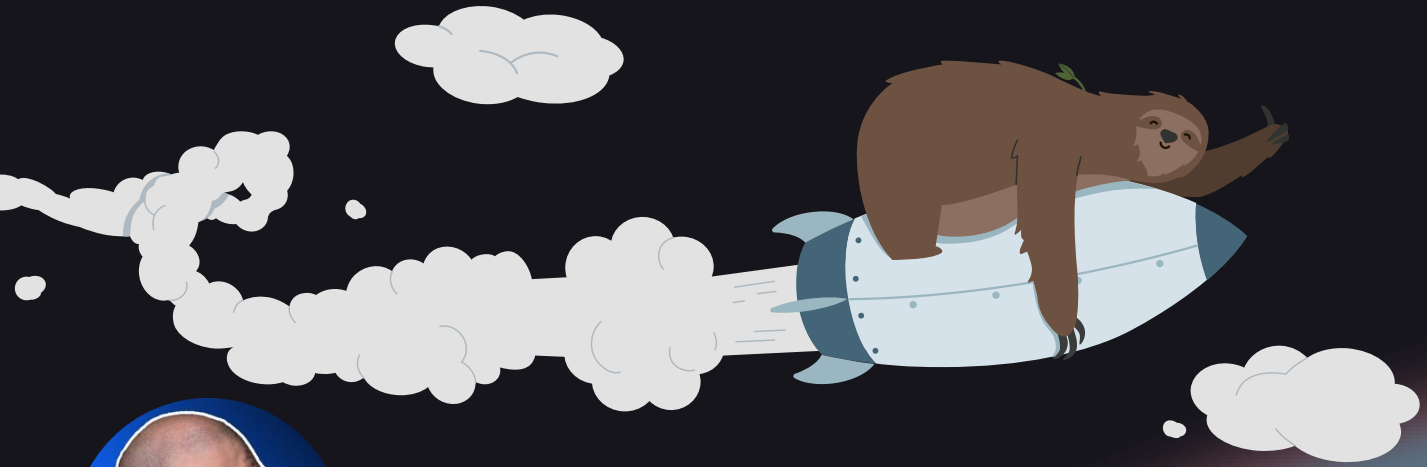
FUNDAMENTALS of Web Performance



Todd H. Gardner
Request Metrics

Workshop Outline

1. Importance
2. Measuring
3. Tests and Tools
4. Setting Goals
5. Improving

Waterfall Charts
Flame Charts
Statistics

Workshop Outline

Requirements

- Github Account
- Google Chrome ~131.0.0
- NodeJS ~20.0

Workshop Outline

Sample Application

bit.ly/fund-web-perf

Workshop Outline

Todd H. Gardner

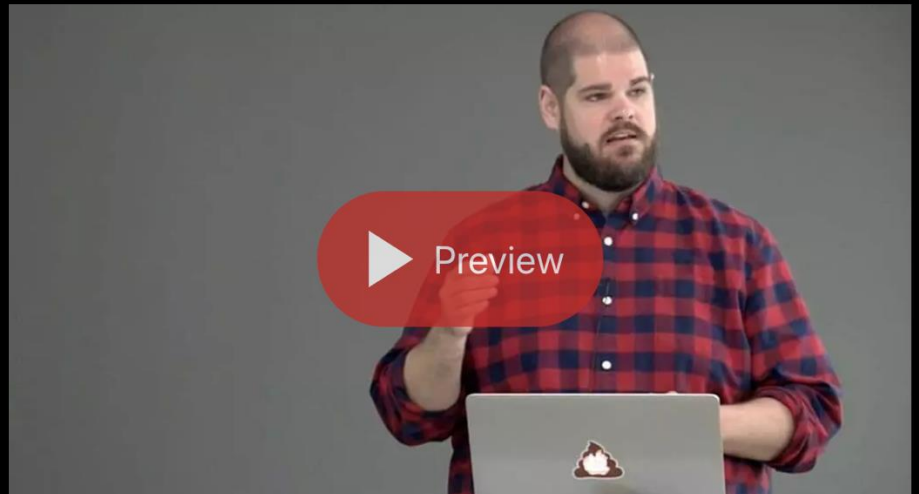
- Software Engineer since 2002
- Frontend Master since 2017
- Consultant and Training
- 2x SaaS Founder

Debugging and Fixing Common JavaScript Errors

Bookmark

Todd Gardner
Request Metrics

3 hours, 39 minutes CC



Course Description

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!

Workshop Outline

Debugging JavaScript Course

bit.ly/debug-javascript

Workshop Outline

Todd H. Gardner

TRACKJS®

JavaScript Error Monitoring

TrackJS.com

Workshop Outline

Todd H. Gardner

REQUEST METRICS

Web Performance Monitoring

RequestMetrics.com

Workshop Outline

Todd H. Gardner

bit.ly/sup-todd

Introducing
Web Performance

FUNDAMENTALS of
Web Performance

Todd H. Gardner

Definition

The **speed** and **efficiency** with which a website **loads**, **renders**, and **responds to interactions** from the visitors.

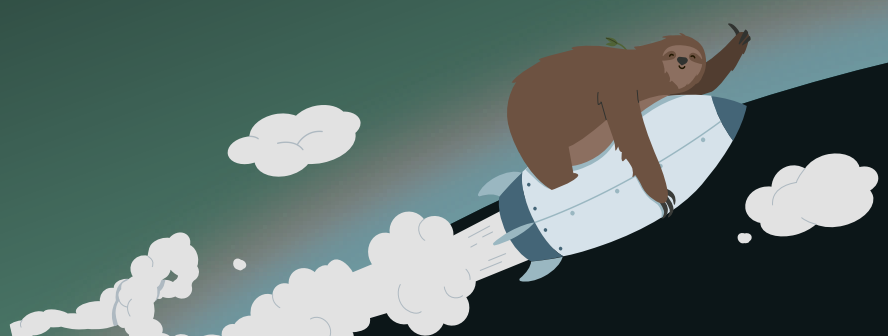
What does Slow feel like?

- Waiting for the page to load
- Elements jump around
- Delays to click responses
- Slow images and video
- Laggy scrolling and animations

What does *Slow* feel like?

Developer Stickers Online

http://eu.devstickers.shop:3000/



Workshop Outline

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Workshop Outline

Importance

- User Experience
- SEO
- Online Advertising

Why is Web Performance Important?

Todd H. Gardner

So your users don't try to strangle you.

Why is Web Performance Important

User Experience

How well your website meets or exceeds user expectations

Todd H. Gardner

Why is Web Performance Important

User Experience

The key to happiness is
low expectations

Why is Web Performance Important

User Experience

websites would be so much easier without these needy users

Todd H. Gardner

User Expectations

"for effective communication, some response is needed within **two seconds of a request**.

A wait longer than two seconds
breaks concentration
and affects productivity."

Source: IEEE Response Times, Miller

User Expectations

- A user feels a response is **instant** at **.01 second**.
- A user experiences **uninterrupted flow** at **1 second**.
- Users break flow and **feel frustration** at **10 seconds**.

Source: Usability Engineering, Neilsen

User Expectations

- **40% of users abandon** a site at 3 seconds

- **75% of users** that experience a “slow” site **will not return**

Source: Time is Money, Everts

SEO
Search Engine Optimization

Why is Web Performance Important / SEO

Search Engine Optimization

Helping search engines understand and **rank** your content

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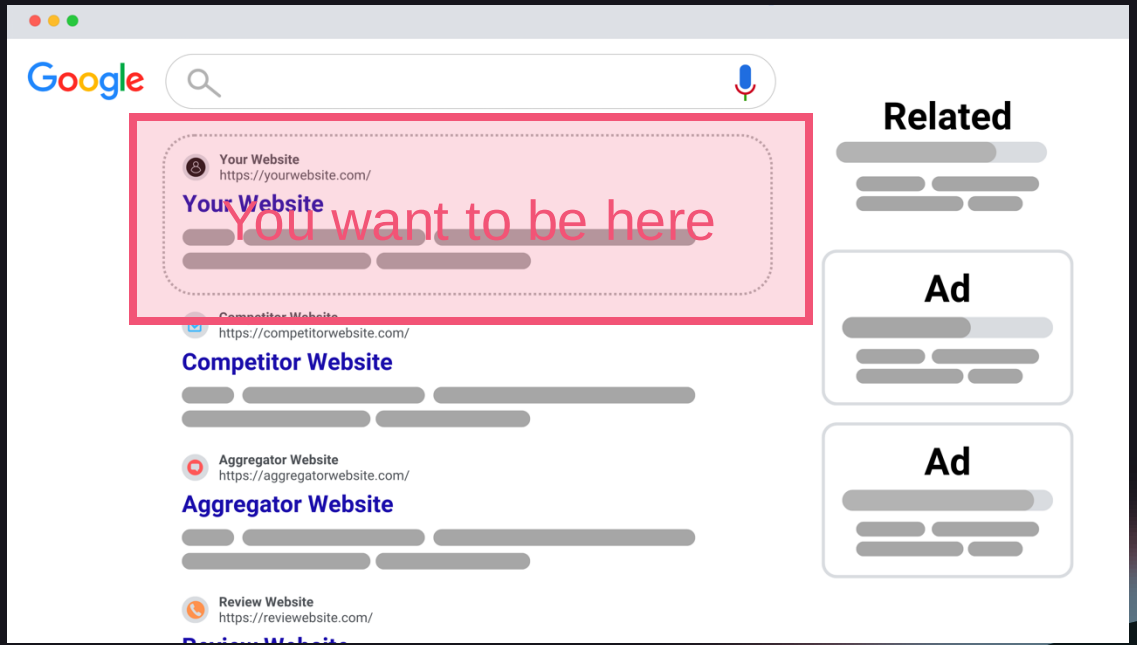
Why is Web Performance Important / SEO

Page Rank



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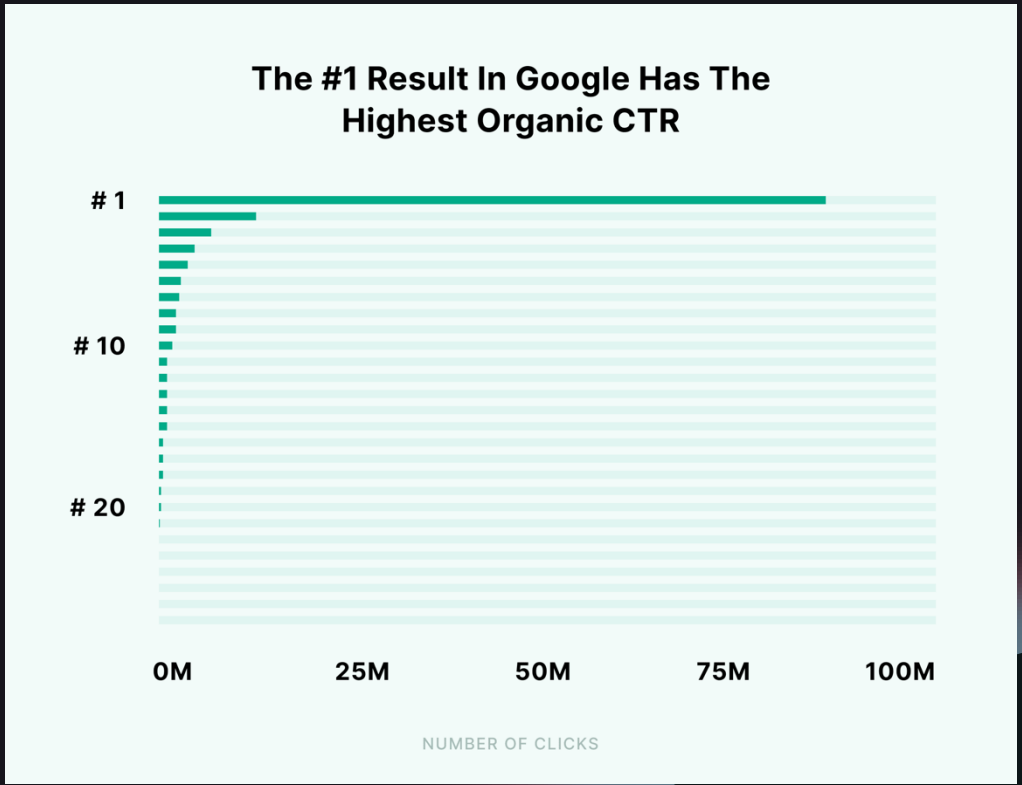
Why is Web Performance Important / SEO

Rank Traffic



Source: backlink.io

SEO and Performance

Great, what does this have to do with web performance?

SEO and Performance

"Search ranking change that incorporates **page experience metrics**. We will introduce a new signal that combines **Core Web Vitals** with our existing signals"

Source: Google Search Central Blog

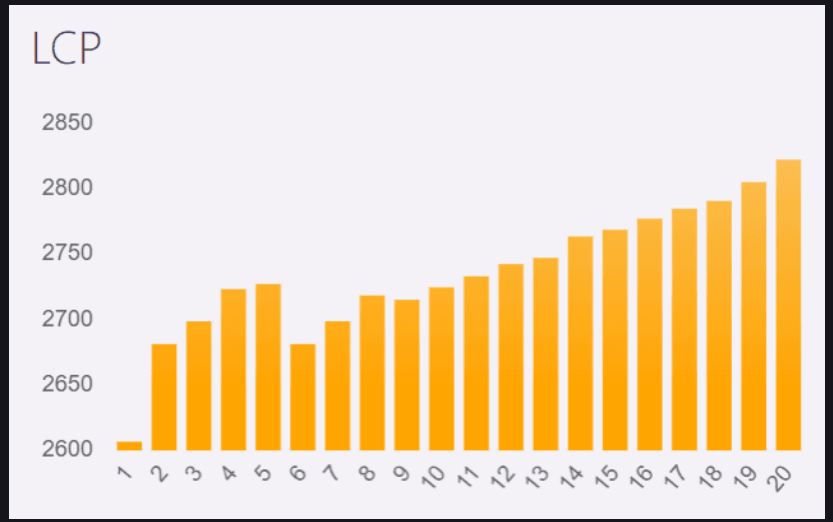
SEO and Performance

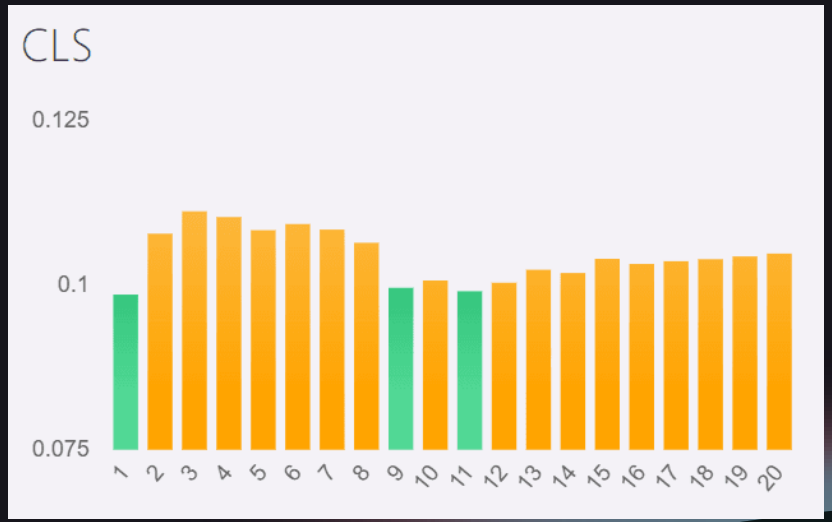
TL;DR

You need to be **fast**
to **rank well**.

Why is Web Performance Important / SEO

Page Rank and Performance





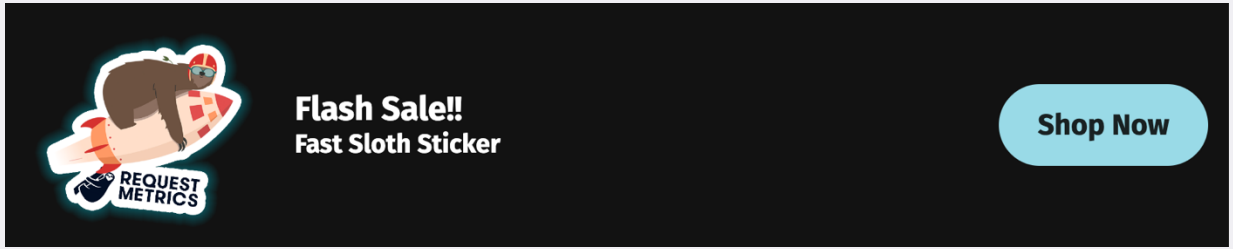
Source: Advanced Web Ranking, 2022

Online Advertising

Why is Web Performance Important / Online Ads

Some website

We’re awesome because of content



The content you actually came here for. Good content is the foundation of any successful website or marketing strategy.

An example

- $1,000
- 160,000 impressio
- 1% click through

Source: Varos

An example

- $1,000
- 1,600 Users
- 60% Bounce Rate

- 640 Shoppers
  - $1.56 per shopper
  - **960 Lost**

Source: Varos

Performance and Bounce

65% Performance improvement reduced **bounce rate 20%** and **200% time on page**.

Source: Furnspace

An example

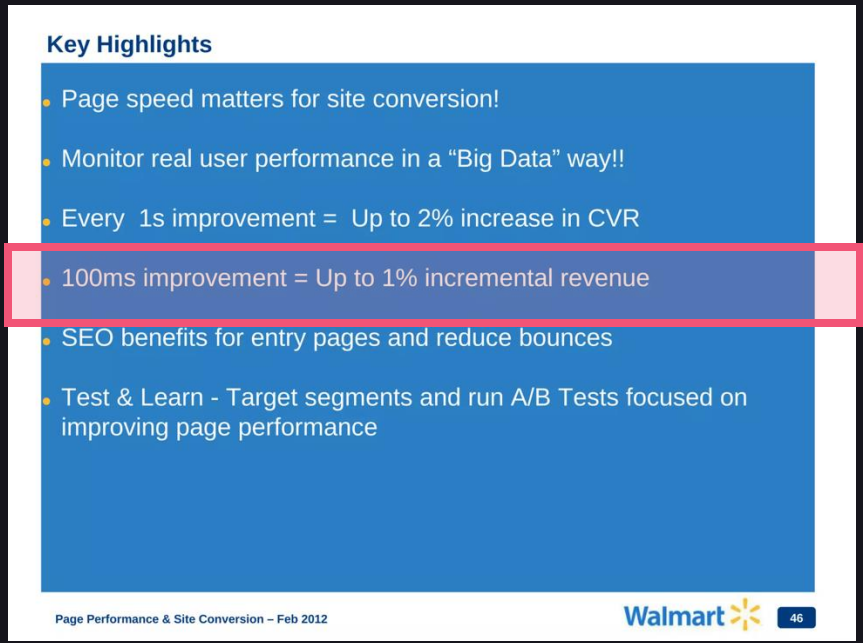
- $1,000
- 1,600 Users
- **48% Bounce Rate**

