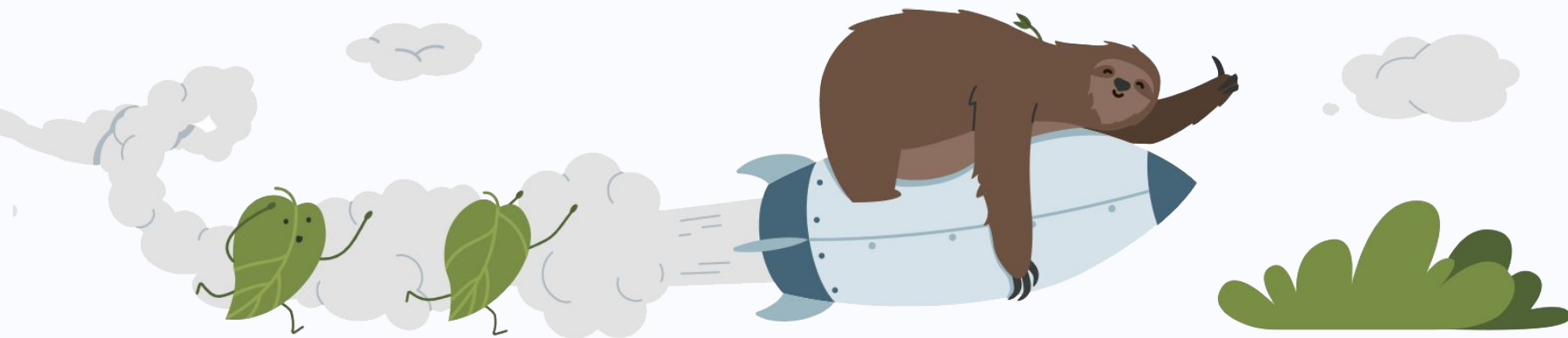


# IMPROVING

# 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

Set Status

Share

Delete

Delete All

Ignore

Telemetry Timeline

19

0

0

> - 27

3

0

Direct Error

+0.19 sec

Message: Network Error

Type: Custom error ⓘ

Google error ⓘ More errors with this message

Network XHR

-0.08 sec

Method: GET

Url: https://int-services.bonzai.com/menu-metadata/v1/menu-metadata?channel=web&region=US

Parameters: channel=web  
region=US

Response: Pending

Network XHR

-0.08 sec

Method: GET

Url: https://int-services.bonzai.com/onlineorderingstatus

Response: 0 ?? 74 milliseconds elapsed

Network XHR

-0.08 sec

Method: GET

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

Response: Pending

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



REQUEST  
METRICS.

APPLICATION  
davidwalsh.name

IMPERSONATING  
David Walsh



Search pages and endpoints...

Last 60 Minutes

Last 24 Hours

Last 48 Hours

Last 7 Days

Last 30 Days

Last 90 Days

Page <https://davidwalsh.name/>

SPEED **OK** VIEWS **365** LOAD TIME **5.5 sec** MEDIAN LOAD **3-4 sec** 95TH LOAD **10-15 sec** UNIQUES **307** PAGE SIZE **13.4 kB**

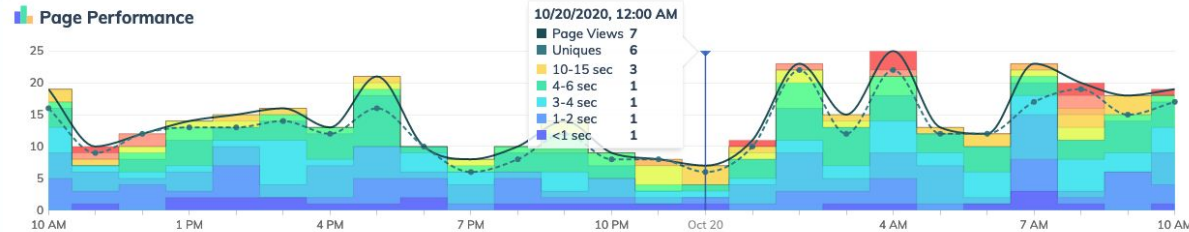
View Performance

Page Breakdown

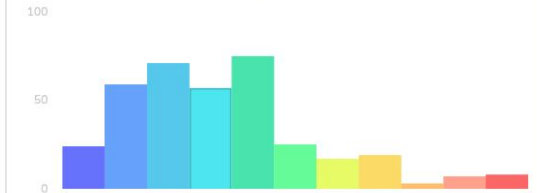
Web Vitals

Devices

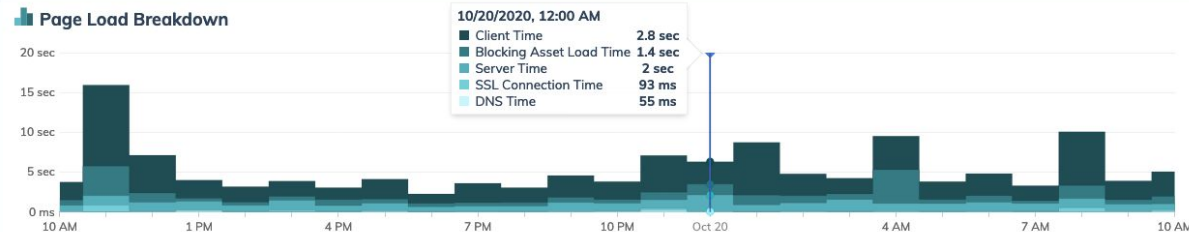
### Page Performance



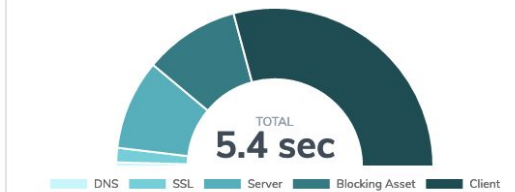
### Page Performance Summary



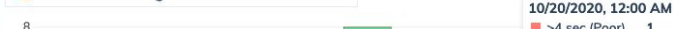
### Page Load Breakdown



### Page Breakdown Summary



### Web Vitals: Largest Contentful Paint



### Web Vitals Summary


CUMULATIVE LAYOUT SHIFT



# 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/>

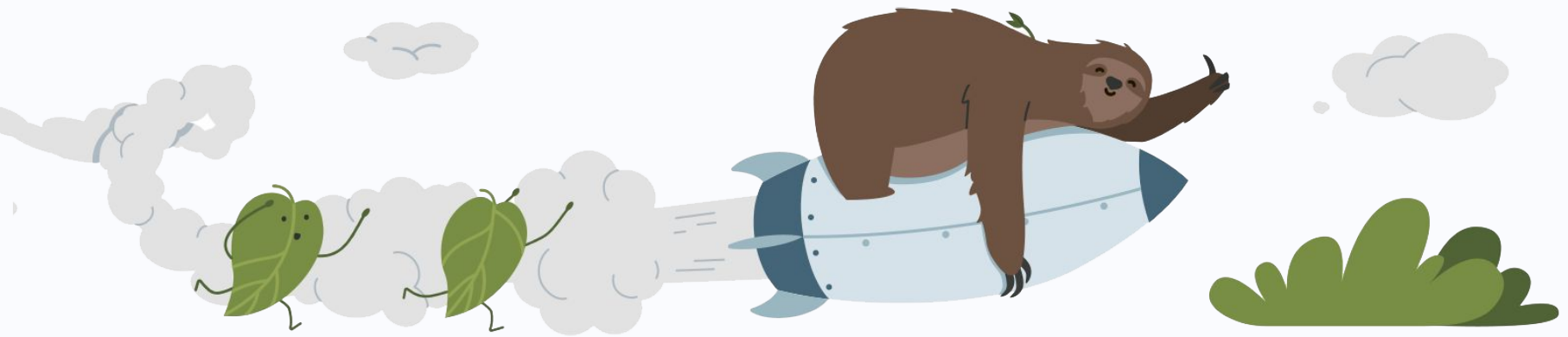
# IMPROVING Web Performance

## PART 1: UNDERSTANDING

- Psychology of performance
- Measuring performance
- Interpreting performance data



# WHY IS PERFORMANCE IMPORTANT?





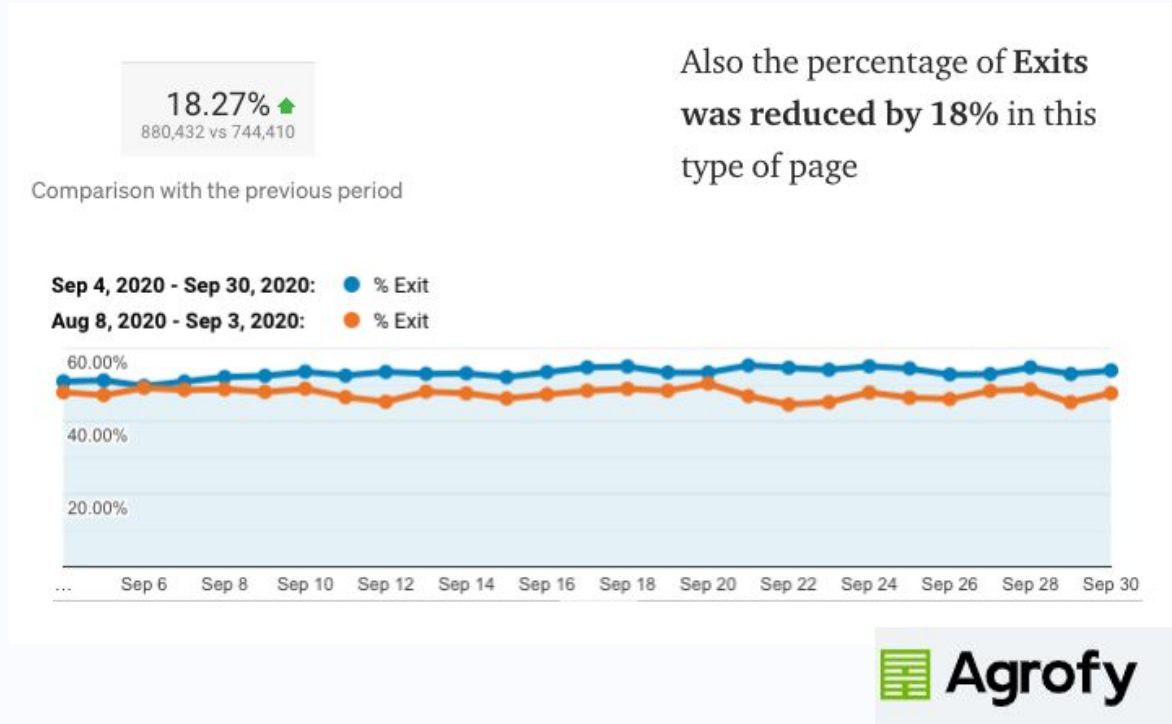
# WHY IS THIS IMPORTANT?

