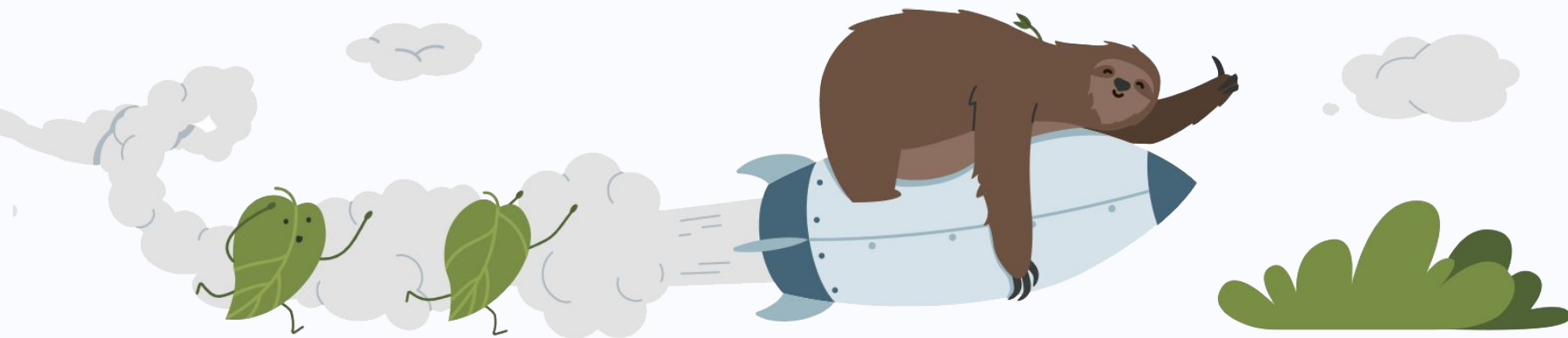


IMPROVING

Web Performance

with Todd Gardner



IMPROVING Web Performance

PART 1: UNDERSTANDING

PART 2: IMPROVING

PART 3: PLANNING





TODD GARDNER

@ToddHGardner

Software Developer and Entrepreneur
Stillwater, MN, USA



JavaScript Error Monitoring

☆ Network Error

Occurred: 15 days ago Application: y1ctuqbody User: Windows 10 Chrome User@0.0.0.0 Total Count: 49,510 Total Users Impacted: 40,735 Entry: Custom Error

Telemetry Timeline

Direct Error

Message: Network Error
Type: Custom error ⓘ
Google error ⓘ More errors with this message

+0.19 sec

Network XHR

Method: GET
Url: https://int-services.bonzai.com/menu-metadata/v1/menu-metadata?channel=web®ion=US
Parameters: channel=web
region=US
Response: Pending

-0.08 sec

Network XHR

Method: GET
Url: https://int-services.bonzai.com/onlineorderingstatus
Response: 0?? 74 milliseconds elapsed

-0.08 sec

Network XHR

Method: GET
Url: https://int-services.bonzai.com/menuinnovation/v1/universalmenus/online

-0.08 sec

Stack Trace

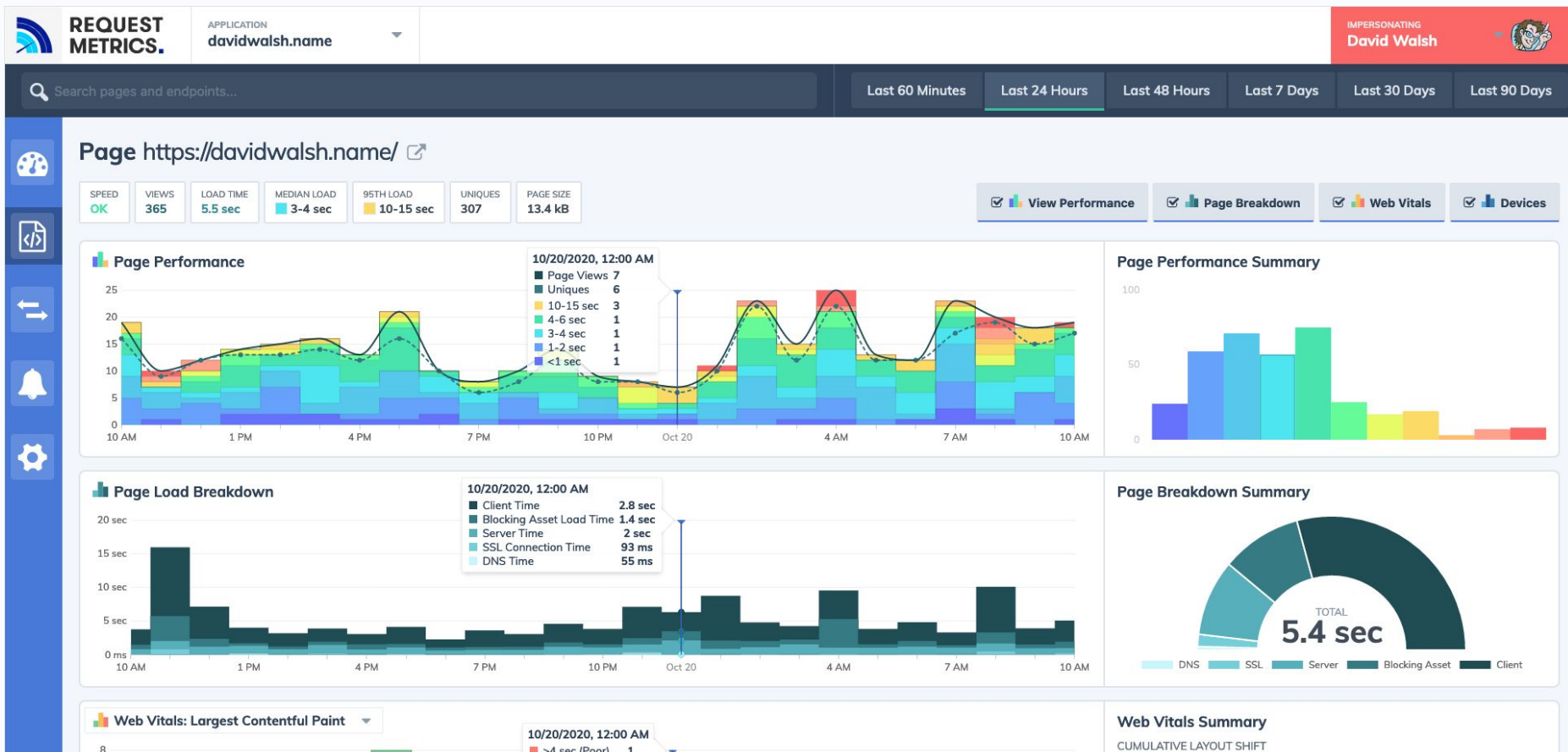
Sourcemap Support ON

t.exports webpack:///./node_modules/axios/lib/core/createError.js 16:0
Showing original source content from sourcemap
* @param {
 string
}
message The error message.*@param {
 Object
}
config The config.*@param {
 string
}
[code] The error code(
 for example, 'ECONNABORTED').*@param {
 Object
}
[request] The request.*@param {
 Object
}
[response] The response.*@returns {
 Error
}
The created error.*/
module.exports = function createError(message, config, code, request, response) {
 var error = new Error(message);
 return enhanceError(error, config, code, request, response);
};



REQUEST METRICS.

Real User Performance, Simplified






Debugging and Fixing Common JavaScript Errors



Todd Gardner
TrackJS

3 hours, 39 minutes 

Preview



Stomp out bugs and clean up JavaScript apps! In this course, Todd Gardner (Co-founder of TrackJS), walks through common JavaScript bugs and how to isolate and fix the source of the problems. By coding along, you'll learn the four stages of a debugging cycle needed to fix bugs. Use Chrome Dev Tools, debugger, network profile and more to fix memory leaks, performance problems, network failures and more! This course is for any JavaScript developer that builds, maintains, or tests an application that uses JavaScript. With the knowledge you gain, you'll be armed to find and squash those bugs faster and for good!

This course and others like it are available as part of our Frontend Masters video subscription.

Published: May 22, 2017

[Get Unlimited Access Now](#)

<https://frontendmasters.com/courses/chrome-dev-tools-v2/>

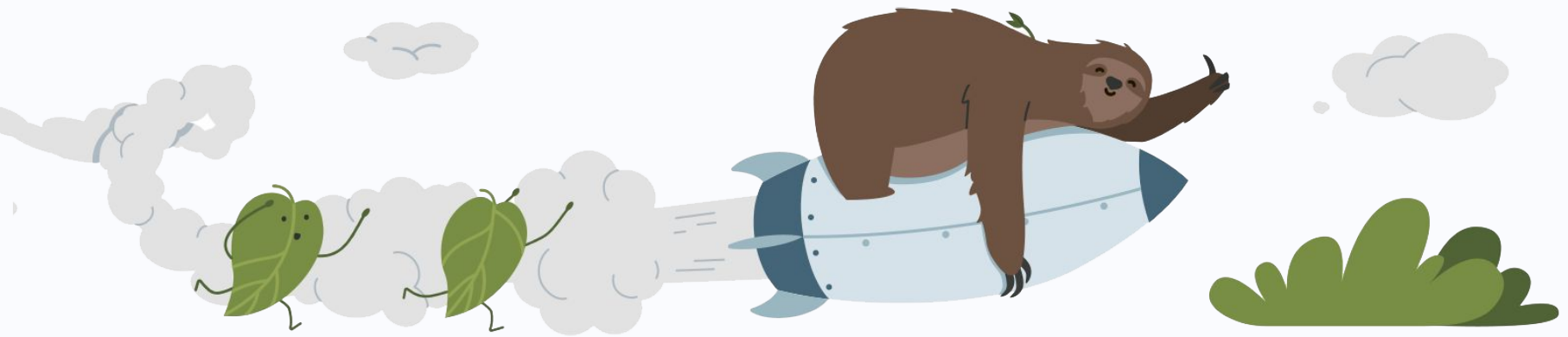
IMPROVING Web Performance

PART 1: UNDERSTANDING

- Psychology of performance
- Measuring performance
- Interpreting performance data



WHY IS PERFORMANCE IMPORTANT?



