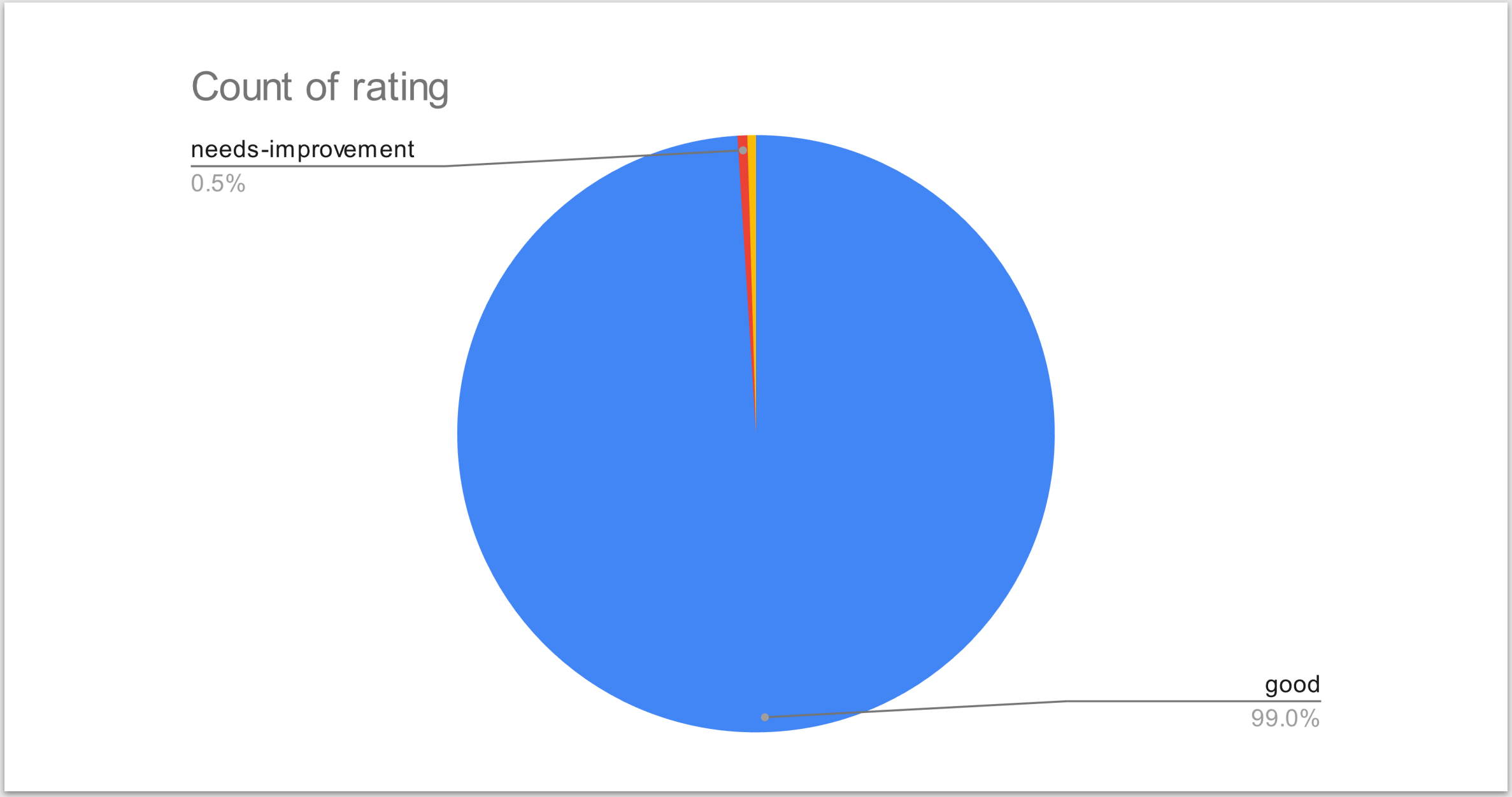
recordings

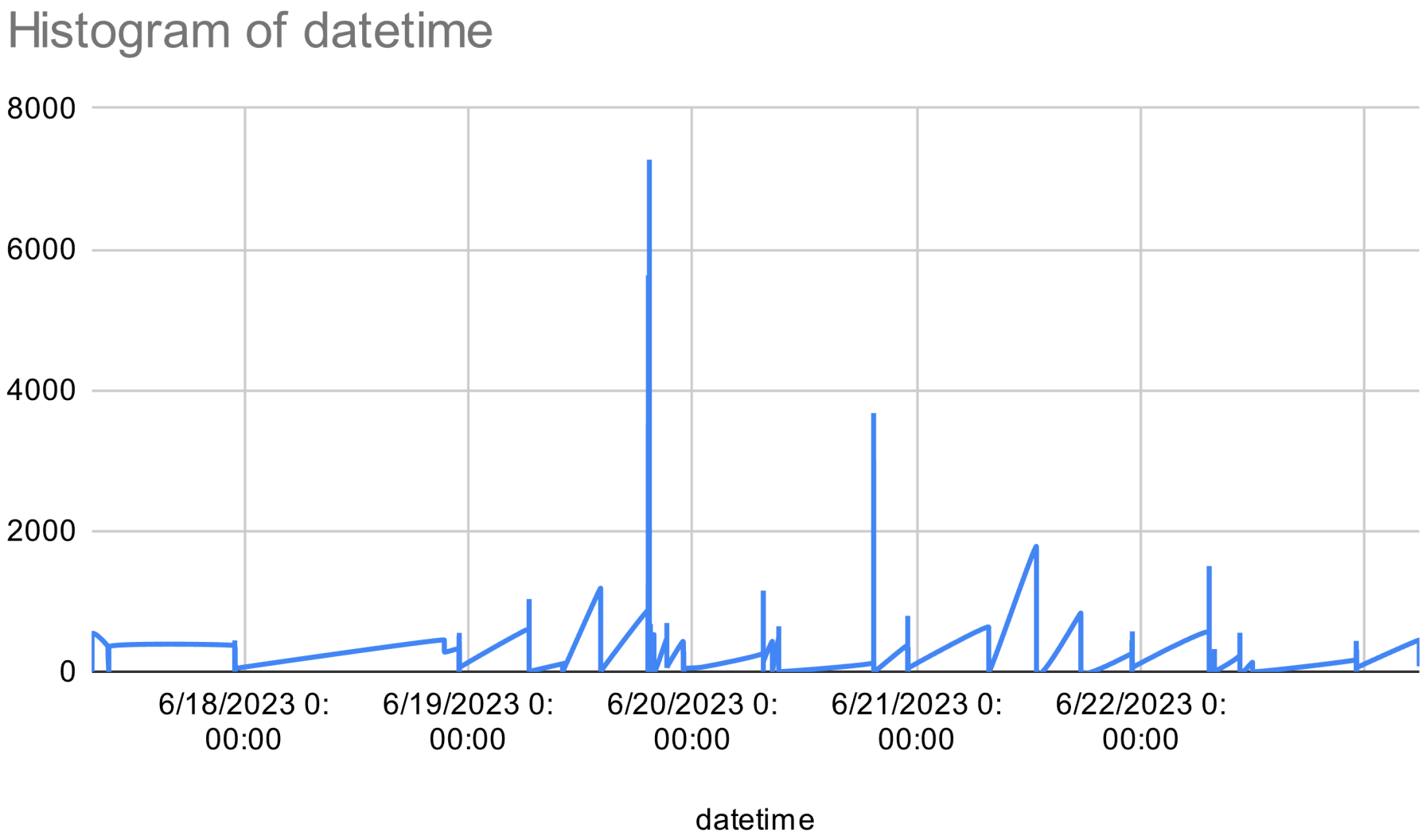
Add data | Manage table

Columns: 7

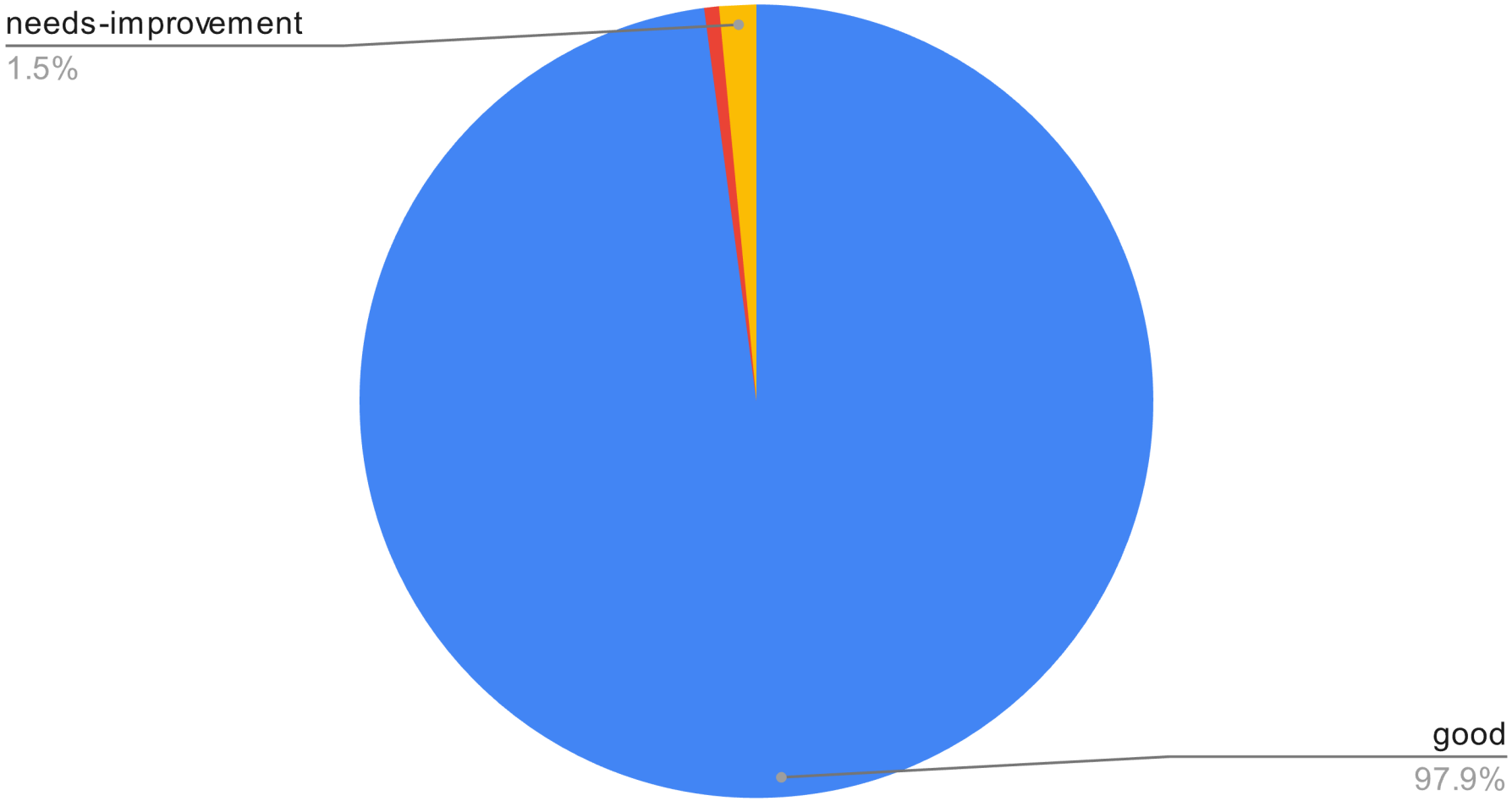
Rows: 2088

id	name	value	rating	delta	navitationType	timestamp	
v3-1686987969834-3880367476223	FCP	525.3000000119209	good	525.3000000119209	reload	1686987970176	•••
v3-1686987969834-9242177656309	TTFB	326.4000000357628	good	326.4000000357628	reload	1686987970177	•••
v3-1686987969837-8554504376567	CLS	0	good	0	reload	1686987974375	•••
v3-1686987969834-6397411957466	LCP	525.3000000119209	good	525.3000000119209	reload	1686987974376	•••
v3-1686994115191-2818542218624	FCP	352.19999998807907	good	352.19999998807907	reload	1686994115332	•••
v3-1686994115191-6209244450714	TTFB	234.5	good	234.5	reload	1686994115362	•••
v3-1686994115191-1938365114639	LCP	352.19999998807907	good	352.19999998807907	reload	1686994438083	•••
v3-1686994115194-1786606818468	CLS	0	good	0	reload	1686994438082	•••

