TOO HOT TO HANDLE
OPTIMIZING FOR LOW POWERED DEVICES

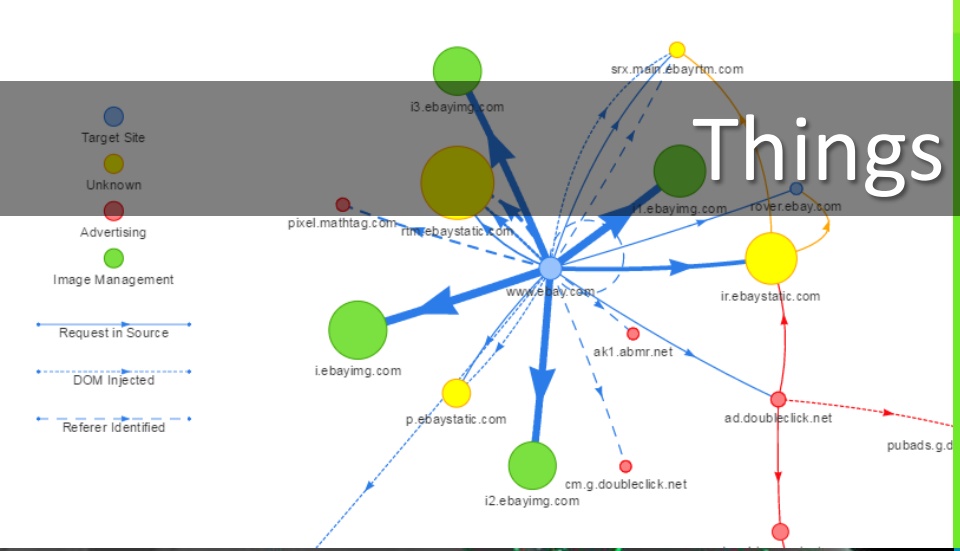
my face →

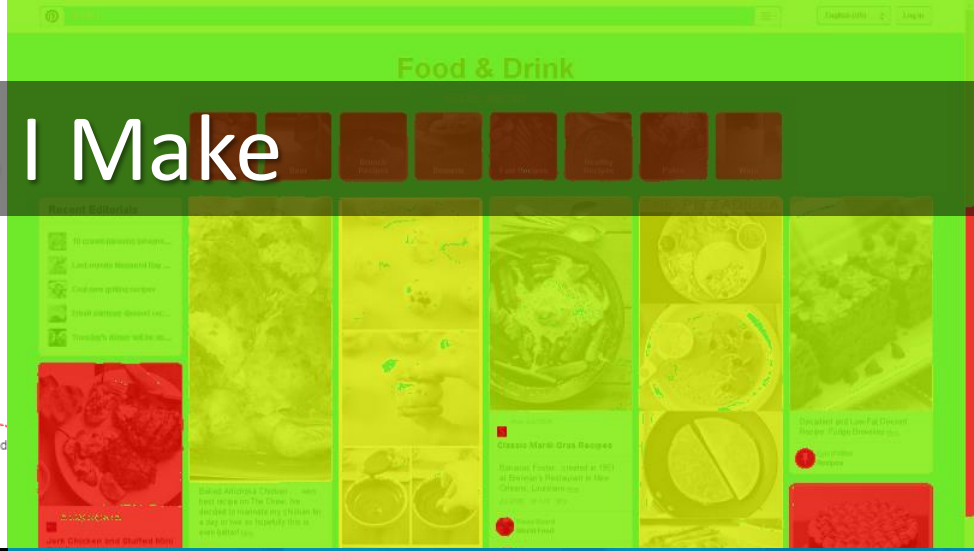
Simon Hearne
@SimonHearne

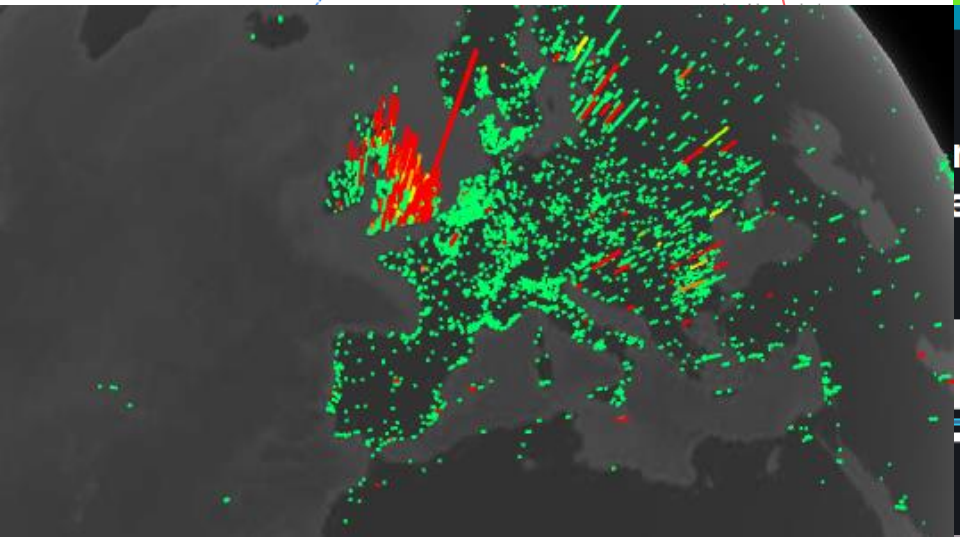
Senior Performance Consultant
NCC Group
slides: hearne.me/2hot