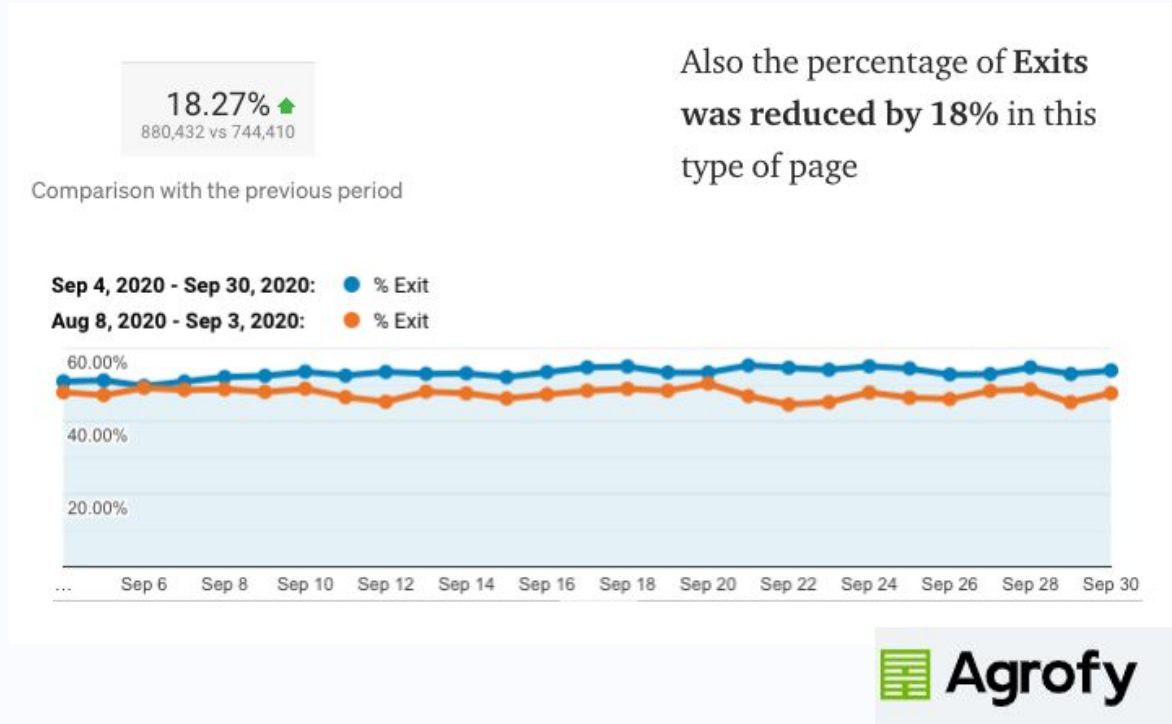
WHY IS THIS IMPORTANT?

Every 1s improvement = Up to 2% increase in CVR

100ms improvement = Up to 1% incremental revenue

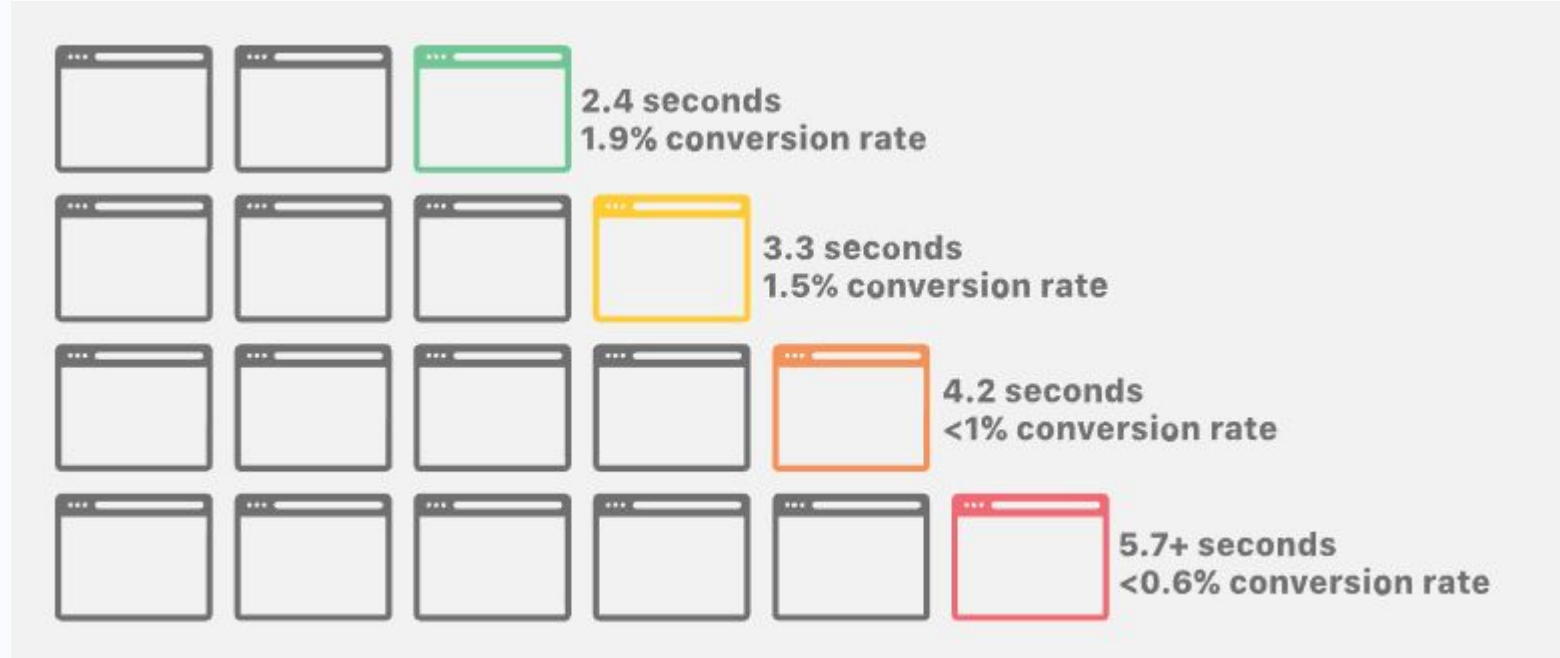


WHY IS THIS IMPORTANT?



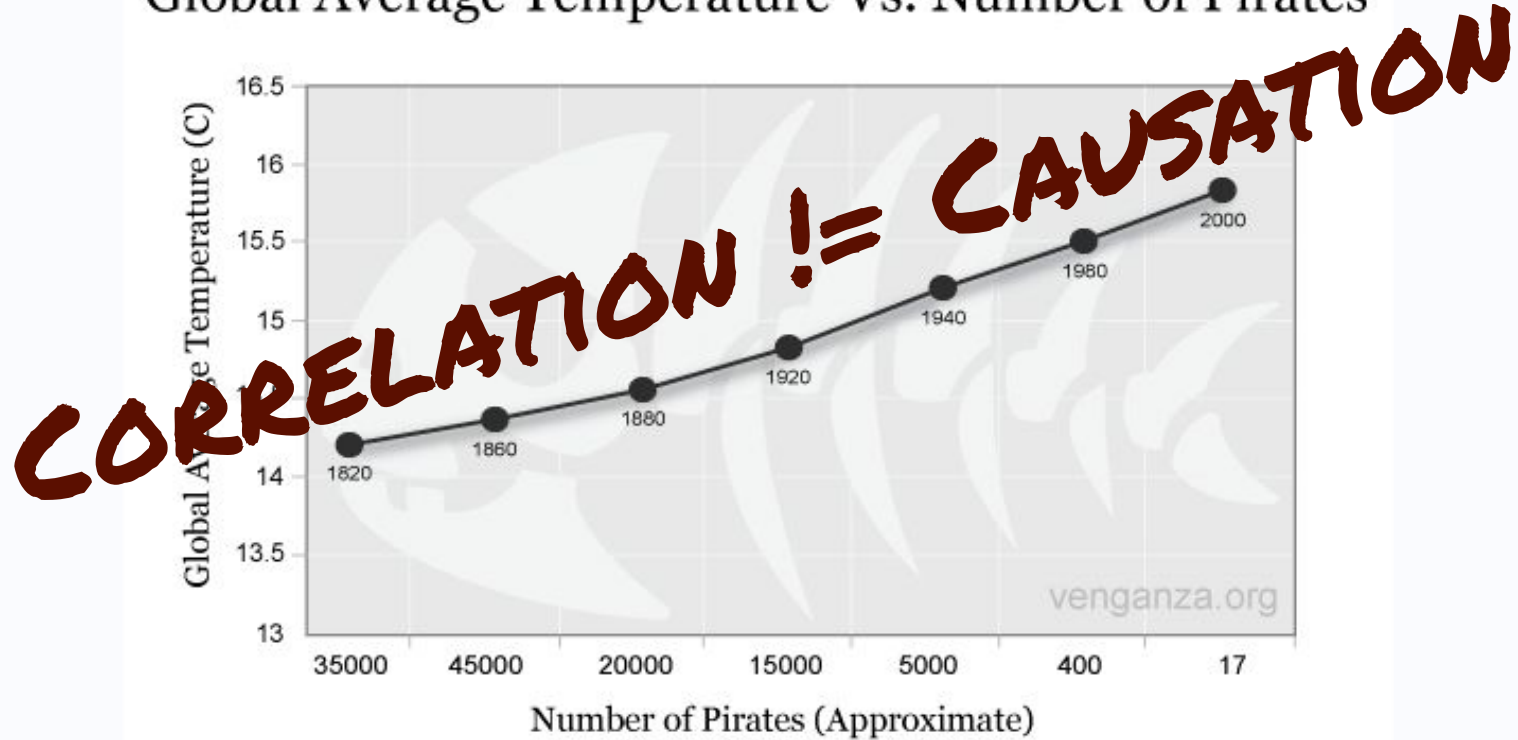
<https://mollar-luciano.medium.com/how-agrofy-optimised-core-web-vitals-and-improved-business-metrics-2f73311bca>

WHY IS THIS IMPORTANT?