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

100ms improvement = Up to 1% incremental revenue

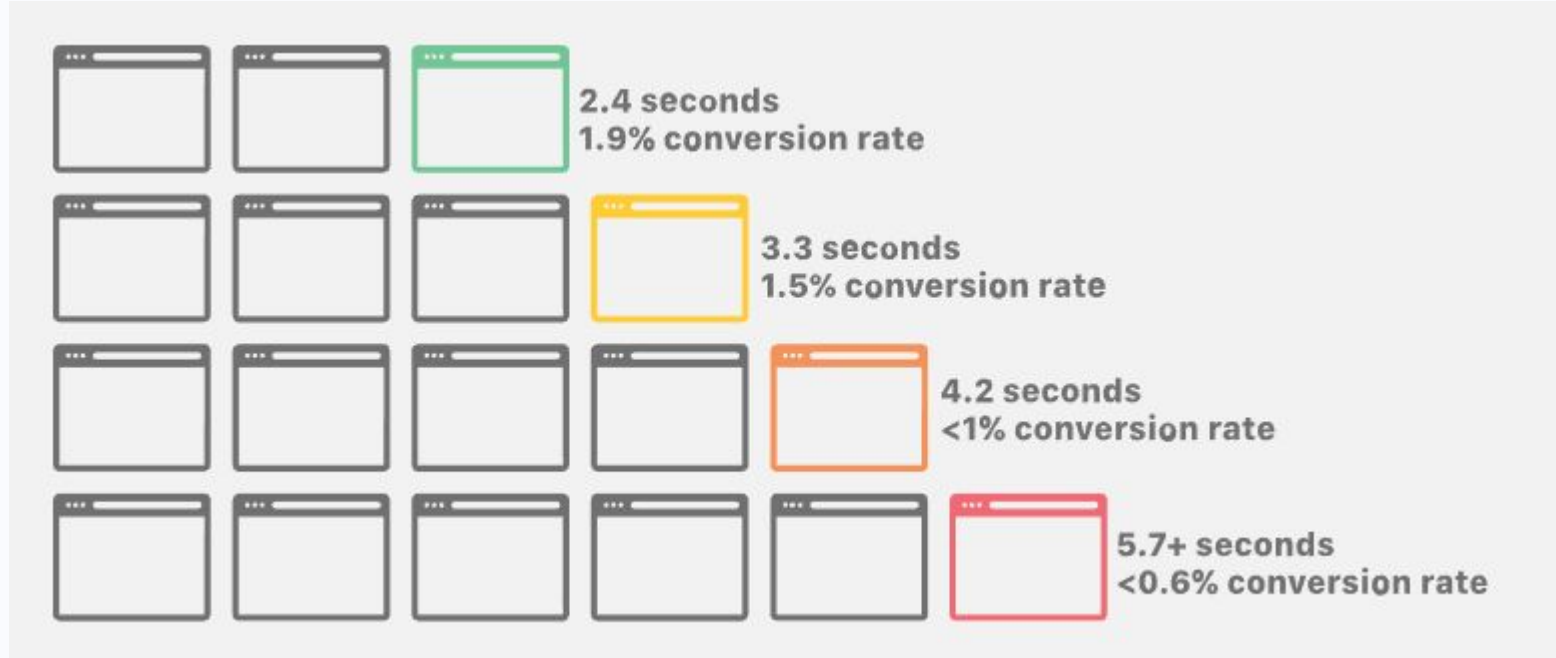


# WHY IS THIS IMPORTANT?



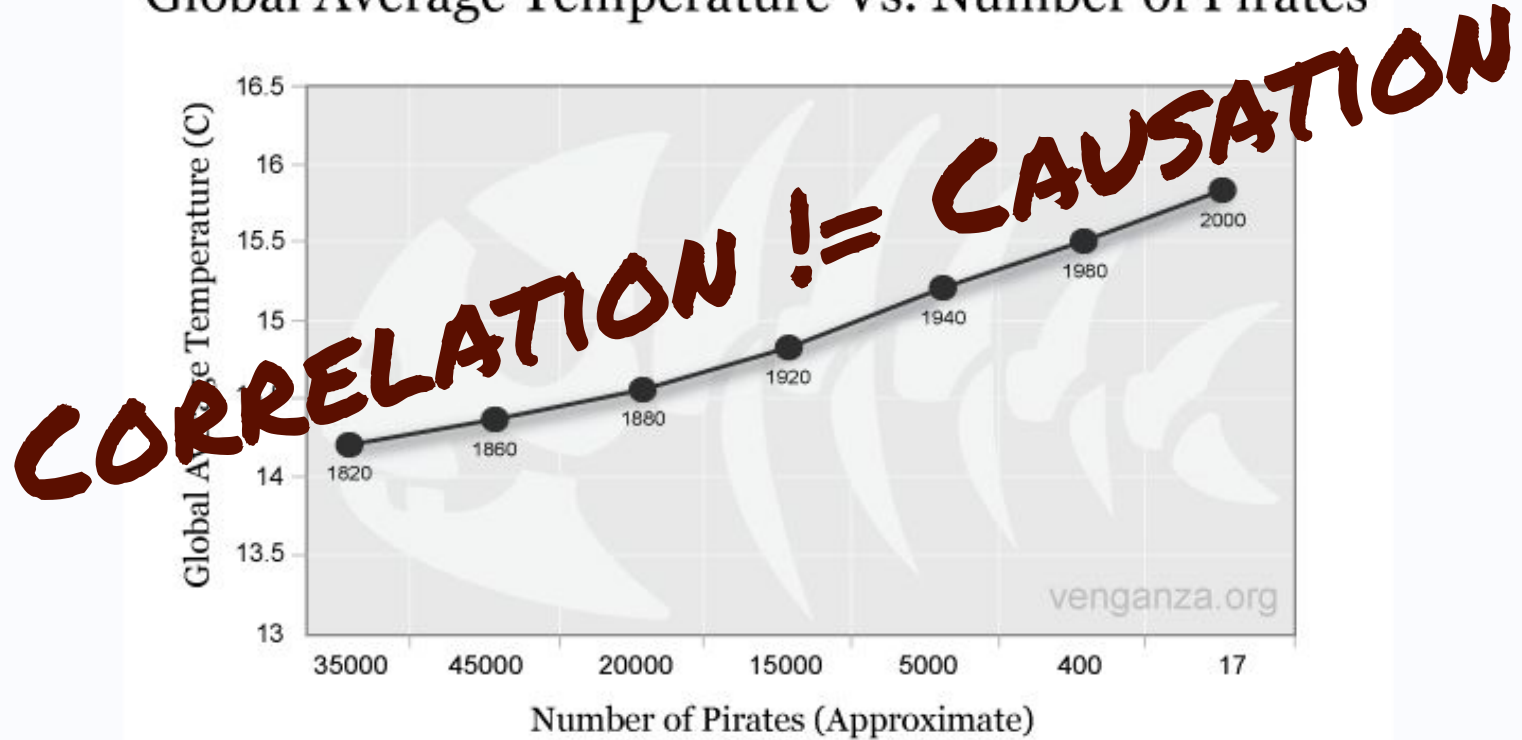
<https://mollar-luciano.medium.com/how-agrofy-optimised-core-web-vitals-and-improved-business-metrics-2f73311bca>

# 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 13, 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
<a href="https://www.npr.org/">https://www.npr.org/</a> <i>Publicly Funded</i>	1
<a href="https://www.cnn.com/">https://www.cnn.com/</a> <i>Advertising Funded</i>	4
<a href="https://www.nytimes.com/">https://www.nytimes.com/</a> <i>Subscription Funded</i>	2
<a href="https://www.wsj.com/">https://www.wsj.com/</a> <i>Subscription Funded</i>	3