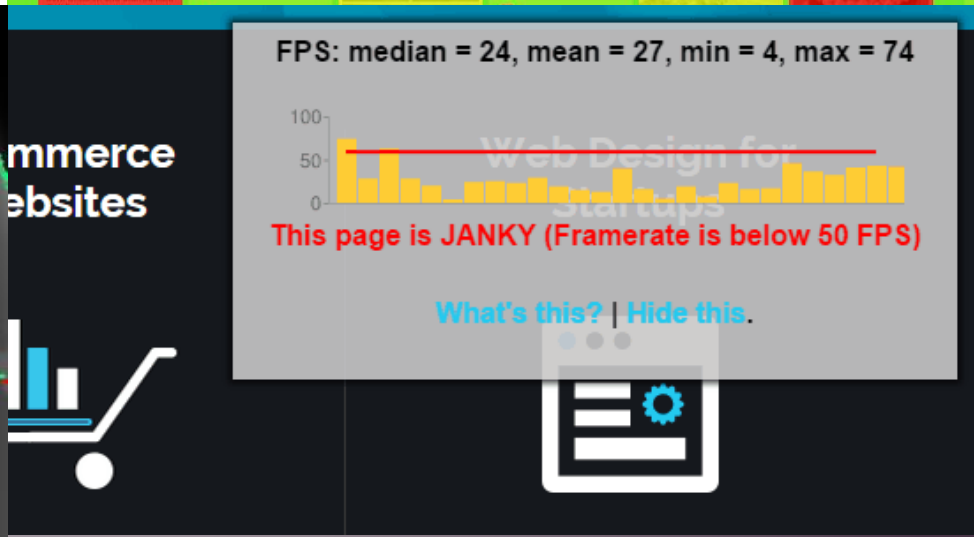
slides

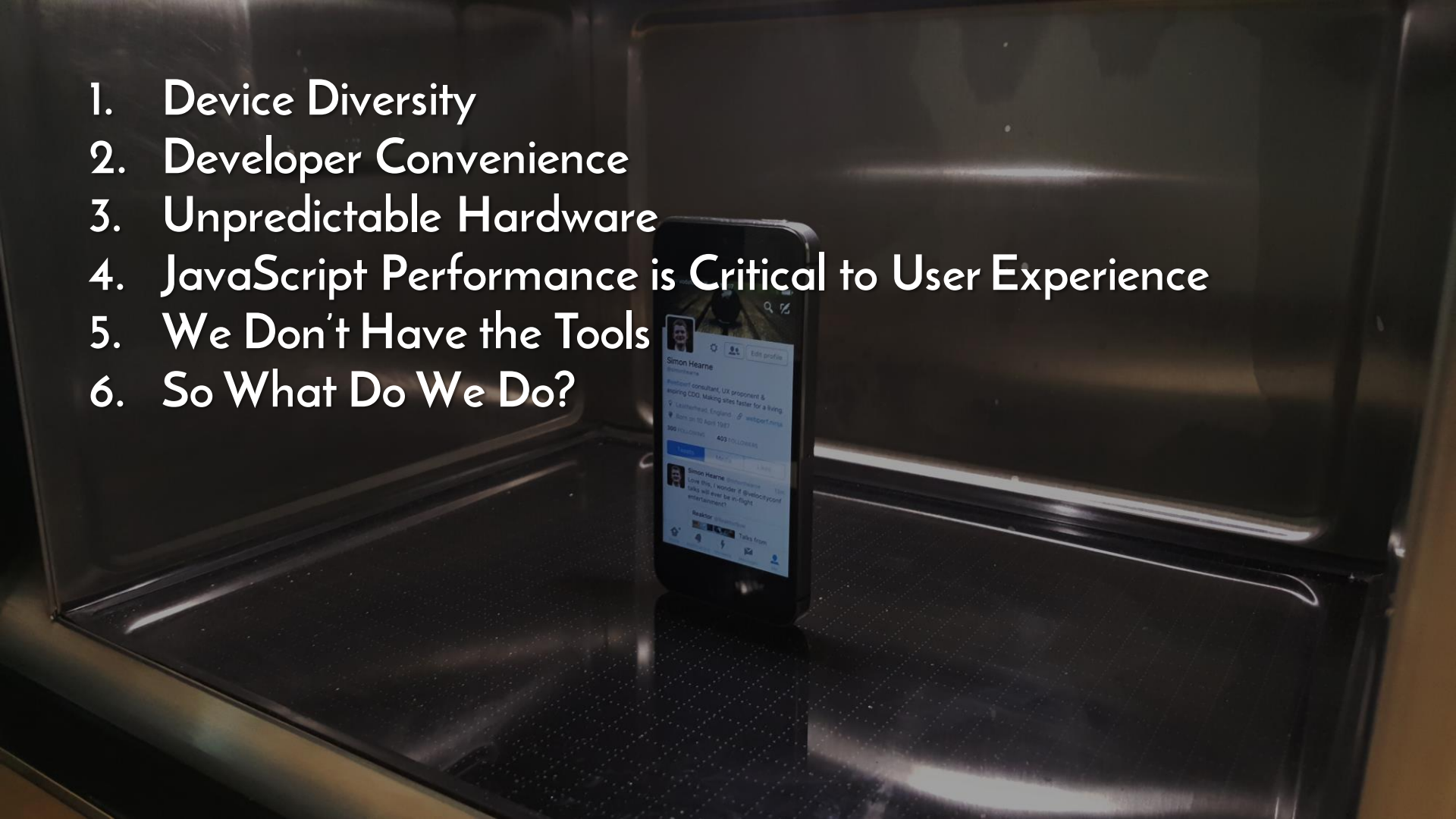
Things I Make



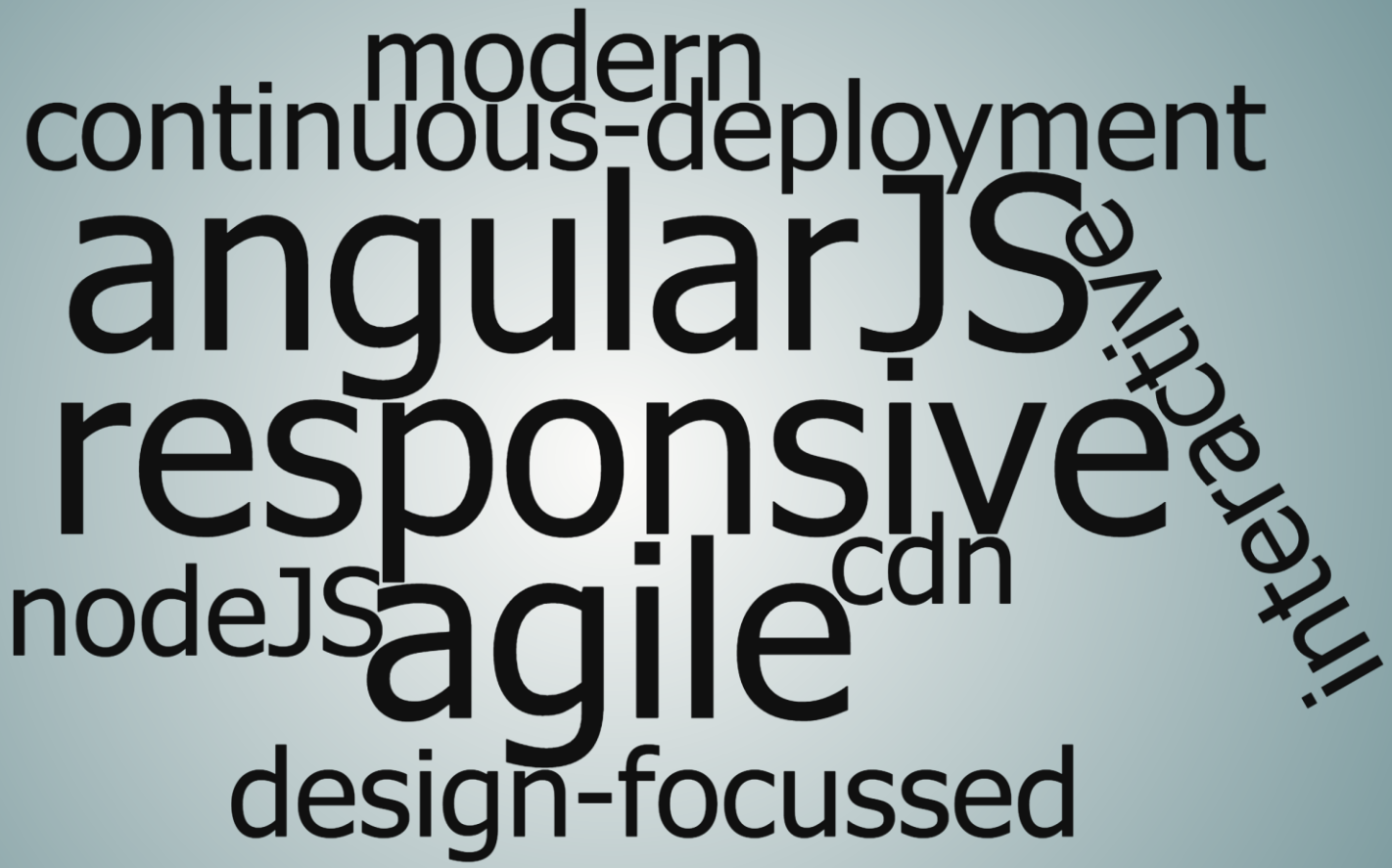




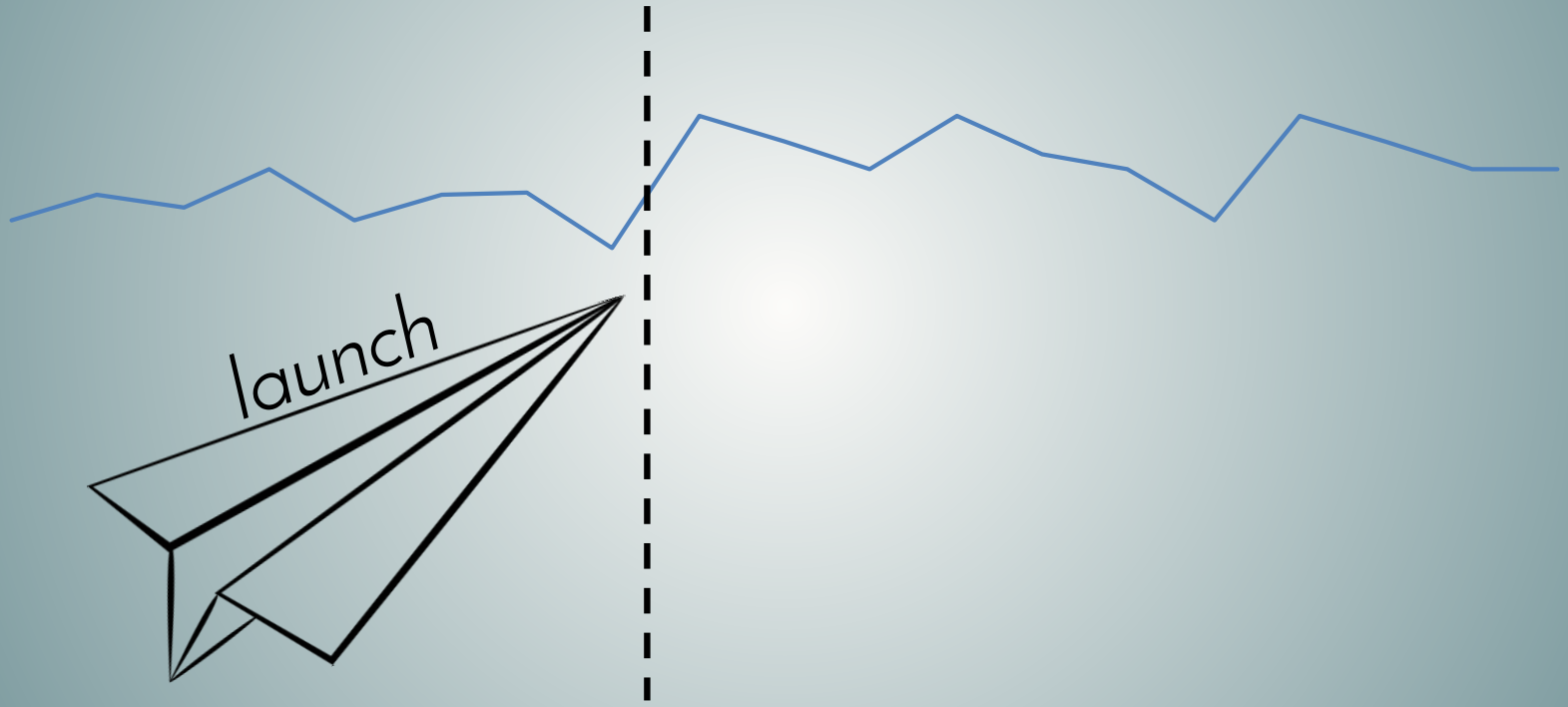



1. Device Diversity
2. Developer Convenience
3. Unpredictable Hardware
4. JavaScript Performance is Critical to User Experience
5. We Don't Have the Tools
6. So What Do We Do?
Simon Hearne

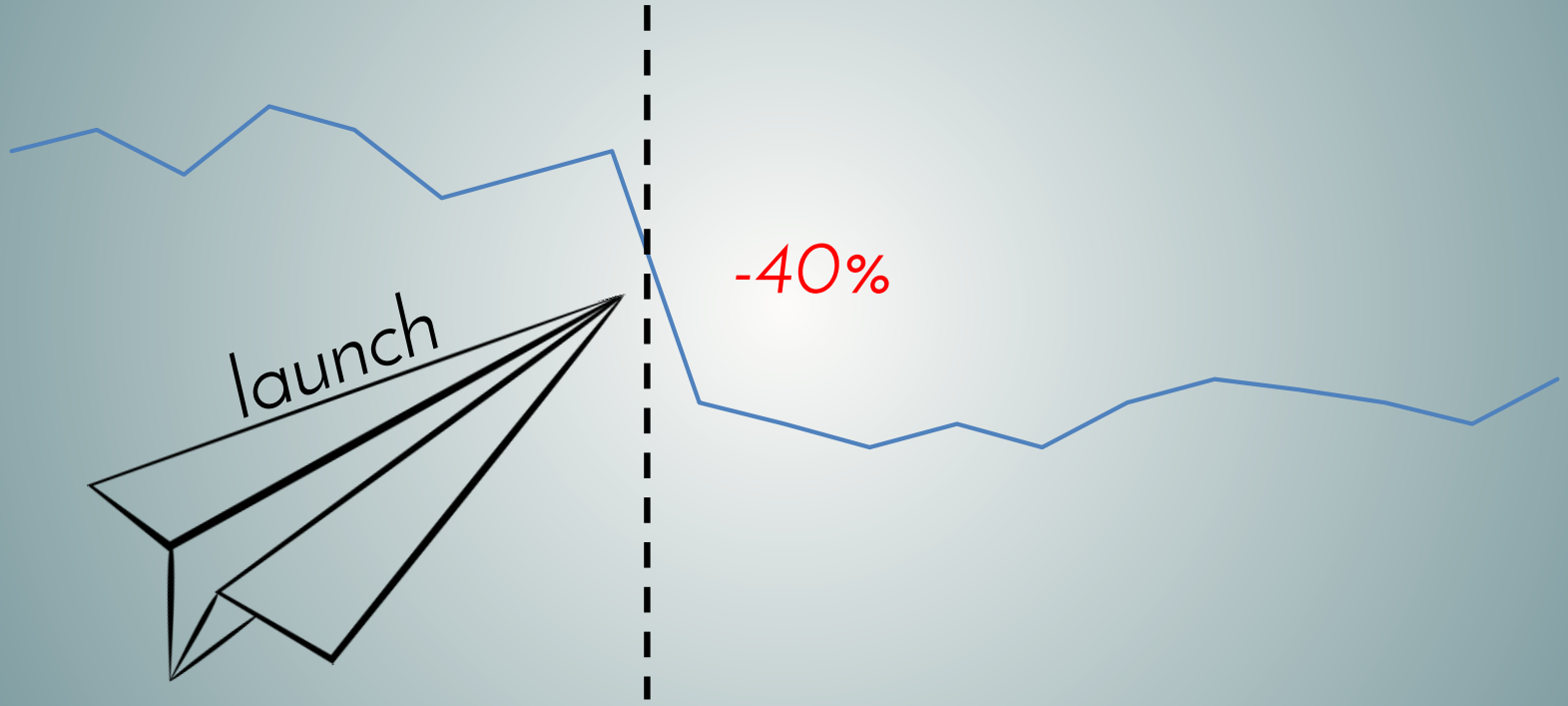
We're launching a new site!


modern
continuous-deployment
angularJS
responsive
interactive
cdn
nodeJS
agile
design-focussed

Performance was 'the same'



High conversion rate expectations...



CEO

User feedback was poor

"old-fashioned"

"hard to use"

"frustrating"

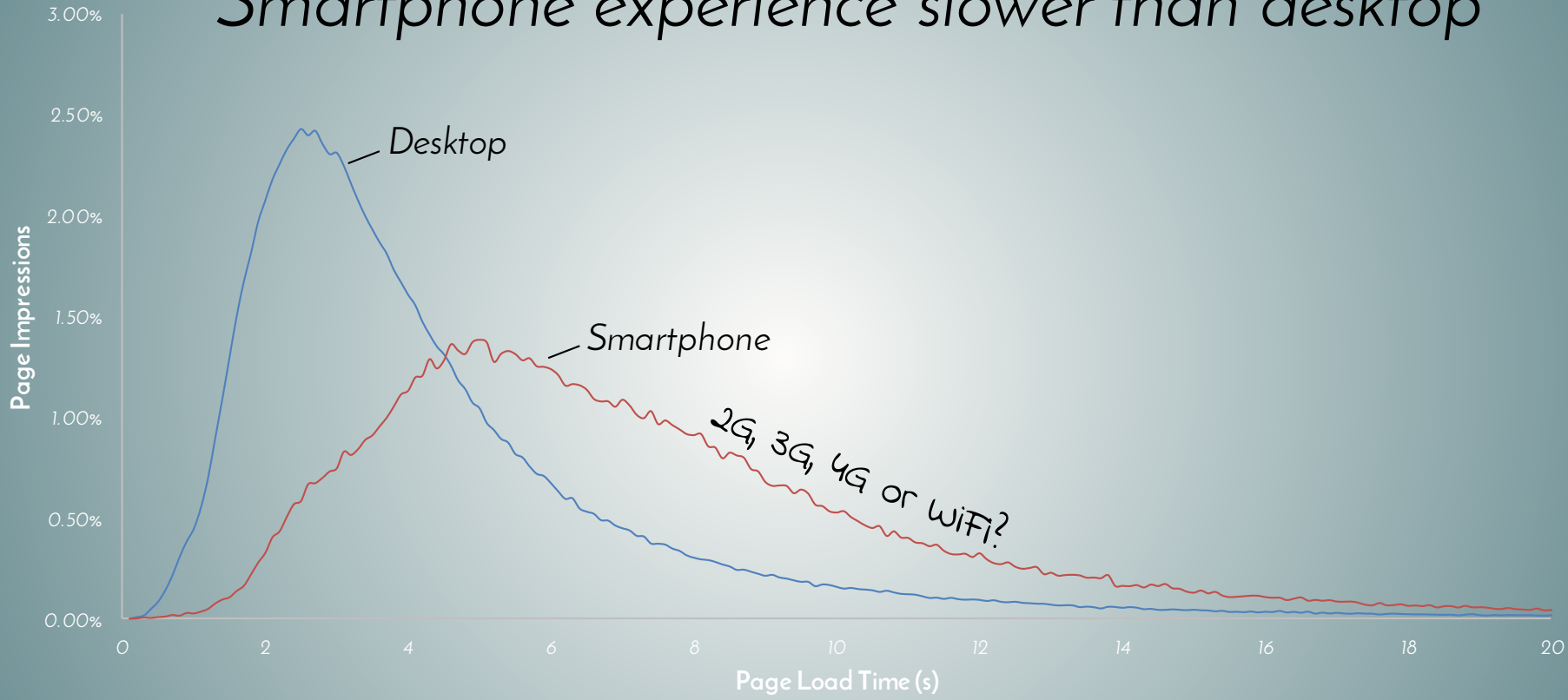
"clunky"

"slow"

"tired"

RUM
1862
LA CASA DEL MURCIELAGO
Est. 1862
BACARDÍ
OAKHEART
SMOOTH & SPICED
SPIRIT DRINK

Smartphone experience slower than desktop



“people on mobile expect a slower experience”

A Customer

Your users' expectations are set by their most recent interactions.

Your users' expectations are set by their most recent interactions.

On mobile, that means you're competing with the OS and native applications

Mobile users are not patient.