WHY IS THIS IMPORTANT?

Global Average Temperature Vs. Number of Pirates



WHY IS PERFORMANCE IMPORTANT #1

Home > Google Search Central > What's new > Google Search Central Blog

Rate and review



Evaluating page experience for a better web

[Send feedback](#)

Thursday, May 14, 2020

**GOOGLE WILL RANK YOU
ON YOUR PERFORMANCE**

Through both [internal studies](#) and [industry research](#), users show they prefer sites with a great page experience. In recent years, Search has added a variety of user experience metrics, such as [how quick pages load](#) and [how easy it is to find things](#), as factors for ranking results. Earlier this month, the Chrome team announced [Core Web Vitals](#), a set of metrics related to speed, responsiveness and visual stability, to help site owners measure user experience on the web.

Today, we're building on this work and providing an early look at an upcoming Search ranking change that incorporates these page experience metrics. We will introduce a new signal that combines Core Web Vitals with our existing signals for page experience to provide a holistic picture of the quality of a user's experience on a web page.

As part of this update, we'll also incorporate the page experience metrics into our ranking criteria for the Top Stories feature in Search on mobile, and remove the AMP requirement from Top Stories eligibility. Google continues to support

WHY IS PERFORMANCE IMPORTANT #2



Angry and frustrated
users don't stick around
long

EXERCISE 1: WHAT FEELS FAST?

Copy the [Performance Comparison Worksheet](#) and use the “Exercise 1” sheet to rank your perceived site performance from fastest to slowest.



EXERCISE 1:

WHAT FEELS FAST?

Website	Performance Rank
https://www.npr.org/ <i>Publicly Funded</i>	1
https://www.cnn.com/ <i>Advertising Funded</i>	4
https://www.nytimes.com/ <i>Subscription Funded</i>	2
https://www.wsj.com/ <i>Subscription Funded</i>	3



PSYCHOLOGY OF WAITING

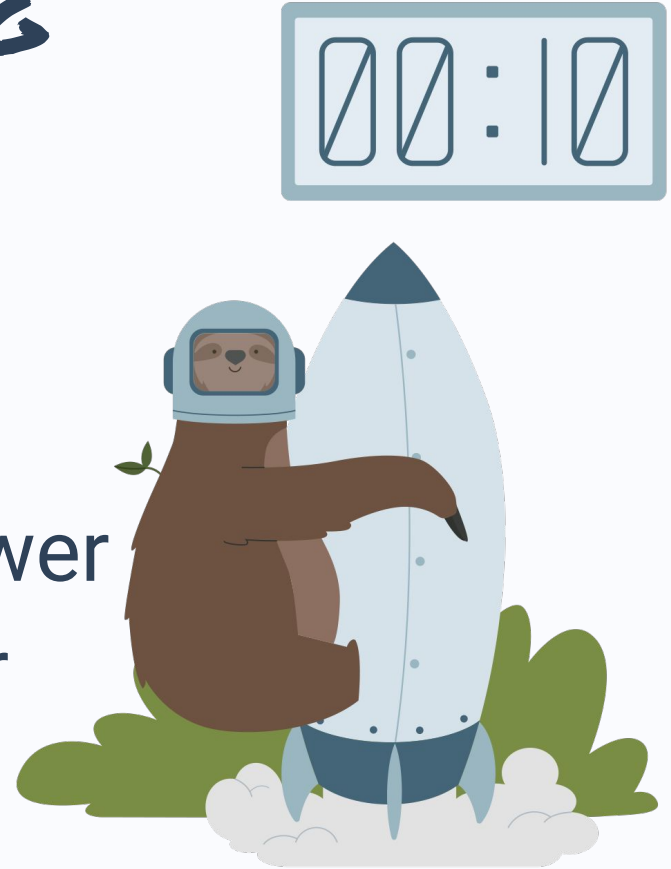
Wait time feels
subjective



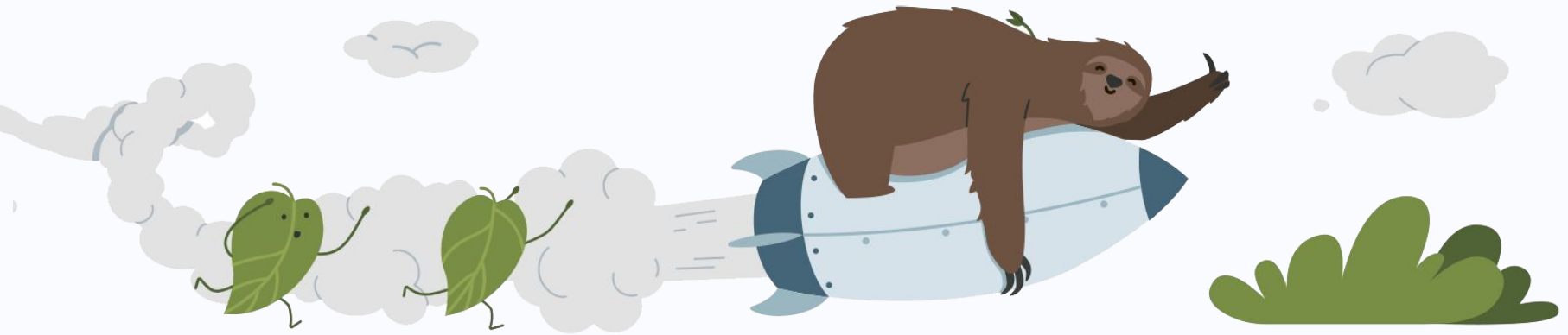
PERCEIVED PERFORMANCE

PSYCHOLOGY OF WAITING

1. People want to start
2. Bored waits feel slower
3. Anxious waits feel slower
4. Unexplained waits feel slower
5. Uncertain waits feel slower
6. People will wait for value