- 832 Shoppers
  - **NET 192 Shoppers**
  - **$1.20 per shopper**

Website Revenue

Why is Web Performance Important / Revenue

Walmart



“Walmart revenue for the twelve months ending July 31, 2024 was $665.035B

$6 Billion Dollars

Source: Walmart

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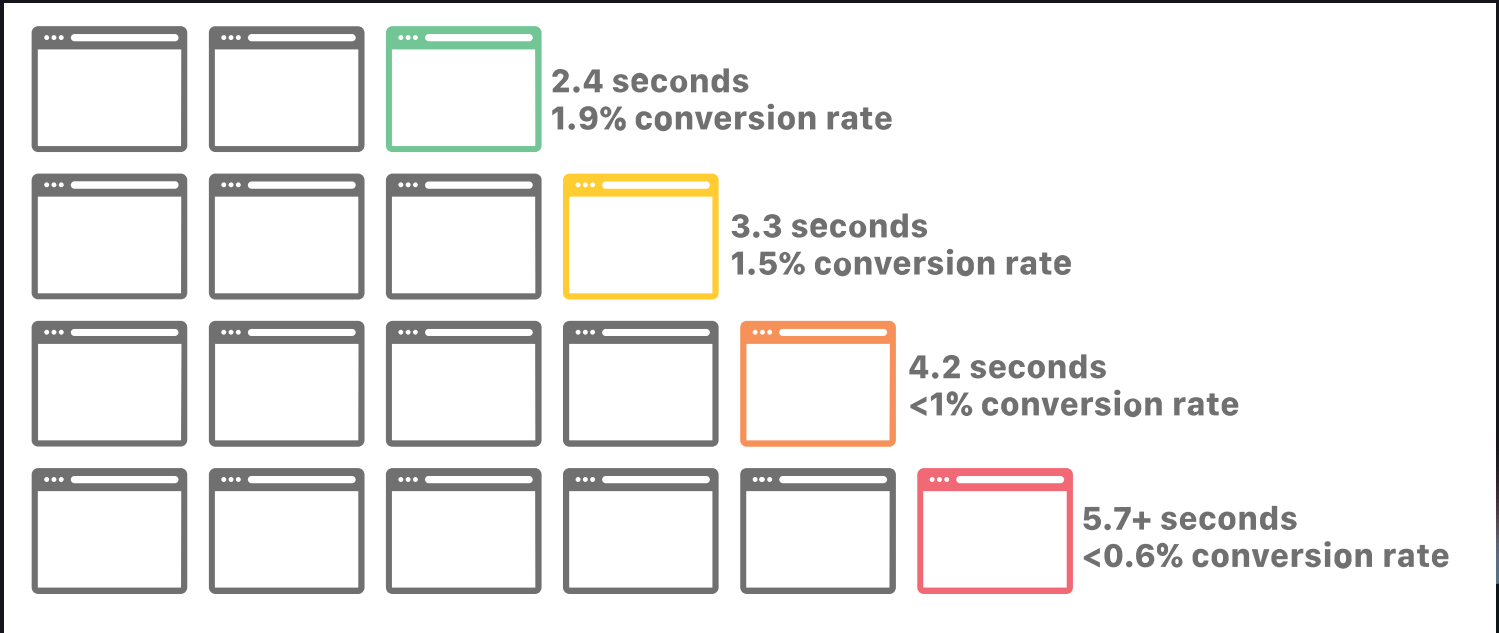
Why is Web Performance Important / Revenue

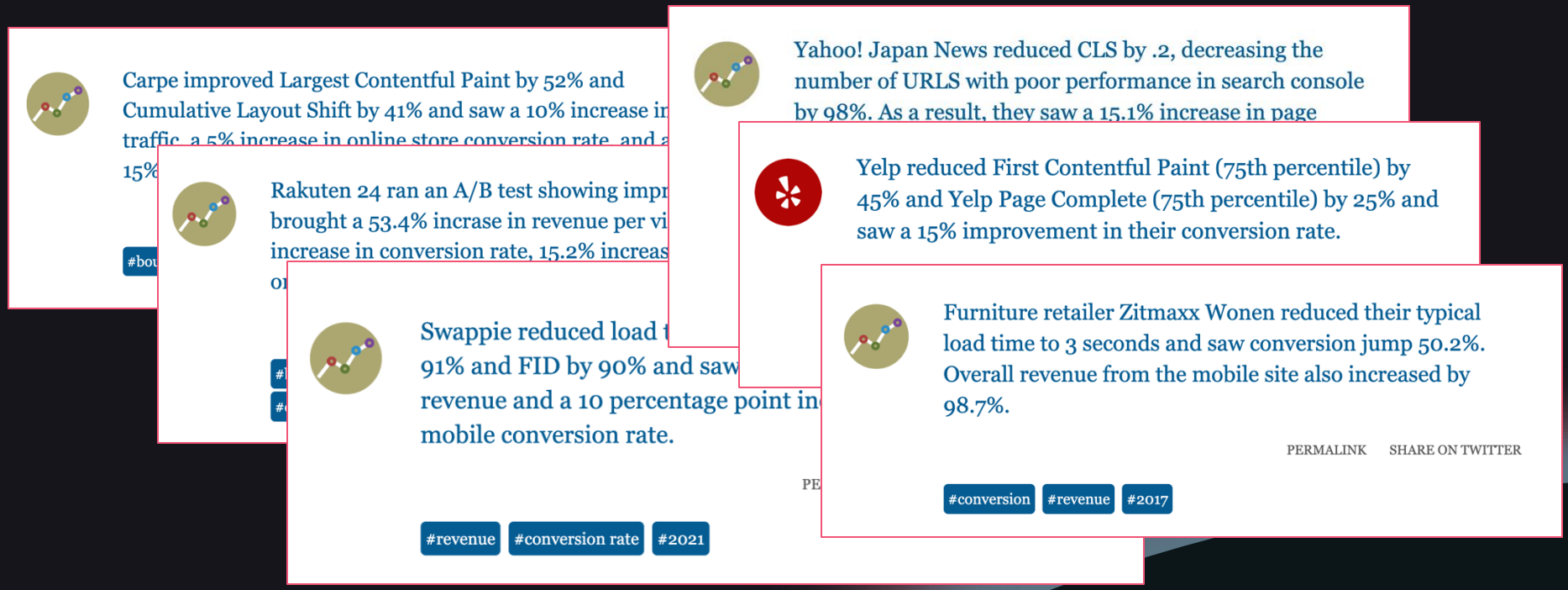
Skilled.co Job Board



Source: Cloudflare

Why is Web Performance Important / Revenue

WPOStats



Source: [WPOStats]

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Workshop Outline

~~1. Importance~~

2. Measuring

3. Tests and Tools

4. Setting Goals

5. Improving

Waterfall Charts

Flame Charts

Statistics

Workshop Outline

Measuring

- Legacy Metrics
- Core Web Vitals
- More Metrics
- Capturing Metrics
- Browser Support

Waterfall Charts

Flame Charts

Measuring Web Performance

FUNDAMENTALS of Web Performance

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How do we measure “fast”?

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Reading Waterfall Charts

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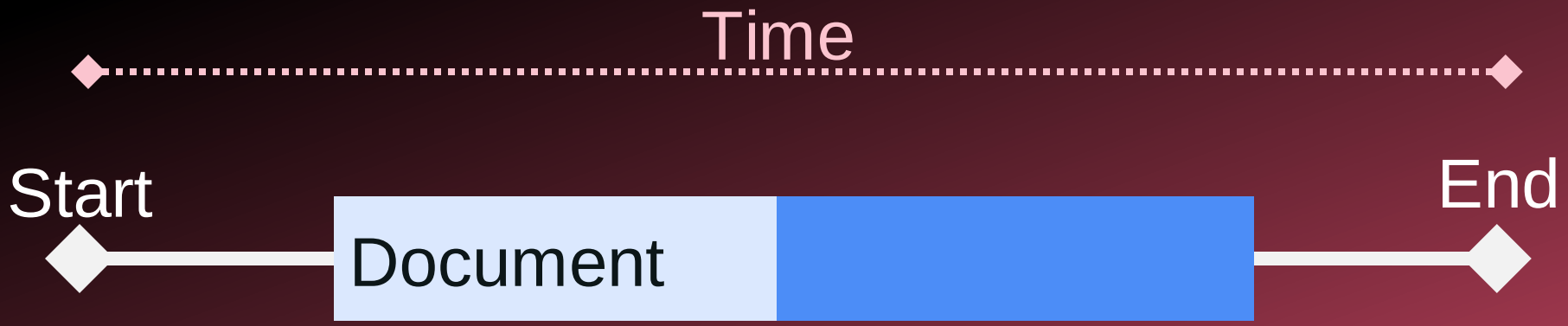
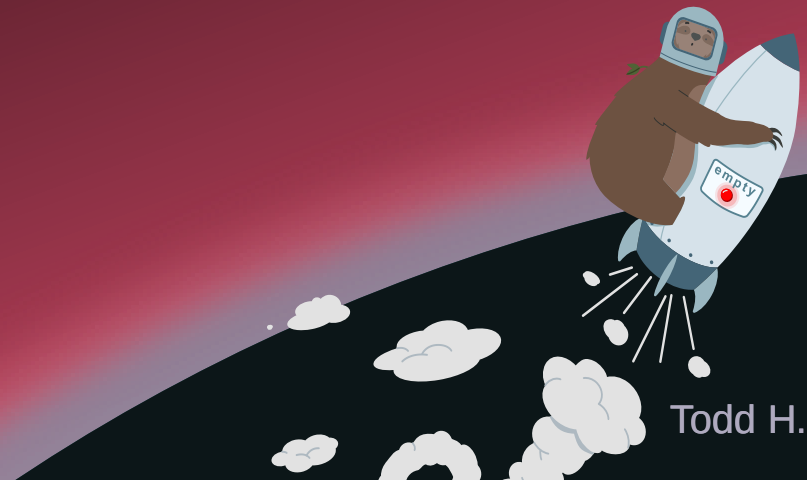
Measuring Web Performance

Waterfall Charts





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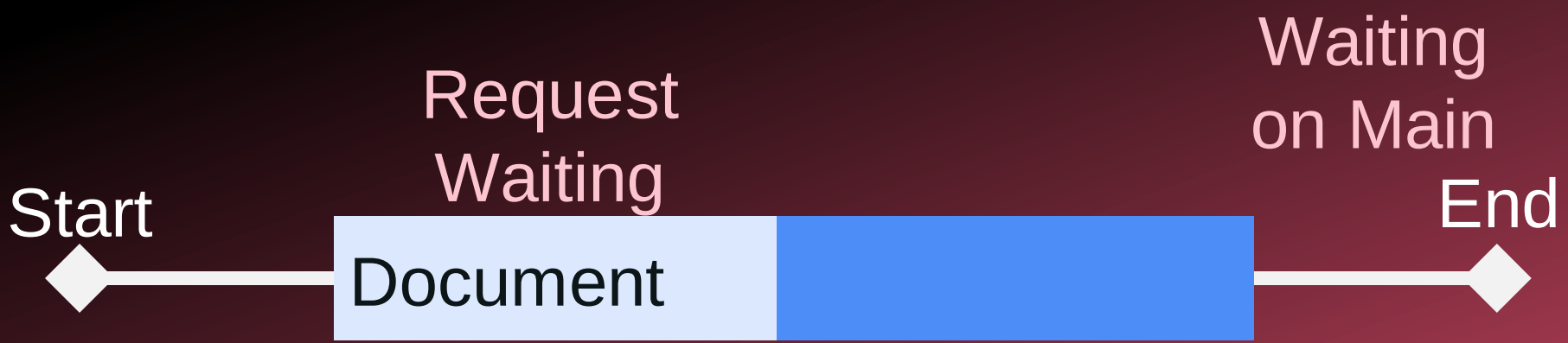
Aside

Measuring Web Performance

Waterfall Charts



Aside

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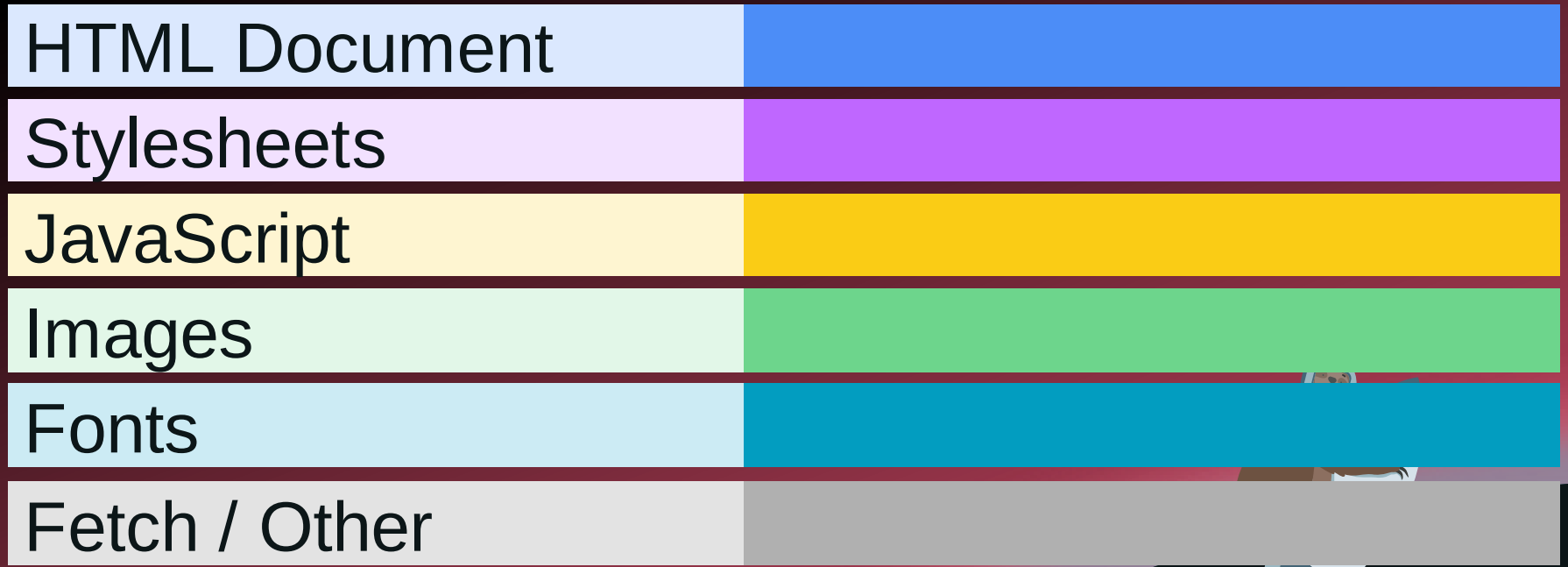
Measuring Web Performance

Waterfall Charts



Aside

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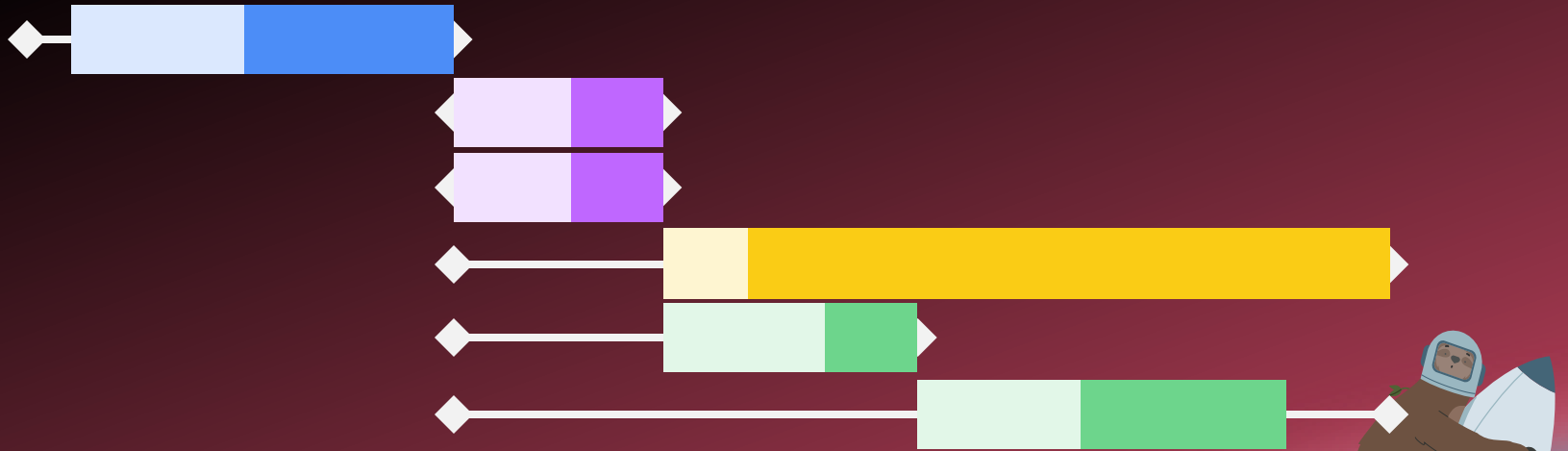
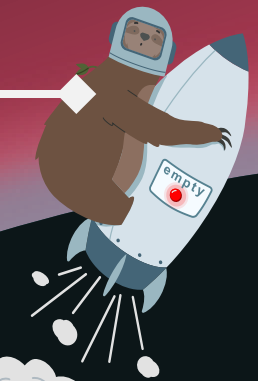
Measuring Web Performance

Waterfall Charts





Aside

Todd H. Gardner

Workshop Outline

Measuring

- **Legacy Metrics**
- Core Web Vitals
- More Metrics
- Capturing Metrics
- Browser Support

~~Waterfall Charts~~

Flame Charts

Legacy Metrics
DOMContentLoaded

DOMContentLoaded

The HTML downloaded and deferred scripts have executed.

Sources: MDN

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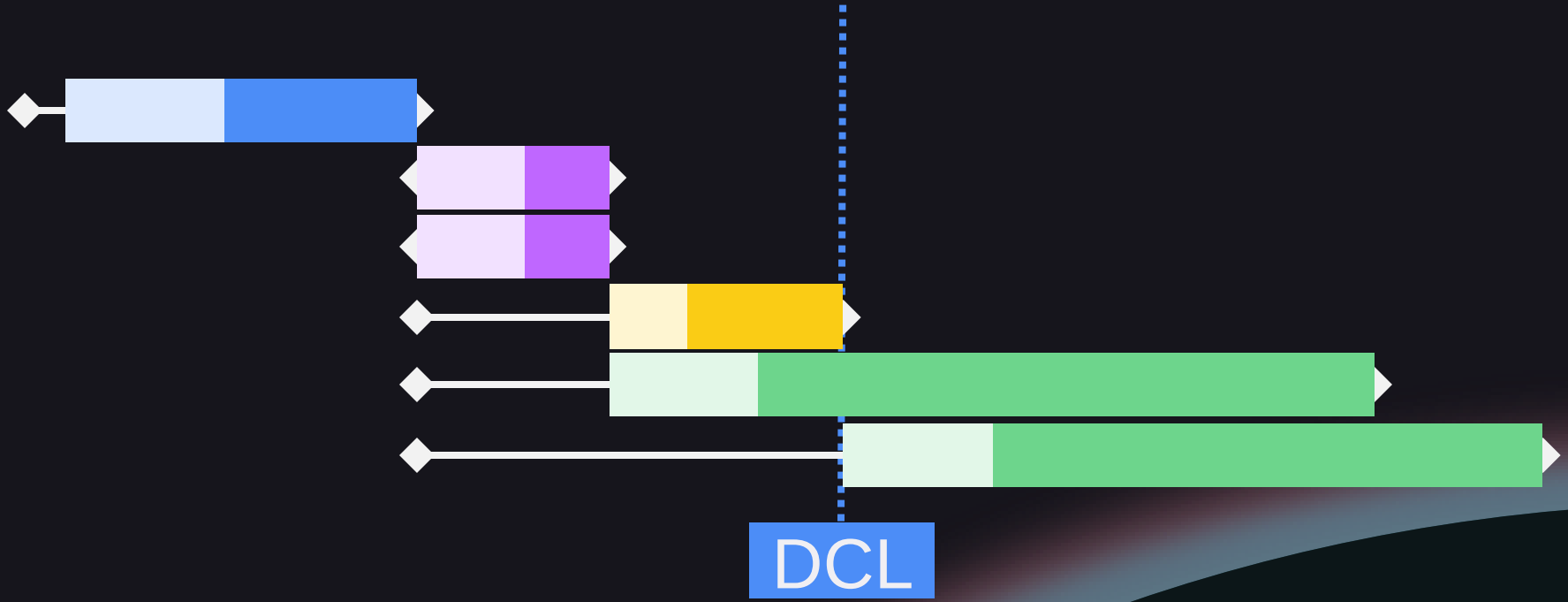
Measuring Web Performance / Legacy Metrics

DOMContentLoaded



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DOMContentLoaded

DCL

When to Use DOMContentLoaded

The structure of the page is done, but images may not be displayed.