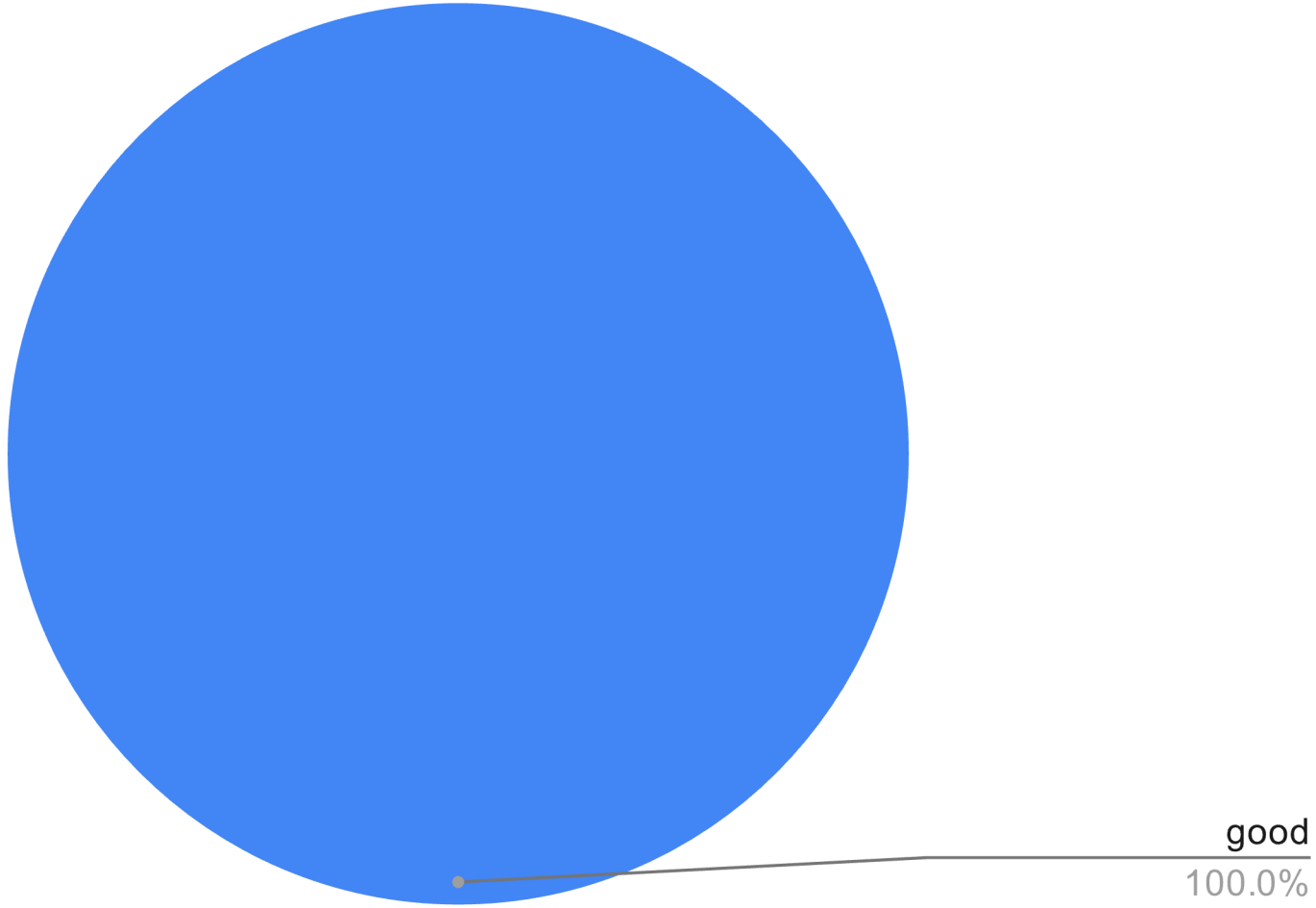

Count of rating
needs-improvement
0.5%
good
99.0%


Histogram of datetime
8000
6000
4000
2000
0
6/18/2023 0:00:00
6/19/2023 0:00:00
6/20/2023 0:00:00
6/21/2023 0:00:00
6/22/2023 0:00:00
datetime