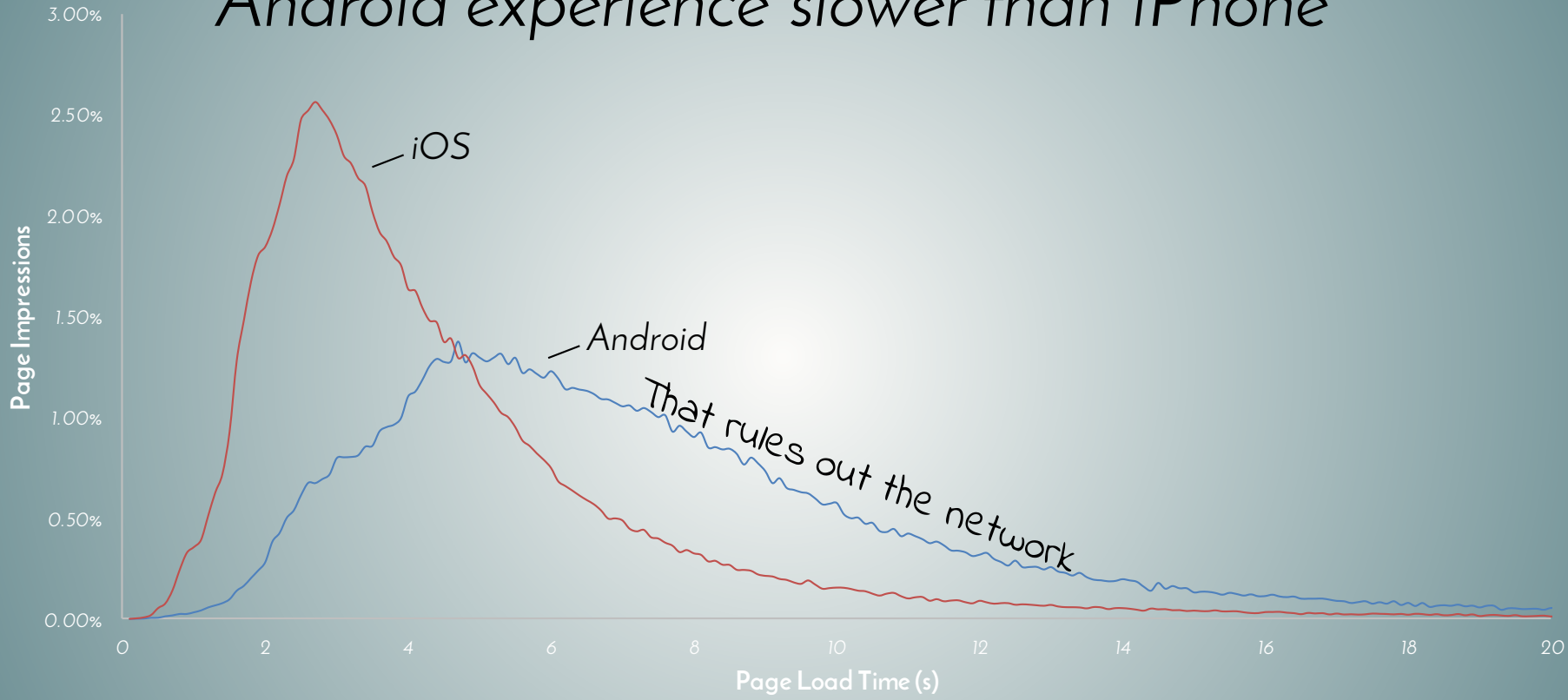
Mobile users are not patient.

53%

of visits are abandoned if a mobile page takes over three seconds

The need for mobile speed. DoubleClick, September 2016.

Android experience slower than iPhone



1

Device Diversity

Increasing device diversity has led to a 'great on some, okay on all' attitude

W3C Candidate Recommendation

Media Queries

W3C Candidate Recommendation 6 June 2007

This version:

http://www.w3.org/TR/2007/CR-css3-mediaqueries-20070606

Latest version:

http://www.w3.org/TR/css3-mediaqueries

Previous version:

http://www.w3.org/TR/2002/CR-css3-mediaqueries-20020708

Editors:

Håkon Wium Lie <howcome @opera.com>
Tantek Çelik <tantek @cs.stanford.edu>
Daniel Glazman <daniel.glazman @disruptive-innovations.com>

2007
no app store, 2G

> Responsive web design is a fluid grid, flexible images and media queries

Ethan Marcotte
(2010)

RESPONSIVE WEB DESIGN WAS CREATED WHEN MOBILE TRAFFIC WAS < 3%

http://www.statista.com/statistics/241462/global-mobile-phone-website-traffic-share/

RESPONSIVE WEB DESIGN WAS CREATED WHEN MOBILE TRAFFIC WAS < 3%

MOBILE TRAFFIC IS NOW >40%

http://www.statista.com/statistics/241462/global-mobile-phone-website-traffic-share/

US Android market share is 25% greater than iPhone

53%

43%

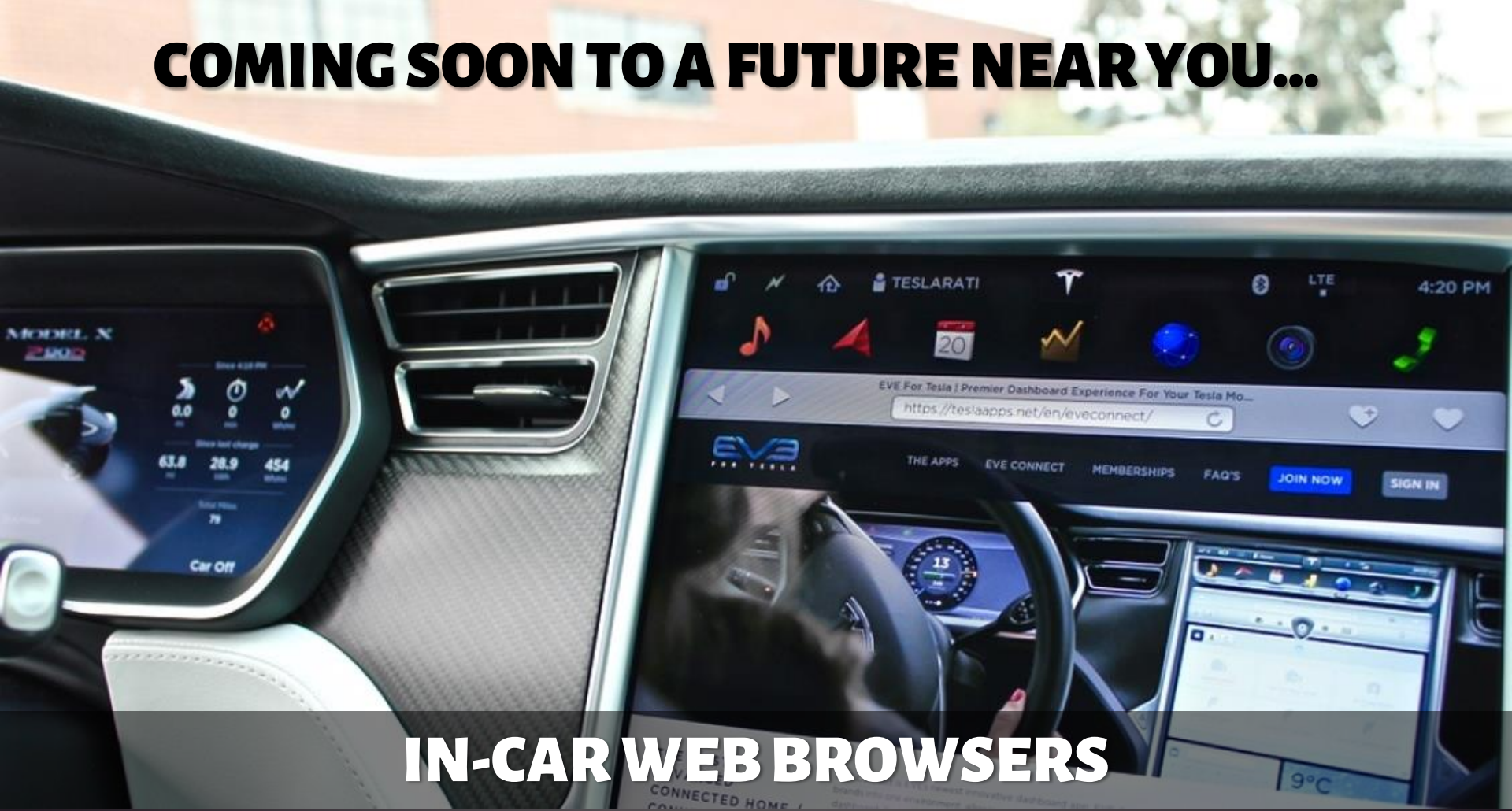
2016 U.S. Cross-Platform Future in Focus – ConScore Inc.

(p.s. smartphone ⊆ mobile)

Smart TV
Smart Watch
Raspberry Pi
Games Console
Wireless Router

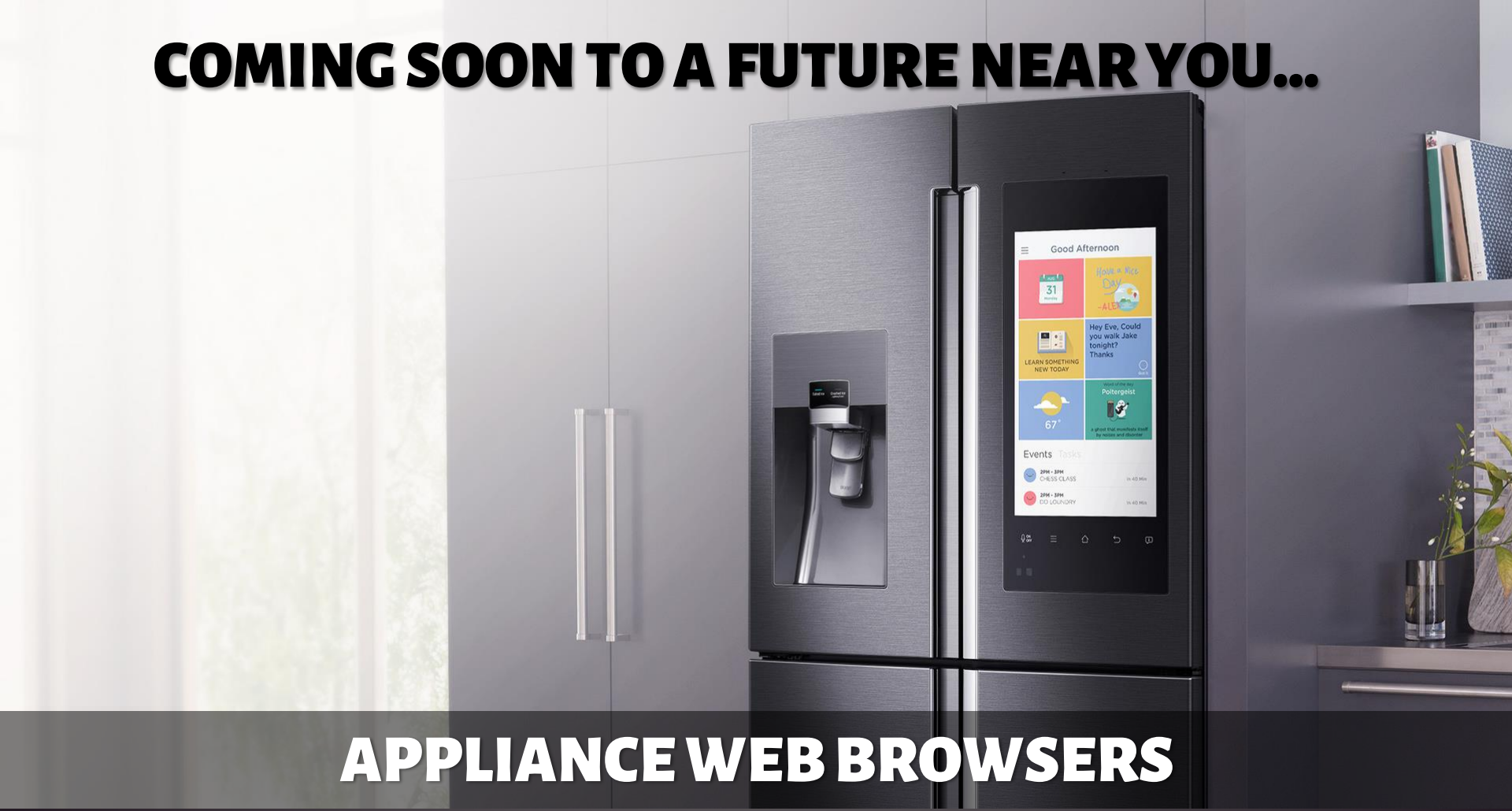
2% of Ecommerce Traffic

COMING SOON TO A FUTURE NEAR YOU...



IN-CAR WEB BROWSERS

COMING SOON TO A FUTURE NEAR YOU...



APPLIANCE WEB BROWSERS

COMING SOON TO A FUTURE NEAR YOU...