MEASURING WEB PERFORMANCE



THE OLD WAY: PAGE LOAD

Start

Load



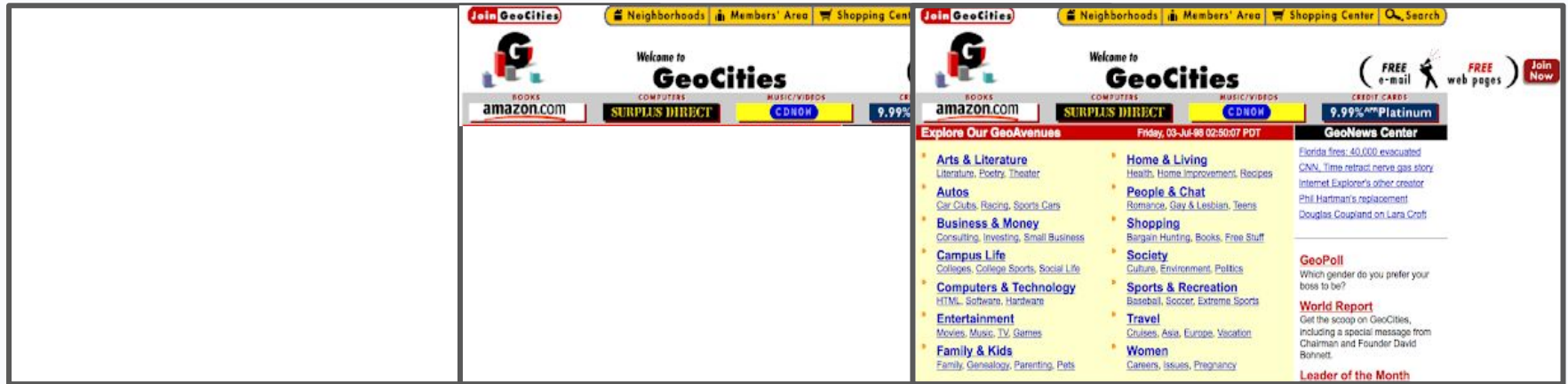
PAGE LOAD

GAMING THE METRICS

Start

Load

LAZY LOADING



PAGE LOAD

GAMING THE METRICS

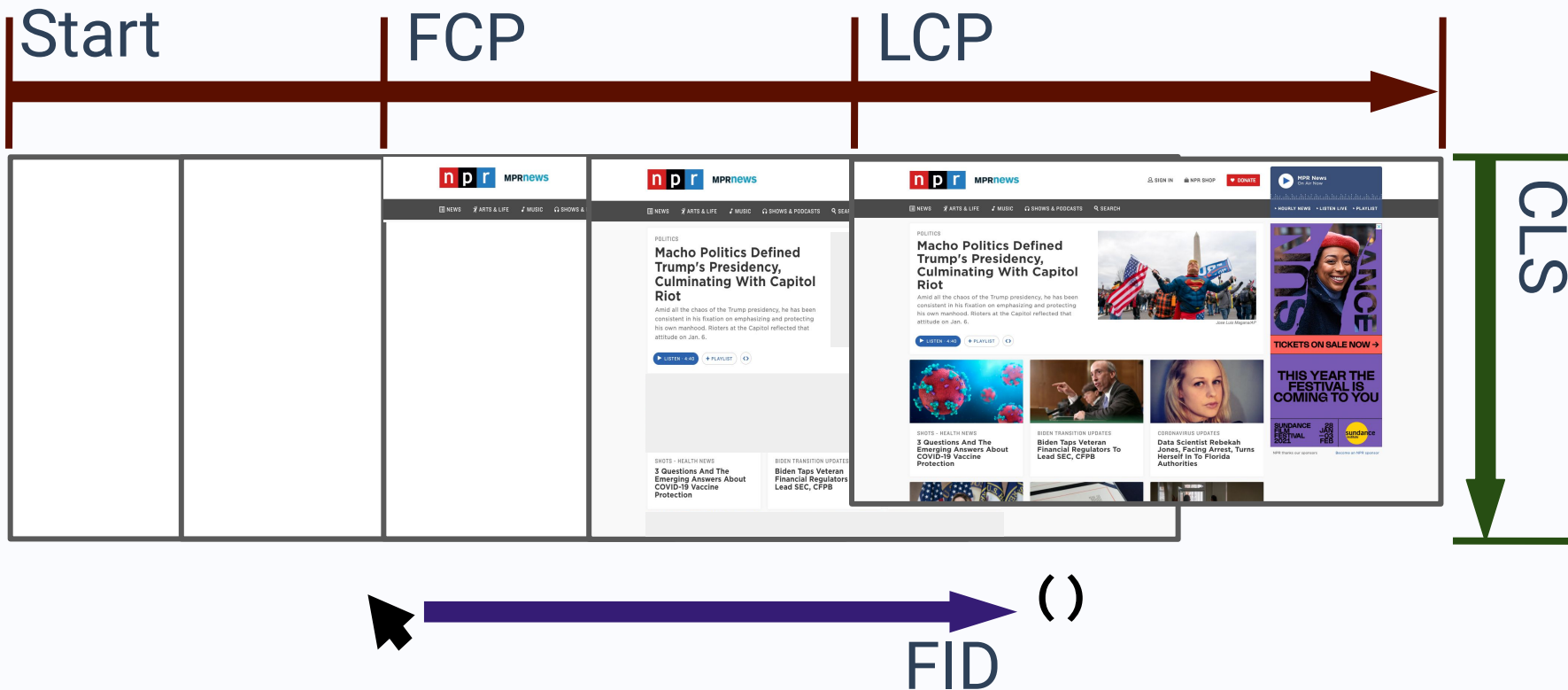
Start

Load

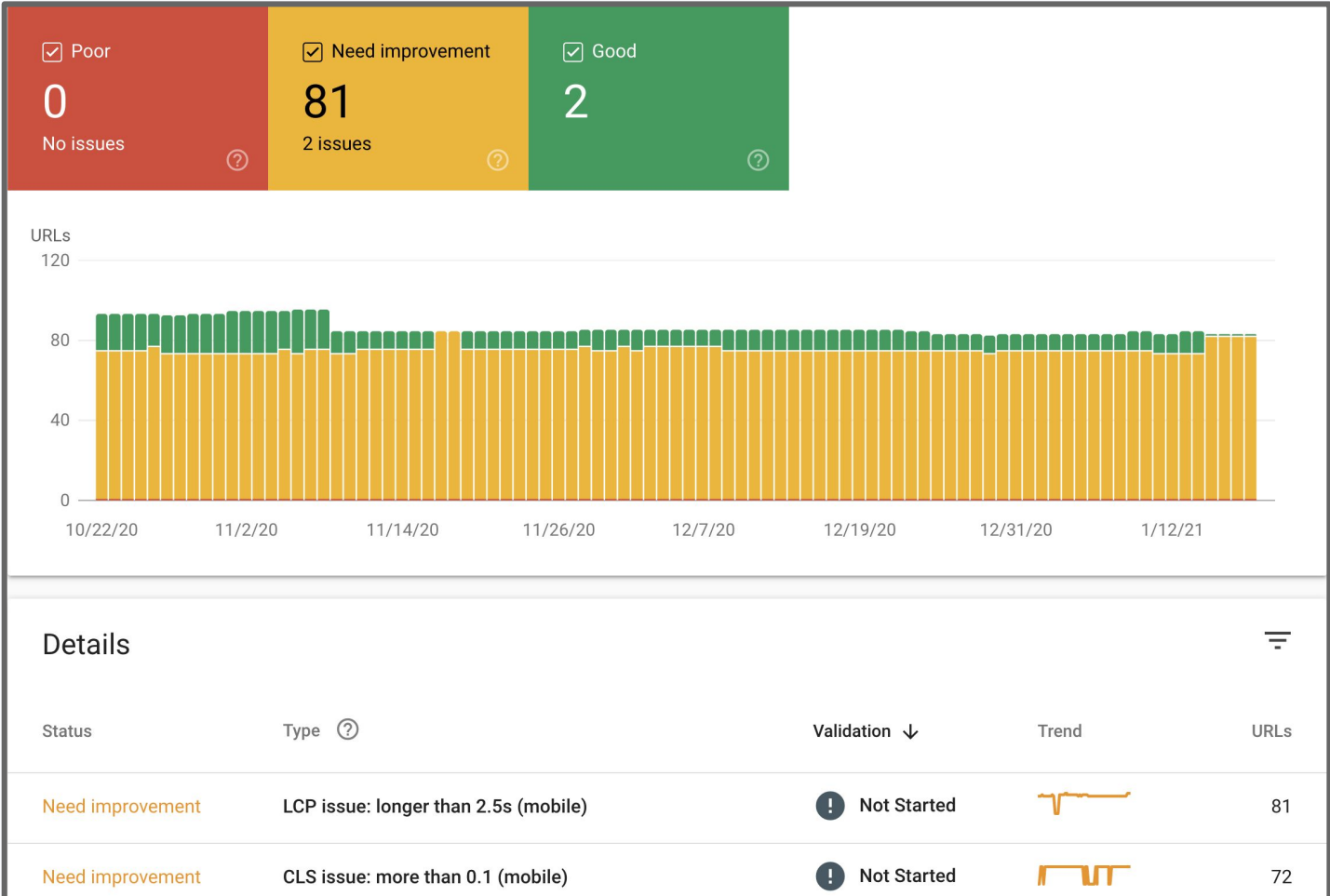
LAZY LOADING



THE NEW WAY: WEB VITALS

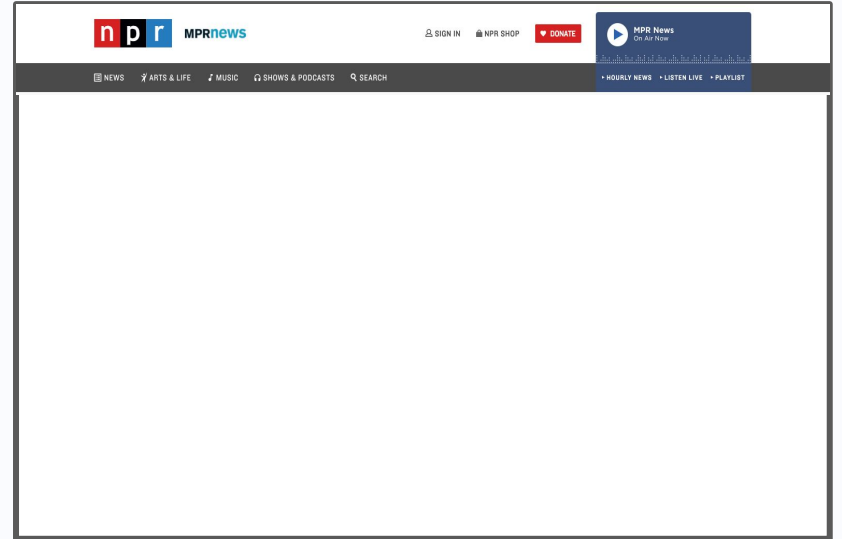


THE NEW WAY: WEB VITALS



WEB VITALS

FIRST CONTENTFUL PAINT (FCP)



WEB VITALS

FIRST CONTENTFUL PAINT (FCP)

The time until the user sees an indication that the page is loading.

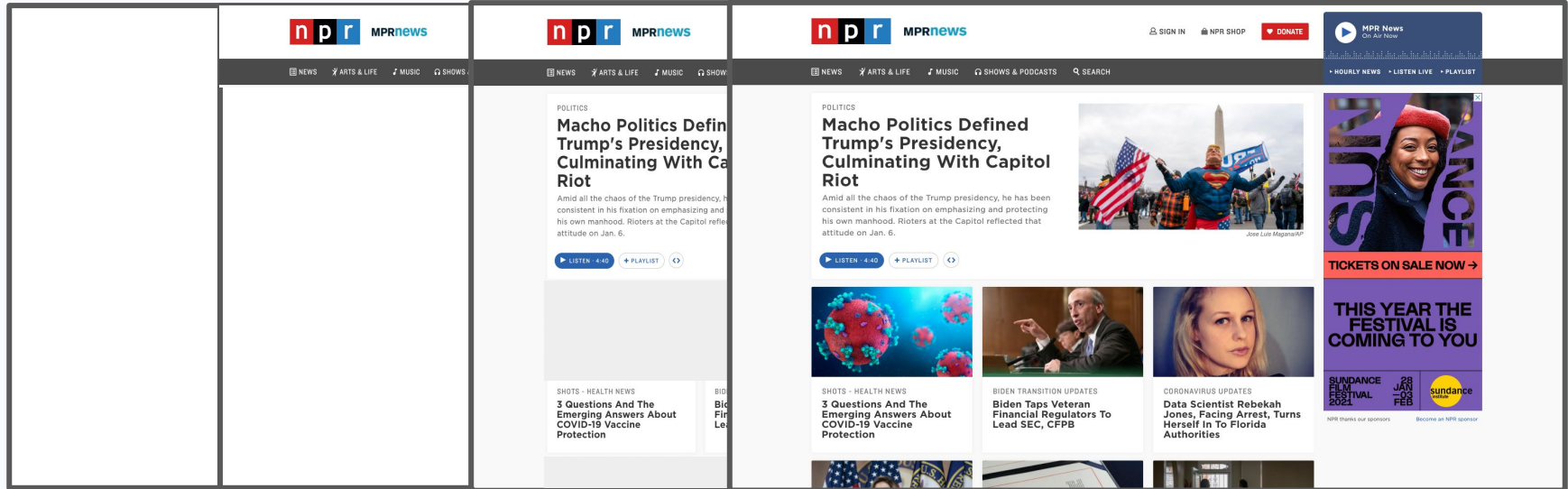
***RESPOND QUICK**



WEB VITALS

LARGEST CONTENTFUL PAINT (LCP)

LCP



WEB VITALS

LARGEST CONTENTFUL PAINT (LCP)

The screenshot shows the NPR website homepage. A red box highlights the main article titled "Macho Politics Defined Trump's Presidency, Culminating With Capitol Riot" under the "POLITICS" category. Another red box highlights a row of three smaller articles: "3 Questions And The Emerging Answers About COVID-19 Vaccine Protection", "Biden Taps Veteran Financial Regulators To Lead SEC, CFPB", and "Data Scientist Rebekah Jones, Facing Arrest, Turns Herself In To Florida Authorities". A third red box highlights a large promotional banner for the Sundance Film Festival 2021. Red arrows indicate the visual flow and layout of these content blocks.

npr MPRnews

SIGN IN NPR SHOP DONATE

MPR News On Air Now

NEWS ARTS & LIFE MUSIC SHOWS & PODCASTS SEARCH

HOURLY NEWS LISTEN LIVE PLAYLIST

POLITICS

Macho Politics Defined Trump's Presidency, Culminating With Capitol Riot

Amid all the chaos of the Trump presidency, he has been consistent in his fixation on emphasizing and protecting his own manhood. Rioters at the Capitol reflected that attitude on Jan. 6.