DOMContentLoaded

```
1
2  window.addEventListener("DOMContentLoaded", (evt) ⇒ {
3    console.log(`DOMContentLoaded at ${evt.timeStamp} ms`);
4  });
5
6  //> DOMContentLoaded at 1807.4000000059605 ms
7
```

Legacy Metrics
Load

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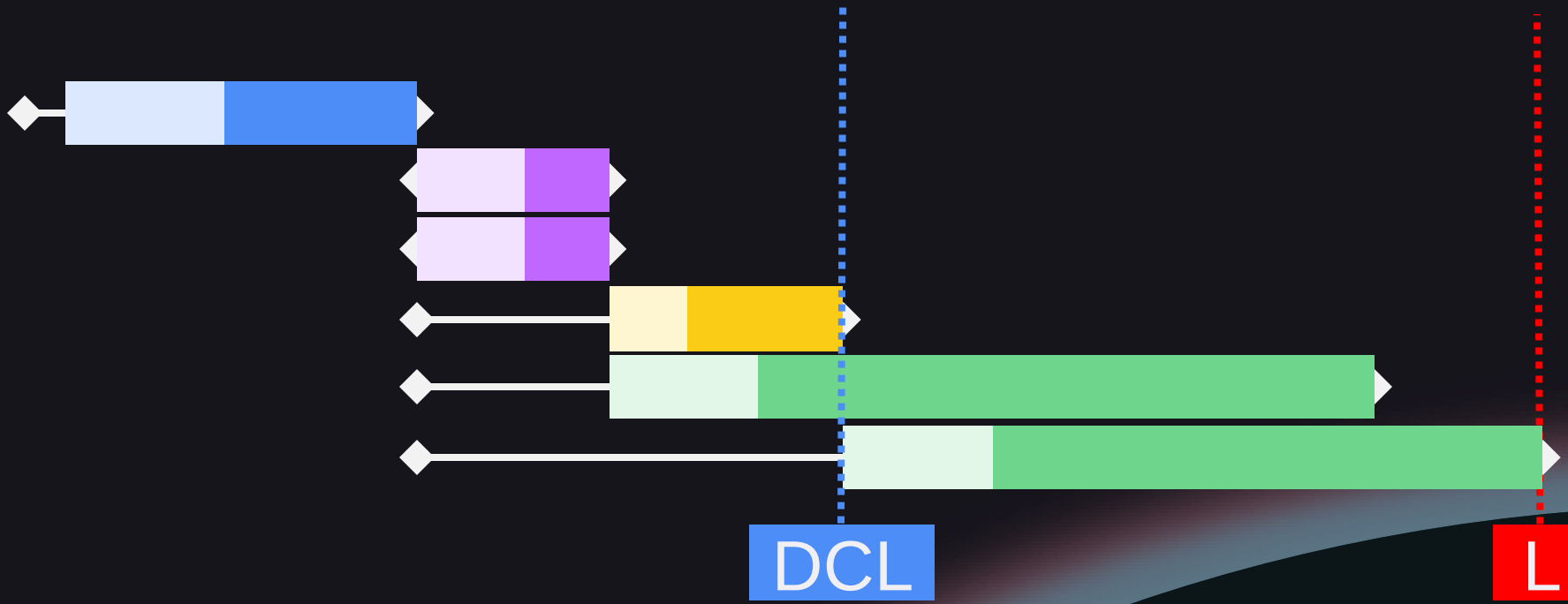
Load

The HTML and all **known** resources have been downloaded and rendered,

except those that are lazy-loaded.

Sources: MDN

Load



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Load


Join GeoCities
Neighborhoods
Members' Area
Shopping Center
Search
Welcome to
GeoCities
FREE e-mail
FREE web pages
amazon.com
SURPLUS DIRECT
CDNOW
9.99%** Platinum
Explore Our GeoAvenues
GeoNews Center
Arts & Literature
Literature, Poetry, Theater
Autos
Car Clubs, Racing, Sports Cars
Business & Money
Consulting, Investing, Small Business
Campus Life
Colleges, College Sports, Social Life
Computers & Technology
HTML, Software, Hardware
Entertainment
Movies, Music, TV, Games
Family & Kids
Family, Genealogy, Parenting, Pets
Home & Living
Health, Home Improvement, Recipes
People & Chat
Romance, Gay & Lesbian, Teens
Shopping
Bargain Hunting, Books, Free Stuff
Society
Culture, Environment, Politics
Sports & Recreation
Baseball, Soccer, Extreme Sports
Travel
Cruises, Asia, Europe, Vacation
Women
Careers, Issues, Pregnancy
GeoPoll
World Report
Leader of the Month

DCL

L

When to Use Load

The document is **ready** and update and reporting tasks can begin.

Load

```
8
9   window.addEventListener("load", (evt) => {
10    console.log(`Load at ${evt.timeStamp} ms`);
11  });
12
13  //> Load at 17117 ms
14
```

The Problem with Legacy Metrics

Todd H. Gardner

The Problem with Legacy Metrics

What Load *Originally* Meant:

Document is Ready

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What Load Originally Meant

```
14
15  /**
16   * Get the Cart Items and update the item count in the header.
17   * jQuery Syntax like it's 2008
18   */
19  $(document).ready(function() {
20    $.ajax("/cart", {
21      complete: function(data) {
22        $("#cart-count").val(data.length)
23      }
24    });
25  });
26
```

Source: jQuery

Then, 2010 Happened

Client-Side Rendering Single-Page Applications

Todd H. Gardner

Single Page Applications

```
27
28  <html>
29    <body>
30      <div id="app"></div>
31      <script>
32        $(document).ready(function() {
33          define('application.js', function (app) {
34            app.initialize("#app");
35          })
36        })
37      </script>
38    </body>
39  </html>
40
```

Single Page Applications

DCL

L

The Problem with Legacy Metrics

Users are more likely to
stay on a fast website.

Google

Source: Google Search Central Blog

The Problem with Legacy Metrics

How do we know if foo.com
is faster than bar.com?

Google

Source: Google Search Central Blog

Workshop Outline

Measuring

- ~~Legacy Metrics~~
- **Core Web Vitals**
- More Metrics
- Capturing Metrics
- Browser Support

~~Waterfall Charts~~

Flame Charts

Google's Core Web Vitals

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Measuring Web Performance

Core Web Vitals

1. how fast your site visibly loads
2. how smooth things load
3. how quickly users can interact

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Measuring Web Performance

Core Web Vitals

1. Largest Contentful Paint (LCP)
2. Cumulative Layout Shift (CLS)
3. Interaction to Next Paint (INP)

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Page Rank

"**Search ranking** incorporates the [**Core Web Vital**] page experience metrics."

Source: Google Search Central Blog

LCP
Largest Contentful Paint

Largest Contentful Paint

How fast your site visibly loads the **most important** element

Source: Request Metrics

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Largest vs Important

Google doesn’t trust you.

Todd H. Gardner

What is the Largest?

- <img>
- <video>
- css:background-image
- Text Elements

Source: Google Chrome Source

What is the Largest?

- Opacity > 0
- Size < 100%
- Low Entropy Images < 0.05

Source: Google Chrome Source

WTF is Entropy

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Bits per Pixel

Unencoded
3.9MB
31,101,368 bytes

Full Size
2800 x 1200
3,360,000 Pixels

Entropy
31M / 3.3M
9.39

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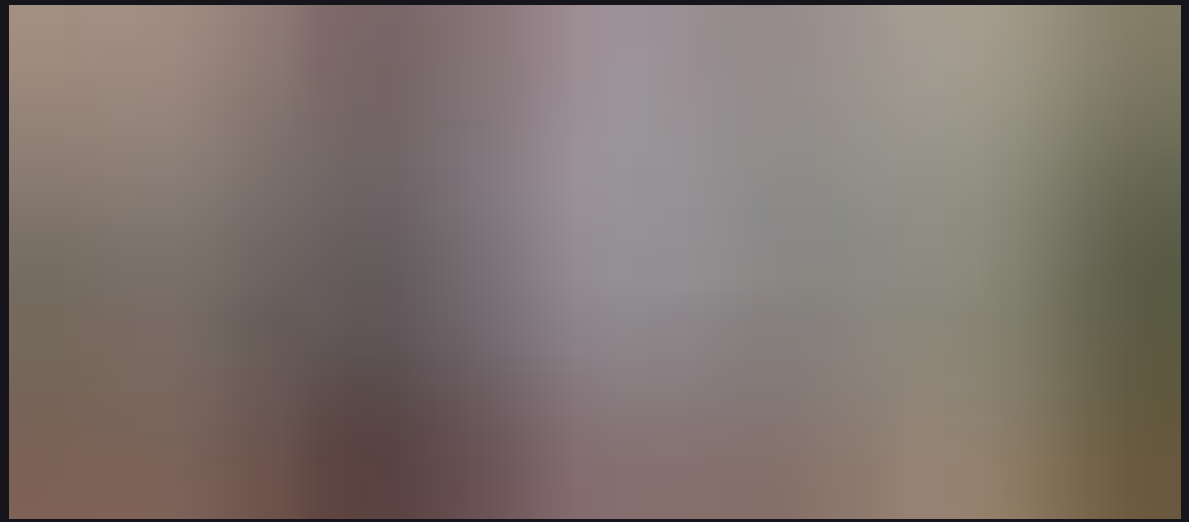
Bits per Pixel



Entropy
17 / 17K
0.001

Unencoded
17 bytes

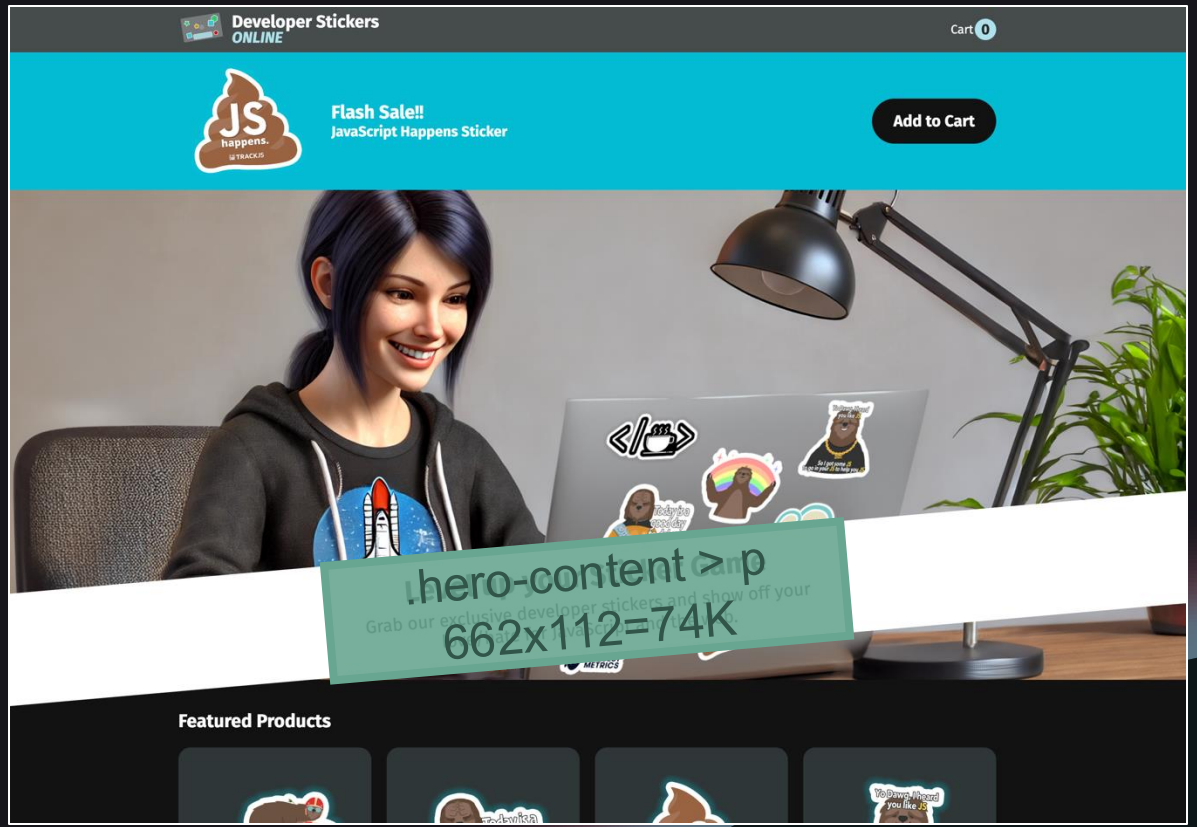
Full Size
200 x 88
17,600 Pixels

Todd H. Gardner

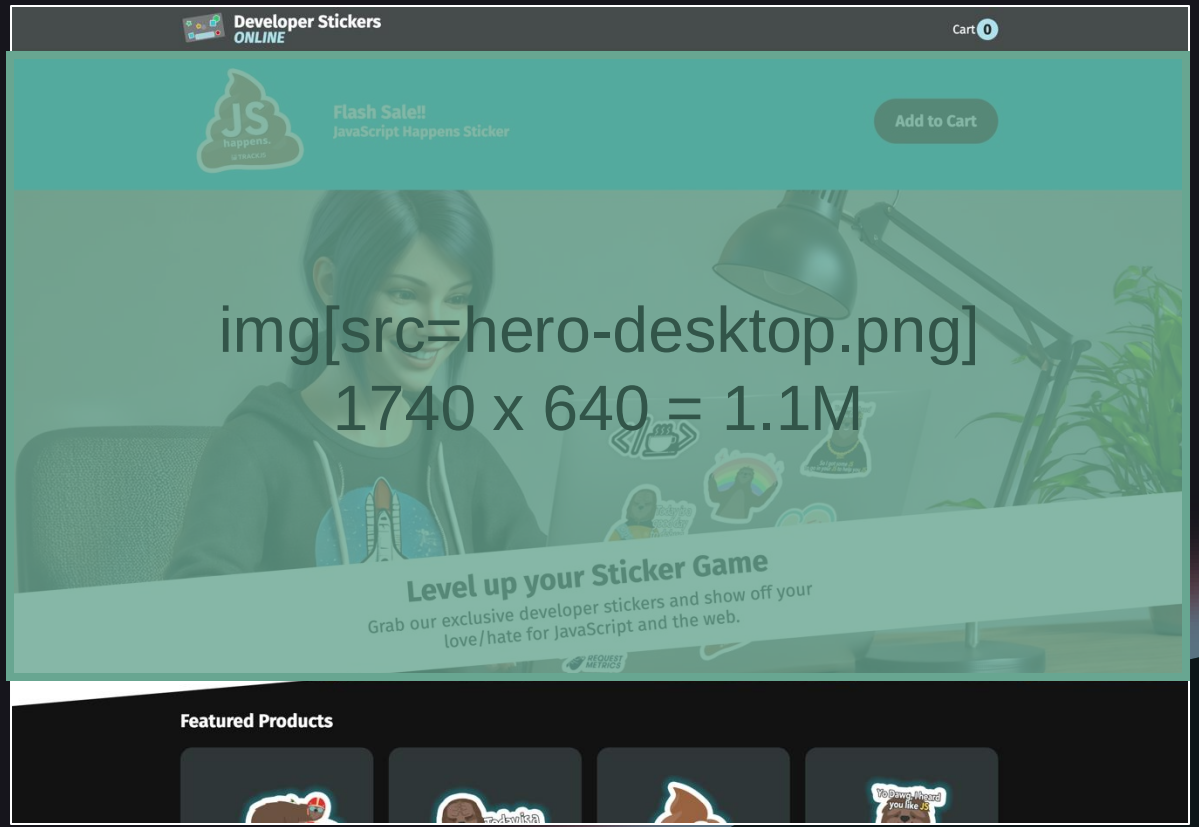
Bits per Pixel

```
40
41  console.table(
42    [...document.images].map((img) => {
43      const entry = performance.getEntriesByName(img.currentSrc)[0];
44      const bytes = (entry?.encodedBodySize * 8);
45      const pixels = (img.width * img.height);
46      return { src: img.currentSrc, bytes, pixels, entropy: (bytes / pixels) };
47    })
48  )
49
```

What is the Largest?



What is the Largest?



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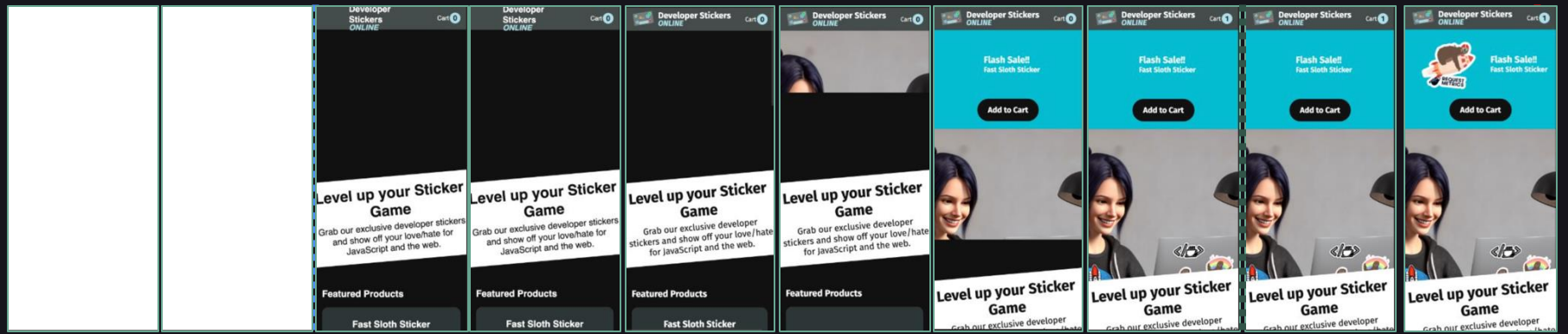
Sequence



DCL

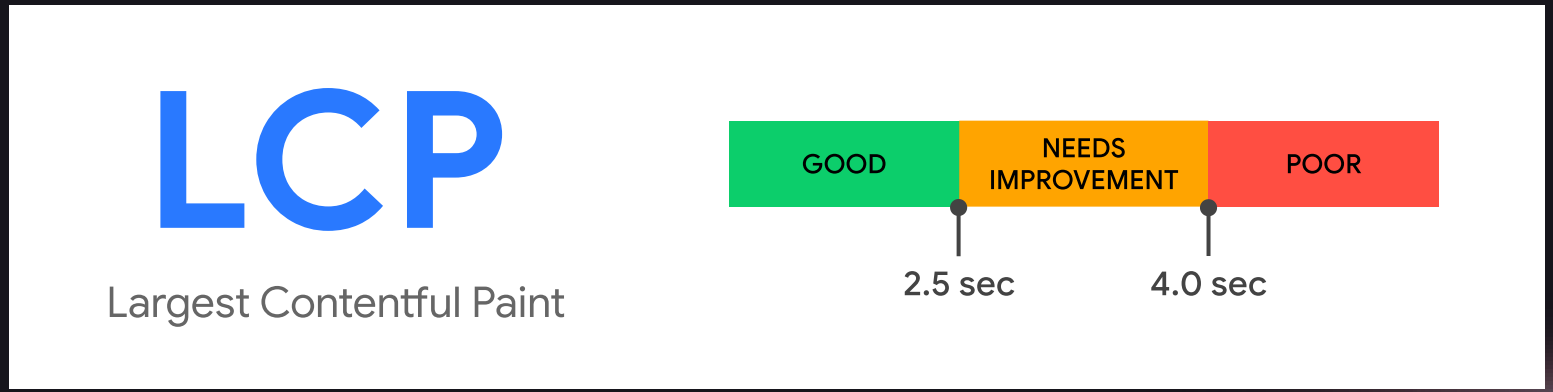
LCP

L

Considerations

- Stops after first user interaction

What is a Good Score (to Google)?