WEARABLE WEB BROWSERS

Responsive (generally) means a desktop site on non-desktop devices

RULE 1

Responsive Web Design Is Not Enough

2

Developer Convenience

We prioritise developer convenience over user experience

> Responsive web design is a fluid grid, flexible images and media queries

Ethan Marcotte
(2010)

i.e.

develop one code-base &

compromise on most viewports

the way we consume the web has changed

19%

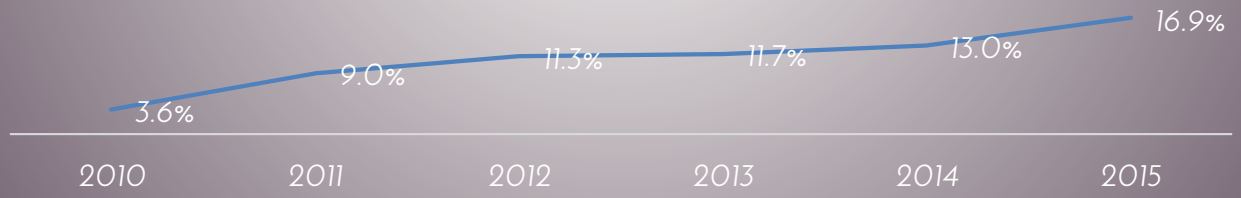
of adults in the United States are Smartphone-dependent

http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/

Mobile revenue share is increasing

16.9%

of digital revenue is mobile



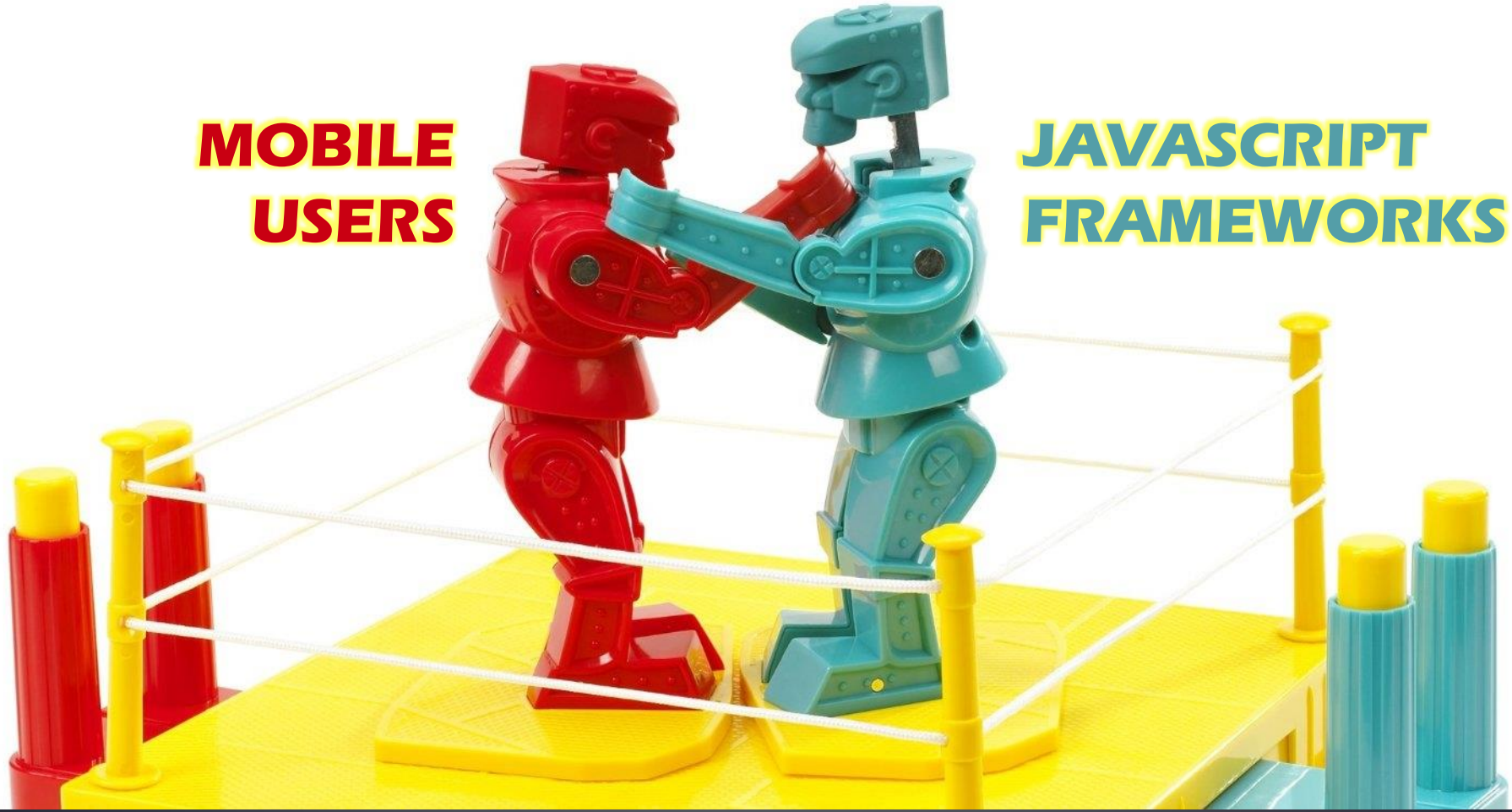
2016 U.S. Cross Platform Future in Focus - ComScore Inc.

*the way we **develop** for the web has changed*

ANGULARJS

2007

2016


MOBILE
USERS
JAVASCRIPT
FRAMEWORKS

"among our 5,400 panellists

15%

do not have JavaScript enabled devices"

"Building Pew Research Center's American Trends Panel," April 8, 2015

1.1%

of UK traffic does not execute JavaScript

https://gds.blog.gov.uk/2013/10/21/how-many-people-are-missing-out-on-javascript-enhancement/

JavaScript frameworks take our code from a safe and controlled environment (server) to the wild west (client).

RULE 2

Question the Use of JavaScript Frameworks

3

Unpredictable Hardware

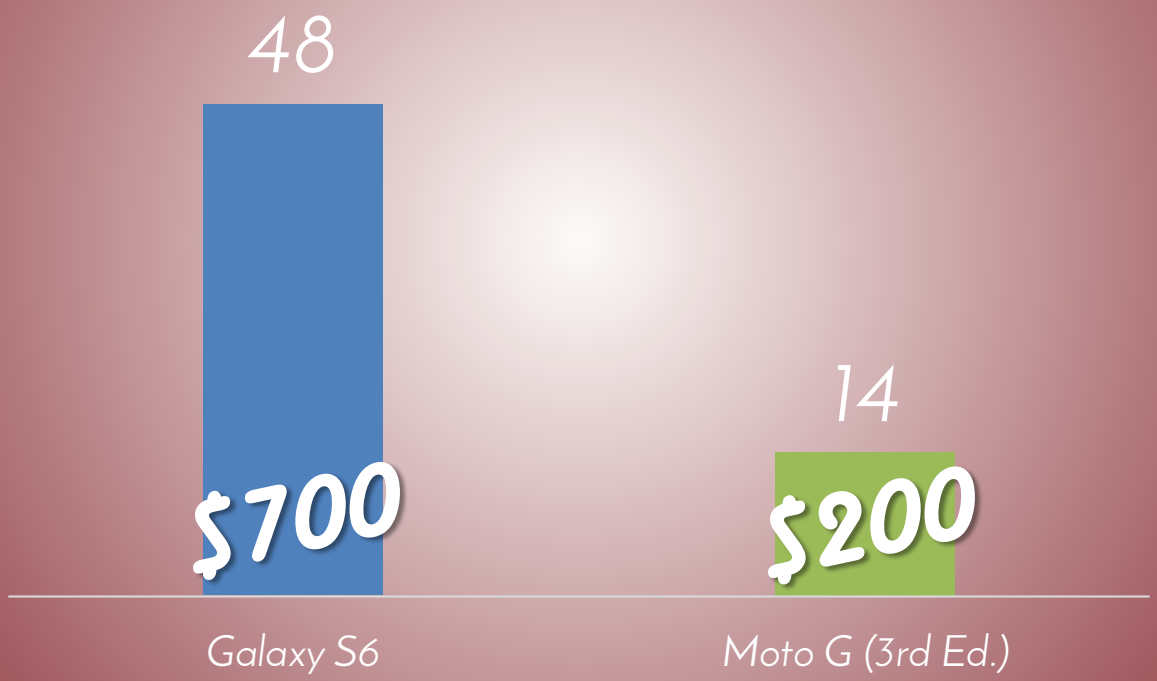
We can't control our users' devices.
Even high-end devices can perform poorly.

“Our customers use iPhones and high-end Android phones, so performance isn't an issue”

A Customer

JetStream JavaScript Benchmark

(bigger = better)



JetStream JavaScript Benchmark

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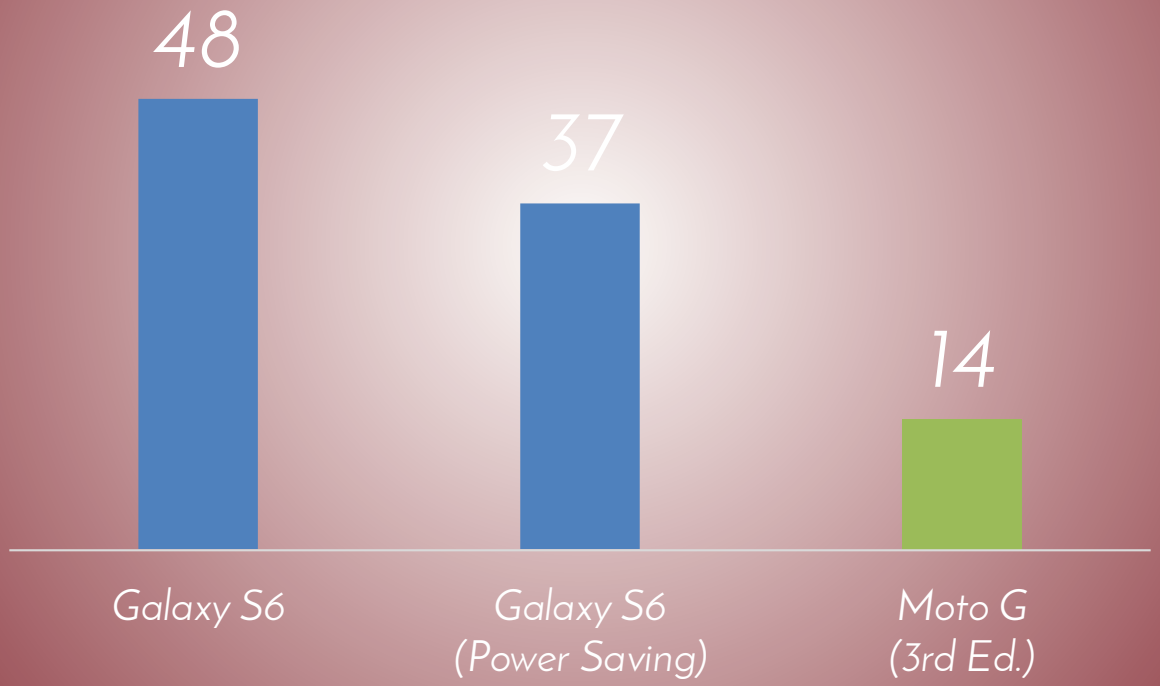
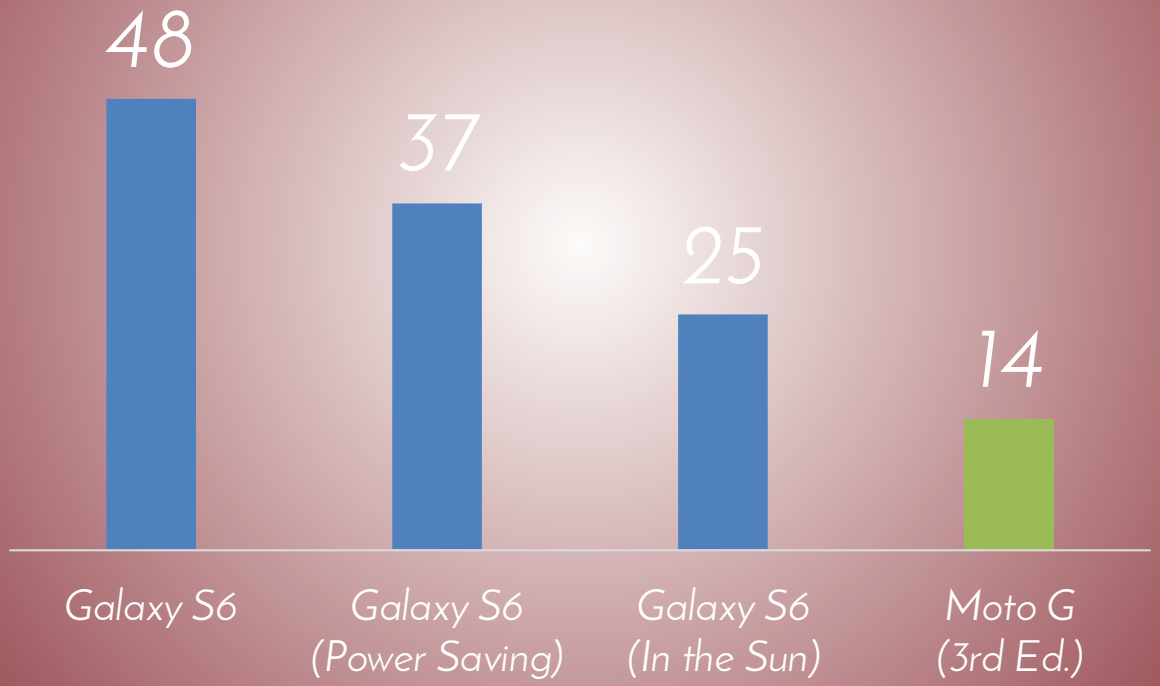


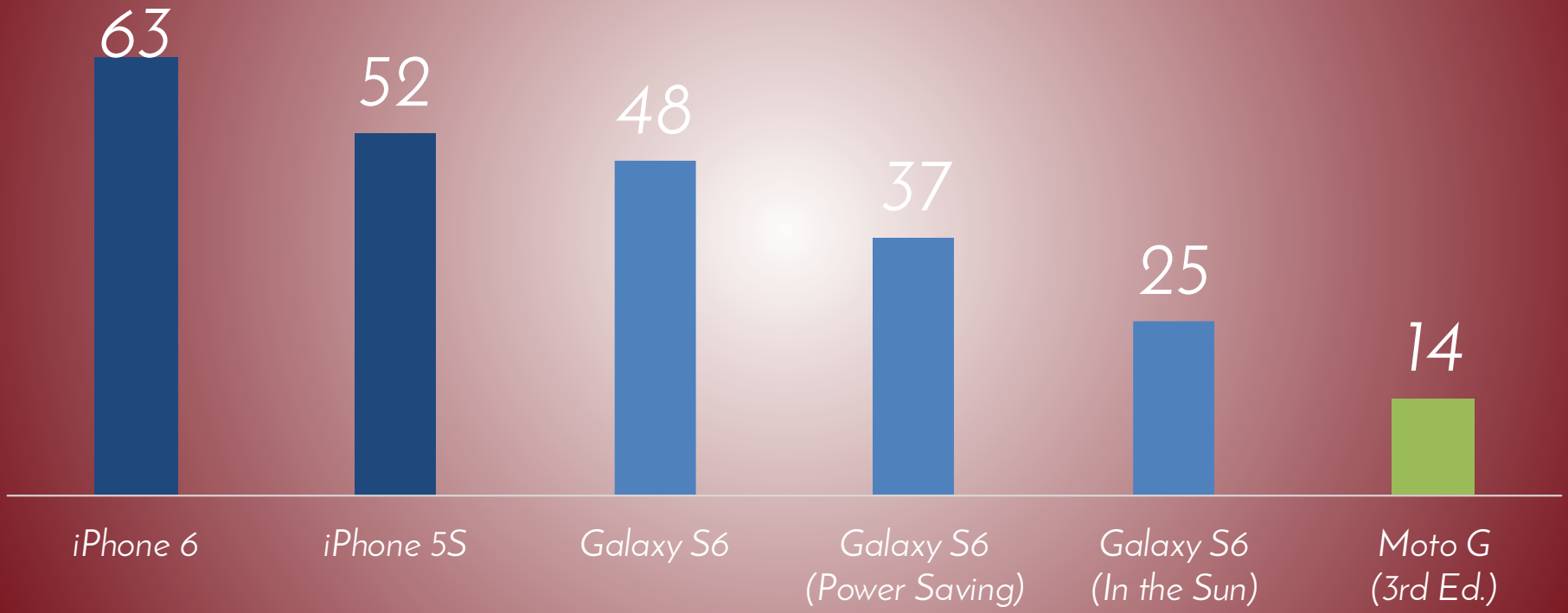
JetStream JavaScript Benchmark

(bigger = better)