LISTEN 4:40 PLAYLIST

SHOTS - HEALTH NEWS

3 Questions And The Emerging Answers About COVID-19 Vaccine Protection

BIDEN TRANSITION UPDATES

Biden Taps Veteran Financial Regulators To Lead SEC, CFPB

CORONAVIRUS UPDATES

Data Scientist Rebekah Jones, Facing Arrest, Turns Herself In To Florida Authorities

SUNDANCE FILM FESTIVAL 2021

TICKETS ON SALE NOW →

THIS YEAR THE FESTIVAL IS COMING TO YOU

SUNDANCE FILM FESTIVAL 2021 JAN 22 - FEB 1

sundance institute

WEB VITALS

LARGEST CONTENTFUL PAINT (LCP)

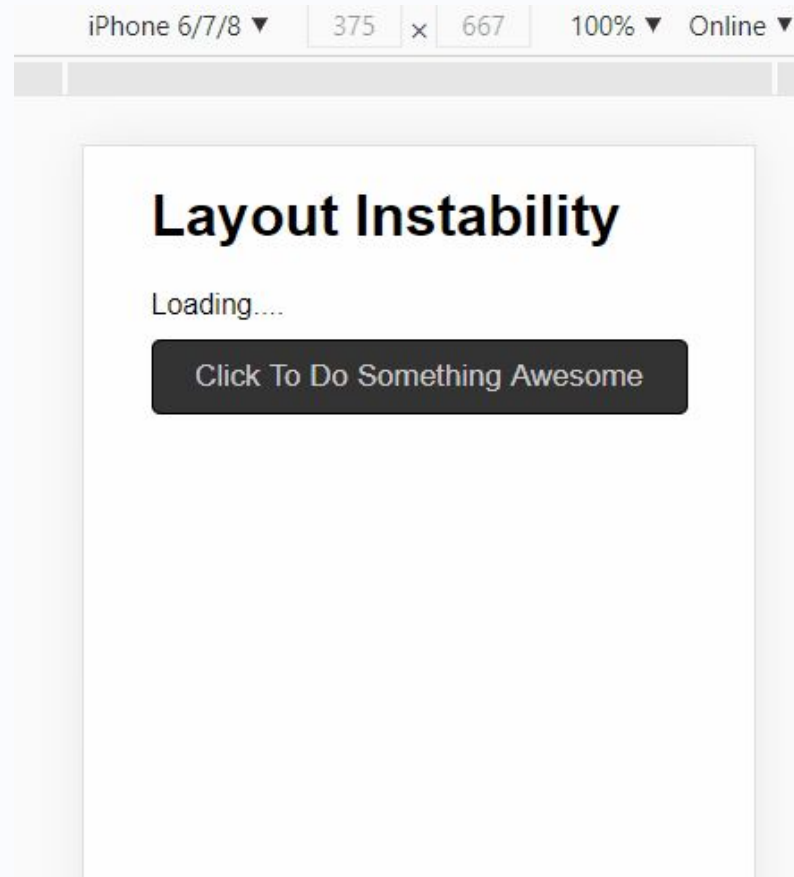
The time until the user sees most of the page and believes it is (almost) ready.

***GET TO THE POINT**



WEB VITALS

CUMULATIVE LAYOUT SHIFT (CLS)



WEB VITALS

CUMULATIVE LAYOUT SHIFT (CLS)



↓

+

↓

CLS

WEB VITALS

CUMULATIVE LAYOUT SHIFT (CLS)

The movement distance and impact of page elements during the entire lifetime of the document the user sees.

**DON'T MOVE STUFF*



WEB VITALS

CUMULATIVE LAYOUT SHIFT (CLS)

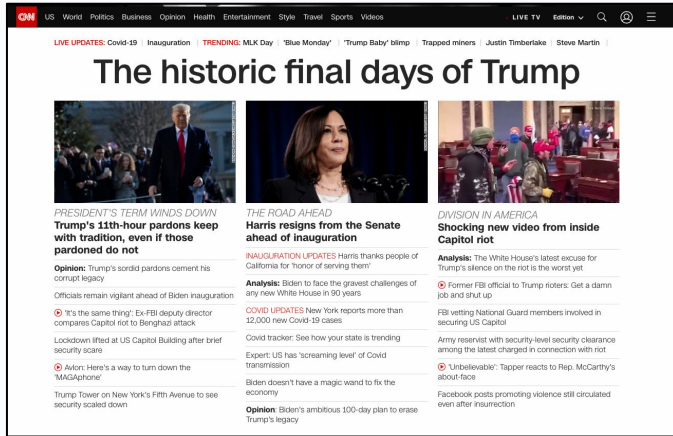
How might this impact

Client-Side Rendering?



WEB VITALS

FIRST INPUT DELAY (FID)



BROWSER
BACKGROUND AND
ASYNC WORK

LOOKS READY



WEB VITALS

FIRST INPUT DELAY (FID)

The browser time delay between the user's first click and execution of application code.

***DON'T LOAD TOO MUCH**



WEB VITALS

First Contentful Paint (FCP)

RESPOND QUICK

Largest Contentful Paint (LCP)

GET TO THE POINT

Cumulative Layout Shift (CLS)

DON'T MOVE STUFF

First Input Delay (FID)

DON'T LOAD TOO MUCH

WEB VITALS

(Loading)

LCP

Largest Contentful Paint



(Interactivity)

FID

First Input Delay



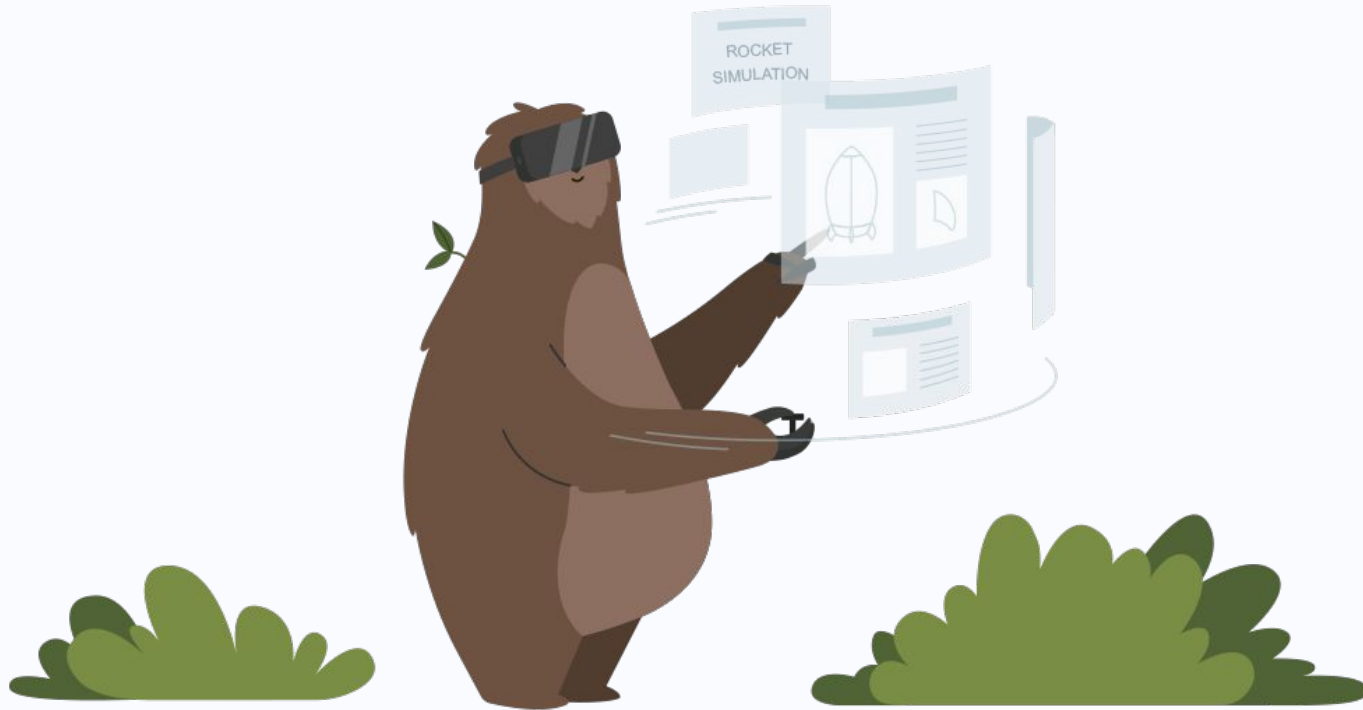
(Visual Stability)

CLS

Cumulative Layout Shift



DEMONSTRATION: CHROME LIGHTHOUSE



CHROME LIGHTHOUSE QUIRKS AND GOTCHAS

- Relative to **your** machine, network
- Chrome window size
- Chrome application priority





Mastering Chrome Developer Tools v2



Jon Kuperman

Adobe

3 hours, 35 minutes 

Preview



Go beyond console.log to master all the built-in tools available in Google's Chrome Developer Tools to edit, debug, and profile your web applications! You'll learn to step through your code with the debugger, audit web page performance, debug Node.js, and remove "page jank" when a site isn't keeping up.