# PSYCHOLOGY OF WAITING

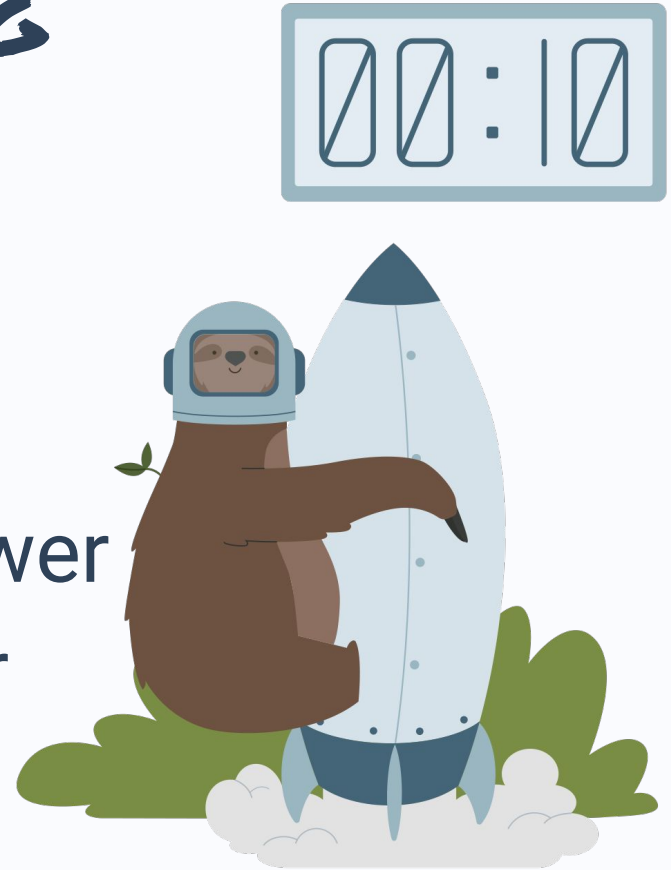
Wait time feels  
subjective



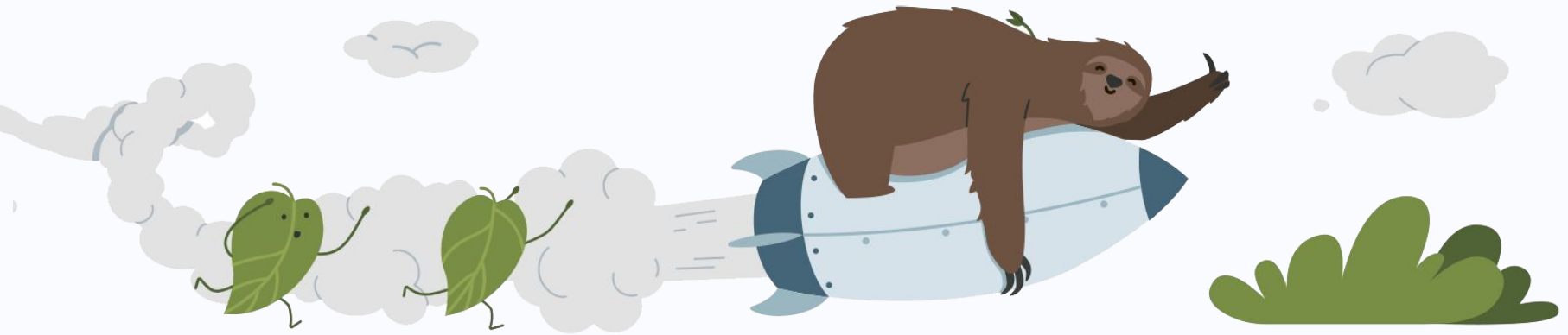
# PERCEIVED PERFORMANCE

# 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



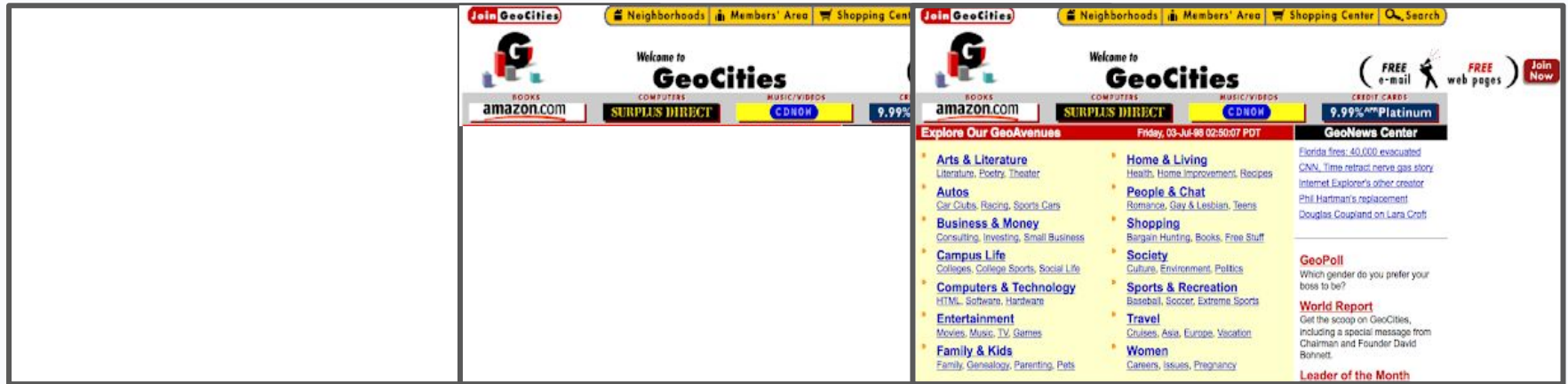
# PAGE LOAD

## GAMING THE METRICS

Start

Load

**LAZY LOADING**



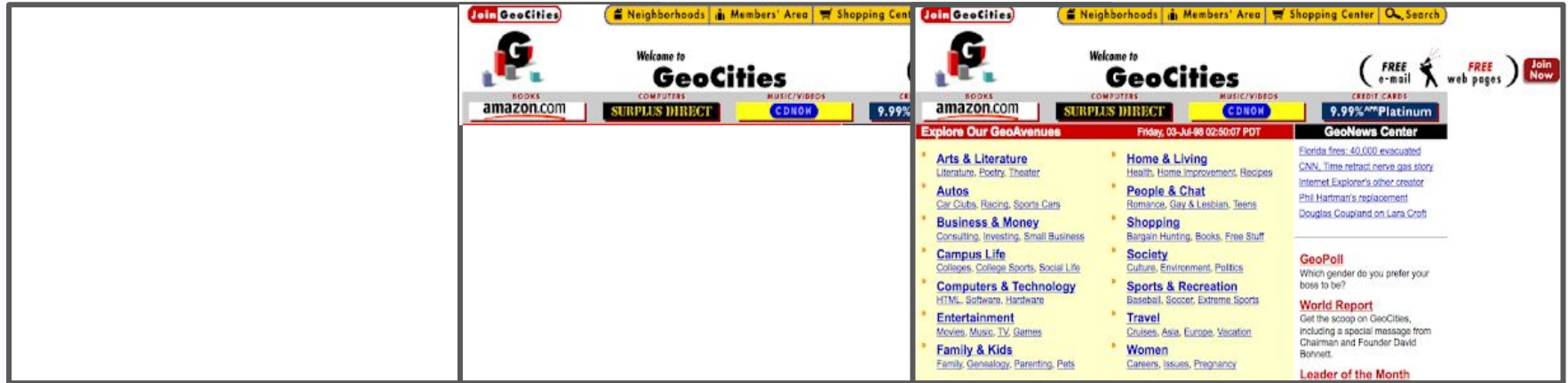
# PAGE LOAD

## GAMING THE METRICS

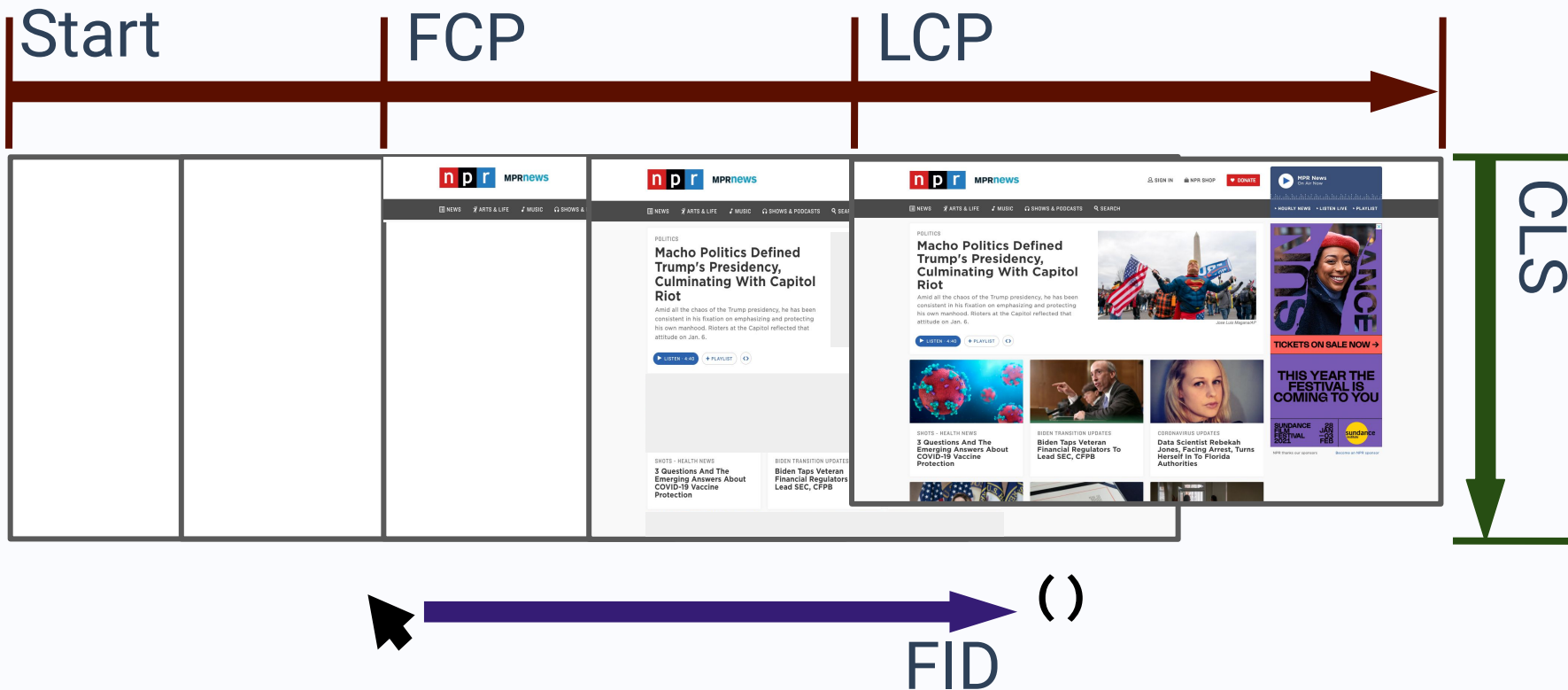
Start

Load

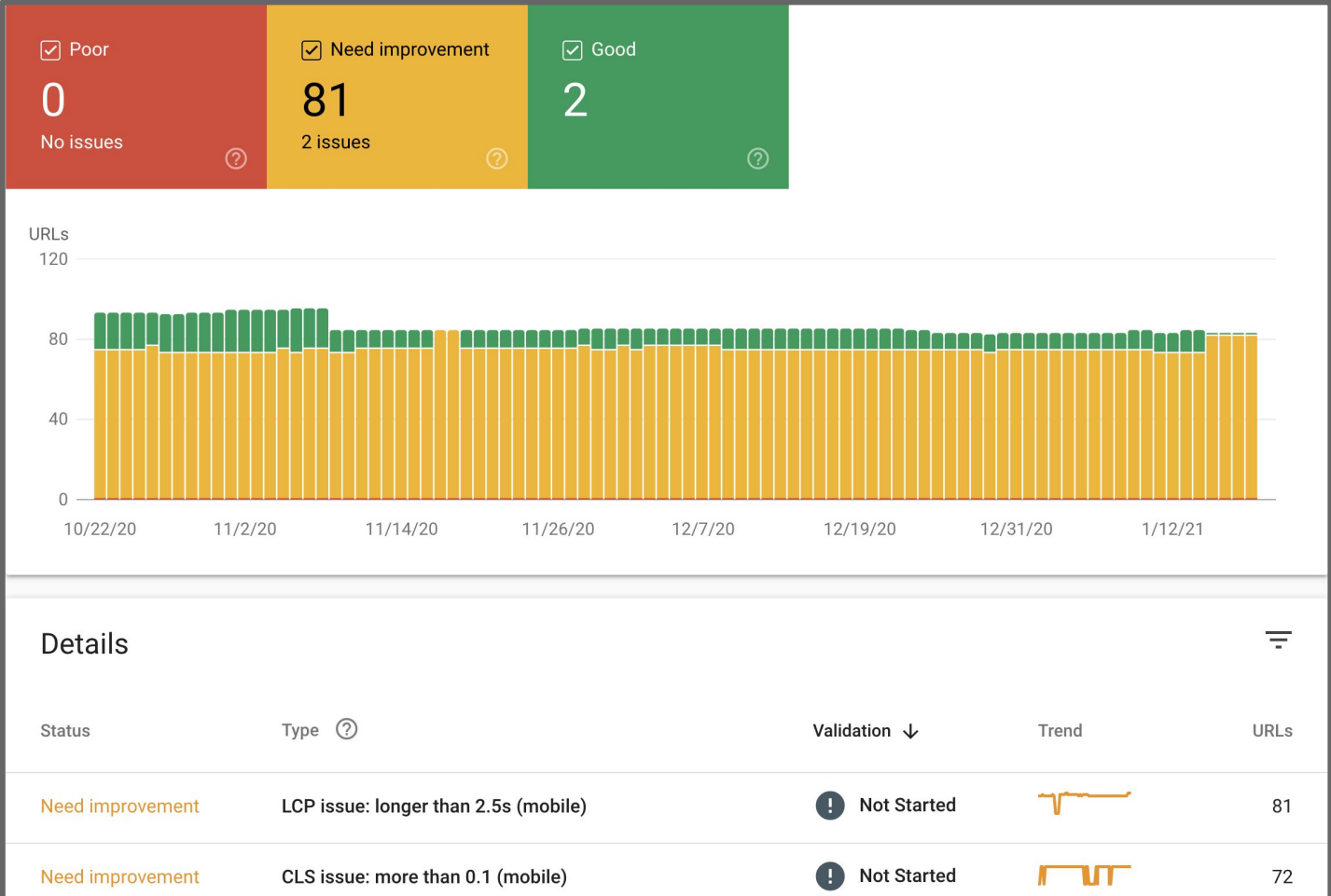