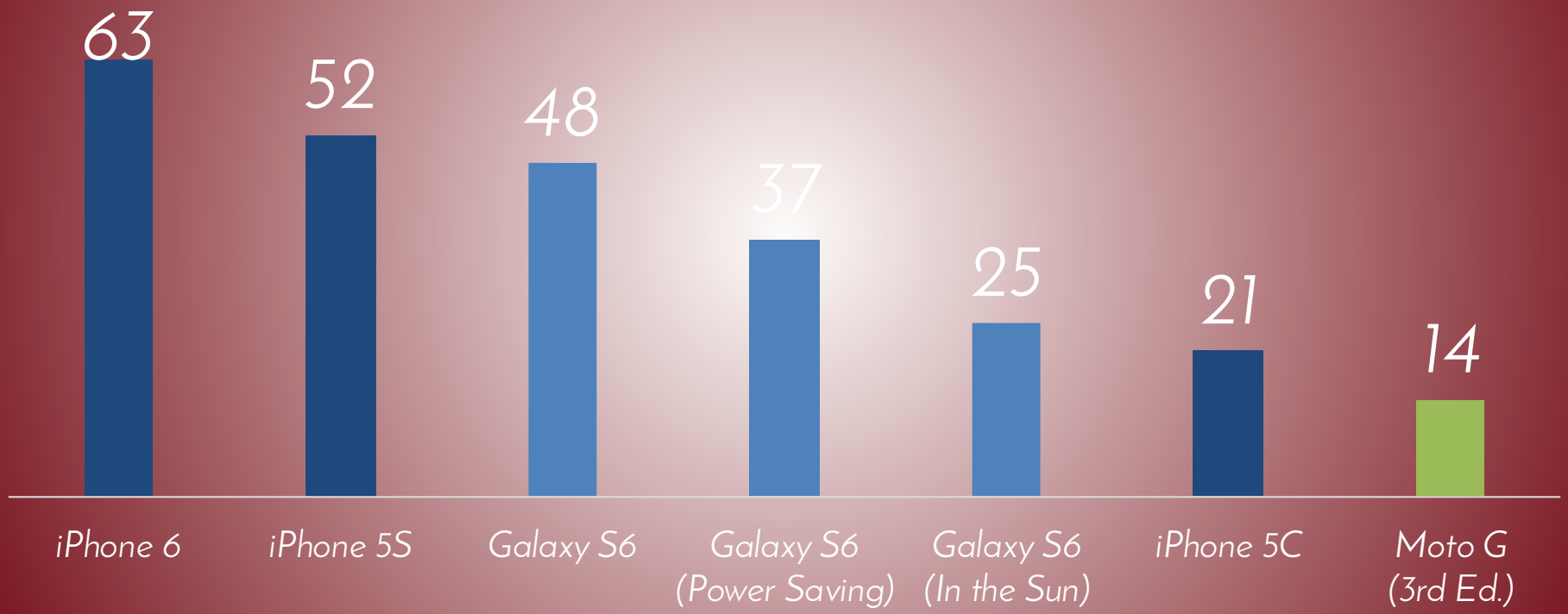
JetStream JavaScript Benchmark

(bigger = better)



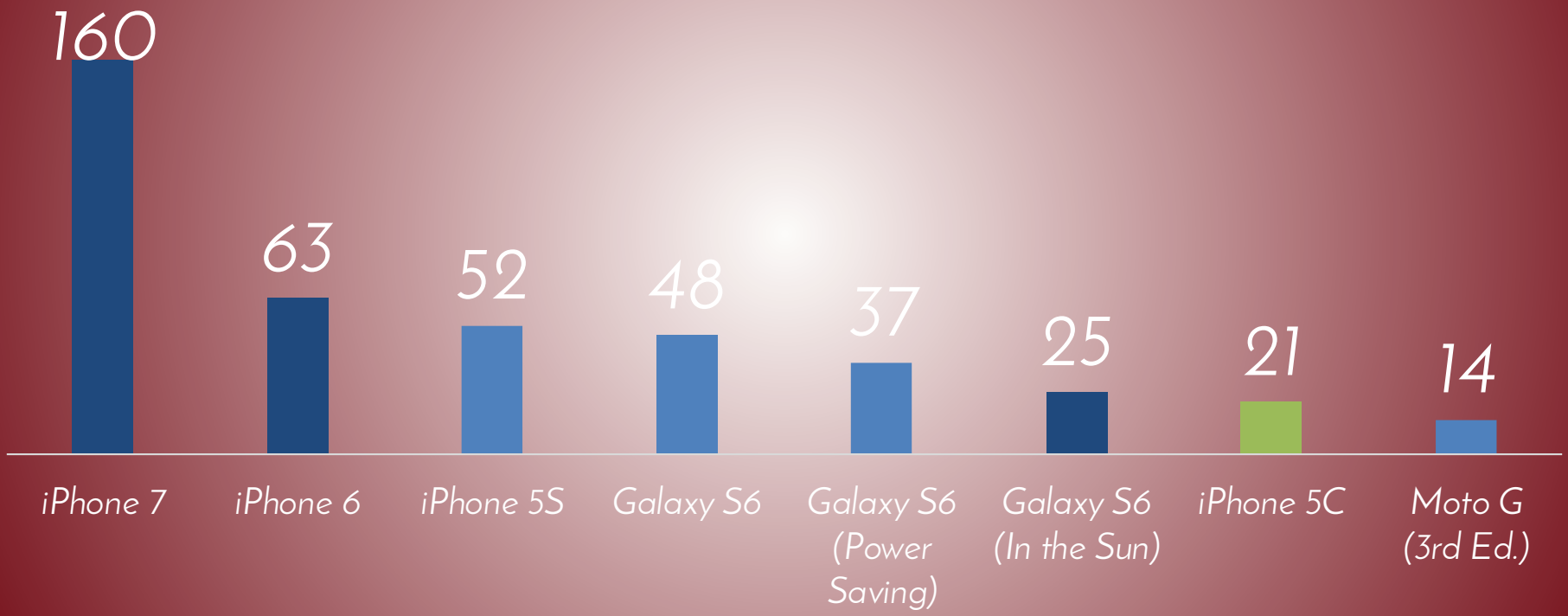
JetStream JavaScript Benchmark

(bigger = better)

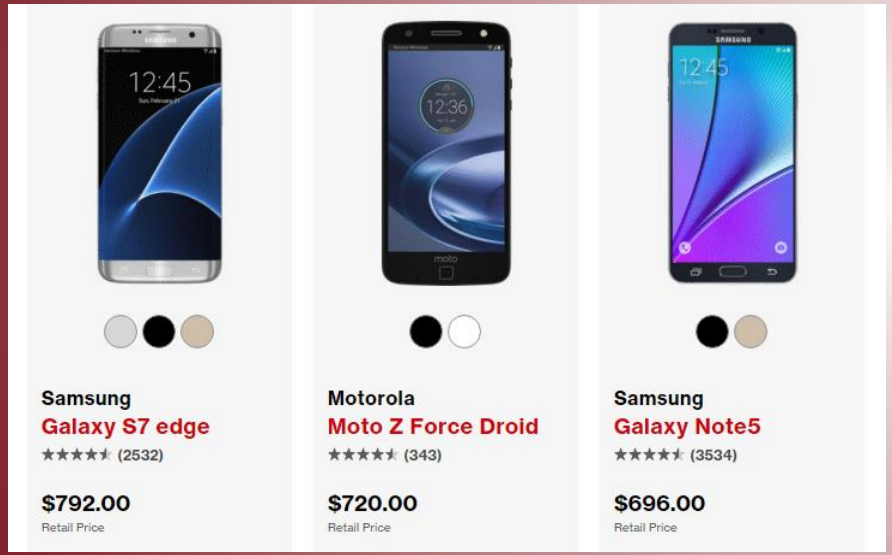


JetStream JavaScript Benchmark

(bigger = better)



Increasing Performance Fragmentation



Should low-income users get a poorer web experience?

Do you test performance on low-end devices?

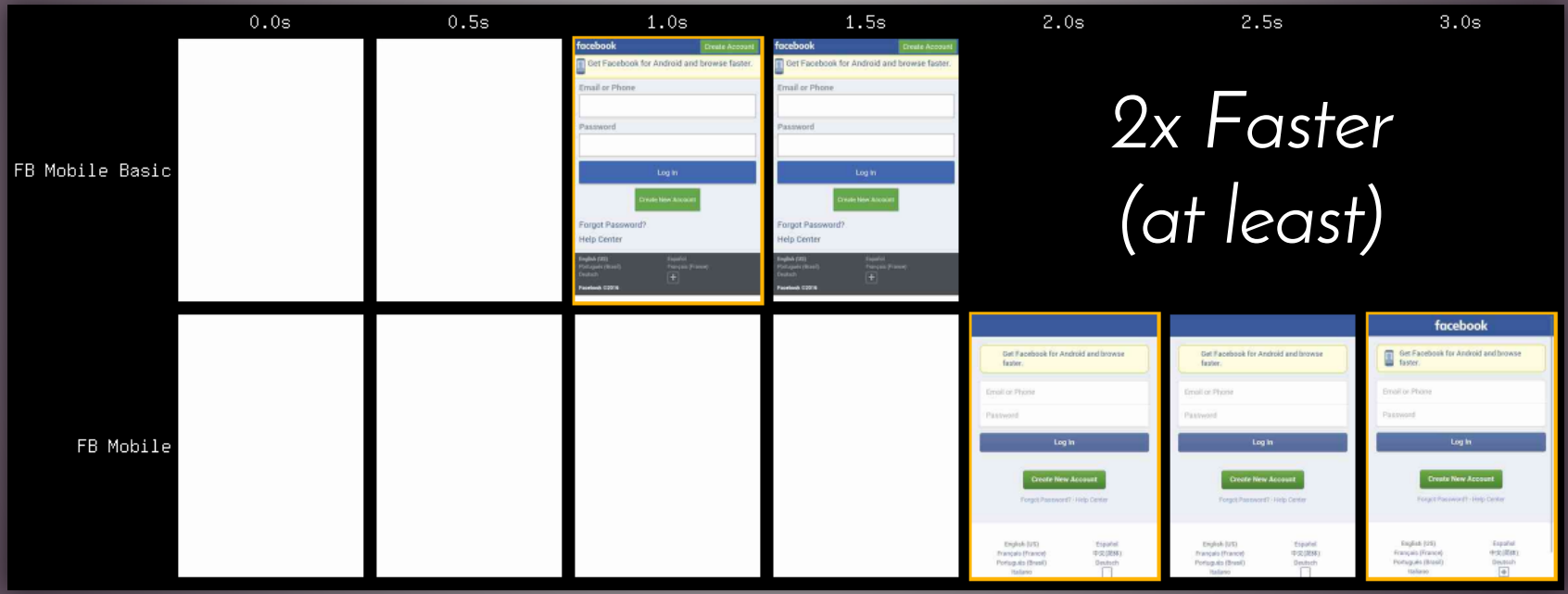
RULE 3

Test on low-end hardware (it's cheap!)