Source: web.dev

CLS
Cumulative Layout Shift

Cumulative Layout Shift

How smooth and predictably elements load into the page

Source: Request Metrics

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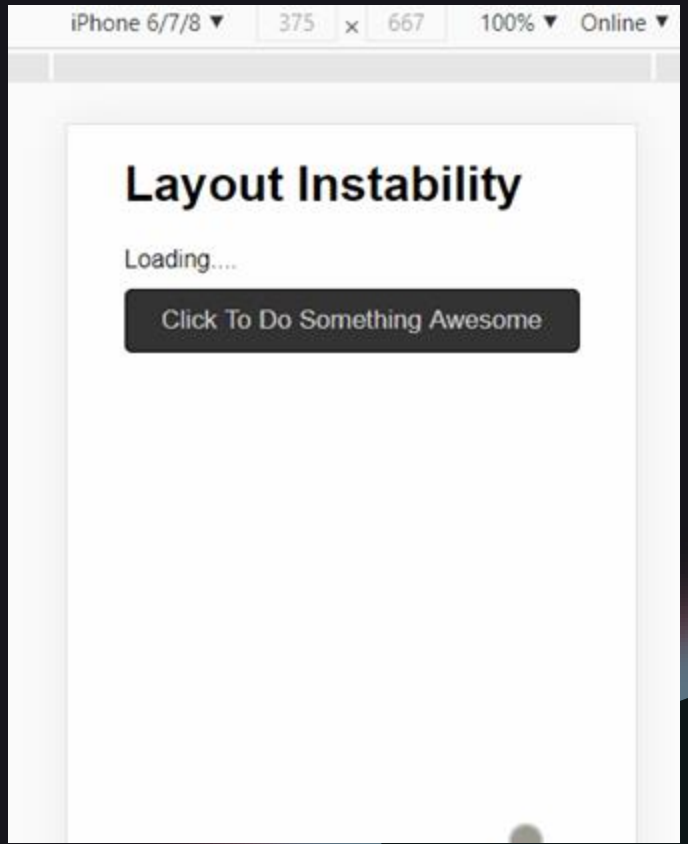
Cumulative Layout Shift

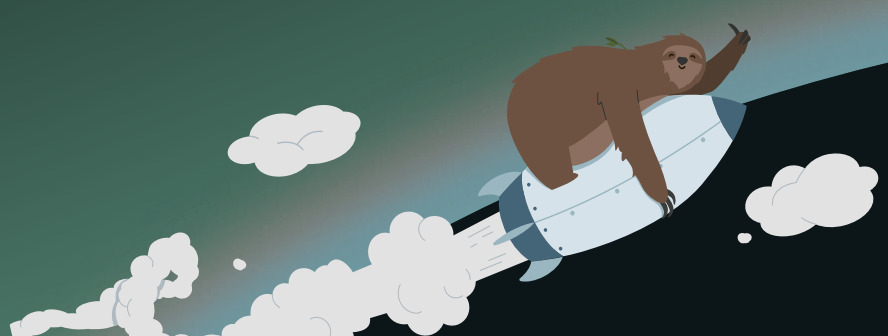


Source: Request Metrics

Cumulative Layout Shift

Play Shifty.site

https://shifty.site/



Demonstration

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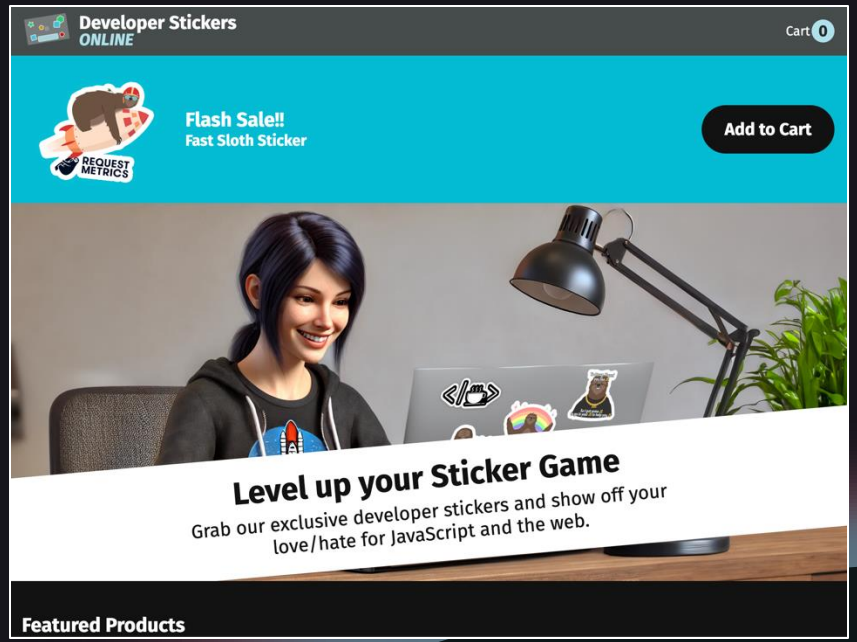
Measuring Web Performance / Core Web Vitals / CLS

Cumulative Layout Shift



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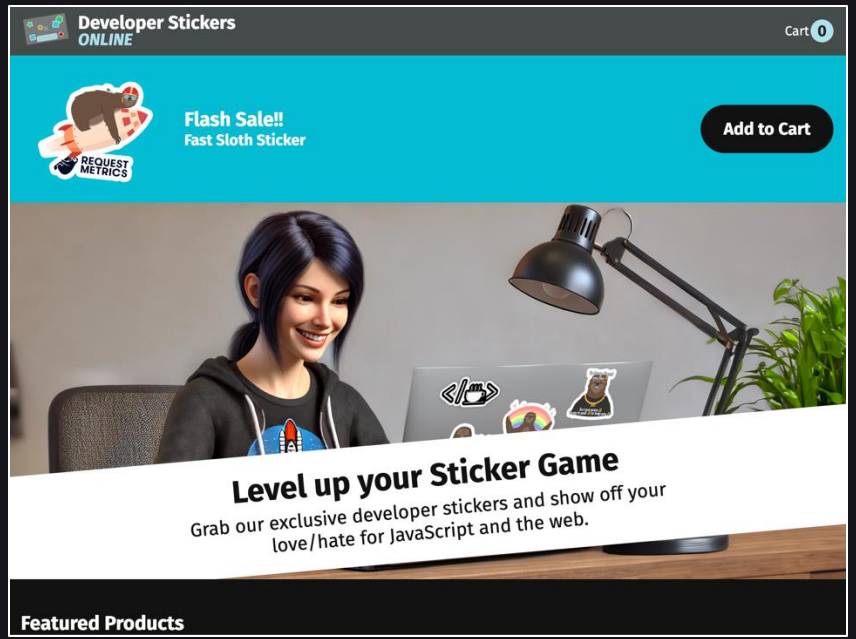
Layout Shift Value

$$\text{Layout Shift Value} = \text{Impact Fraction} \times \text{Distance Fraction}$$

Source: Request Metrics

Impact Fraction



Viewport Height

768 px

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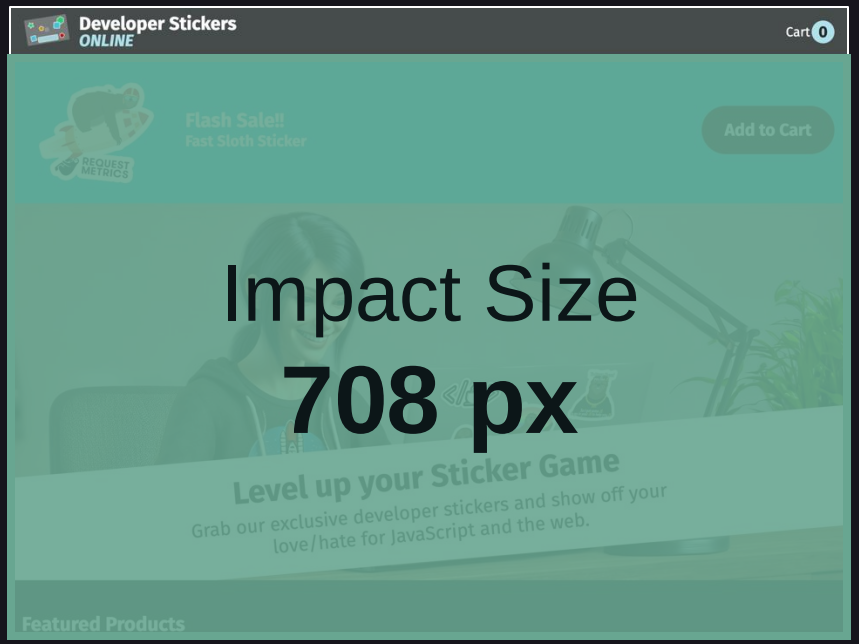
Impact Fraction



Viewport Height

768 px

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Impact Fraction

Viewport Height

768 px

Impact Fraction

708 ÷ 768

0.922

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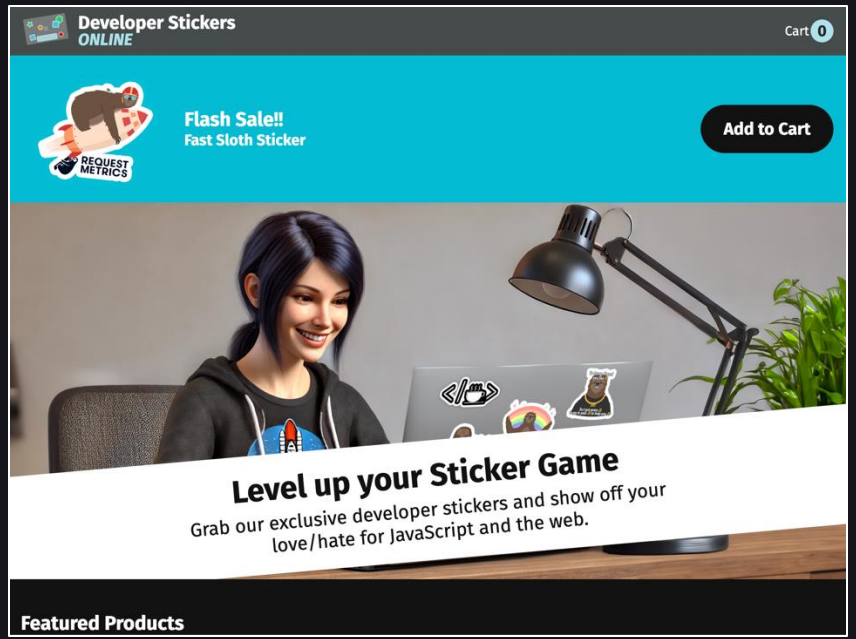
Distance Fraction



Viewport Height

768 px

Distance Fraction

Viewport Height

768 px

Todd H. Gardner

Distance Fraction

Viewport Height

768 px

Distance Fraction

180 ÷ 768

0.234

Todd H. Gardner

Layout Shift Value

$$\text{Layout Shift Value} = \text{Impact Fraction} \times \text{Distance Fraction}$$

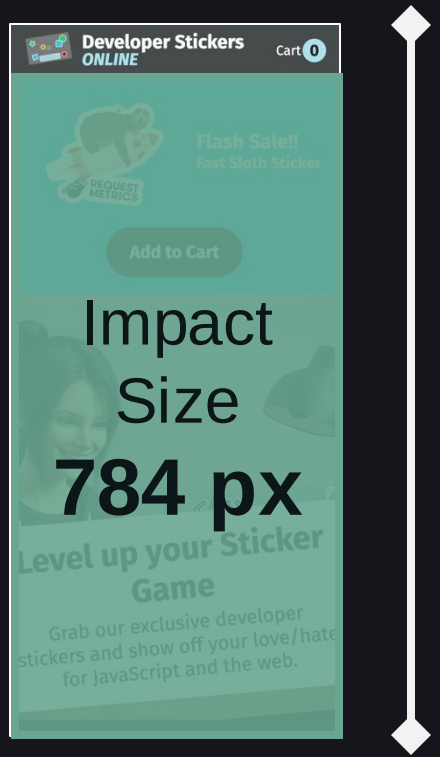
Source: Request Metrics

Layout Shift Value

$$
\begin{array}{r}
0.922 \\
\times \quad 0.234 \\
\hline
0.215
\end{array}
$$

Source: Request Metrics

Impact Fraction



Viewport Height

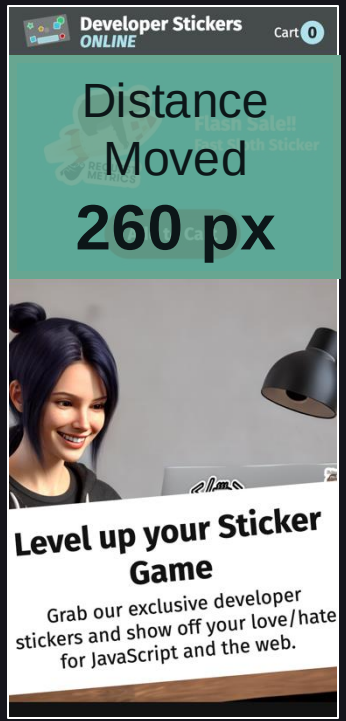
844 px

Impact Fraction

784 ÷ 844

0.929

Impact Fraction



Viewport Height

844 px

Distance Fraction

260 ÷ 844

0.308

Layout Shift Value

Desktop

$$0.922 \times 0.234 \approx 0.215$$

Mobile

$$0.929 \times 0.308 \approx 0.286$$

Layout Shift Value

This applies to both
height and width

Cumulative?

The sum of all layout shifts

Source: Request Metrics

Considerations

- Not including Shifts from user actions
  < 500ms

Source: web.dev

What is a Good Score (to Google)?

CLS

Cumulative Layout Shift

Source: web.dev

Workshop Outline

How to Measure Web Performance

- ~~Legacy Metrics~~
- **Core Web Vitals**
- More Metrics
- Capturing Metrics
- Browser Support

- ~~Waterfall Charts~~
- Flame Charts

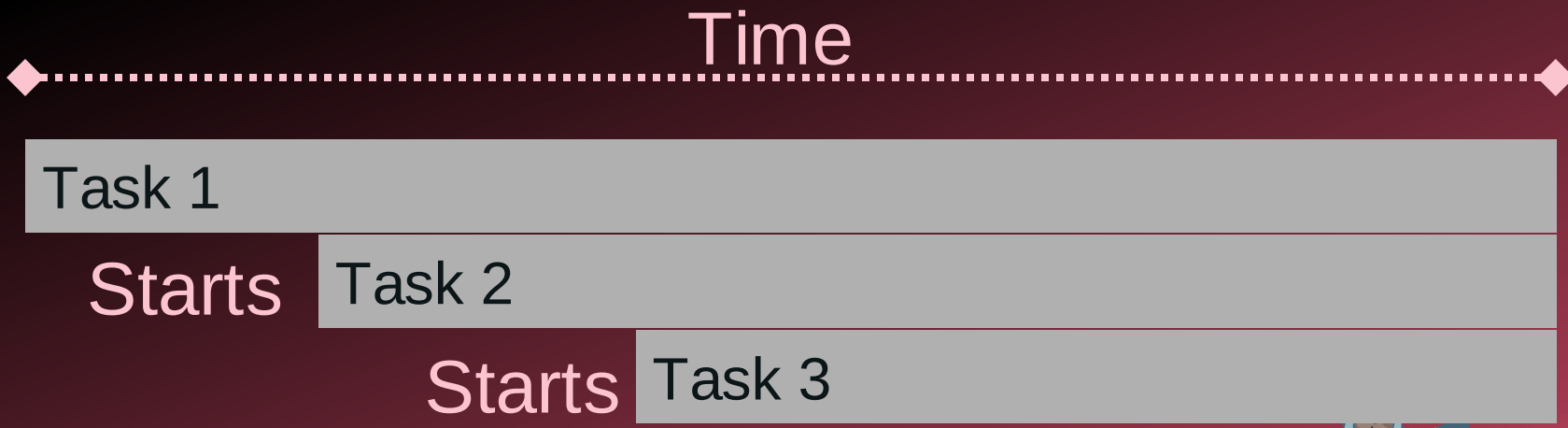
Todd H. Gardner

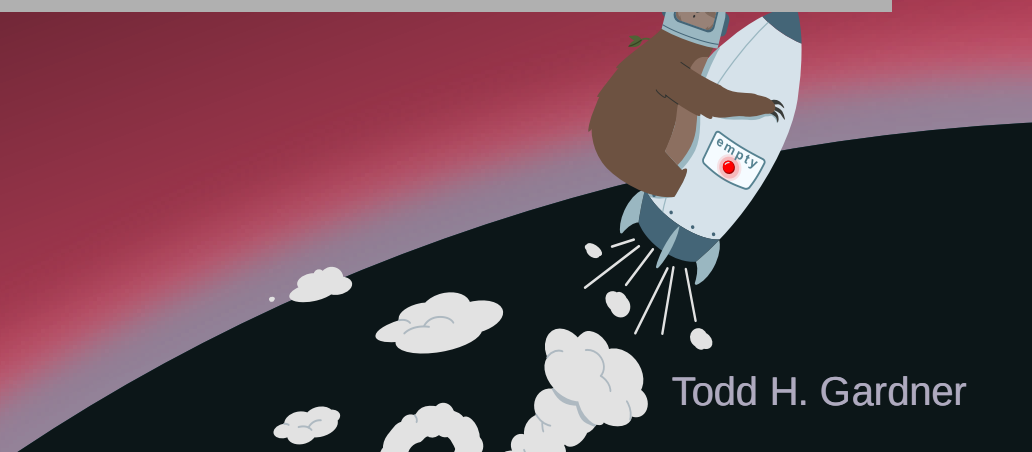
Reading Flame Charts

Todd H. Gardner

Measuring Web Performance

Flame Charts





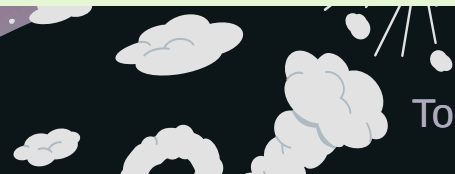
Aside

Todd H. Gardner

Measuring Web Performance

Flame Charts

```
53
54  function task1() {
55    task2();
56  }
57
58  function task2() {
59    task3();
60  }
61
62  function task3() {
63    // something
64  }
65
```



Aside

Todd H. Gardner

Measuring Web Performance

Flame Charts

Browser Tasks

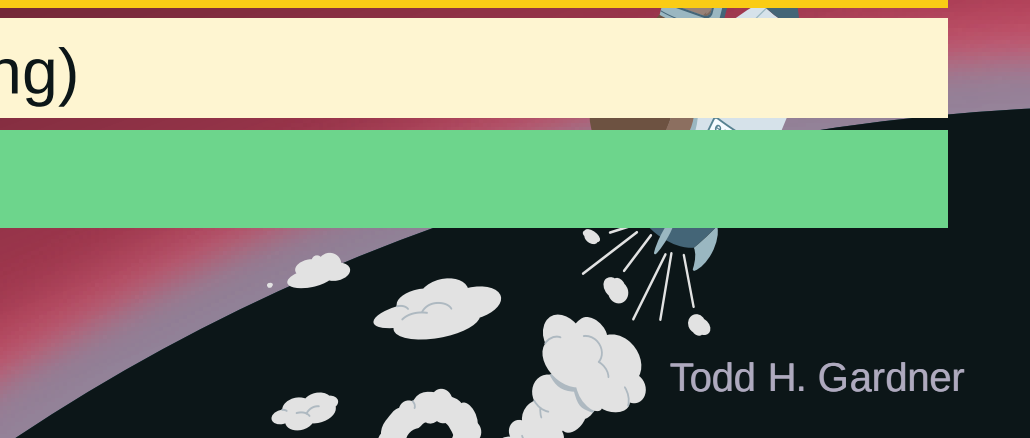
Parse HTML

Layout and Paint

Evaluate and Compile Scripts (passthrough)

JavaScript Execution (working)

Extensions

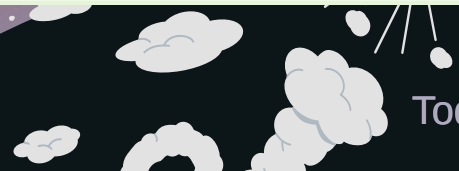


Aside

Measuring Web Performance

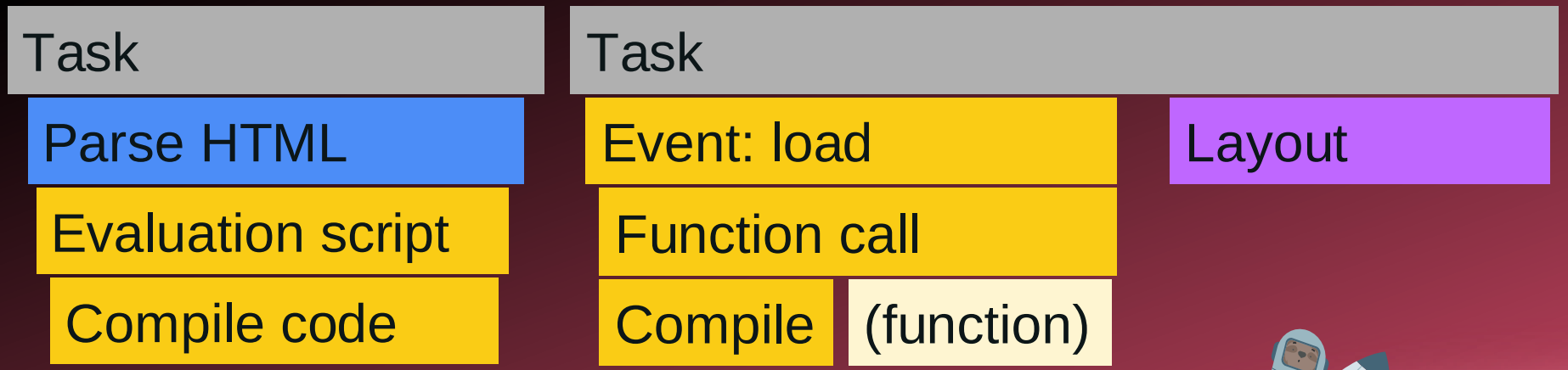
Flame Charts

```
1
2   <html>
3   <body>
4     <script>
5       window.addEventListener("load", () ⇒ {
6         var el = document.createElement("div");
7         el.innerHTML = "<h1>Hey</h1>"
8         document.body.appendChild(el);
9       });
10    </script>
11  </body>
12  </html>
13
```



Measuring Web Performance

Flame Charts



Aside

Todd H. Gardner

The Main Thread

The single thread of work the browser has for handling user events, layout, paint, and running JavaScript

Aside

Todd H. Gardner

Workshop Outline

Measuring

- ~~Legacy Metrics~~
- **Core Web Vitals**
- More Metrics
- Capturing Metrics
- Browser Support

~~Waterfall Charts~~

~~Flame Charts~~

INP

Interaction to Next Paint

Todd H. Gardner

Interaction to Next Paint

How quickly users can interact

Source: Request Metrics

Todd H. Gardner

What's an interaction?