LAZY LOADING



# THE NEW WAY: WEB VITALS



# THE NEW WAY: WEB VITALS



URLs

Date	Need improvement	Good	Total
10/22/20	80	20	100
11/2/20	75	25	100
11/14/20	75	25	100
11/26/20	75	25	100
12/7/20	75	25	100
12/19/20	75	25	100
12/31/20	75	25	100
1/12/21	75	25	100

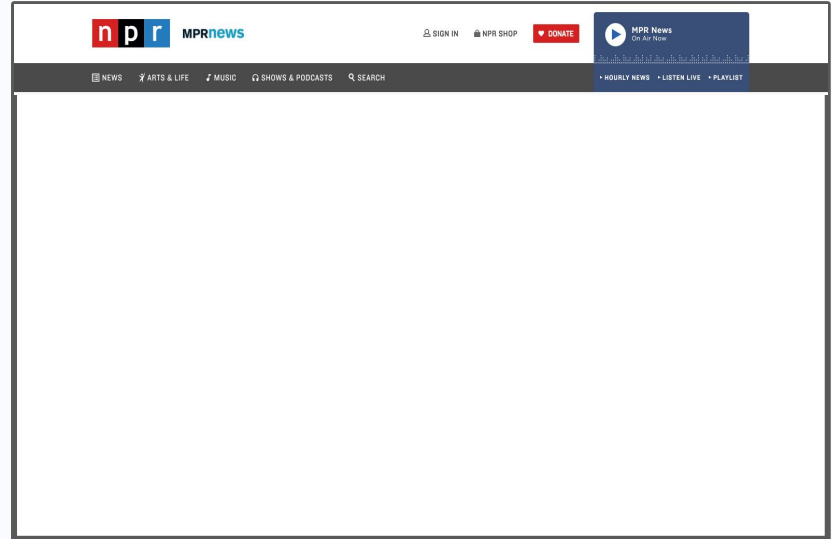
### Details

Status	Type ?	Validation ↓	Trend	URLs
Need improvement	LCP issue: longer than 2.5s (mobile)	! Not Started		81
Need improvement	CLS issue: more than 0.1 (mobile)	! Not Started		72