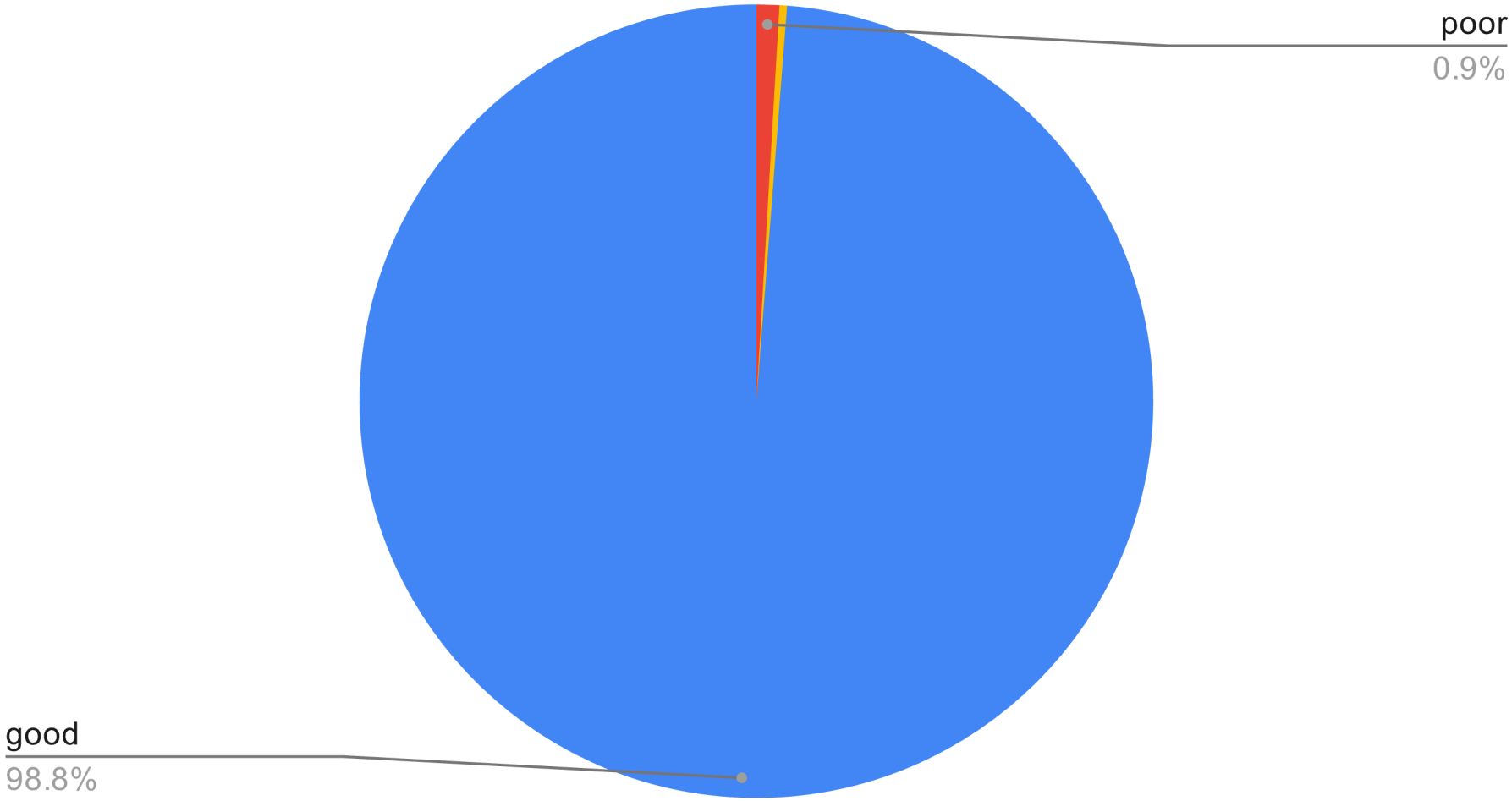
LCP ratings



INP ratings



CLS ratings



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From the lab to the field

A talk on Web Performance

by Kristján Oddsson

at Amsterdam JS

November 23rd 2023