This course and others like it are available as part of our Frontend Masters video subscription.

Published: September 12, 2018

[Get Unlimited Access Now](#)

<https://frontendmasters.com/courses/chrome-dev-tools-v2/>

EXERCISE 2:

PERFORMANCE IN THE LAB

Run Chrome Lighthouse reports for the sites in your

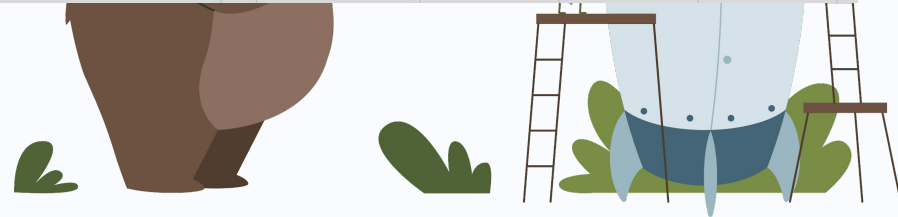
Performance Comparison Worksheet and record your metrics in the “Exercise 2” sheet.



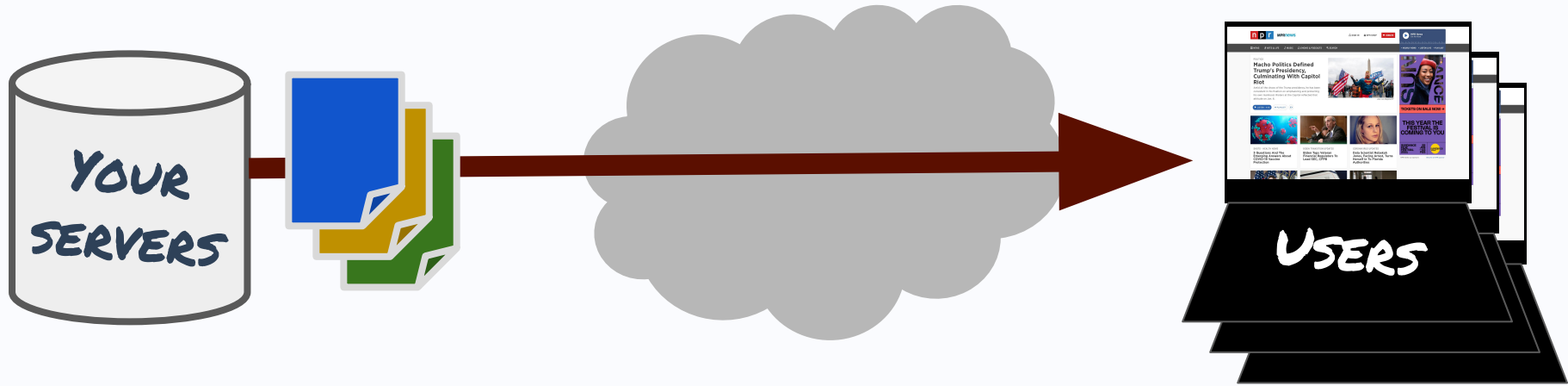
EXERCISE 2:

PERFORMANCE IN THE LAB

Website	First Contentful Paint (FCP)	Largest Contentful Paint (LCP)	Cumulative Layout Shift (CLS)	Perceived Speed Rank	FCP Rank	LCP Rank	CLS Rank
https://www.npr.org/ <i>Publicly Funded</i>	0.9	2	0.001	1	2	1	1
https://www.cnn.com/ <i>Advertising Funded</i>	2	5.5	0.159	4	4	3	3
https://www.nytimes.com/ <i>Subscription Funded</i>	0.9	2.3	0.01	2	2	2	2
https://www.wsj.com/ <i>Subscription Funded</i>	0.5	14.8	0.631	3	1	4	4

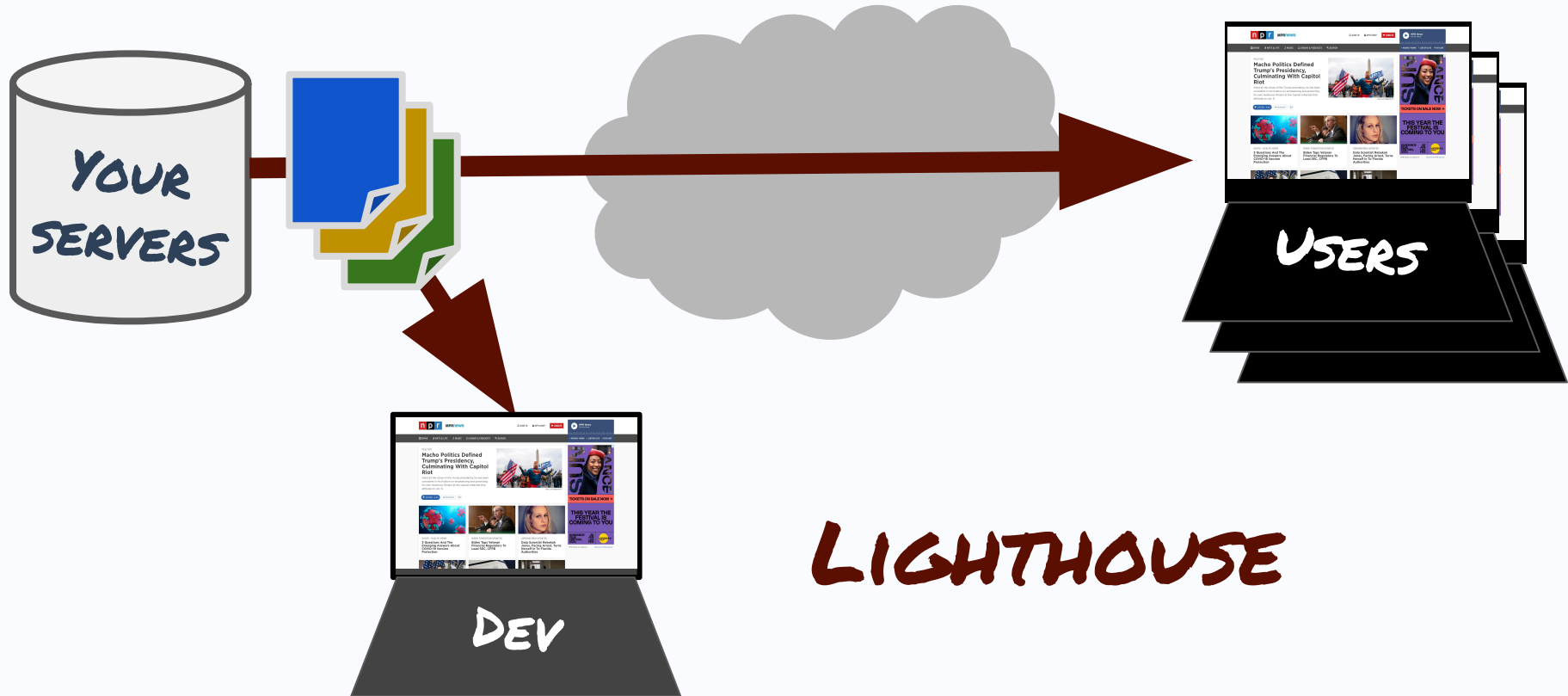


WHERE DO WE MEASURE FROM?

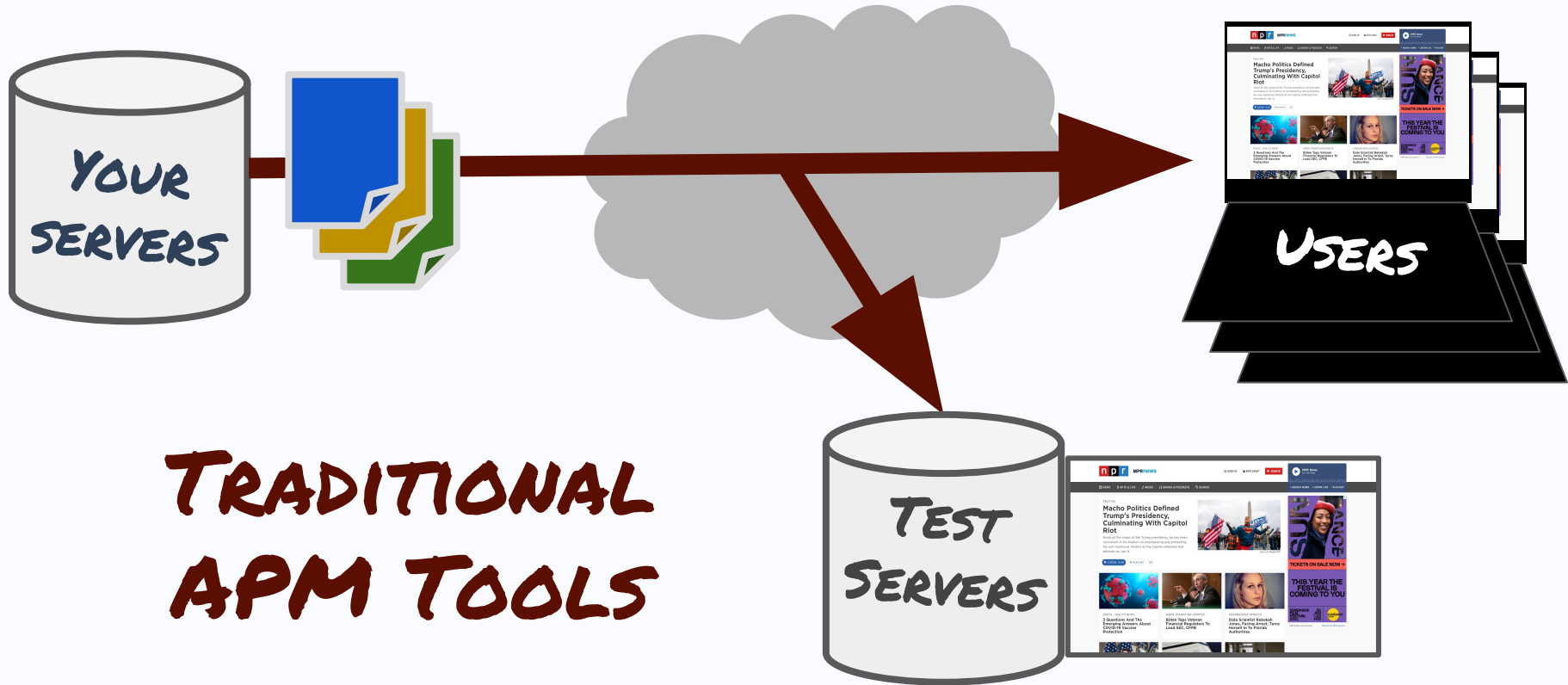


WHERE DO WE MEASURE FROM?