# 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.

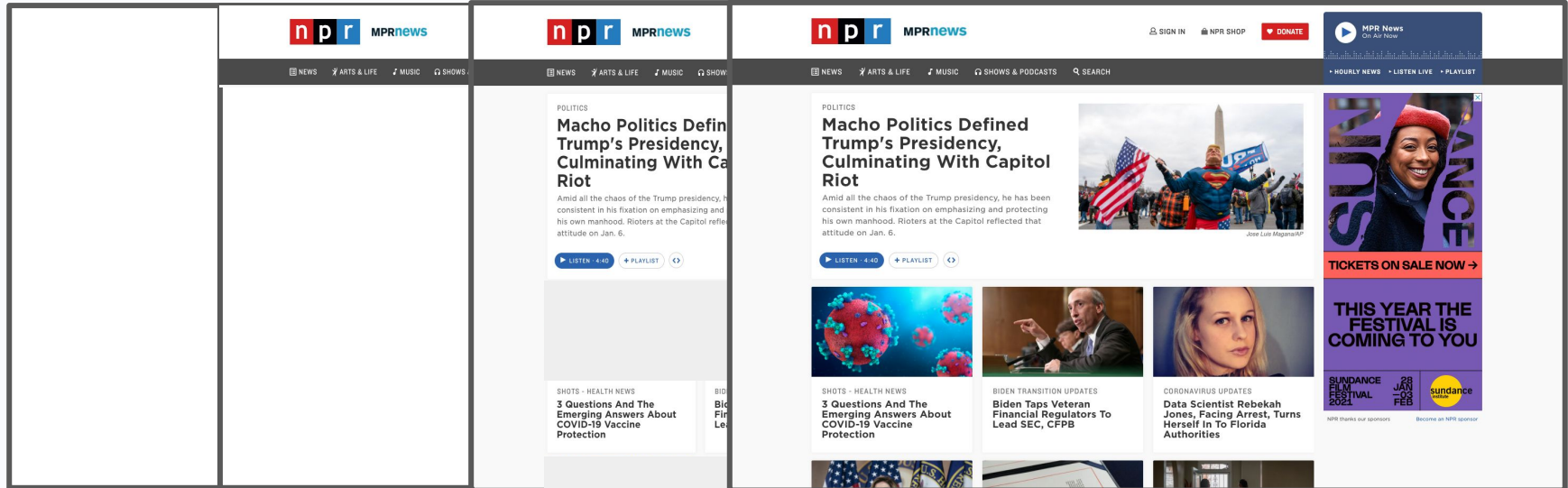
**\*RESPOND QUICK**



# WEB VITALS

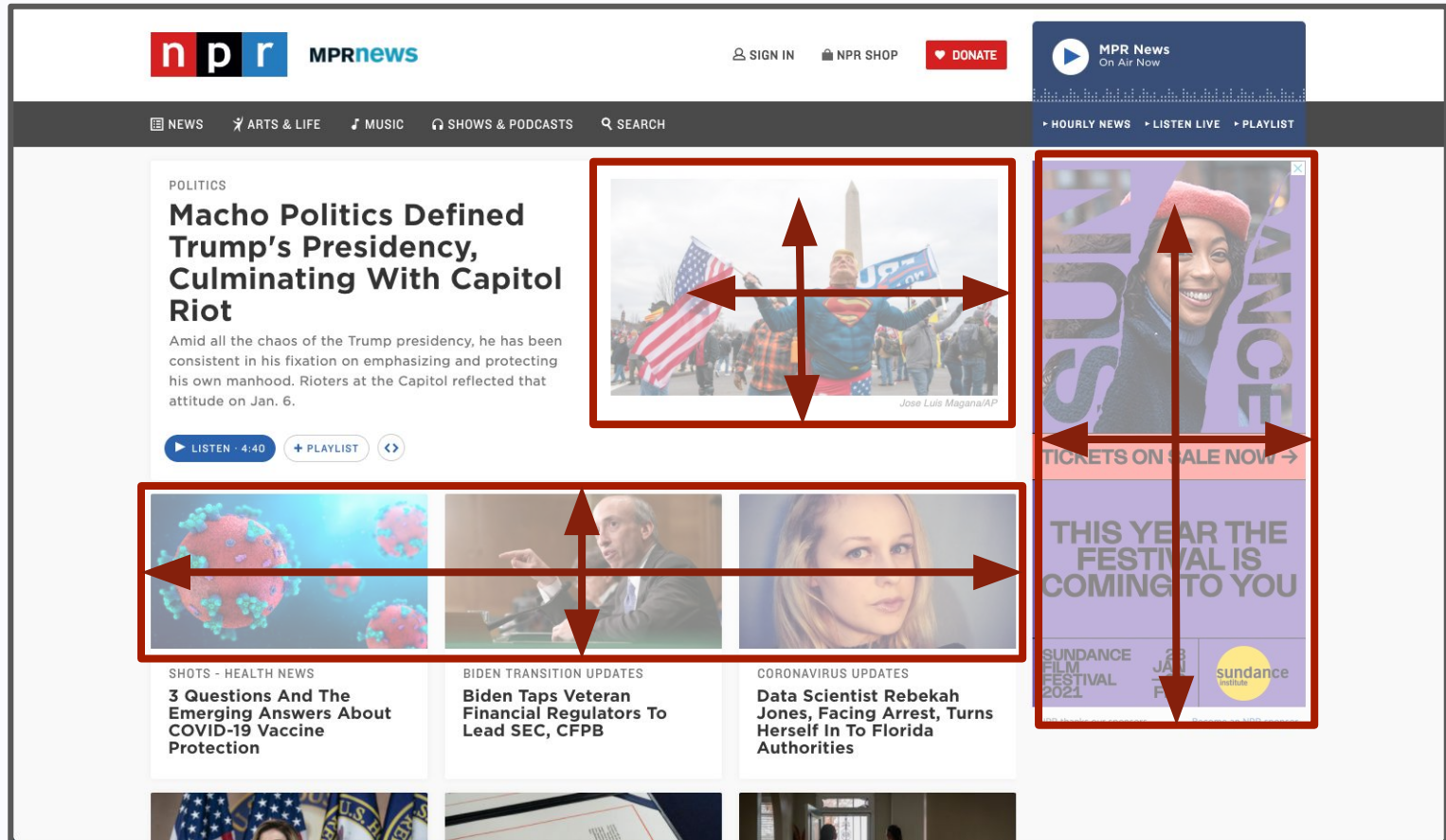
## LARGEST CONTENTFUL PAINT (LCP)

LCP



# WEB VITALS

## LARGEST CONTENTFUL PAINT (LCP)



# WEB VITALS

## LARGEST CONTENTFUL PAINT (LCP)

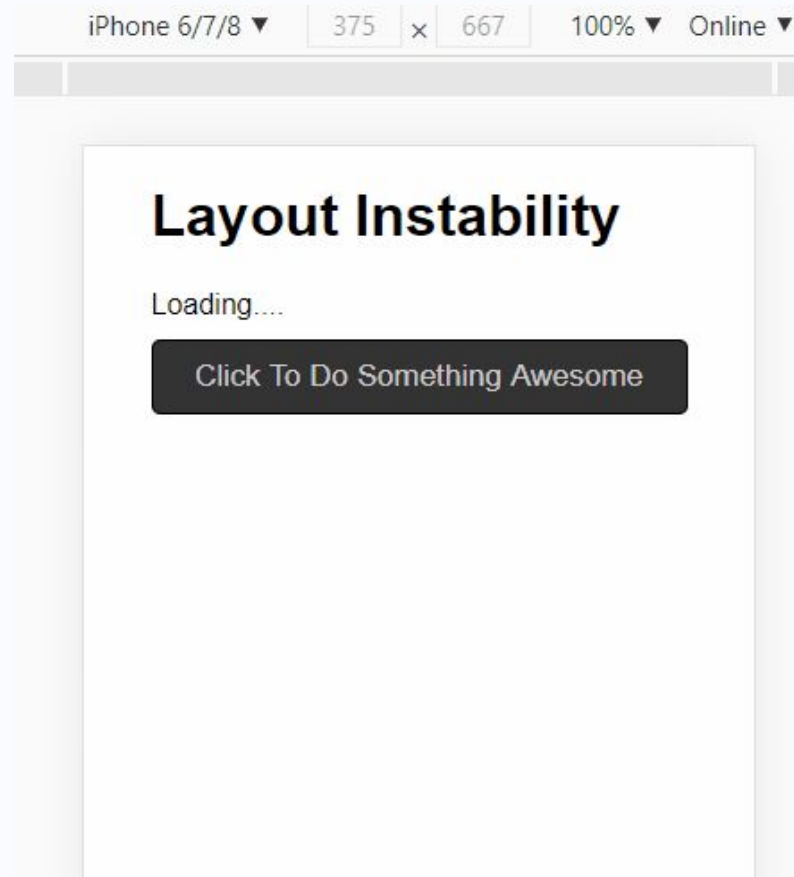
The time until the user sees most of the page and believes it is (almost) ready.

**\*GET TO THE POINT**



# WEB VITALS

## CUMULATIVE LAYOUT SHIFT (CLS)



## 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)

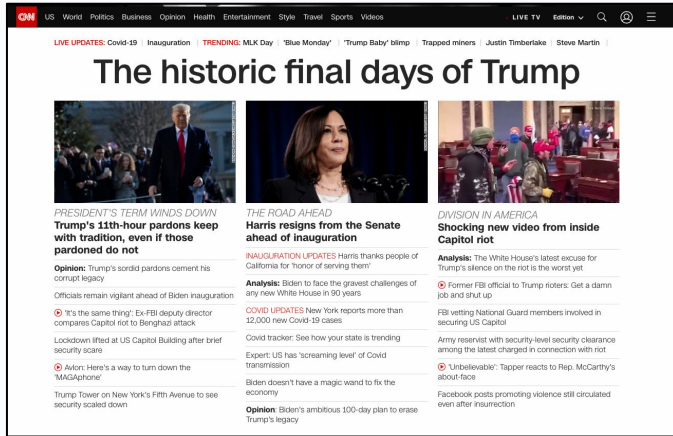
How might this impact

***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



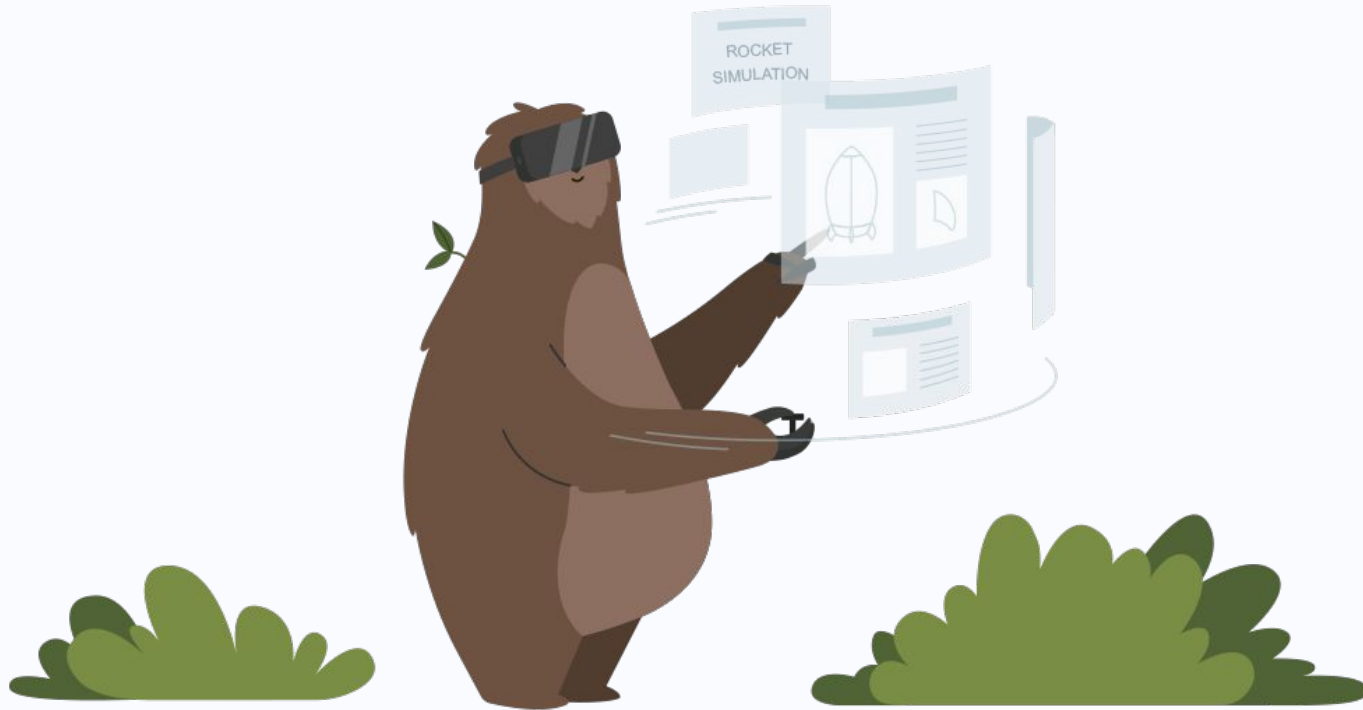
(Visual Stability)

## 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

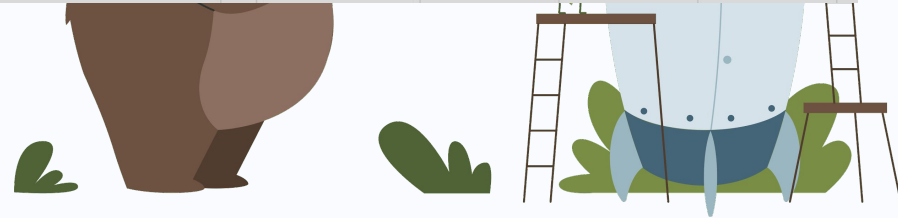
Worksheet and record your metrics in the “Exercise 2” sheet.