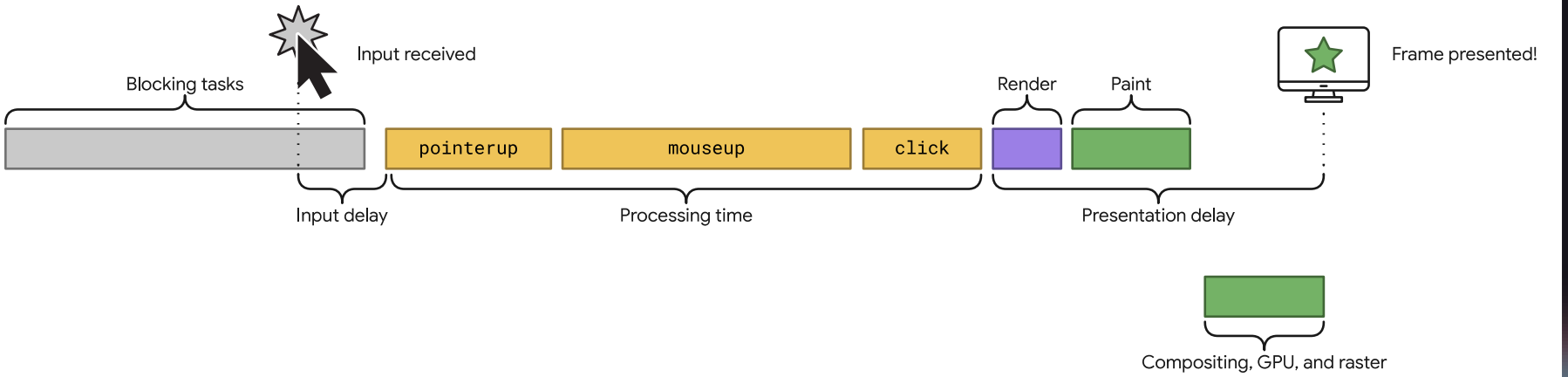
- Click
- Drag
- Touch
- Keypress

But not

- *Scroll*

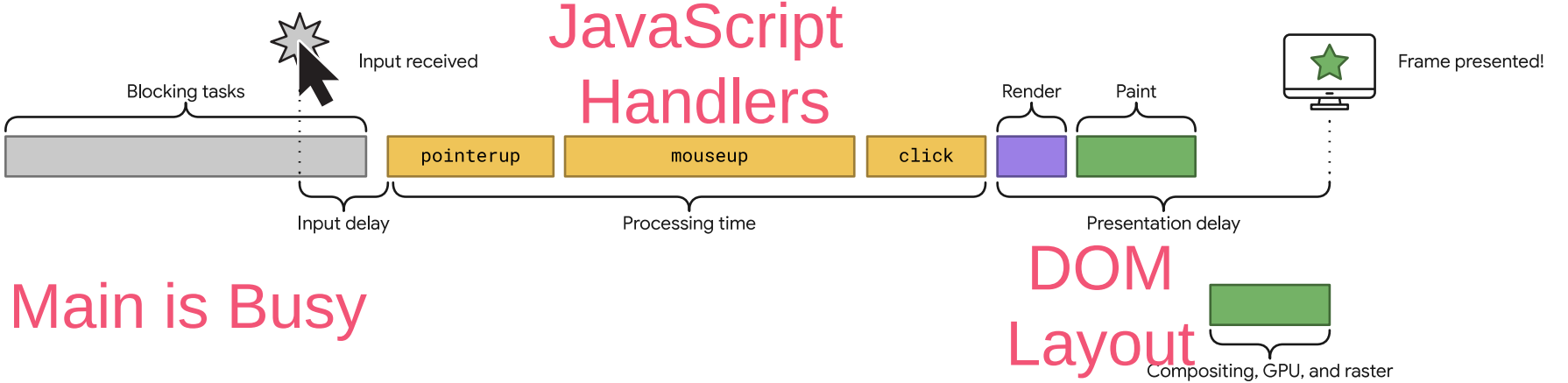
Source: web.dev

What's an interaction?



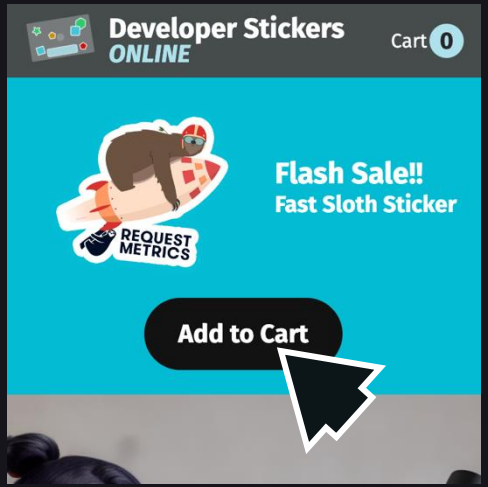
Source: web.dev

What's an interaction?



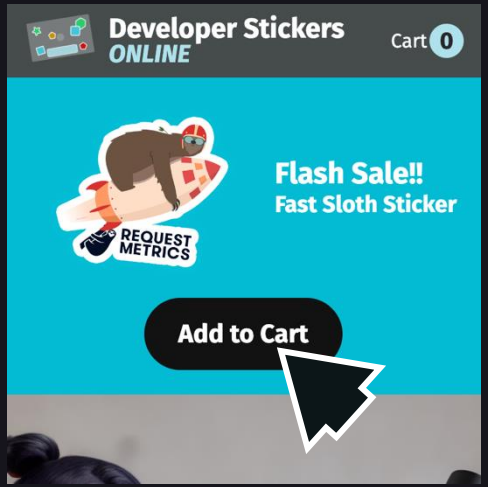
Source: web.dev

What's the "next paint"?



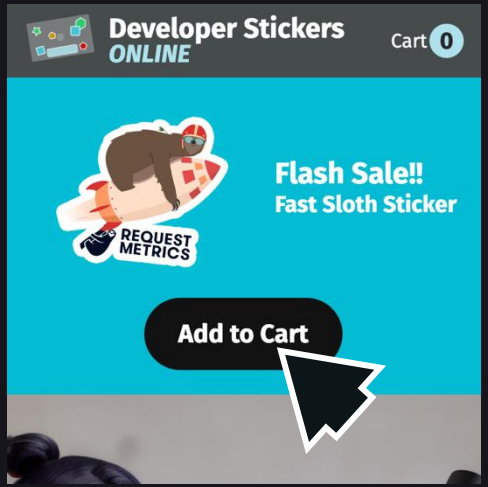
Todd H. Gardner

What's the "next paint"?

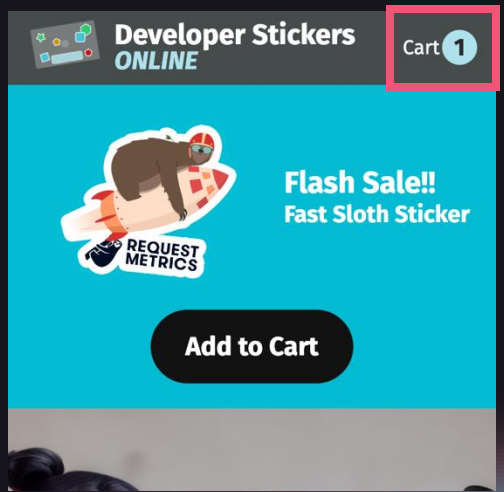



```
(evt) => {
        //handle it
}
```

What's the "next paint"?




```
(evt) => {
        //handle it
}
```



The worst Interaction

4 ms	7 ms	9 ms
43 ms	243 ms	12 ms
89 ms	79 ms	54 ms
2 ms	23 ms	5 ms

Considerations

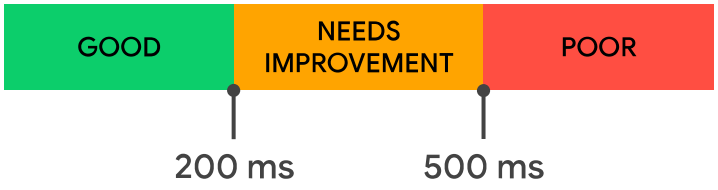
- There might not be an interaction
- We don’t know the worst until it’s over
- Heavily influenced by device capability

Source: web.dev

What is a Good Score (to Google)?

INP

Interaction to Next Paint



Source: web.dev

FID

First Input Delay

In memorial

2020-2024

Todd H. Gardner

First Input Delay

Measured the first INP

Todd H. Gardner

Problems with FID

- Emphasized Blocking Time over Processing Time
- Users interact many times

Workshop Outline

Measuring

- ~~Legacy Metrics~~
- ~~Core Web Vitals~~
- **More Metrics**
- Capturing Metrics
- Browser Support

~~Waterfall Charts~~

~~Flame Charts~~

More Performance Metrics

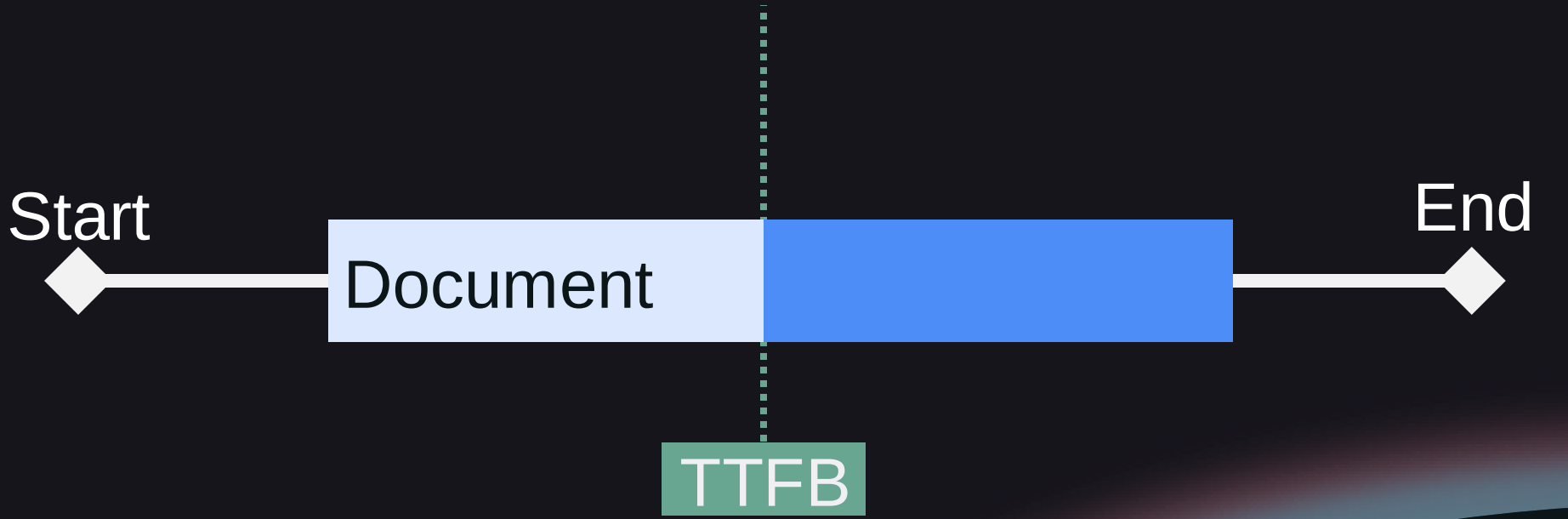
TTFB
Time to First Byte

Time to First Byte

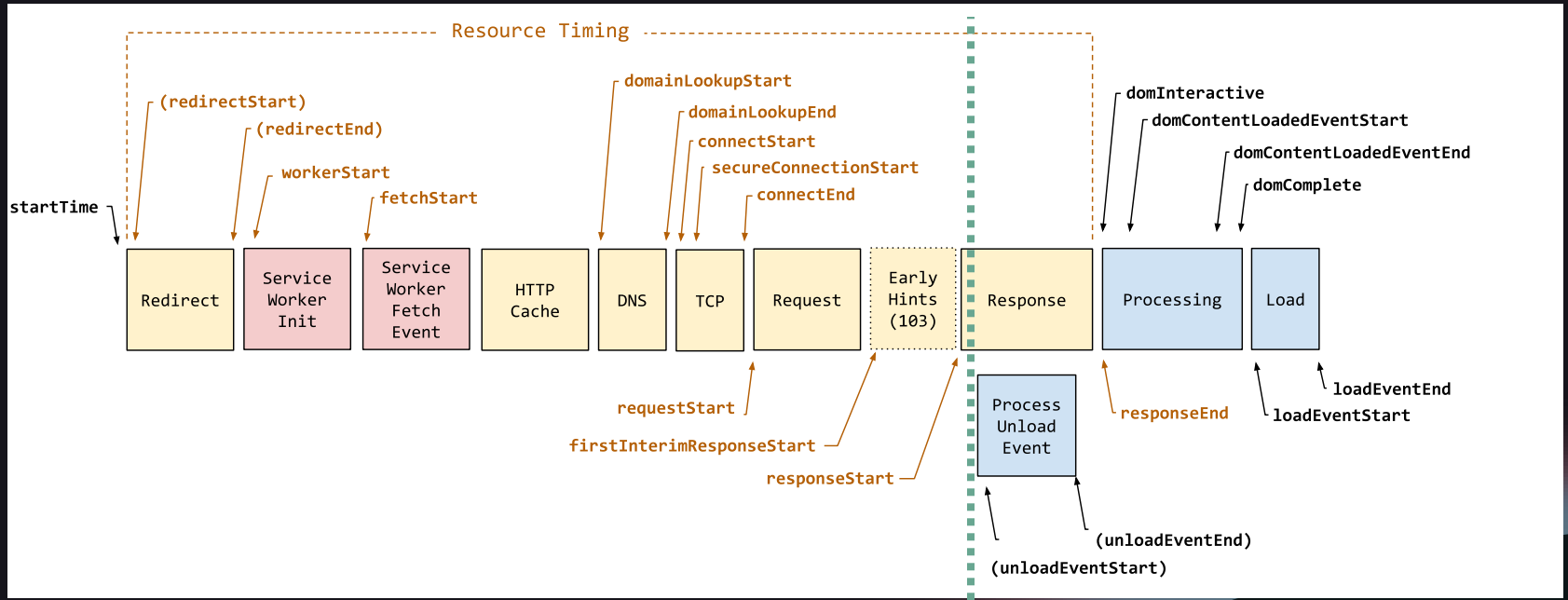
How quickly your host **responds**.

Todd H. Gardner

Time to First Byte



Time to First Byte

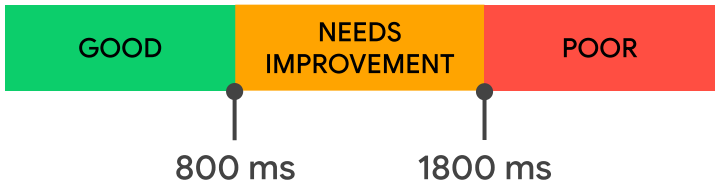


Source: [web.dev](web.dev)

What is a Good Score (to Google)?

TTFB

Time To First Byte



Source: web.dev

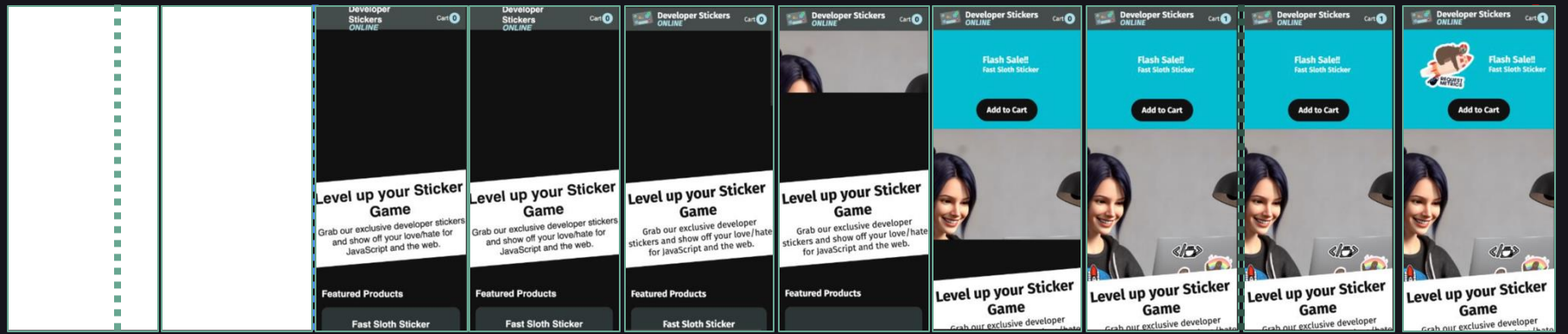
FCP
First Contentful Paint

First Contentful Paint

How fast your site visibly loads the **something.**

Source: Request Metrics

Sequence

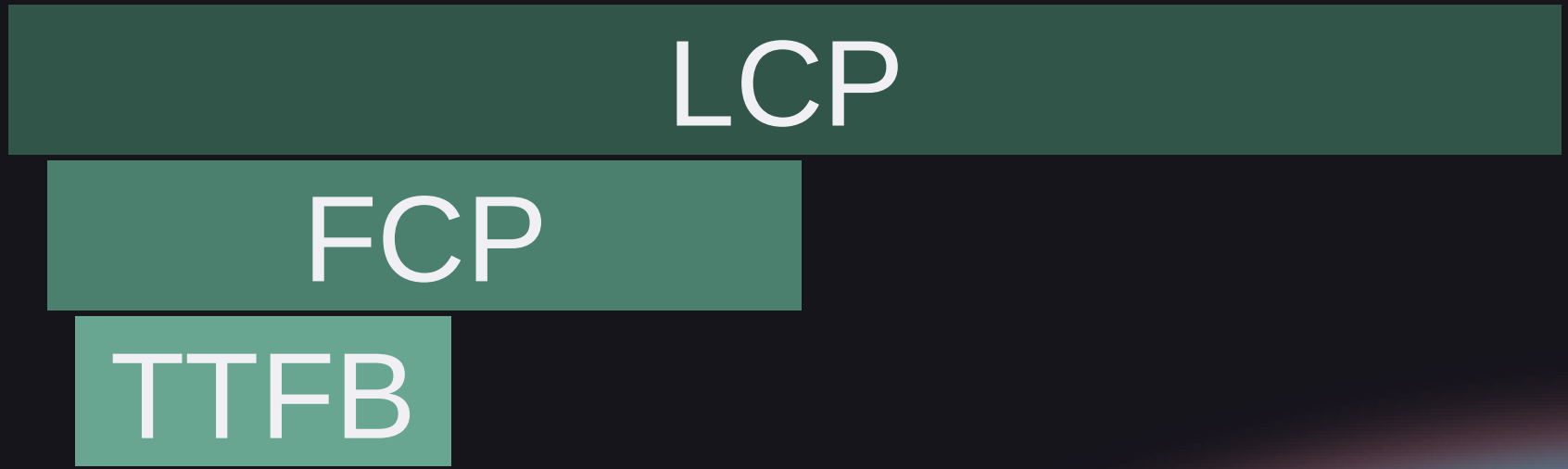


TTFB DCL FCP LCP L

What is a Good Score (to Google)?