4

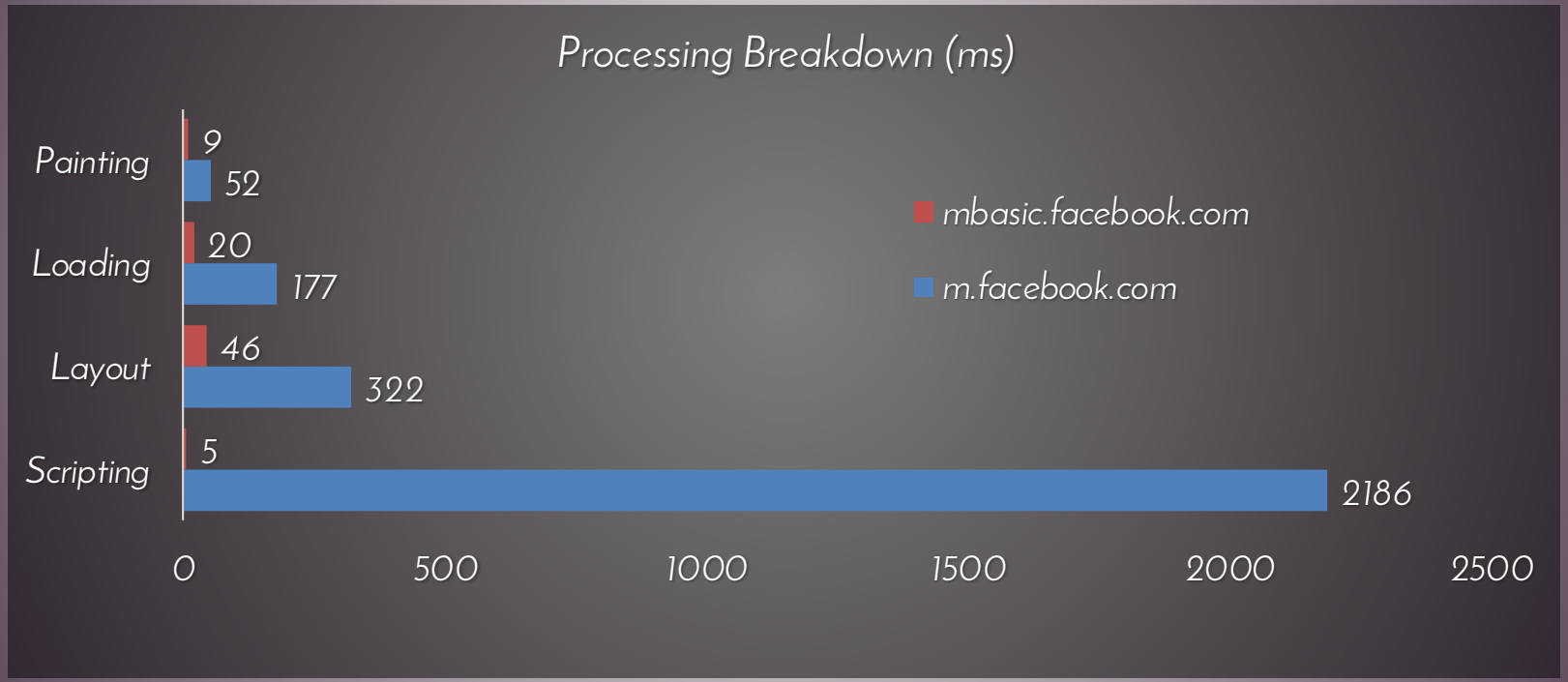
JavaScript Performance is Critical to User Experience

Facebook @ Line Speed



https://www.webpagetest.org/video/compare.php?tests=160918_2A_SSH,160918_05_SSF

Facebook @ Line Speed



https://www.webpagetest.org/breakdownTimeline.php?test=160918_2A_SSH , https://www.webpagetest.org/breakdownTimeline.php?test=160918_05_SSF

Parsing & executing jQuery can take

700ms

on low-powered devices

https://timkadlec.com/2014/09/js-parse-and-execution-time/

Here comes some data...

- QuantCast top 10,000 websites
- WebPageTest Private
  - AWS North California
  - Chrome mobile **emulation**
  - Cable speed
- 8,289 valid page tests
- 12.4% have a single-page application framework (hearne.me/spajs)