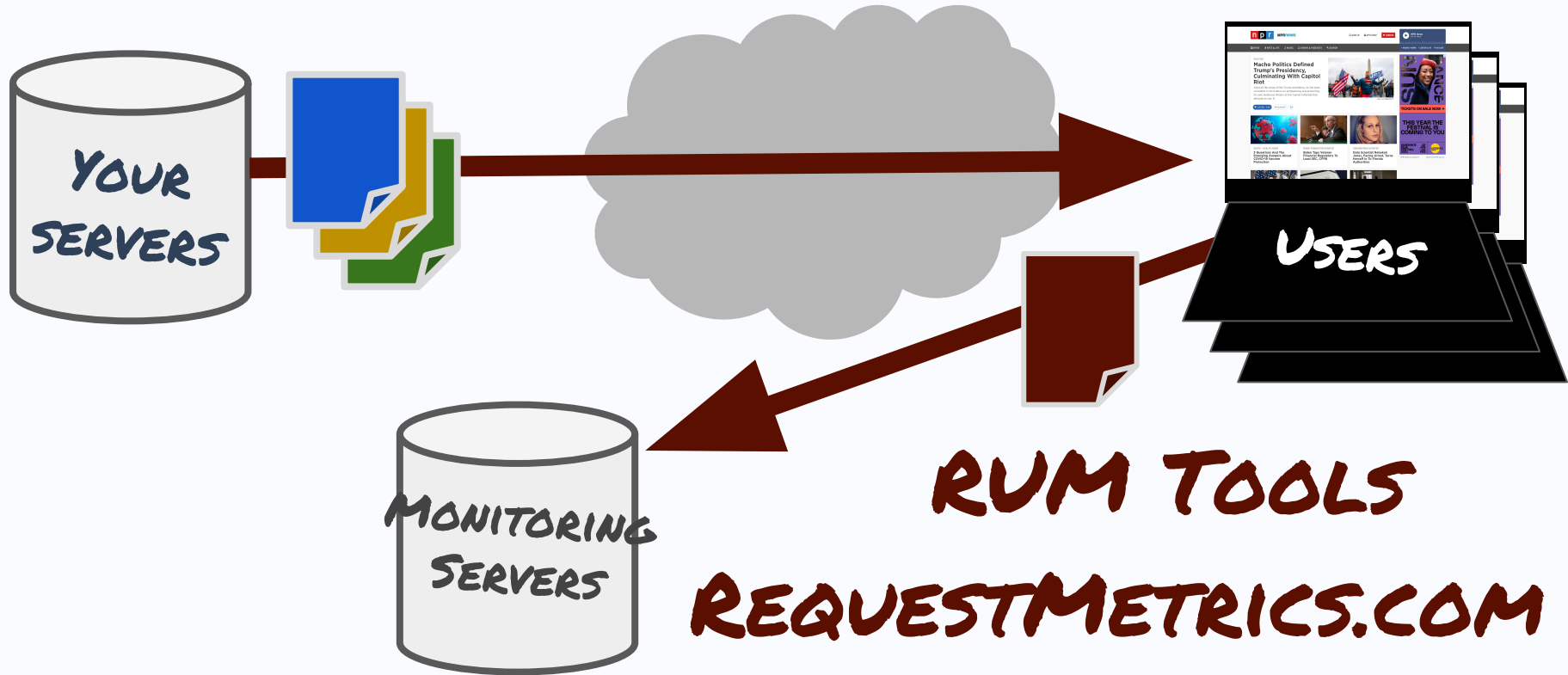
LAB DATA



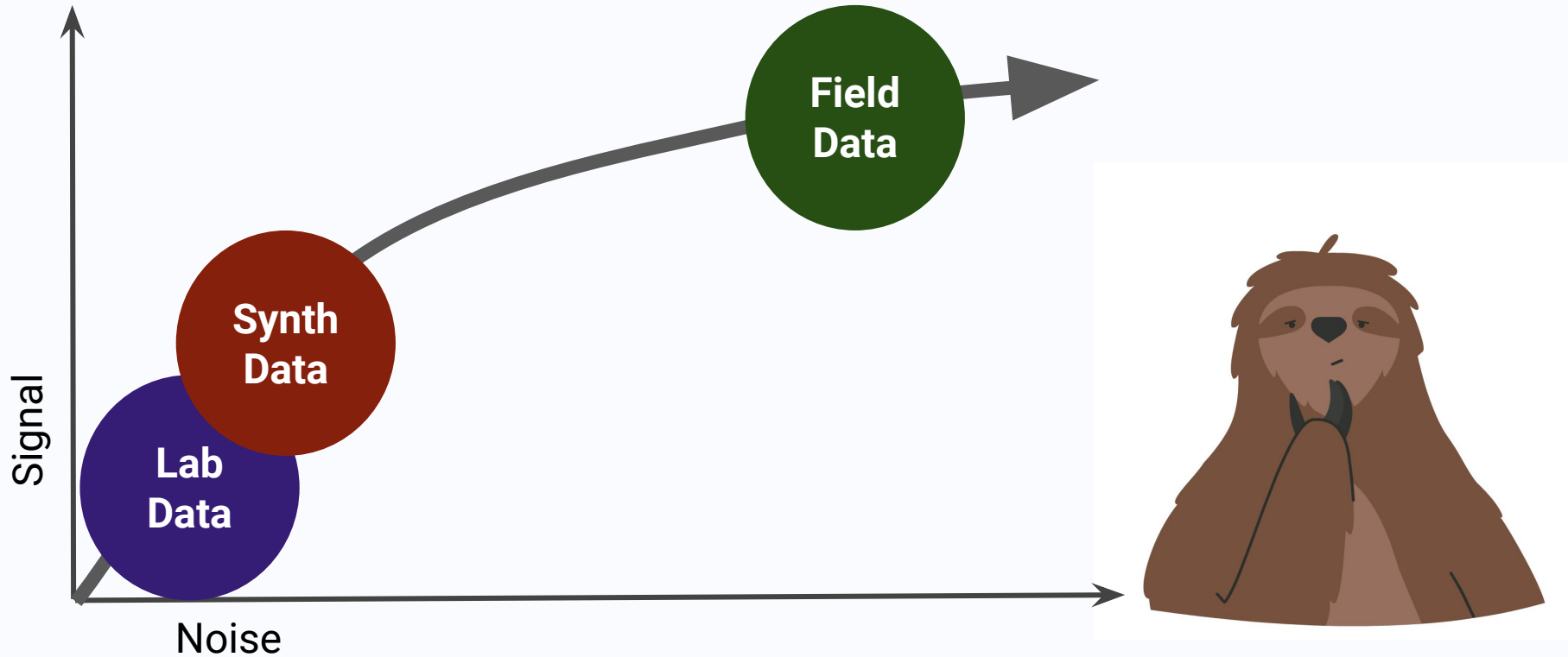
WHERE DO WE MEASURE FROM? SYNTHETIC DATA



WHERE DO WE MEASURE FROM? FIELD DATA



WHERE DO WE MEASURE FROM? SIGNAL TO NOISE



EXERCISE 3:

PERFORMANCE IN THE FIELD

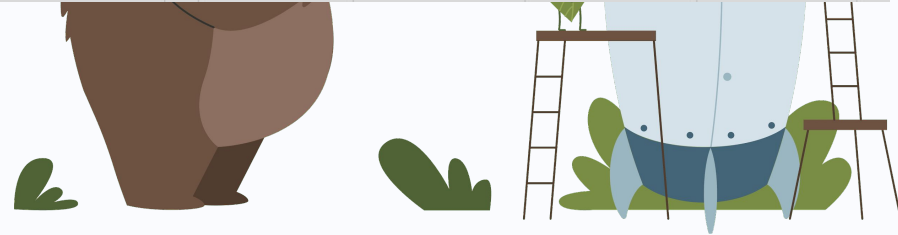
Check the CrUX data for the sites in your [Performance Comparison Worksheet](#) and record your metrics in the “Exercise 3” sheet.