Source: web.dev

Relationship to LCP



Workshop Outline

Measuring

- ~~Legacy Metrics~~
- ~~Core Web Vitals~~
- ~~More Metrics~~
- **Capturing Metrics**
- Browser Support

~~Waterfall Charts~~

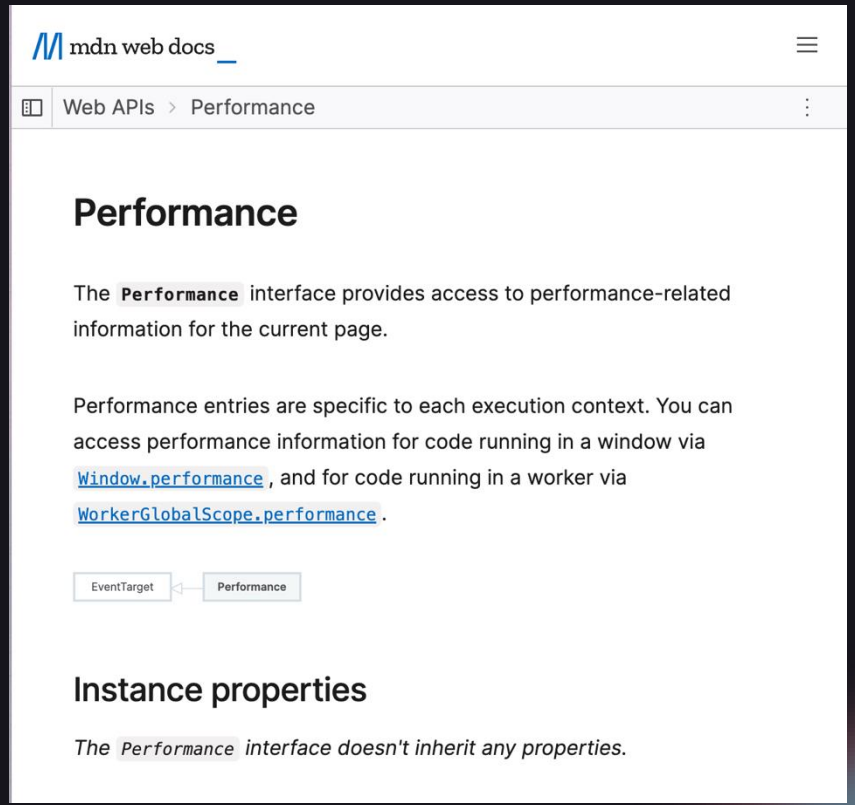
~~Flame Charts~~

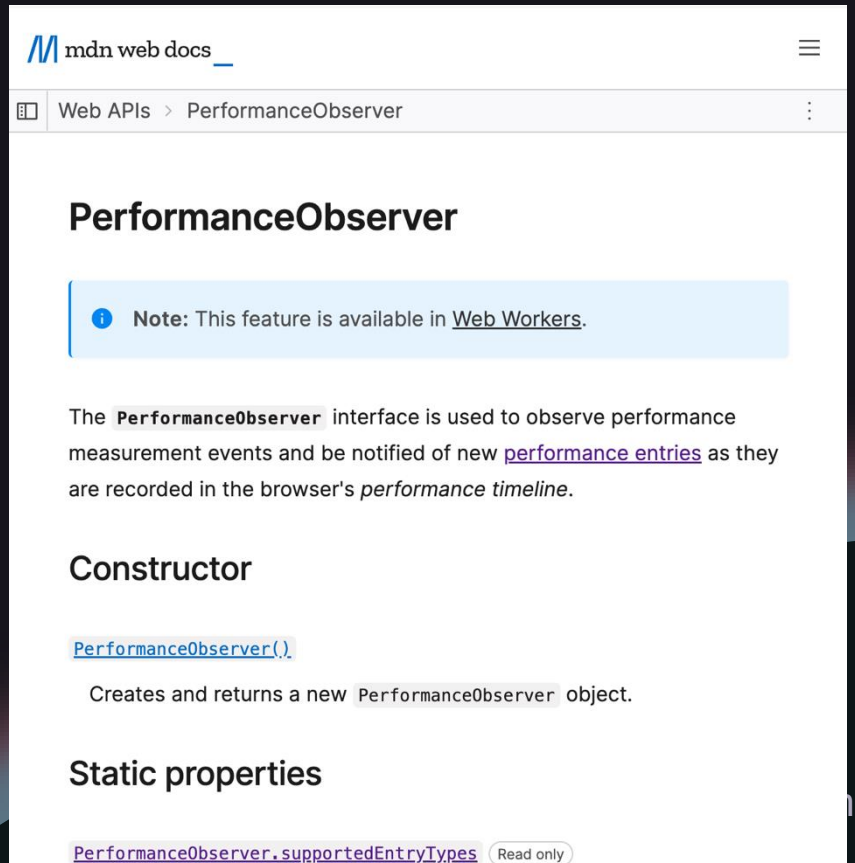
Capturing Metrics

Todd H. Gardner

Capturing Metrics

How to capture performance metrics





Capturing Metrics

Performance API

- .now()
- .getEntries()
- .mark()
- .measure()

Source: MDN

performance.now()

High-resolution timestamp relative to start of page

Source: MDN

Todd H. Gardner

vs Date.now()

```
66
67  Date.now()
68  //> 1727181644813
69
70  performance.now()
71  //> 8994.199999988079
72
73  performance.timeOrigin
74  //> 1727181678939.8
75
76  performance.timeOrigin + performance.now()
77  //> 1727181763103.9001
78
```

performance.getEntries()

Timing information for

1. Page Navigation
2. Resource Requests
3. Performance Events
4. Custom Events

Performance API

Developer Stickers Online

http://eu.devstickers.shop:3000/

- performance.getEntries()

Observer Effect

Disturbance of Observed System by the act of observation

Source: Wikipedia

Capturing Metrics

Performance Observer

Observe performance entries when idle

Source: MDN

Todd H. Gardner

Capturing Metrics

Performance Observer

```
80
81  const performanceObserver = new PerformanceObserver((list, observer) => {
82    list.getEntries().forEach((entry) => {
83      console.log(`Layout shifted by ${entry.value}`);
84    })
85  });
86  performanceObserver.observe({ type: "layout-shift", buffered: true });
87
```

Capturing Metrics

web-vitals.js

```
88
89  import { onLCP, onCLS, onINP } from "web-vitals";
90
91  onLCP(console.log);
92  onCLS(console.log);
93  onINP(console.log);
94
```

Source: [Github/web-vitals]

Workshop Outline

Measuring

- ~~Legacy Metrics~~
- ~~Core Web Vitals~~
- ~~More Metrics~~
- ~~Capturing Metrics~~
- **Browser Support**

~~Waterfall Charts~~

~~Flame Charts~~

Performance Metric
Browser Support

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Browser Engines

Blink

- Chrome
- Edge
- Opera
- Samsung
- Brave
- Arc

Webkit

- Safari
- Mobile Safari
- Chrome on iOS

Gecko

- Firefox

Compatibility Table

	Blink	Webkit	Gecko
DOMContentLoaded (DCL)	✅	✅	✅
Load (L)	✅	✅	✅
Largest Contentful Paint (LCP)	✅	⛔	✅
Cumulative Layout Shift (CLS)	✅	⛔	⛔
Interaction to Next Paint (INP)	✅	⛔	⛔
Time to First Byte (TTFB)	✅	✅	✅
First Contentful Paint (FCP)	✅	✅	✅
Custom Metrics	✅	✅	✅

Sources: MDN, Web.dev

Market Share

Source: StatCounter

Market Share

Safari

Source: StatCounter

What do we do about Safari?

I don’t know.
Hope?

Workshop Outline

~~1. Importance~~

~~2. Measuring~~

3. Tests and Tools

4. Setting Goals

5. Improving

~~**Waterfall Charts**~~

~~**Flame Charts**~~

Statistics

FUNDAMENTALS of
Web Performance

Workshop Outline

Testing and Tools

- **Testing Methods**
- Common Tools
- Real User Monitoring

Statistics

Testing Performance

FUNDAMENTALS of Web Performance

Todd H. Gardner

Testing Performance

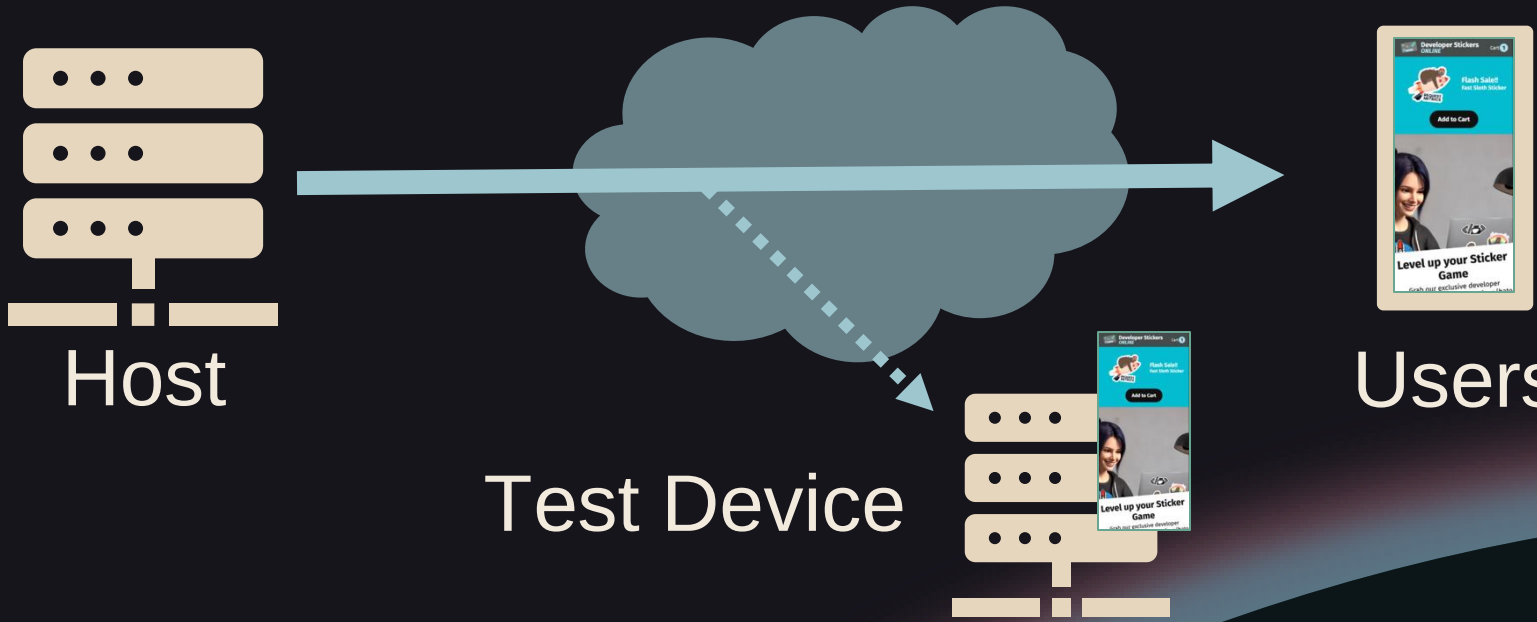
Where do we measure from?

Lab Data


Host
Test Device
Users
Developer Stickers
Flash Sale!!
Add to Cart
Level up your Sticker Game

Testing Performance / Where do we measure

Synthetic Data



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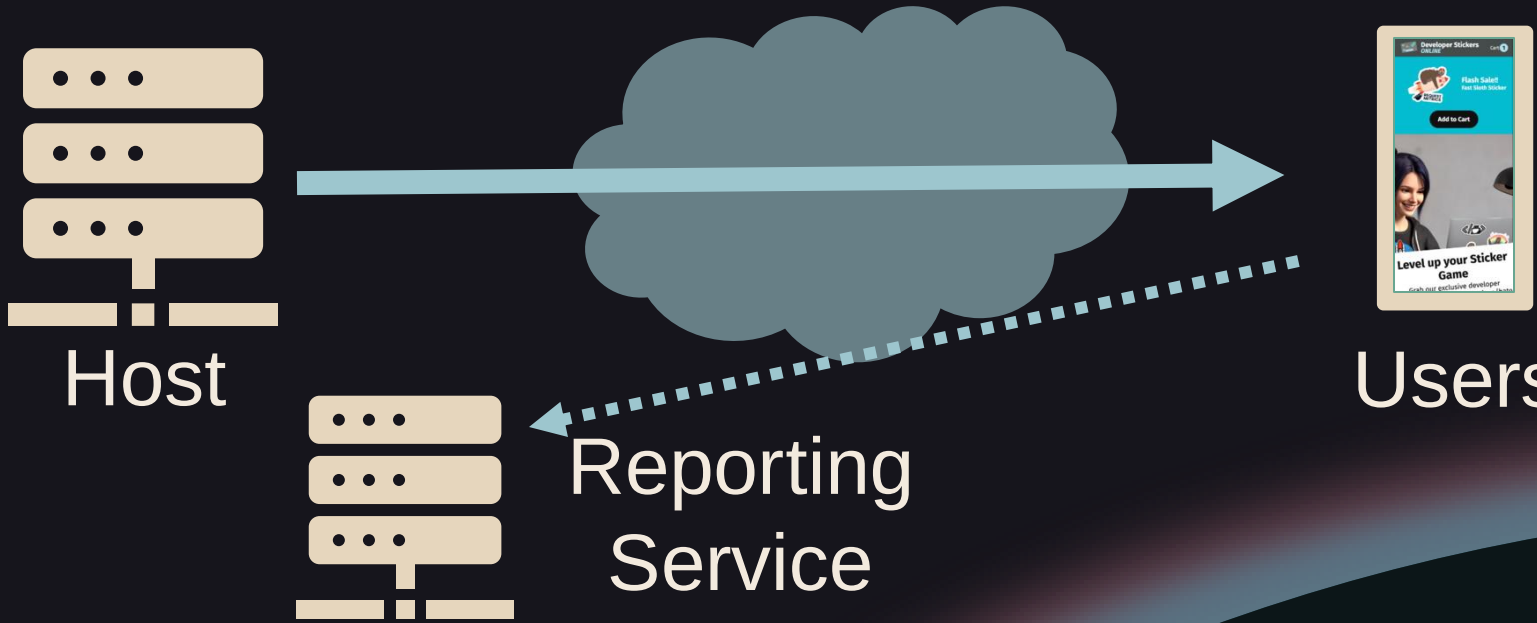
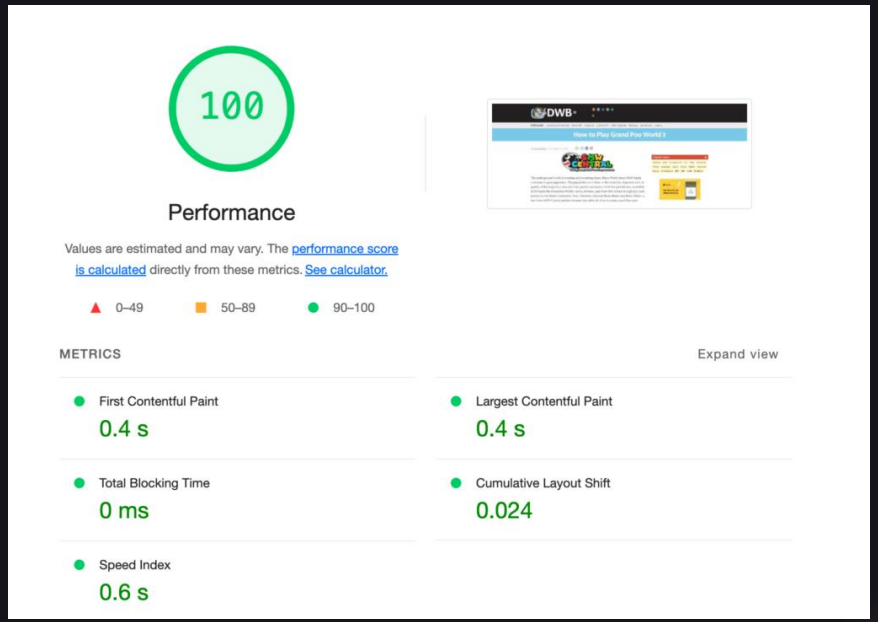
Field Data

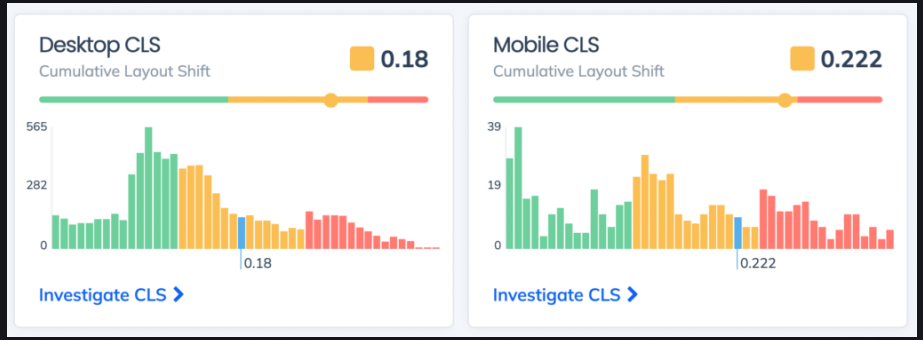

Host
Users
Reporting
Service
Developer Stickers
Flash Sale!
Fast Sloth Sticker
Add to Cart
Level up your Sticker Game

Sample Size

Lab Data



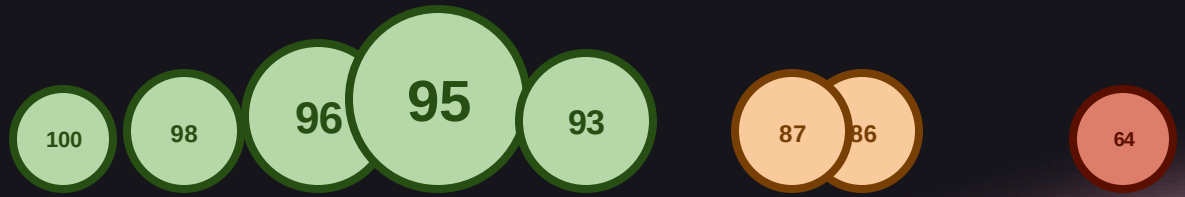
Field Data



Source: [Perf test on DavidWalsh.name]

Sample Size

Lab Data



Field Data

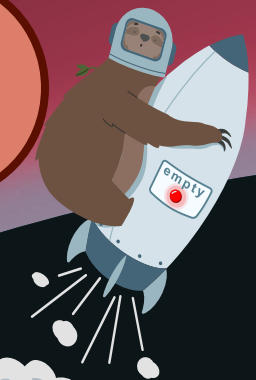
Statistics

Average Problems

80 Average Score

99 90 70 60

Raw Scores



Average Problems

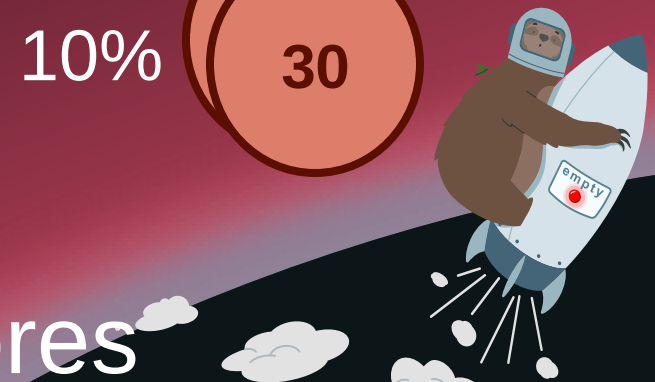
80 Average Score

---

90 85

Raw Scores

10% 30



Percentiles

Aside

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Percentiles

50th Percentile

0 10 20 30 40 50 60 70 80 90 100

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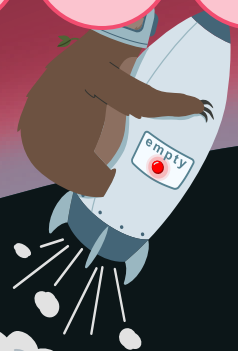
Percentiles