mobile sites with
SPA frameworks are

43%

slower than those without

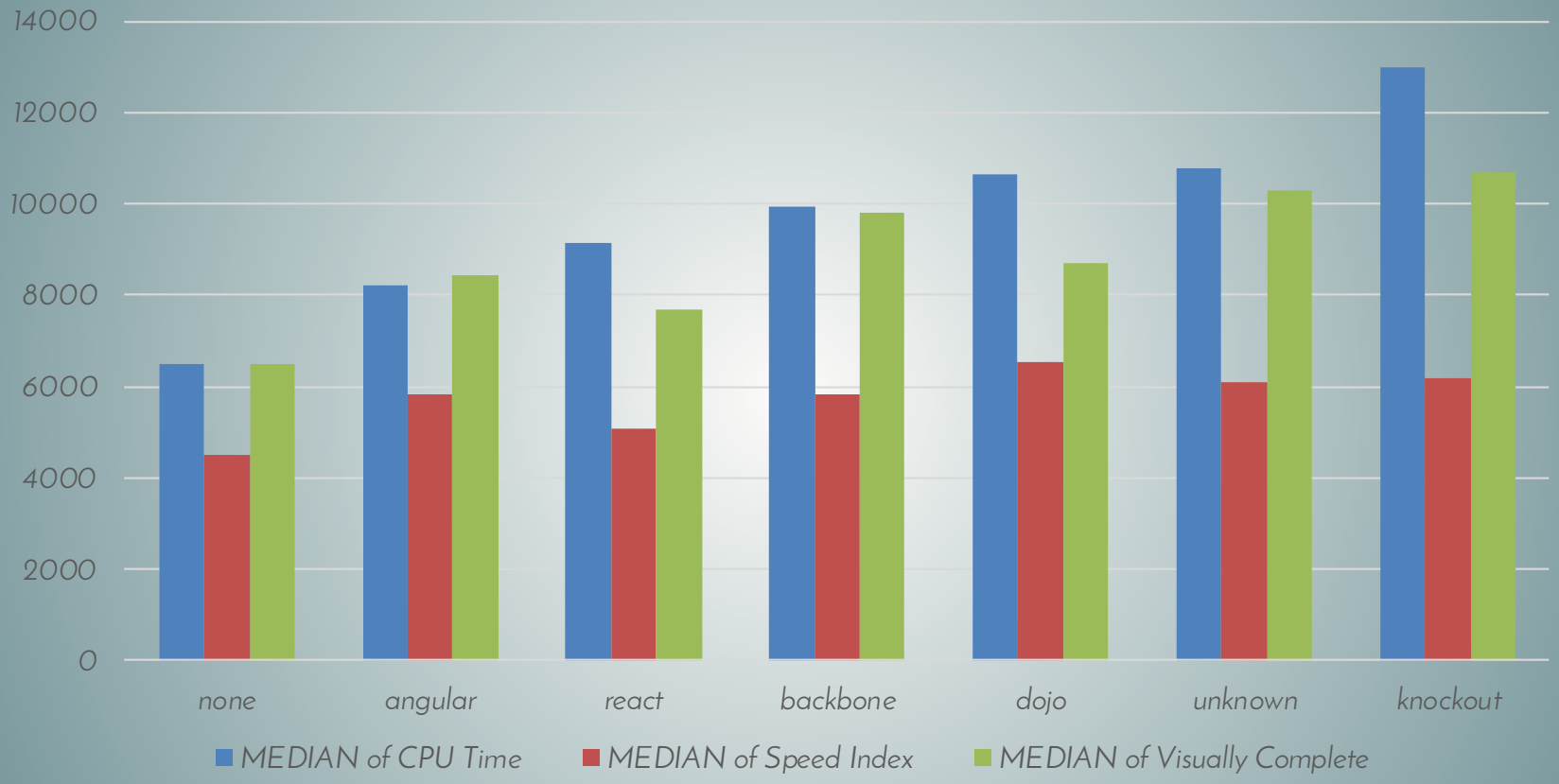
Measured by Speed Index

mobile sites with

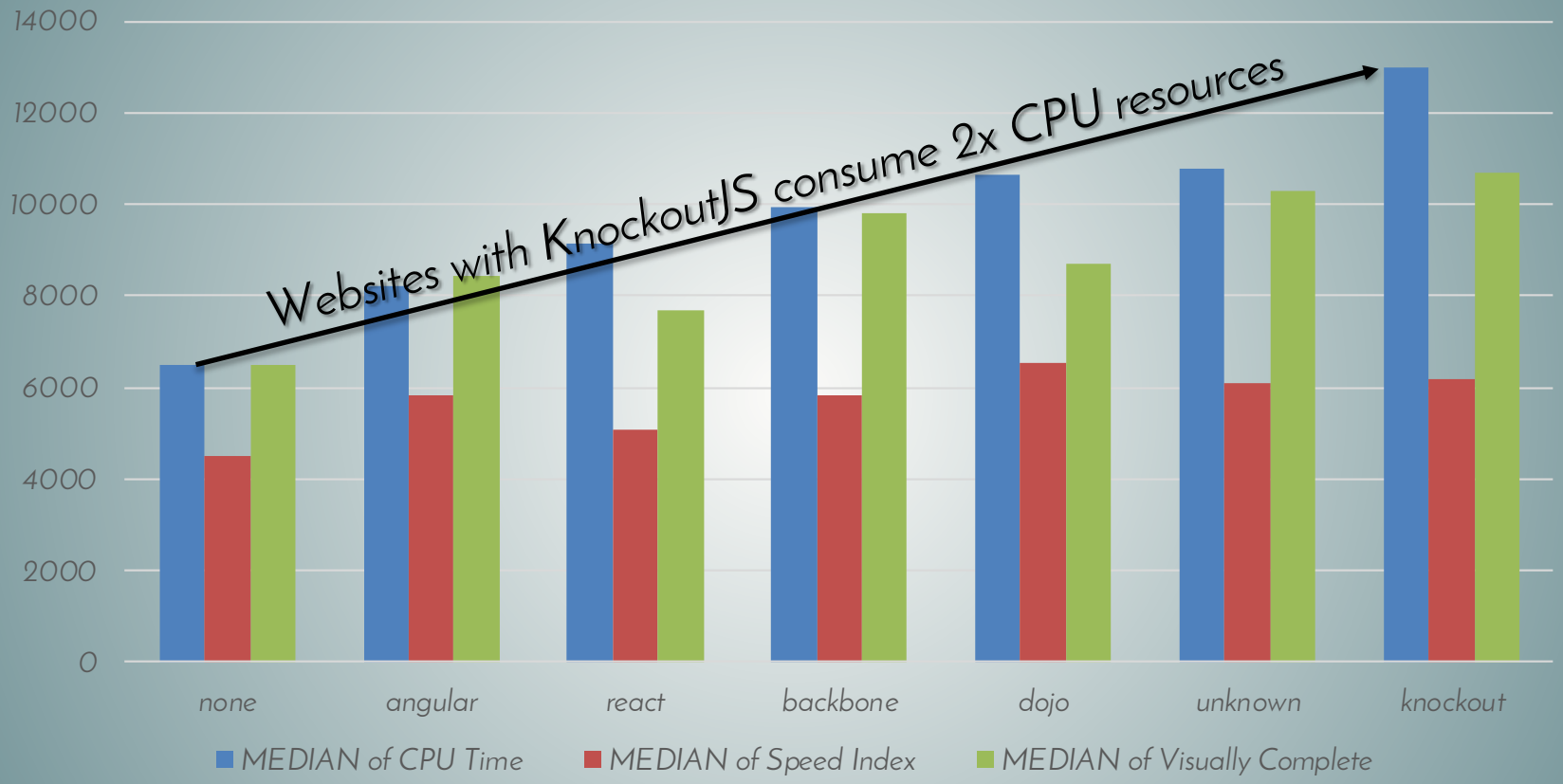
SPA frameworks take

500ms

longer to start render



hearne.me/spadata

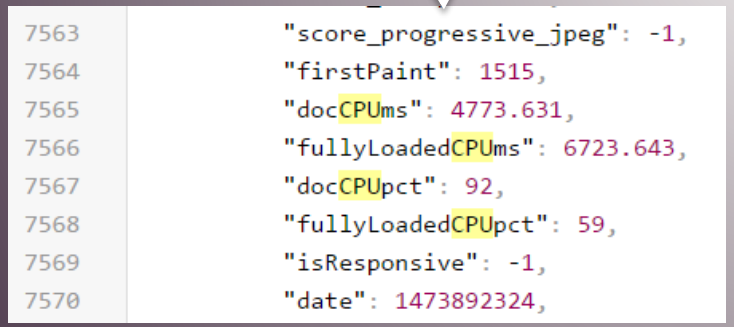


hearne.me/spadata

WPT API

Chrome Mobile

Chrome Desktop



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2786        "Idle": 2227
2787      },
```

You can make it faster

Any JavaScript single-page application framework or template can be pre-rendered

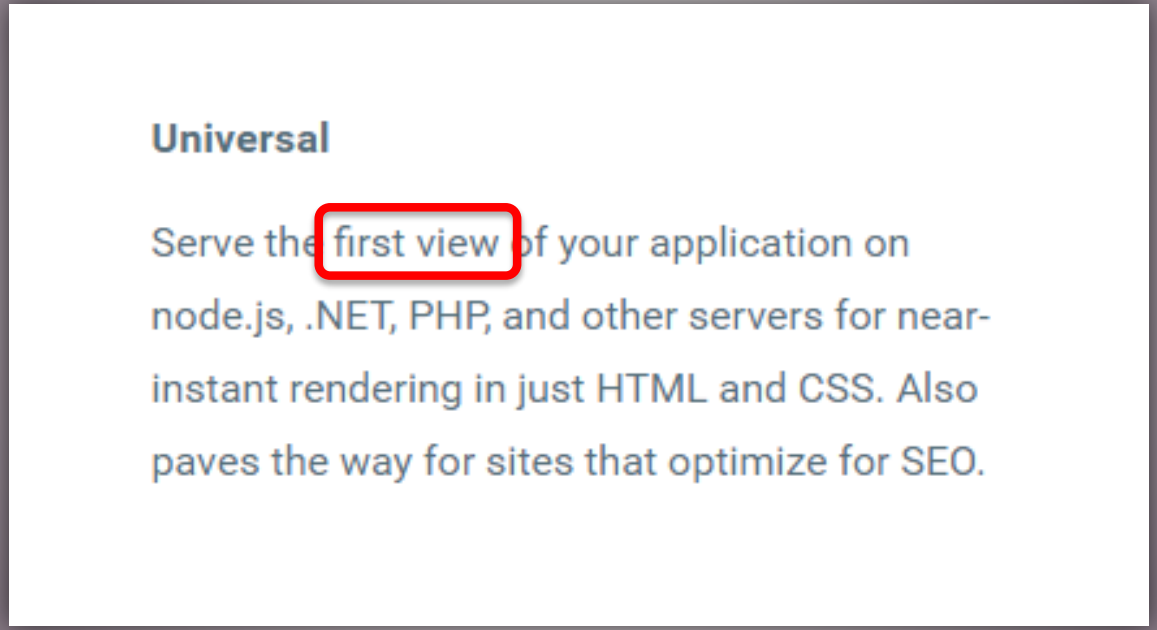
Angular 2 Universal Pre-Render

Universal

Serve the first view of your application on node.js, .NET, PHP, and other servers for near-instant rendering in just HTML and CSS. Also paves the way for sites that optimize for SEO.

https://angular.io/features.html

Angular 2 Universal Pre-Render



https://angular.io/features.html

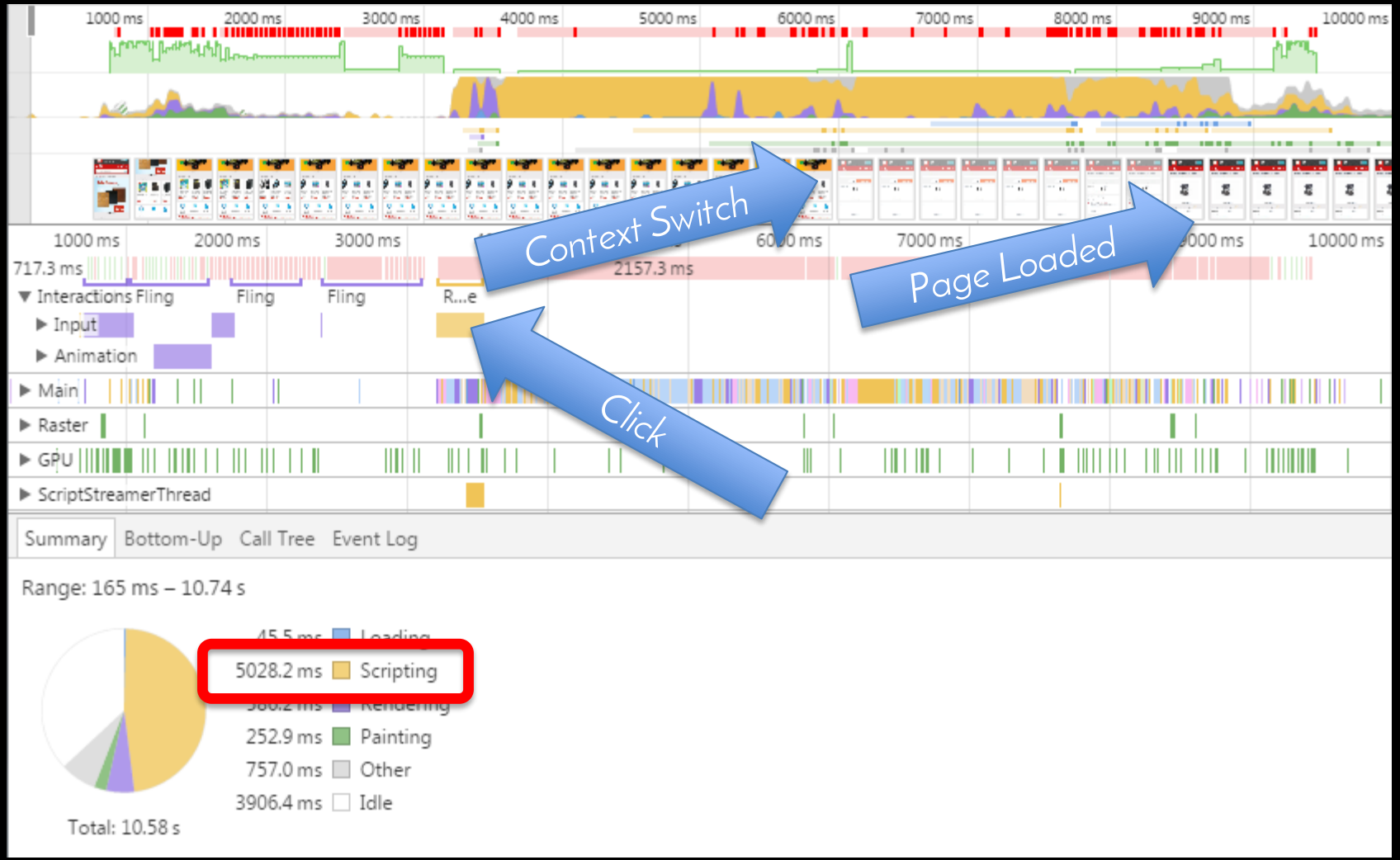
Kmart
Kmart
GET - In Google Play
View

find something great... close

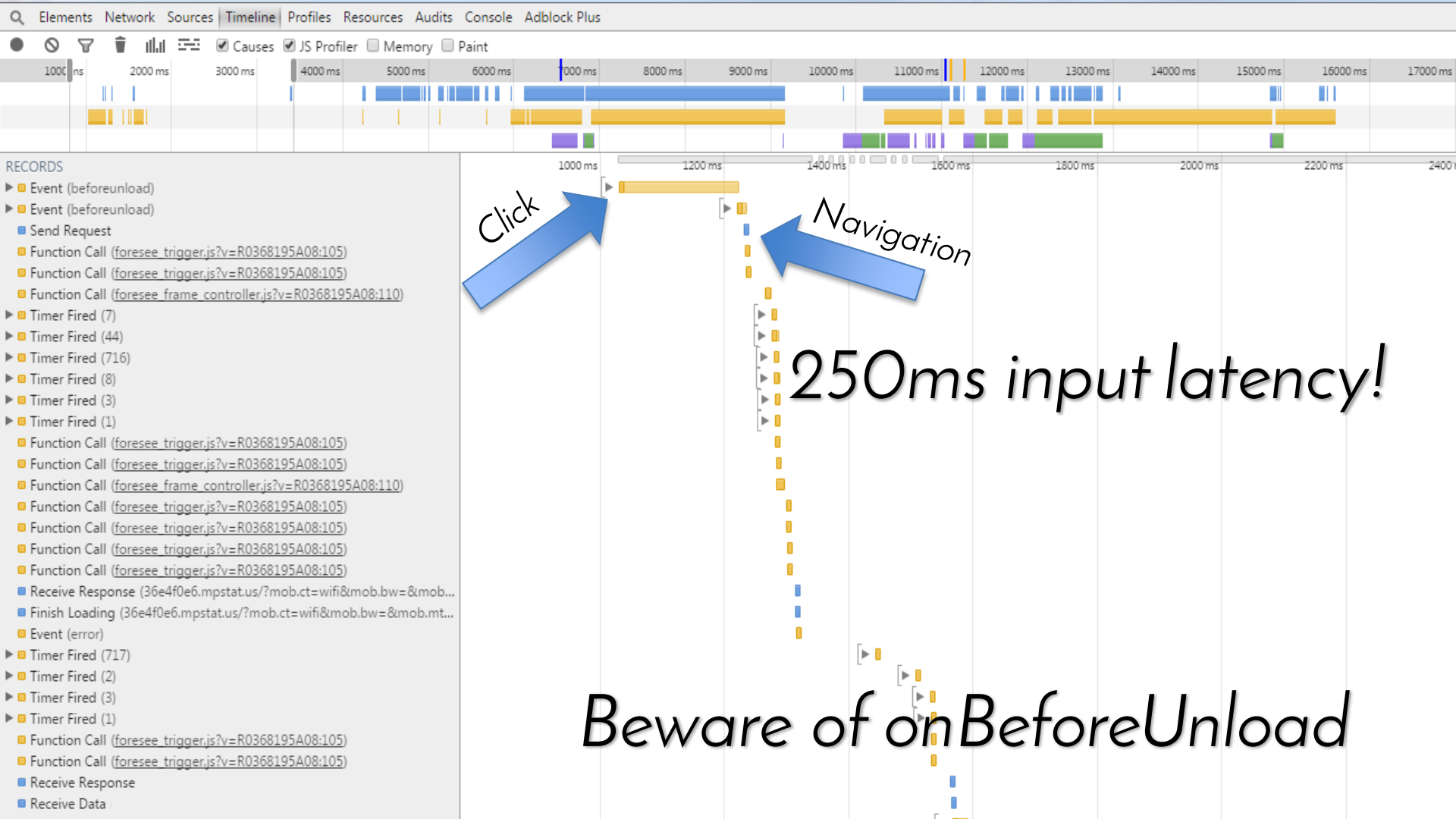
Using 10001 for pricing and availability.

WE'VE LOWERED PRICES
ON HUNDREDS OF ITEMS

$11.99
Tide Liquid Detergent
92-100 oz.


1000 ms
2000 ms
3000 ms
4000 ms
5000 ms
6000 ms
7000 ms
8000 ms
9000 ms
10000 ms
Context Switch
Page Loaded
Click
717.3 ms
2157.3 ms
Interactions
Fling
Fling
Fling
Input
Animation
Main
Raster
GPU
ScriptStreamerThread
Summary
Bottom-Up
Call Tree
Event Log
Range: 165 ms – 10.74 s
5028.2 ms Scripting
252.9 ms Painting
757.0 ms Other
3906.4 ms Idle
Total: 10.58 s

Third-Parties can lock the UI


Elements Network Sources Timeline Profiles Resources Audits Console Adblock Plus
Causes JS Profiler Memory Paint
RECORDS
Event (beforeunload)
Event (beforeunload)
Send Request
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_frame_controller.js?v=R0368195A08:110)
Timer Fired (7)
Timer Fired (44)
Timer Fired (716)
Timer Fired (8)
Timer Fired (3)
Timer Fired (1)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_frame_controller.js?v=R0368195A08:110)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Receive Response (36e4f0e6.mpstat.us/?mob.ct=wifi&mob.bw=&mob...
Finish Loading (36e4f0e6.mpstat.us/?mob.ct=wifi&mob.bw=&mob.mt...