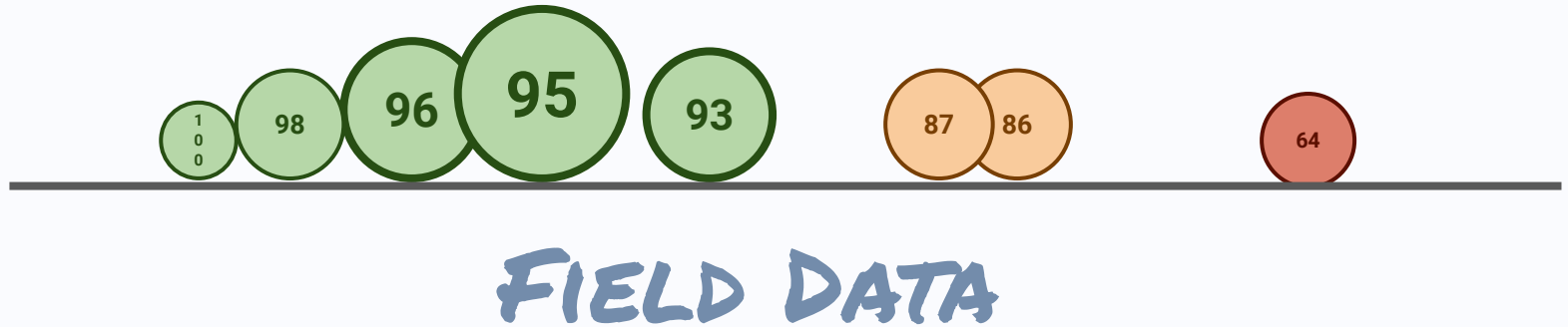
EXERCISE 3:

PERFORMANCE IN THE FIELD

Website	p75 First Contentful Paint	p75 Largest Contentful Paint	p75 Cumulative Layout Shift	Perceived Speed Rank	FCP Rank and Change	LCP Rank and Change	CLS Rank and Change
https://www.npr.org/ <i>Publicly Funded</i>	1.3	3.5	0.05	1	3 -30.77%	3 -42.86%	1 -98.00%
https://www.cnn.com/ <i>Advertising Funded</i>	2.4	5	0.63	4	4 -16.67%	4 10.00%	3 -74.76%
https://www.nytimes.com/ <i>Subscription Funded</i>	1.1	2.2	0.13	2	1 -18.18%	1 4.55%	2 -92.31%
https://www.wsj.com/ <i>Subscription Funded</i>	1.2	3.4	0.66	3	2 -58.33%	2 335.29%	4 -4.39%

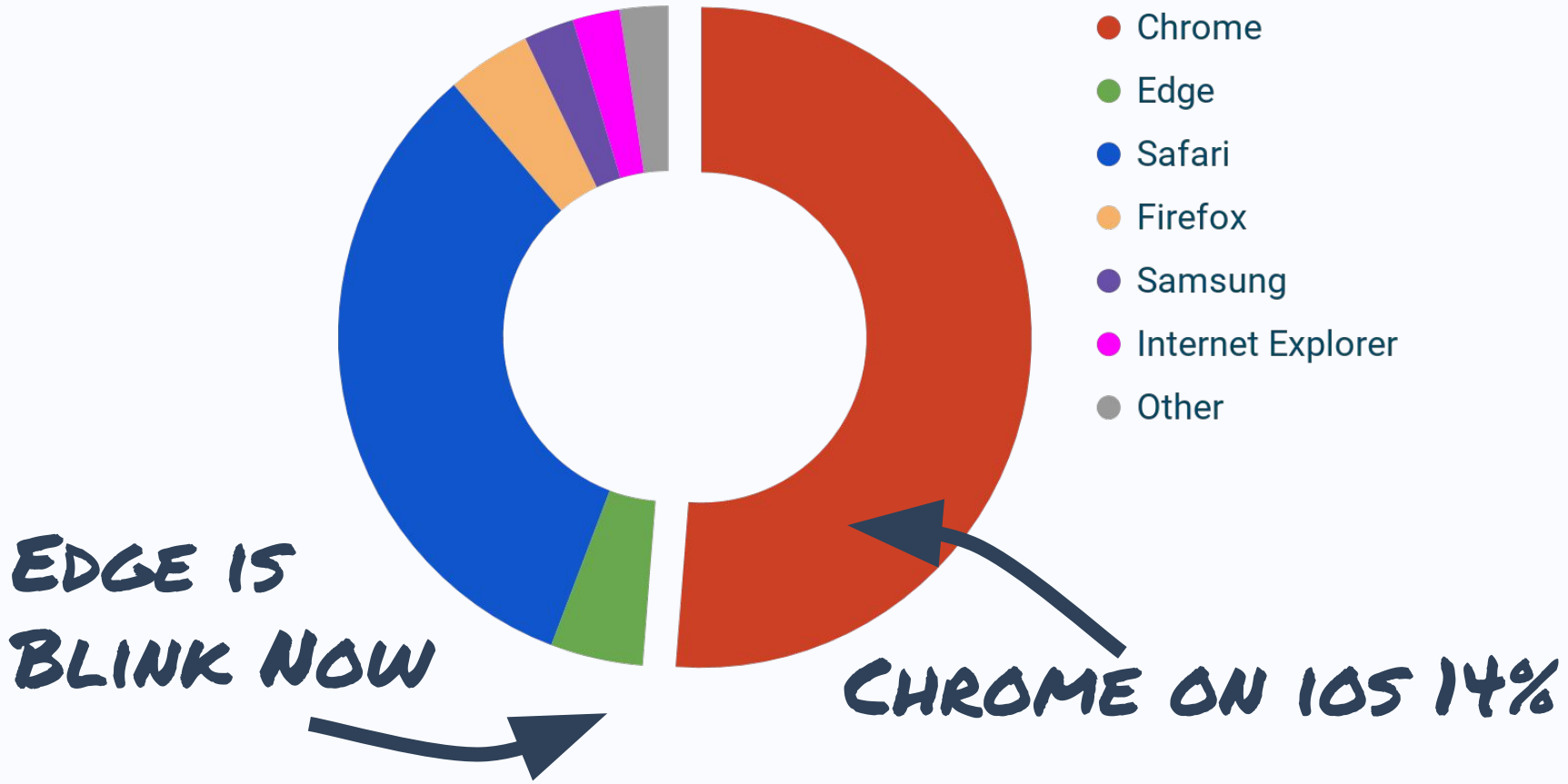


INTERPRETING FIELD DATA



INTERPRETING FIELD DATA

UNDERSTANDING THE SAMPLE



INTERPRETING FIELD DATA AVERAGES

80

99
~~x3~~

90
~~x3~~

70
~~x3~~

60
~~x3~~

INTERPRETING FIELD DATA AVERAGES

80

90
x9

85
x7

30
x2

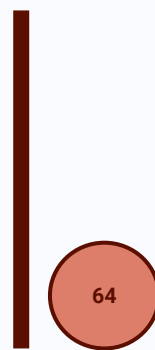
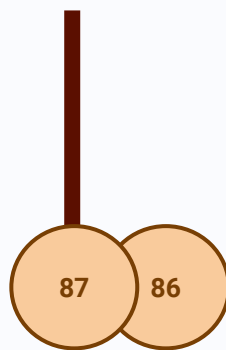
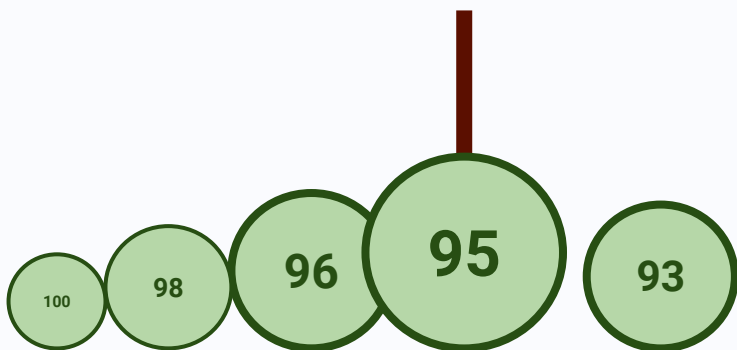
INTERPRETING FIELD DATA

MEDIAN AND PERCENTILES

MEDIAN
(P50)

P75

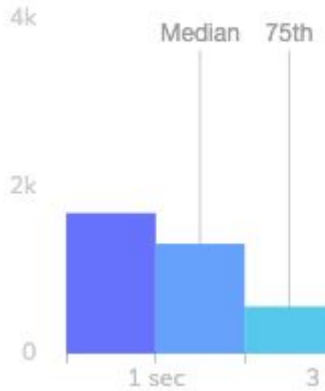
P95



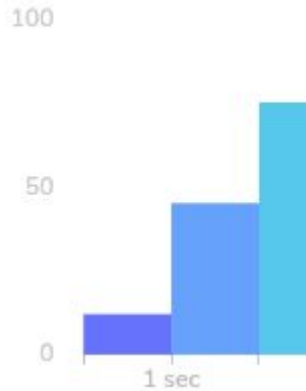
INTERPRETING FIELD DATA

MEDIAN AND PERCENTILES

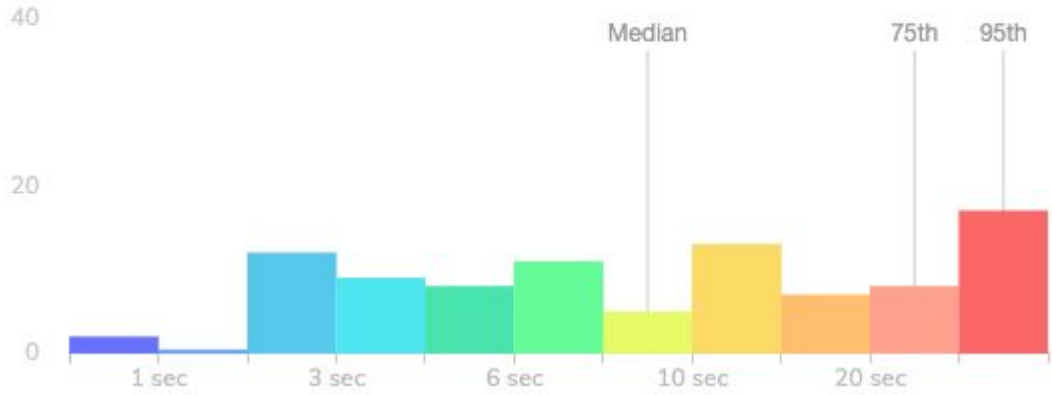
Page Performance Summary



Page Performance Summary



Page Performance Summary



IMPROVING Web Performance

PART 1: UNDERSTANDING

- Psychology of performance
- Measuring performance
- Interpreting performance data



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