Aside

Todd H. Gardner

Percentiles

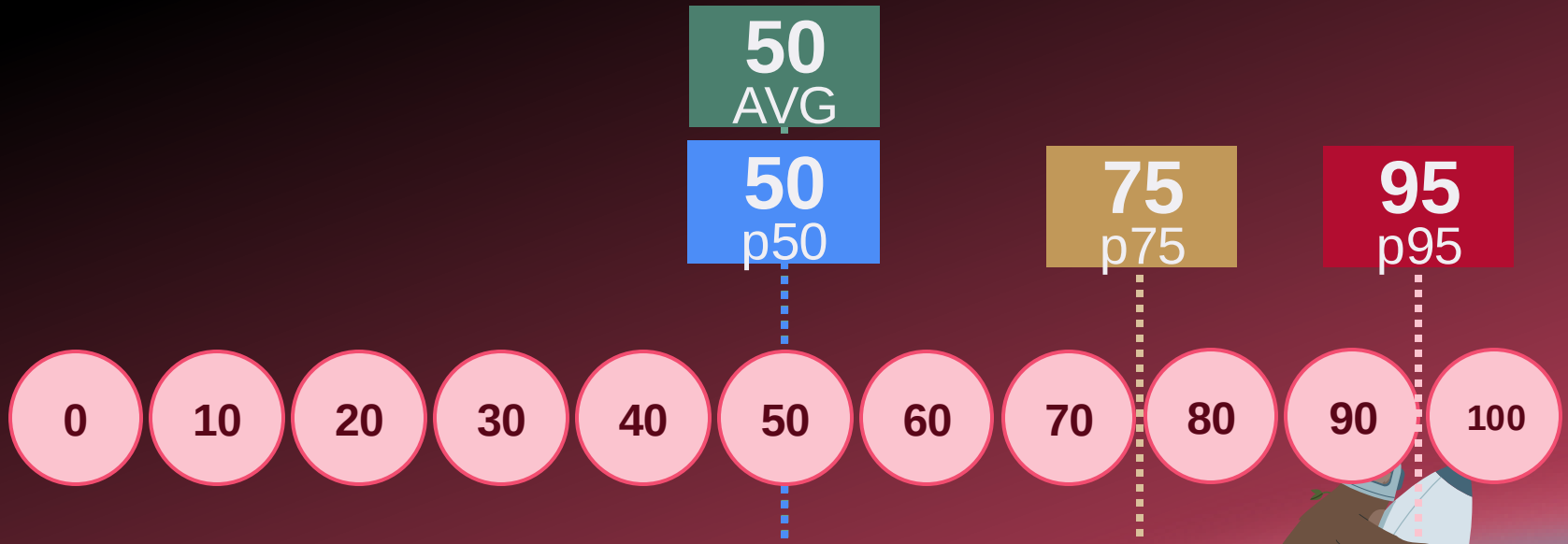
Aside

Todd H. Gardner

Percentiles

Todd H. Gardner

Percentiles



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Percentiles

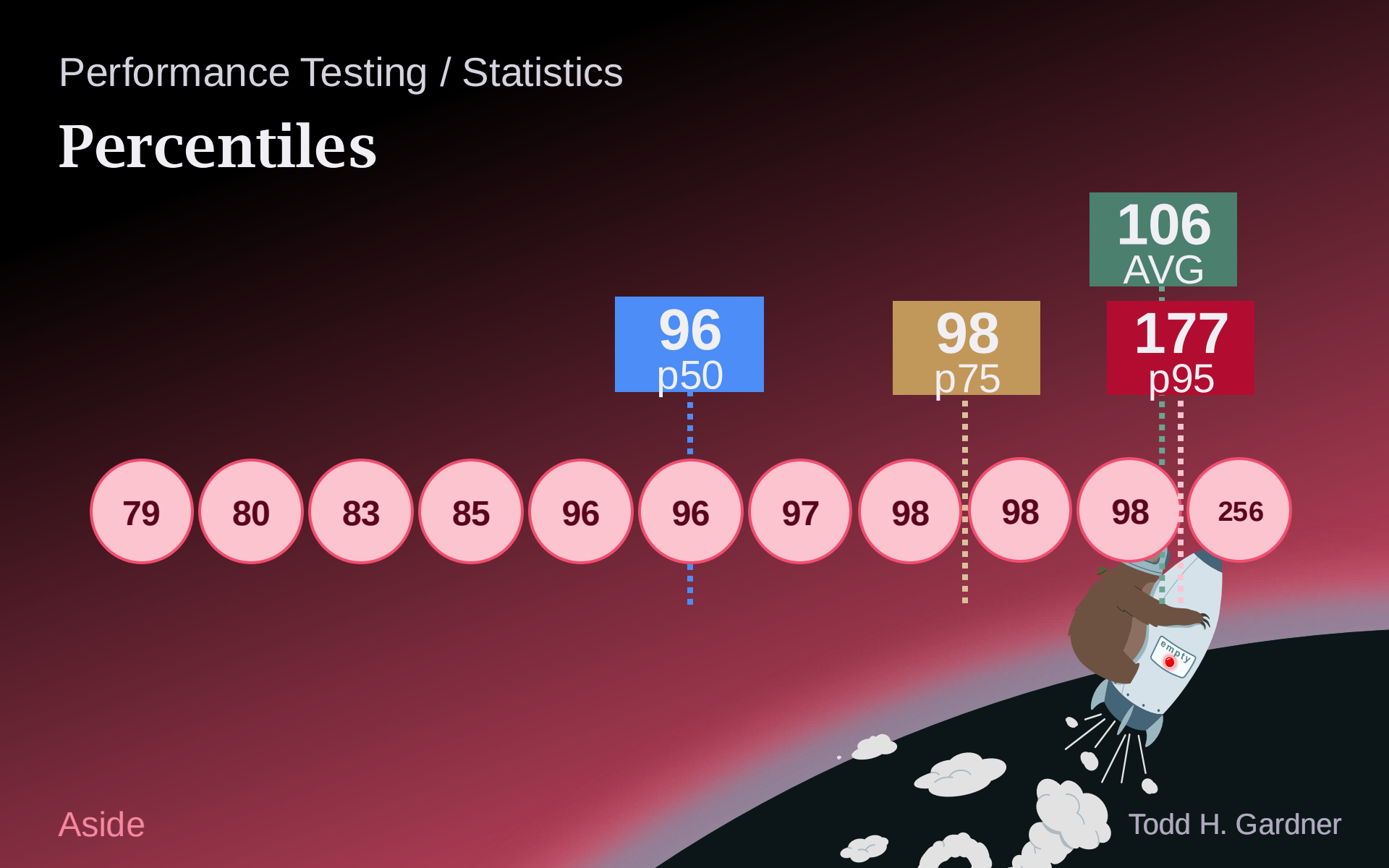
106
AVG

96
p50

98
p75

177
p95

79 80 83 85 96 96 97 98 98 98 256



Testing Performance

Lab Data vs Field Data

Lab Data is ***easier***

Field Data is ***more accurate***

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Testing Performance

Lab Data vs Field Data

Lab Data is ***diagnostic***

Field Data is ***experience***

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Testing Performance

Making Lab Data Better

Simulation

- Mobile vs Desktop
- Network Conditions
- Processing Power

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Workshop Outline

Testing and Tools

- ~~Testing Methods~~
- **Common Tools**
- Real User Monitoring

~~Statistics~~

Web Performance
Tools

FUNDAMENTALS of
Web Performance

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Web Performance Tools

Google Chrome

Developer Stickers Online

http://eu.devstickers.shop:3000/

- Lighthouse
- Device Toolbar
- Network Panel
  - Network Throttling
- Performance Panel
  - Waterfall Chart
  - Flame Chart
  - CPU Throttling

Web Vitals Extension

Web Vitals Extension

- Console Logging
- Field Data Comparison

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Web Performance Tools

Chrome User Experience Report

- Field Data
- Logged in Chrome Users
- Top 1M Public Websites
- Anonymous and Public
- 28 Day Rolling Average
- Google BigQuery,
  - API, PageSpeed Insights, Google Search Console

Source: Request Metrics

Web Performance Tools

Chrome User Experience Report

Speed Check Tool

- Compare Target.com to competitors

Demonstration

Todd H. Gardner

PageSpeed Insights

PageSpeed Insights

pagespeed.web.dev

- Run against Target.com
- Run against http://eu.devstickers.shop:3000/

WebPageTest.org

WebPageTest

WebPageTest.org

- Simulating Real Users
- Run against http://eu.devstickers.shop:3000/
- Waterfall
- Opportunities

Workshop Outline

Testing and Tools

- ~~Testing Methods~~
- ~~Common Tools~~
- **Real User Monitoring**

~~Statistics~~

RUM
Real User Monitoring

Todd H. Gardner

CrUX vs Real User Monitoring

CrUX

- Field Data
- Logged in Chrome Users
- Top 1M Public Websites
- Anonymous and Public
- 28 Day Rolling Average
- Google BigQuery,

Real User Monitoring

- Field Data
- All Users
- Private sites
- Private details
- Realtime
- Custom Dashboard and Alerts

Source: Request Metrics

Installing RUM Tools

```
95
96  import { RM } from "@request-metrics/browser-agent";
97
98  RM.install({
99    token: "your-app-token",
100   /* other settings */
101 })
102
```

RUM Tools

Enterprise RUM

- Akamai mPulse
- Dynatrace
- AppDynamics
- DataDog
- Sentry

Project RUM

- Request Metrics
- SpeedCurve
- RUMVision
- Pingdom
- Raygun

Web Performance Tools / RUM

Request Metrics

REQUEST METRICS

Request Metrics

RequestMetrics.com

- Real Time Data
- Filtering Views
- User Information
- Waterfall
- Core Web Vital Attribution
- CrUX Integration
- Resource Reports

Demonstration

Todd H. Gardner

Workshop Outline

~~1. Importance~~

~~2. Measuring~~

~~3. Tests and Tools~~

4. Setting Goals

5. Improving

~~**Waterfall Charts**~~

~~**Flame Charts**~~

~~**Statistics**~~

Workshop Outline

Setting Goals

- **How fast is enough**
- Who gets to decide
- Understanding users

How Fast is **Fast Enough?**

FUNDAMENTALS of Web Performance

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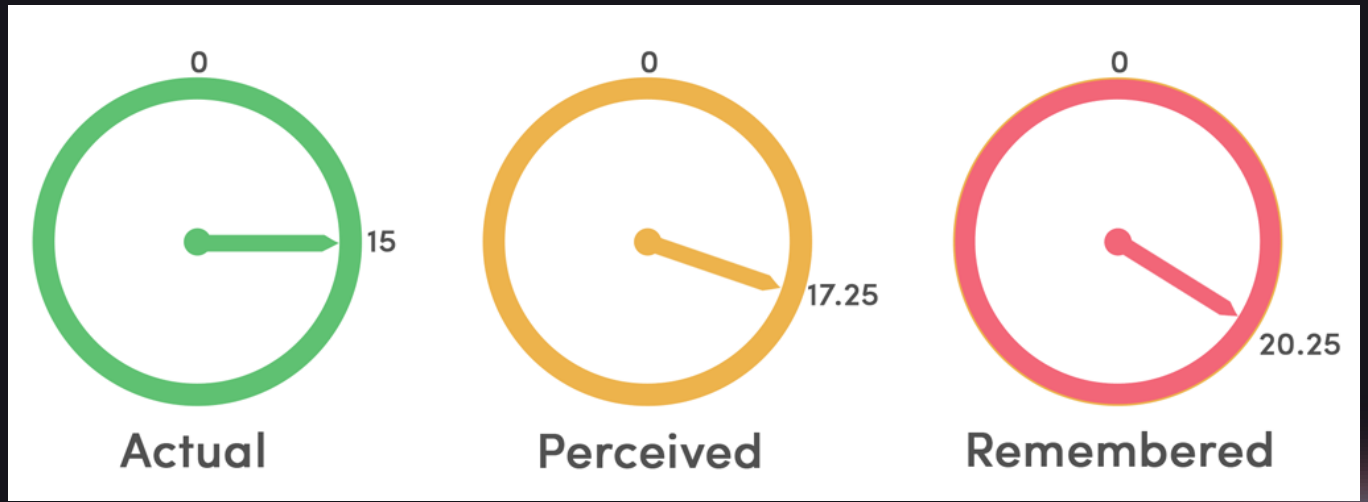
Fast is subjective user perception

How Fast is Fast Enough

Perceived Performance



They remember it slower

Source: Velocity 2010, Stoyan Stephanov

The 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**

Source: Simon Hearne

Intentionally Slow

"TurboTax's '*Looking over every detail*' loading animation was fixed.

It didn't appear to be communicating with the site's servers at all once it began playing."

People **want** to wait for **value**

Source: The Atlantic

Workshop Outline

Setting Goals

- ~~How fast is enough~~
- **Who gets to decide**
- Understanding users

Who gets to decide?
Not you.

How Fast is Fast Enough

Who Get's to Decide

1. User Experience
2. Competitors
3. SEO PageRank

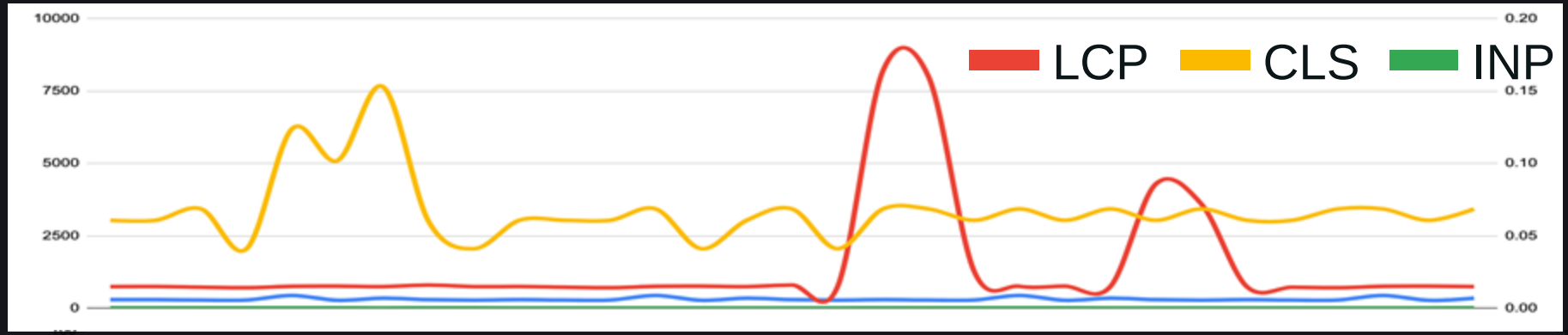
User Experience

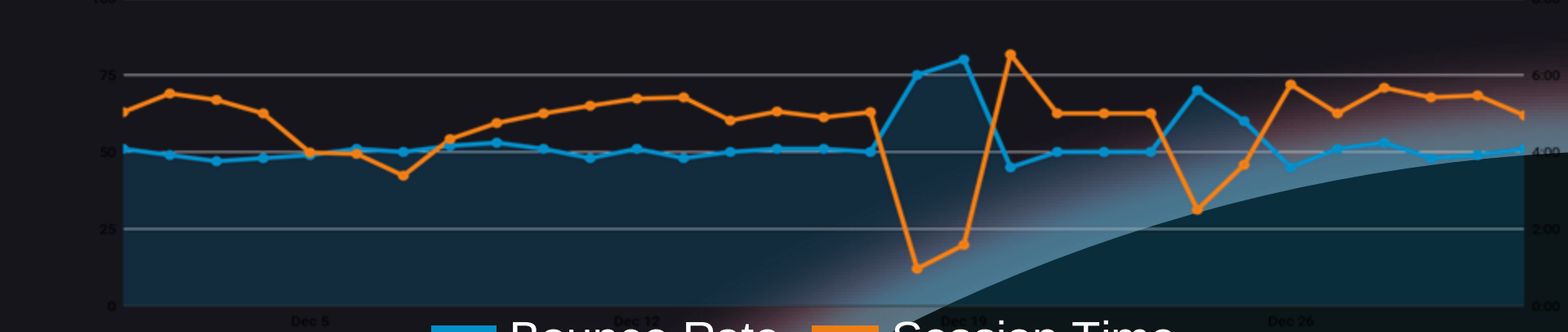
Follow Your Business Metrics

- Bounce Rate
- Session Time
- Add-to-Cart Rate
- Cart Abandonment Rate
- Conversion Rate

How Fast is Fast Enough / UX

Follow Your Business Metrics





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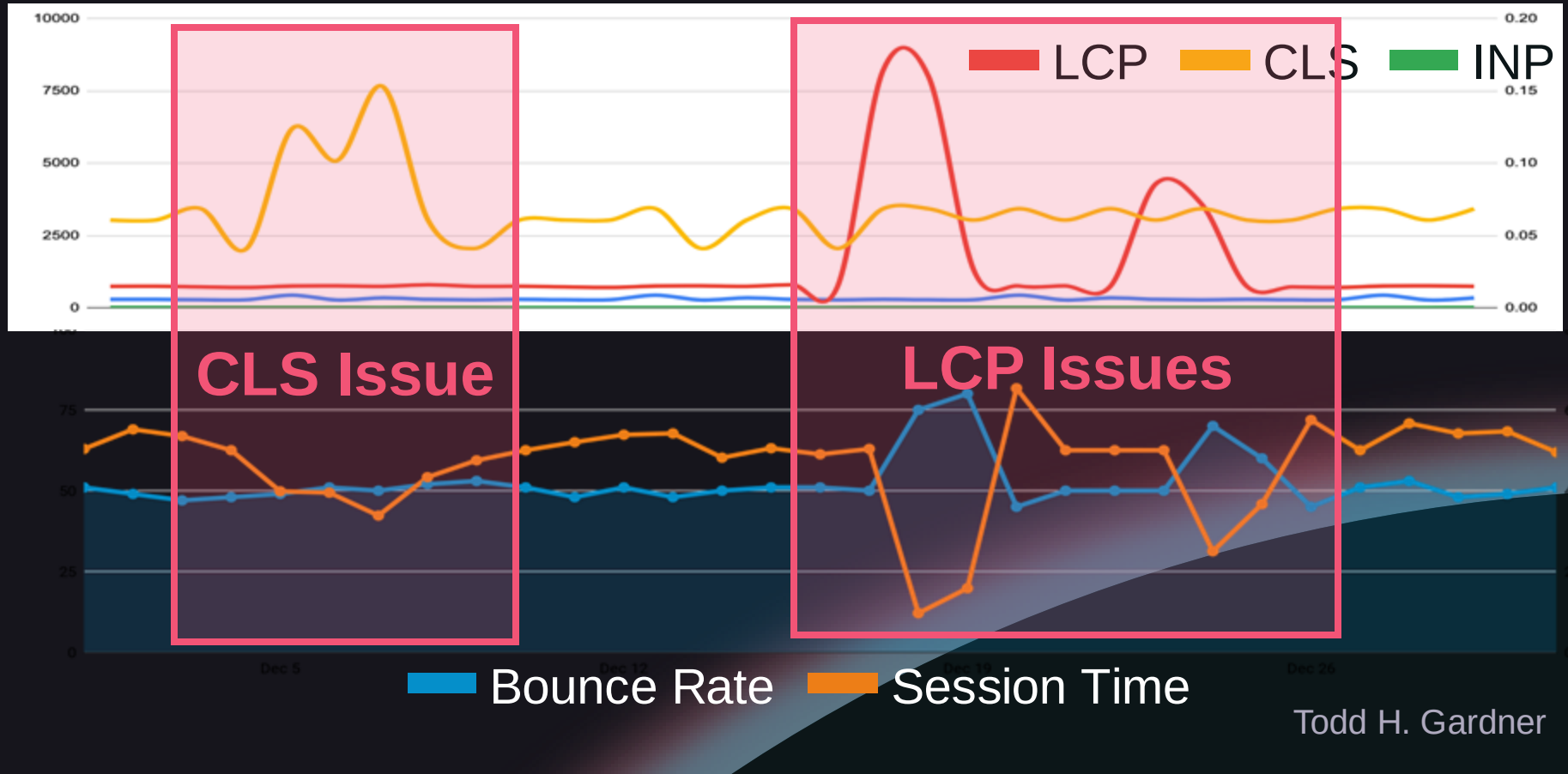
Follow Your Business Metrics