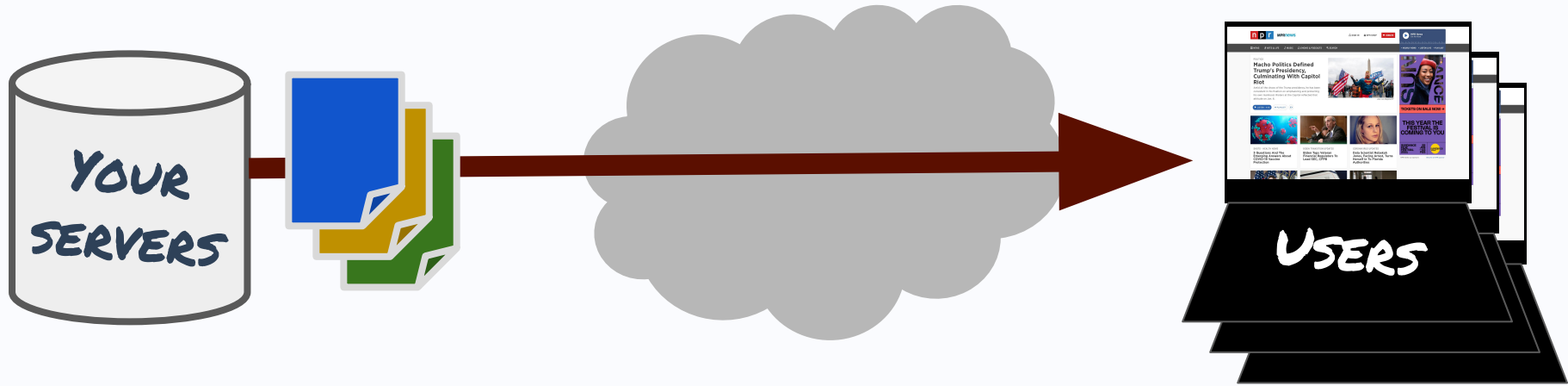
# EXERCISE 2:

## 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
<a href="https://www.npr.org/">https://www.npr.org/</a> <i>Publicly Funded</i>	0.9	2	0.001	1	2	1	1
<a href="https://www.cnn.com/">https://www.cnn.com/</a> <i>Advertising Funded</i>	2	5.5	0.159	4	4	3	3
<a href="https://www.nytimes.com/">https://www.nytimes.com/</a> <i>Subscription Funded</i>	0.9	2.3	0.01	2	2	2	2
<a href="https://www.wsj.com/">https://www.wsj.com/</a> <i>Subscription Funded</i>	0.5	14.8	0.631	3	1	4	4