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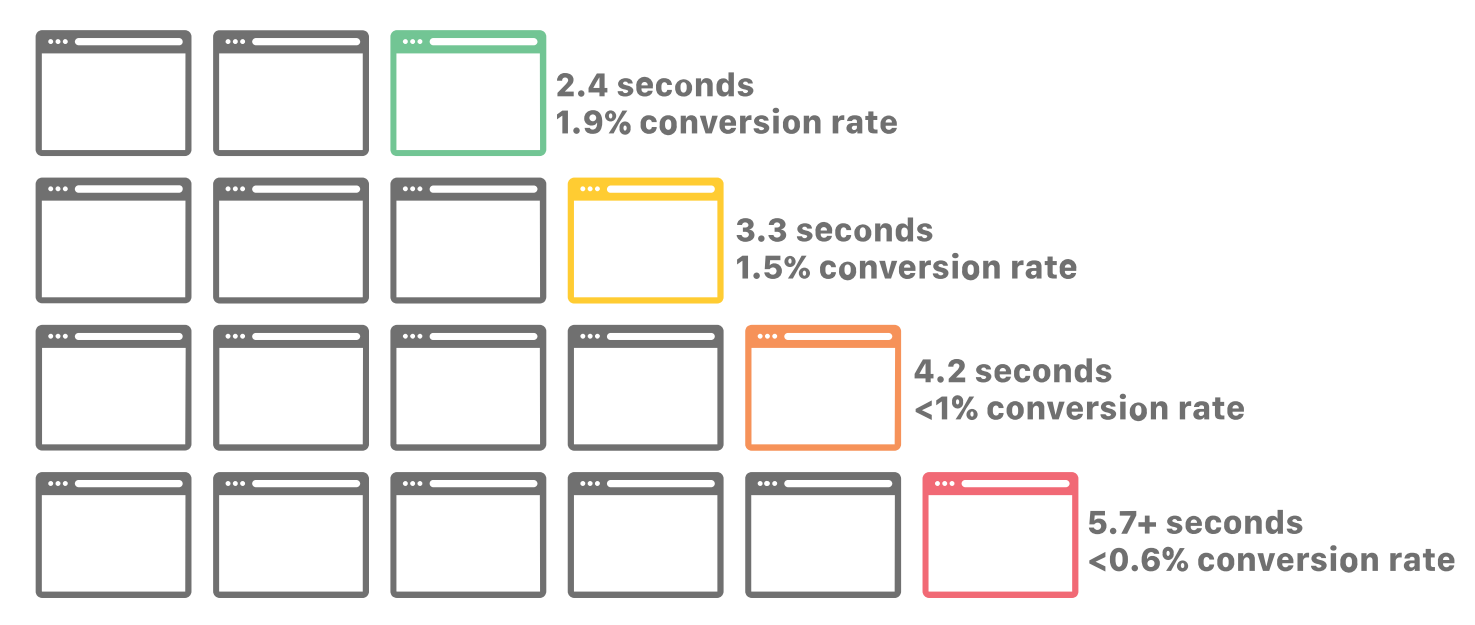
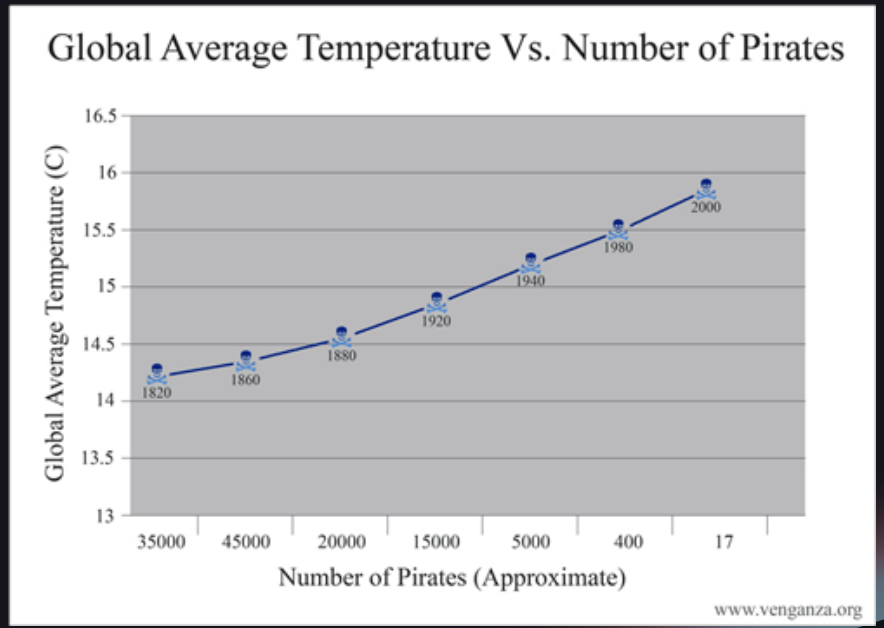
Follow Your Business Metrics



Source: Cloudflare

Correlation !== Causation

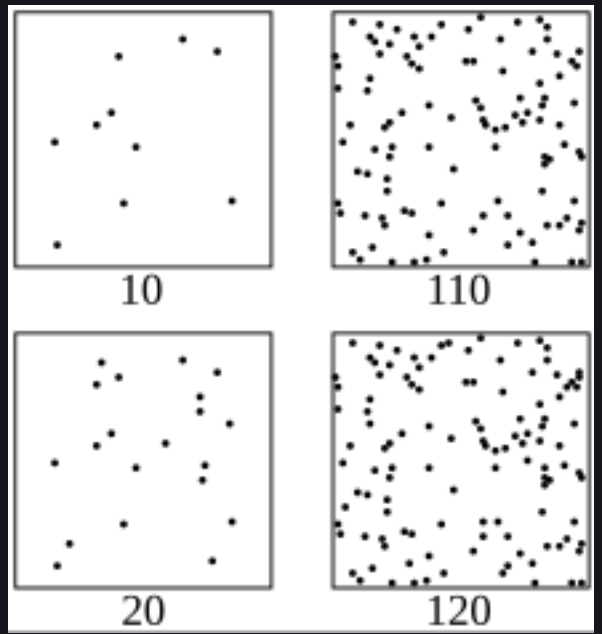


Source: Wikipedia

Competitors

You need to be ***20% Faster***

Weber's Law (the 20% Rule)

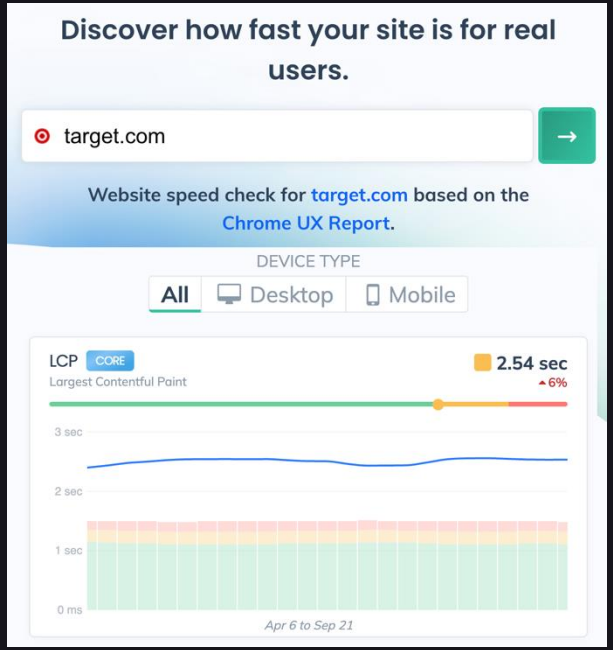


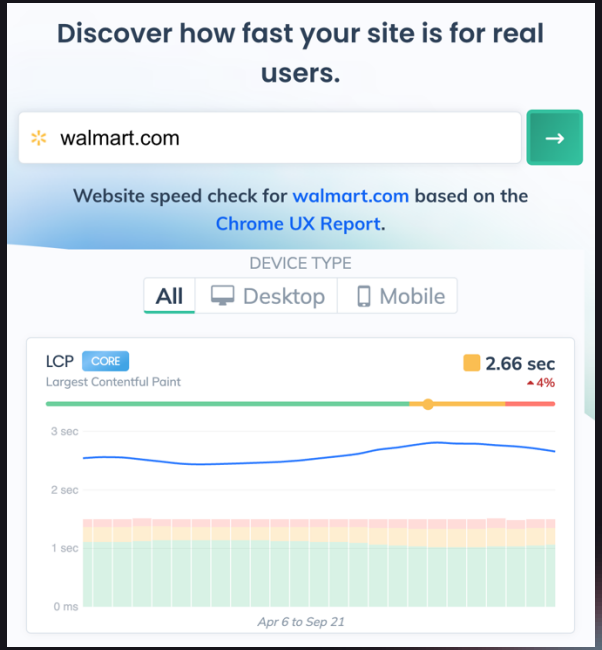
- Top and Bottom changed same amount
- Left changed proportionally more
- **20% Difference minimum for people to notice**

Source: Wikipedia

How Fast is Fast Enough / Competitors

Weber's Law (the 20% Rule)





Target is only 4% Faster

Nobody Cares

Source: Speed Check

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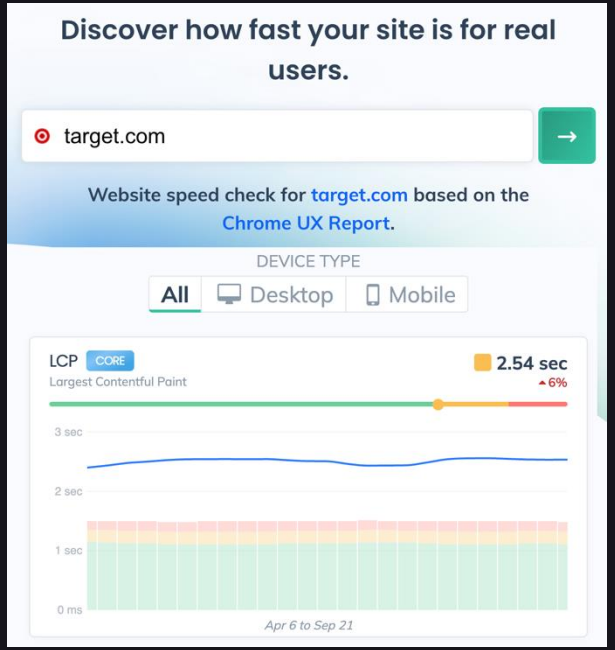
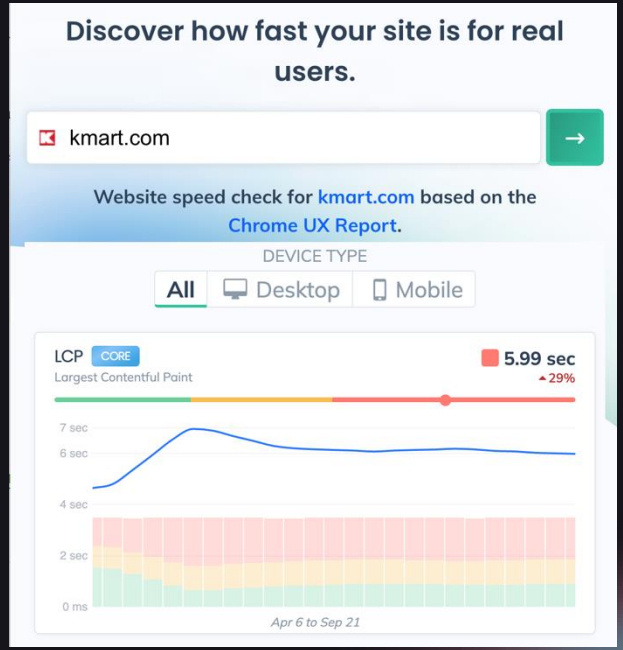
How Fast is Fast Enough / Competitors

Weber's Law (the 20% Rule)





Target is 57% Faster

Clearly Faster

Source: Speed Check

How Fast is Fast Enough

SEO PageRank

LCP

Largest Contentful Paint

CLS

Cumulative Layout Shift

INP

Interaction to Next Paint

Google

Source: web.dev

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Workshop Outline

Setting Goals

- ~~How fast is enough~~
- ~~Who gets to decide~~
- **Understanding users**

Who are these Users?

Who are these Users

Device Share

Source: StatCounter

Who are these Users

Screen Size

Source: StatCounter

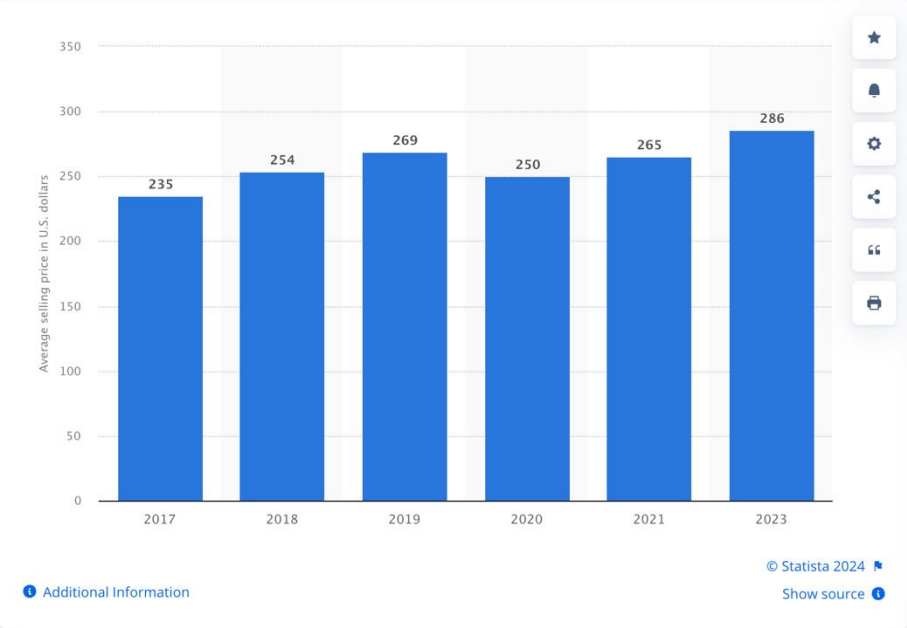
Who are these Users

OS Share

Source: StatCounter

Who are these Users

Device Cost

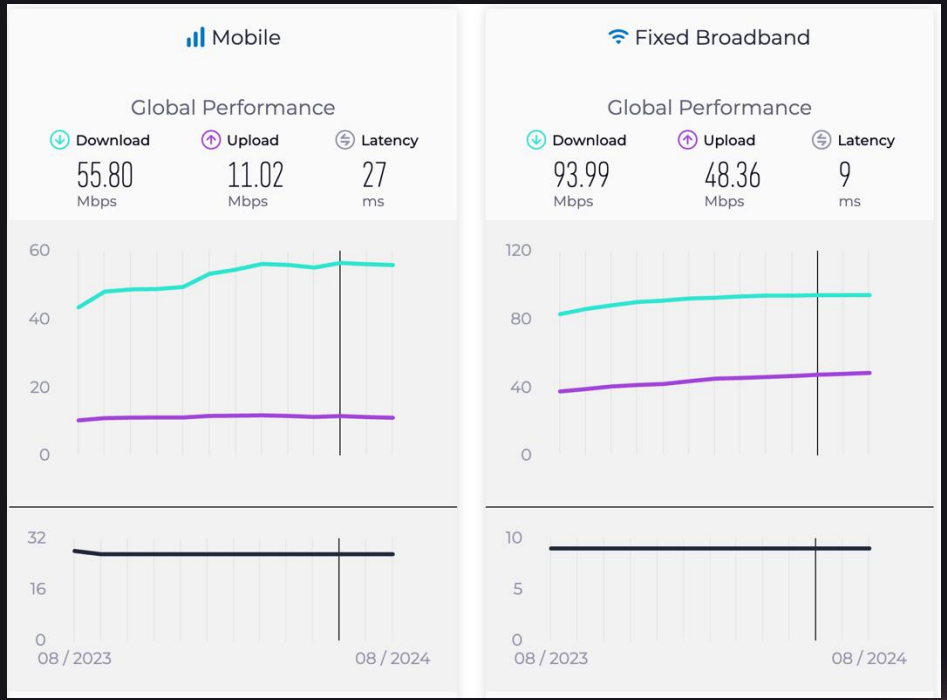


$286 Android Phones

Source: Statistica

Who are these Users

Network Speed



Source: SpeedTest.net

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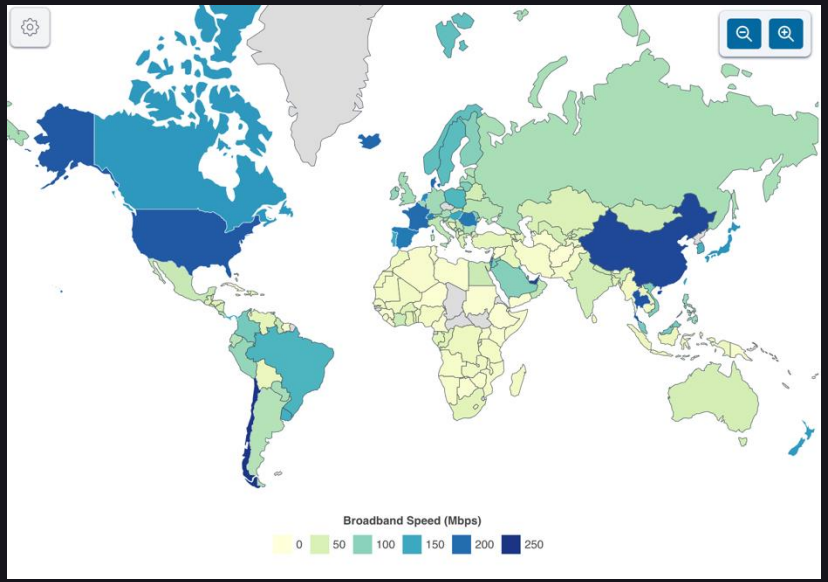
Who are these Users

Network Speed

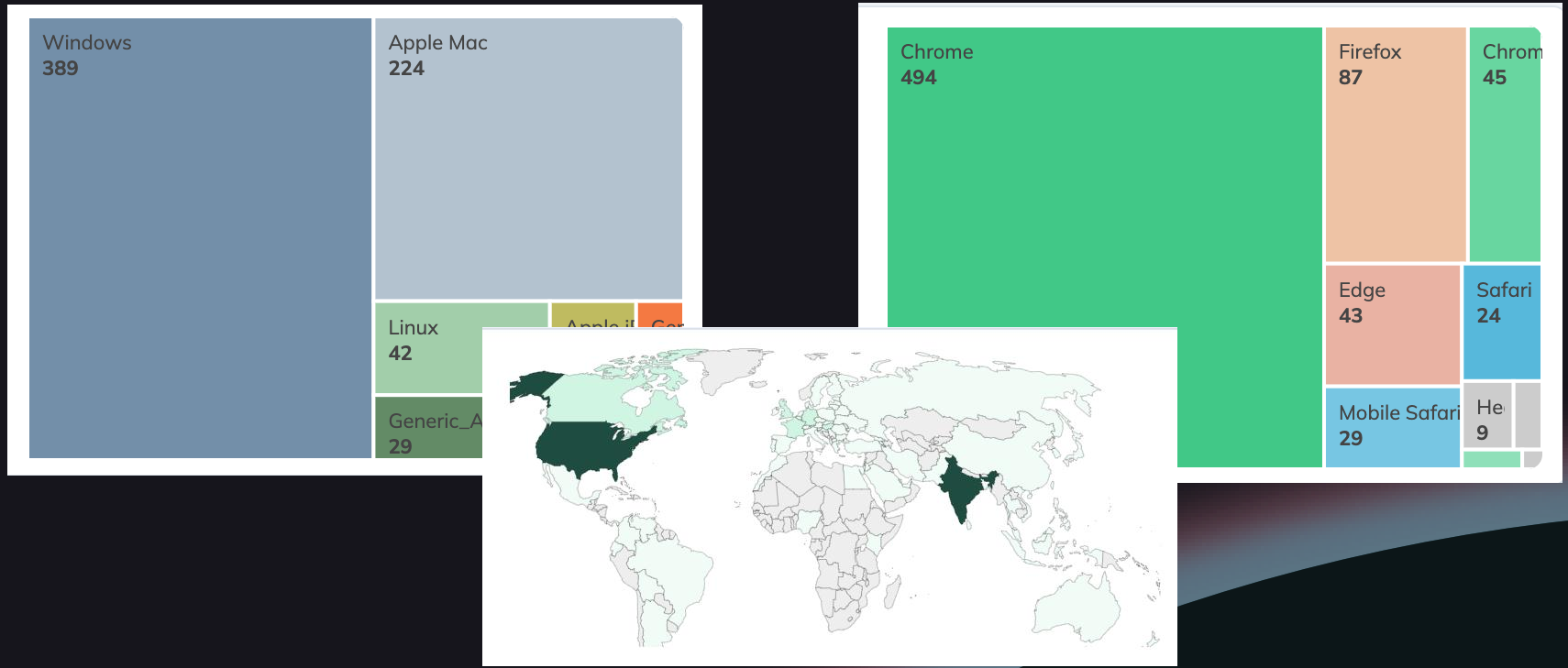


The Future is not evenly distributed yet.

Source: SpeedTest.net

Who are these Users

Understand Your Users



Source: Request Metrics

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Workshop Outline

~~1. Importance~~

~~2. Measuring~~

~~3. Tests and Tools~~

~~4. Setting Goals~~

5. Improving

~~Waterfall Charts~~

~~Flame Charts~~

~~Statistics~~

FUNDAMENTALS of
Web Performance

FUNDAMENTALS of Web Performance

End of Part 1