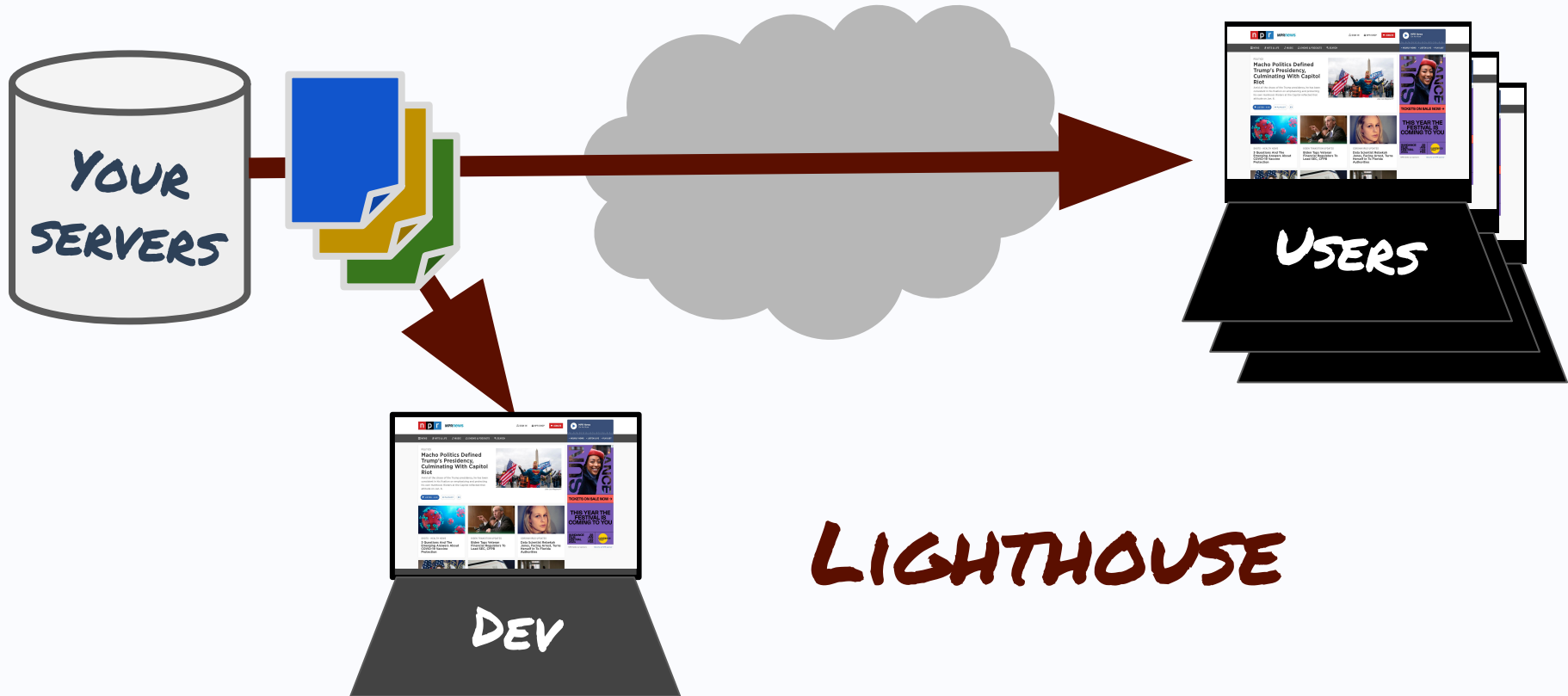


# WHERE DO WE MEASURE FROM?

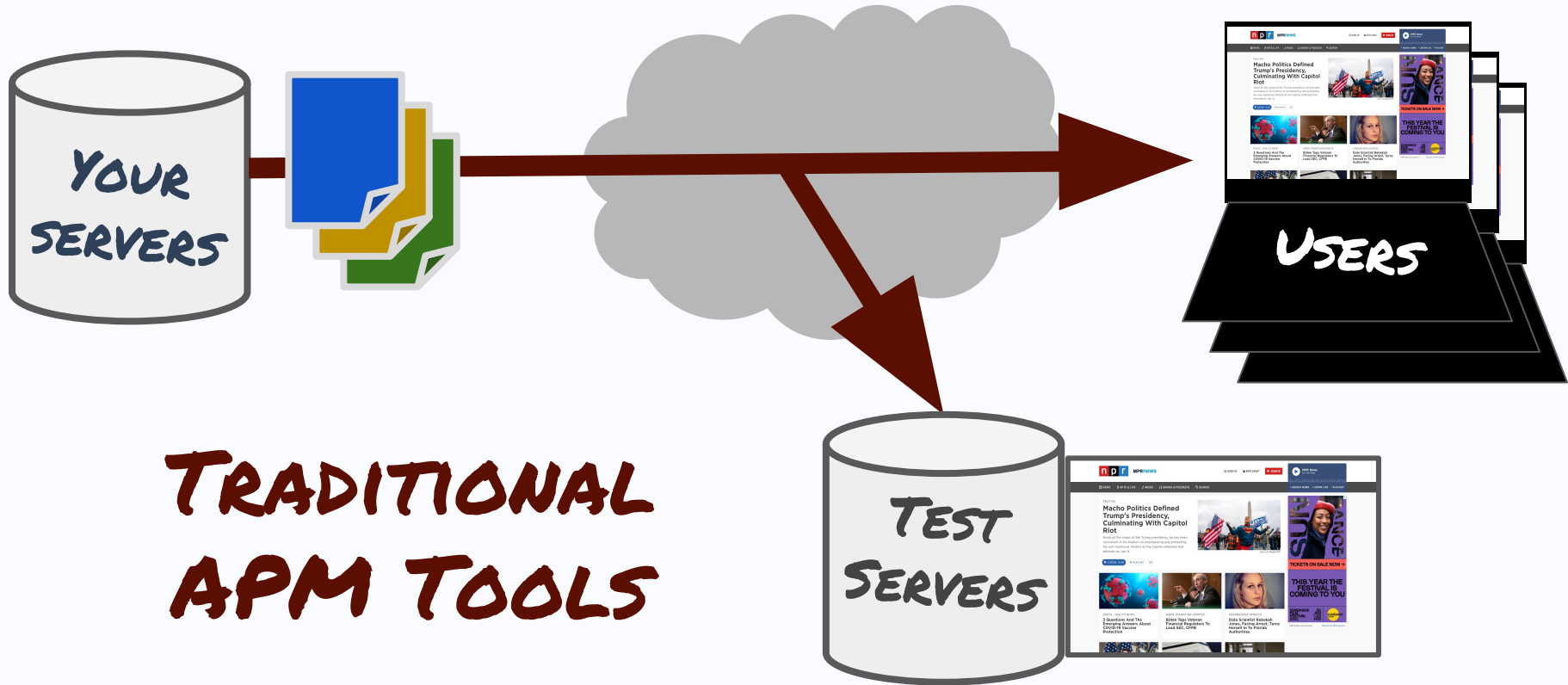


# WHERE DO WE MEASURE FROM?

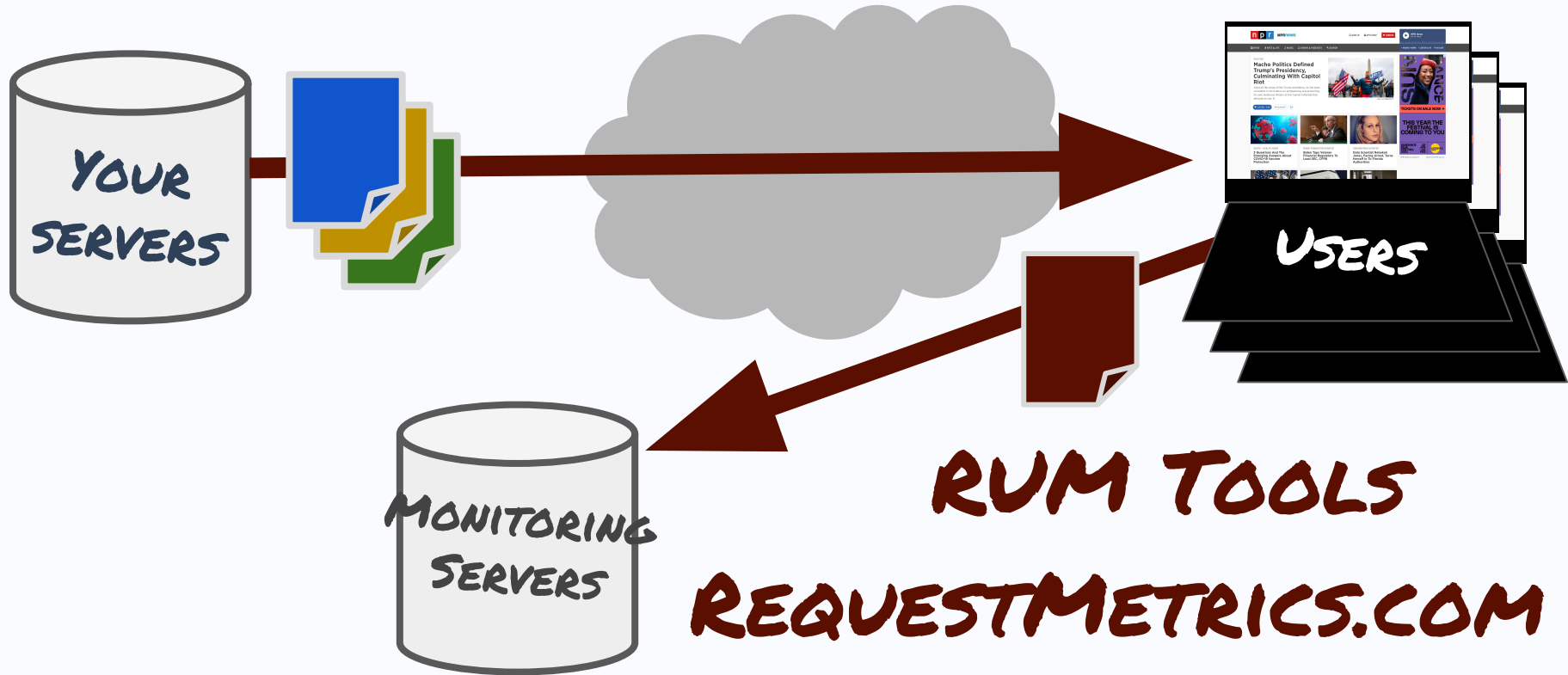
## LAB DATA



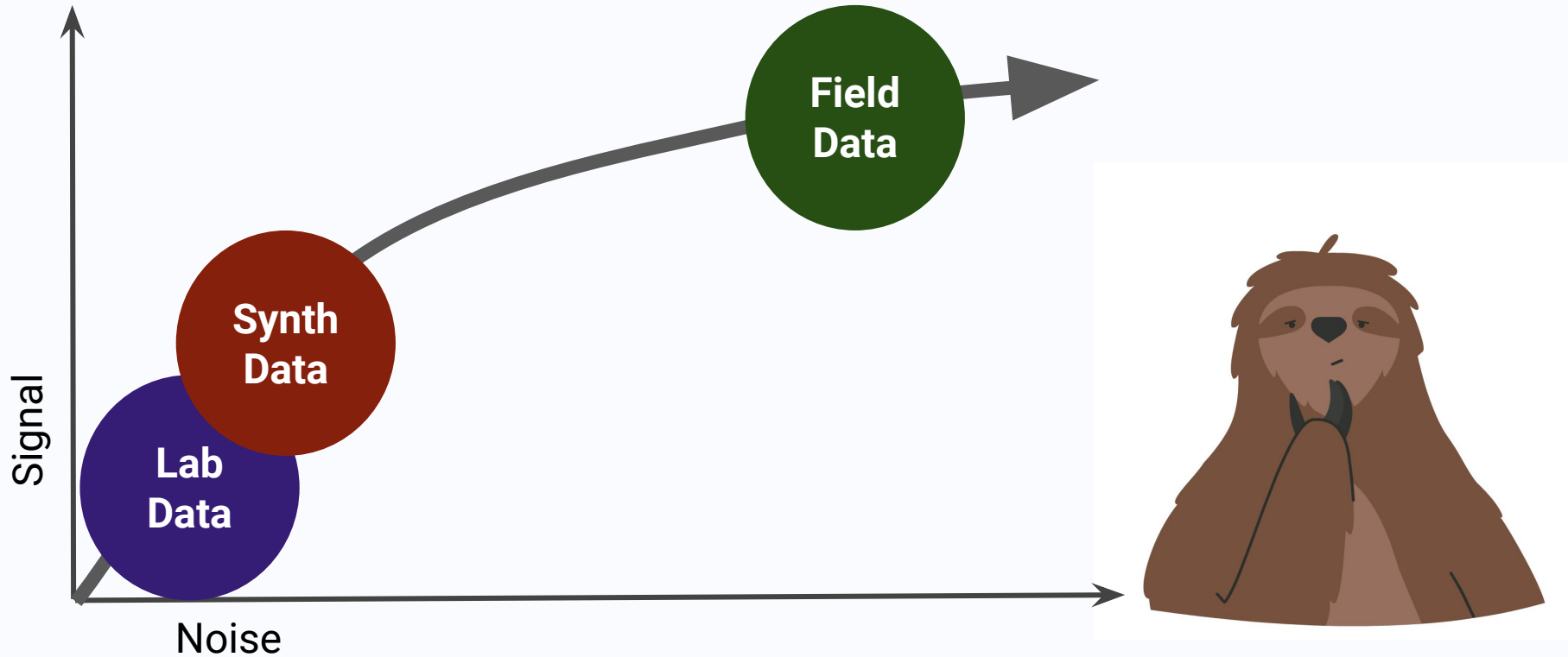
# WHERE DO WE MEASURE FROM? SYNTHETIC DATA



# 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.

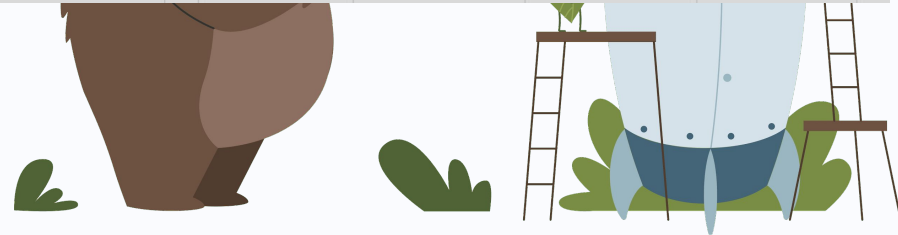




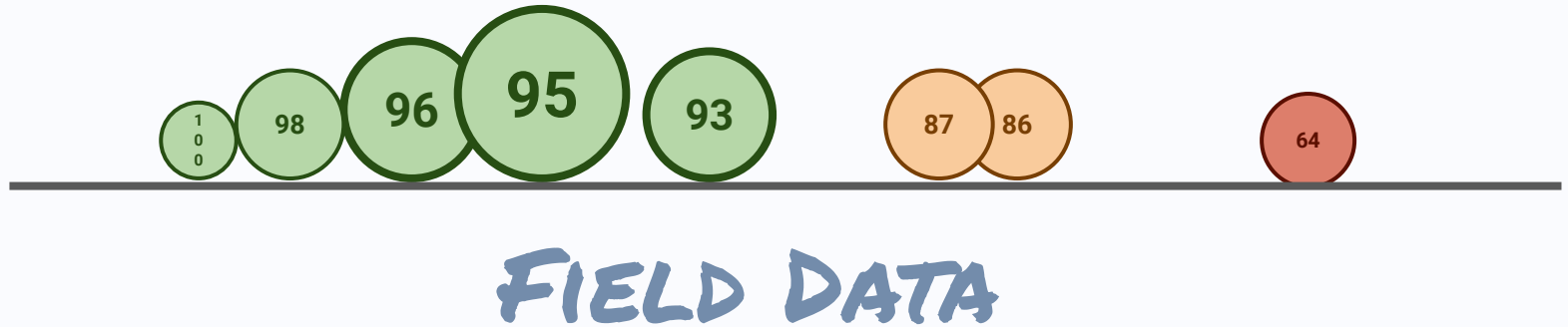
# EXERCISE 3:

## 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
<a href="https://www.npr.org/">https://www.npr.org/</a> <i>Publicly Funded</i>	1.3	3.5	0.05	1	3 -30.77%	3 -42.86%	1 -98.00%
<a href="https://www.cnn.com/">https://www.cnn.com/</a> <i>Advertising Funded</i>	2.4	5	0.63	4	4 -16.67%	4 10.00%	3 -74.76%
<a href="https://www.nytimes.com/">https://www.nytimes.com/</a> <i>Subscription Funded</i>	1.1	2.2	0.13	2	1 -18.18%	1 4.55%	2 -92.31%
<a href="https://www.wsj.com/">https://www.wsj.com/</a> <i>Subscription Funded</i>	1.2	3.4	0.66	3	2 -58.33%	2 335.29%	4 -4.39%

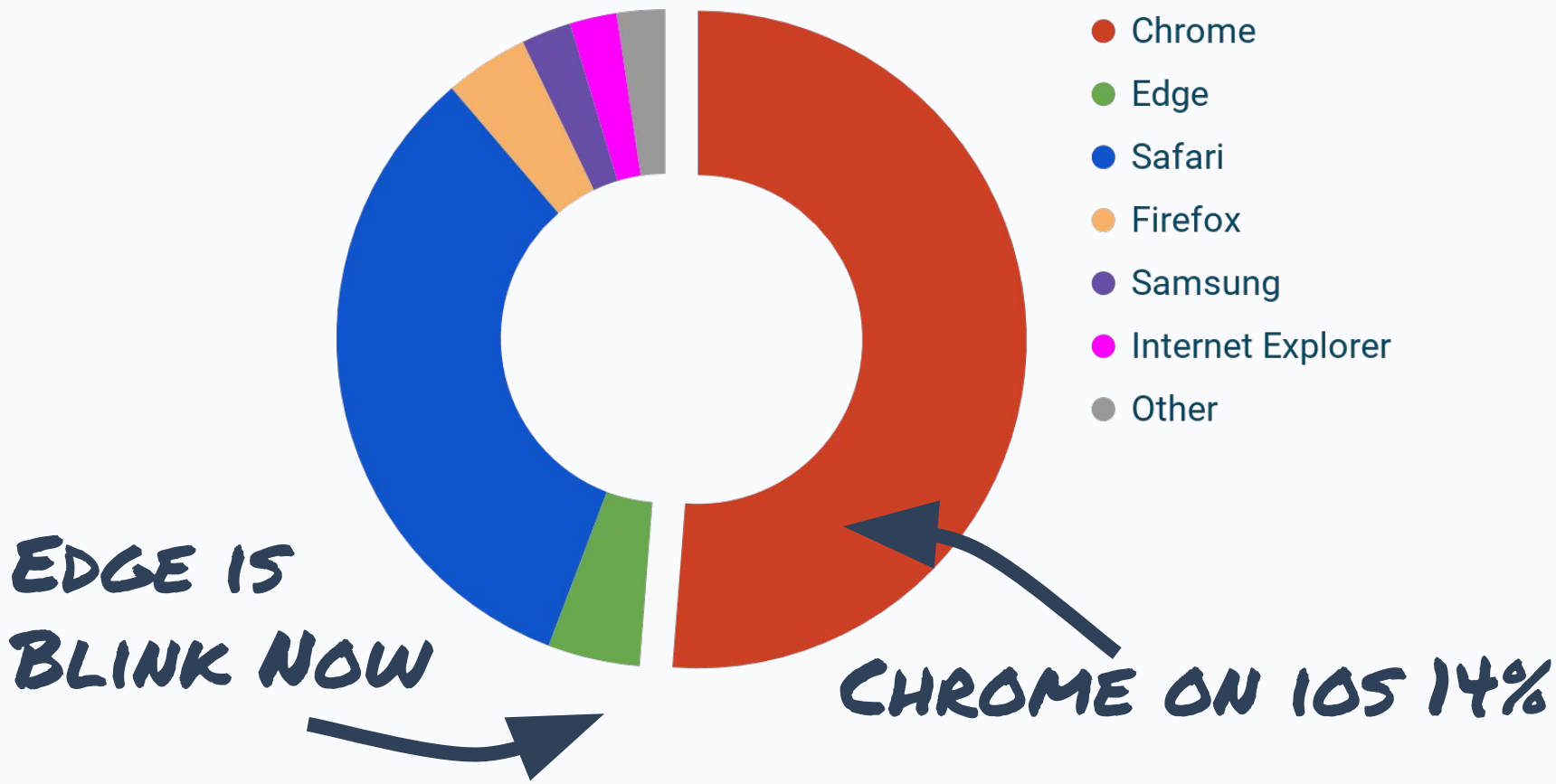


# INTERPRETING FIELD DATA



# 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

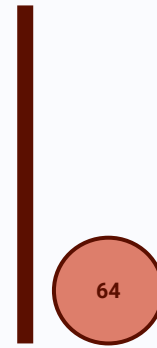
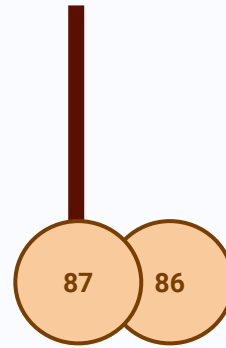
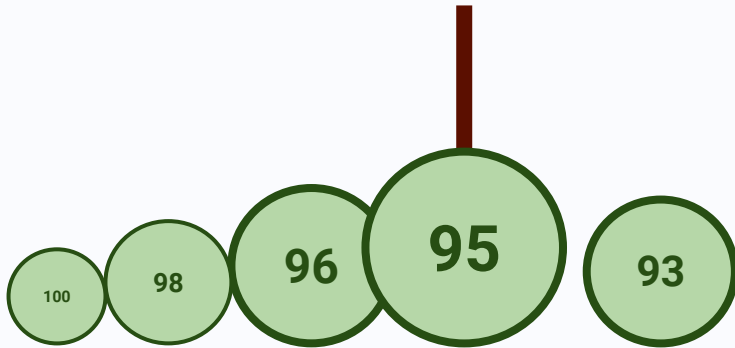
# INTERPRETING FIELD DATA

## MEDIAN AND PERCENTILES

**MEDIAN  
(P50)**

**P75**

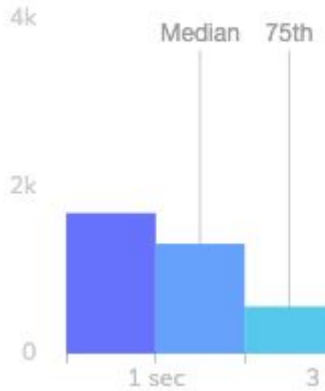
**P95**



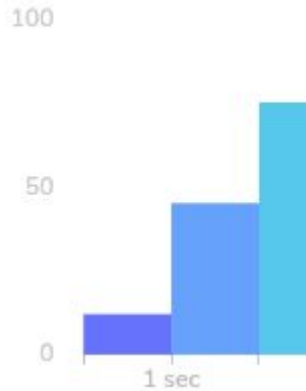
# INTERPRETING FIELD DATA

## MEDIAN AND PERCENTILES

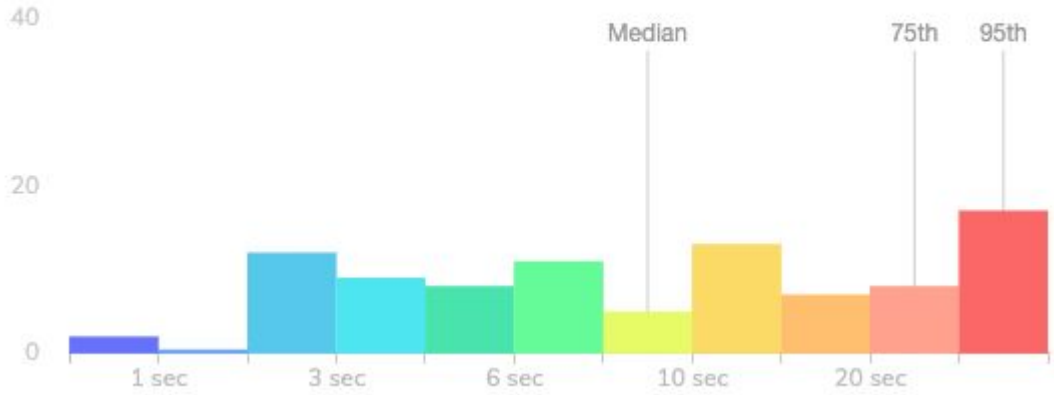
Page Performance Summary



Page Performance Summary



Page Performance Summary



# IMPROVING Web Performance

## PART 1: UNDERSTANDING

- Psychology of performance
- Measuring performance
- Interpreting performance data





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