Event (error)
Timer Fired (717)
Timer Fired (2)
Timer Fired (3)
Timer Fired (1)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Function Call (foresee_trigger.js?v=R0368195A08:105)
Receive Response
Receive Data
Click
Navigation
250ms input latency!
Beware of onBeforeUnload

RULE 4

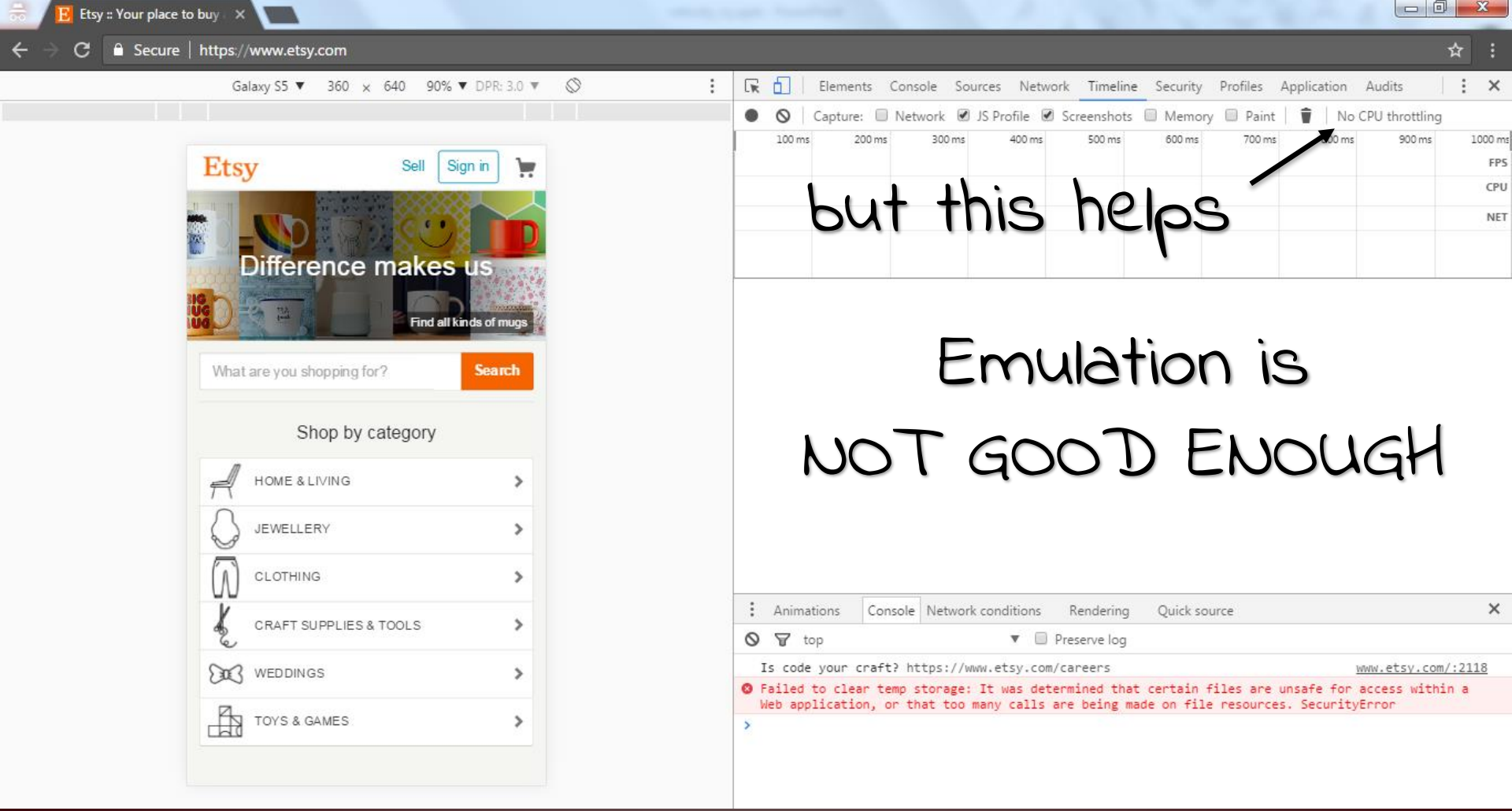
Measure and Monitor CPU Usage
Including page interactions!

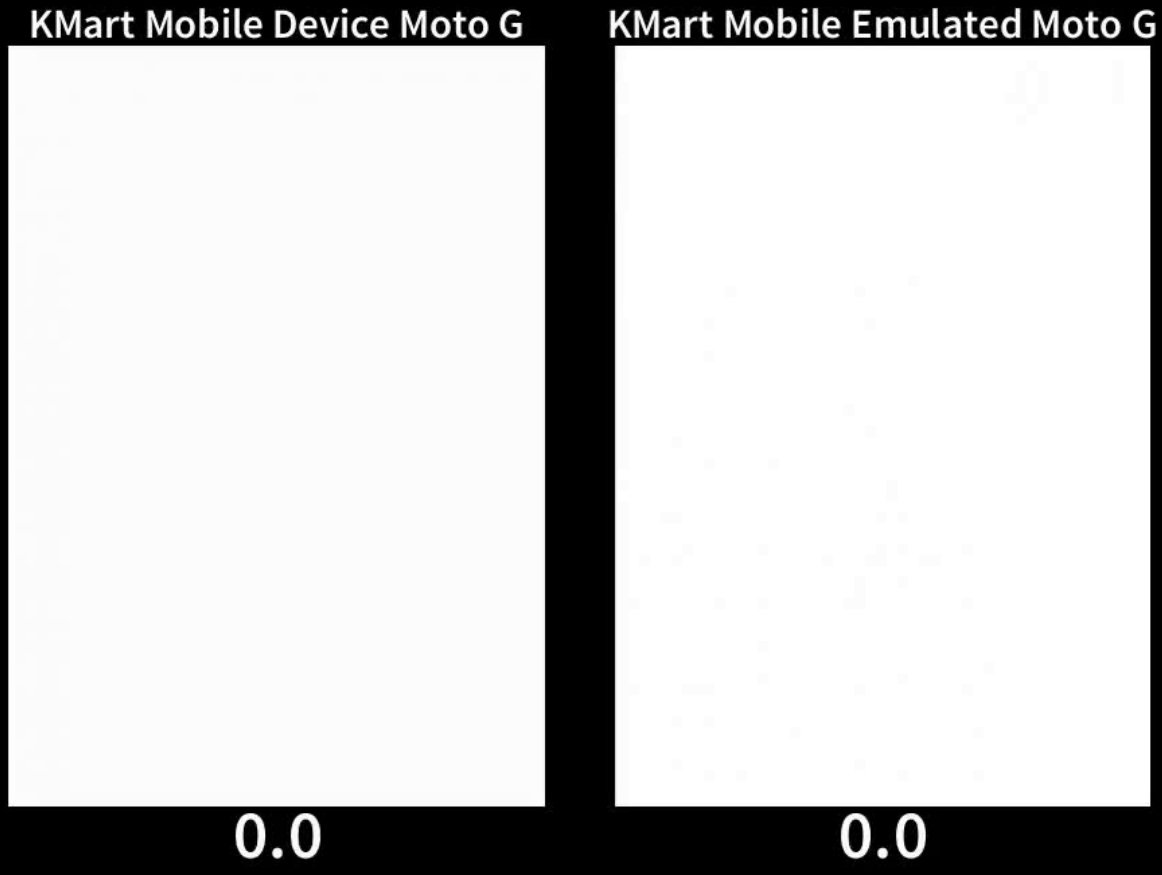
5

We Don't Have the Tools

You can't manage what you don't measure.

Developer Machines vs Customer Machines


Etsy :: Your place to buy
Secure | https://www.etsy.com
Galaxy S5 360 x 640 90% DPR: 3.0
Etsy
Sell
Sign in
Difference makes us
Find all kinds of mugs
What are you shopping for?
Search
Shop by category
HOME & LIVING
JEWELLERY
CLOTHING
CRAFT SUPPLIES & TOOLS
WEDDINGS
TOYS & GAMES
Elements Console Sources Network Timeline Security Profiles Application Audits
Capture: Network JS Profile Screenshots Memory Paint
No CPU throttling
100 ms 200 ms 300 ms 400 ms 500 ms 600 ms 700 ms 800 ms 900 ms 1000 ms
FPS
CPU
NET
but this helps
Emulation is
NOT GOOD ENOUGH
Animations Console Network conditions Rendering Quick source
top
Preserve log
Is code your craft? https://www.etsy.com/careers
www.etsy.com/:2118
Failed to clear temp storage: It was determined that certain files are unsafe for access within a Web application, or that too many calls are being made on file resources. SecurityError

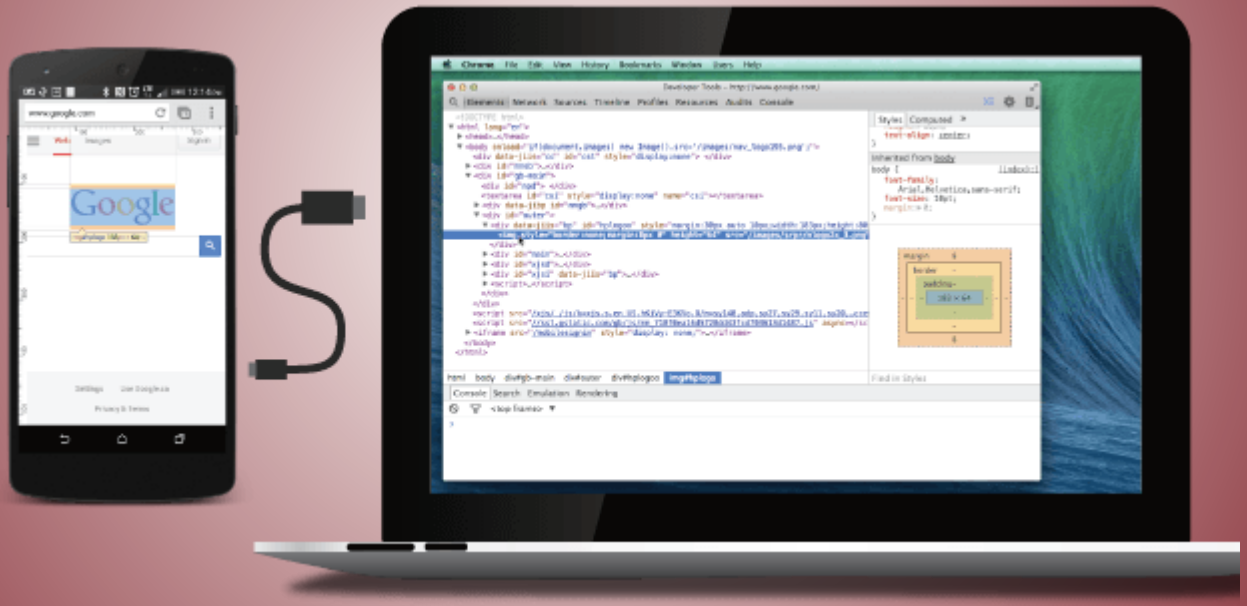


https://www.webpagetest.org/video/compare.php?tests=160915_V5_2177,160915_6R_2170

Mobile Labs are Design-Focused

https://codeascraft.com/2013/08/09/mobile-device-lab/

Chrome & Safari Remote Debugging



Use Real Data!

> The web Performance industry is lacking a good way of measuring real client CPU usage

Me, just now

Simon Hearne
@simonhearne
Ready to start building the performance lab!
Mac mini
iPad Pro
iPad Air
fire
amazon
SAMSUNG
Galaxy Tab S2
SAMSUNG
Galaxy
S6
iPhone 5

RULE 5

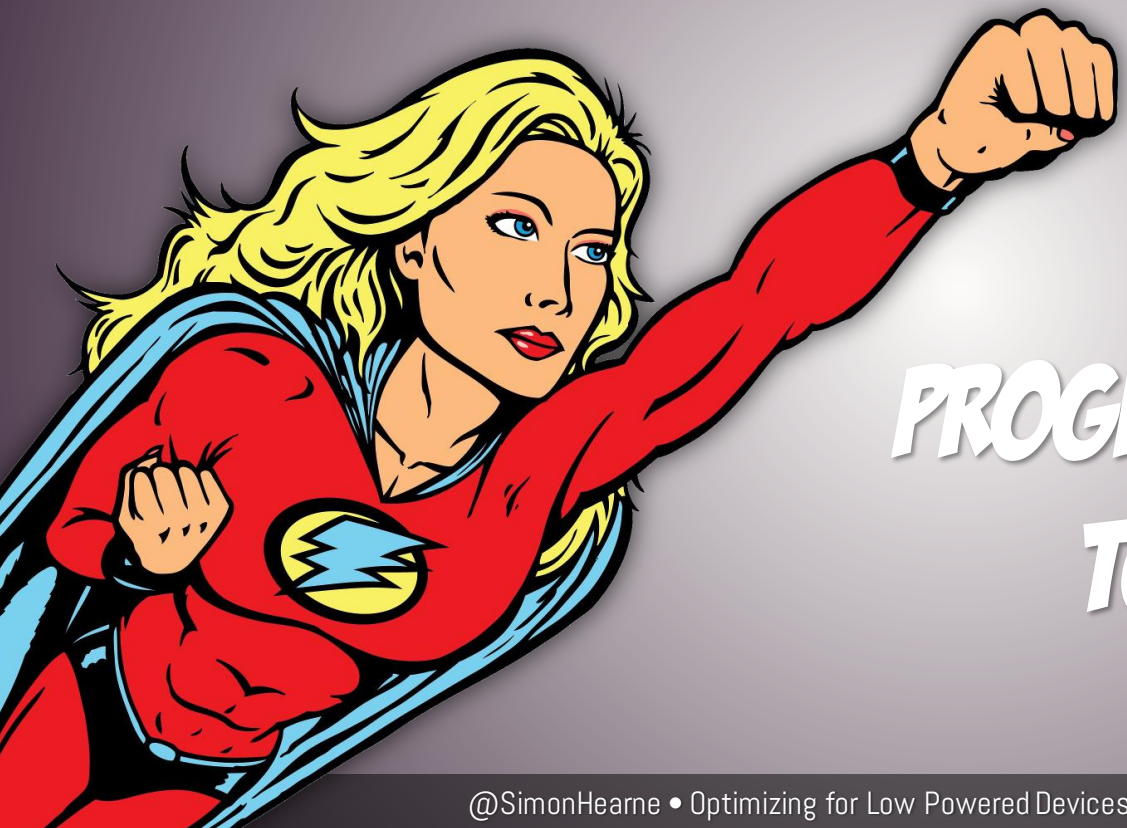
Understand the Data &
Invest in a Mobile **Performance** *Lab*

6

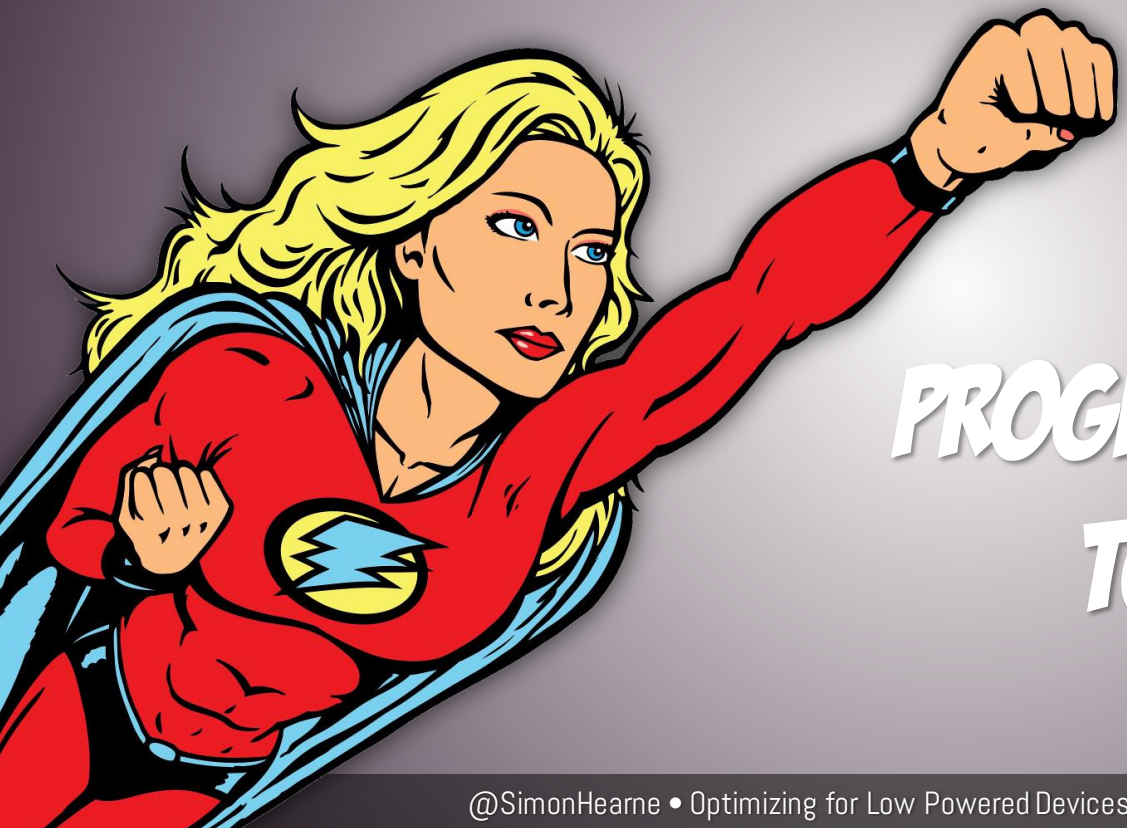
So...

What do we do?

the Web is not about pixel perfect results
for a reduced subset of devices



Progressive Web Apps to the Rescue



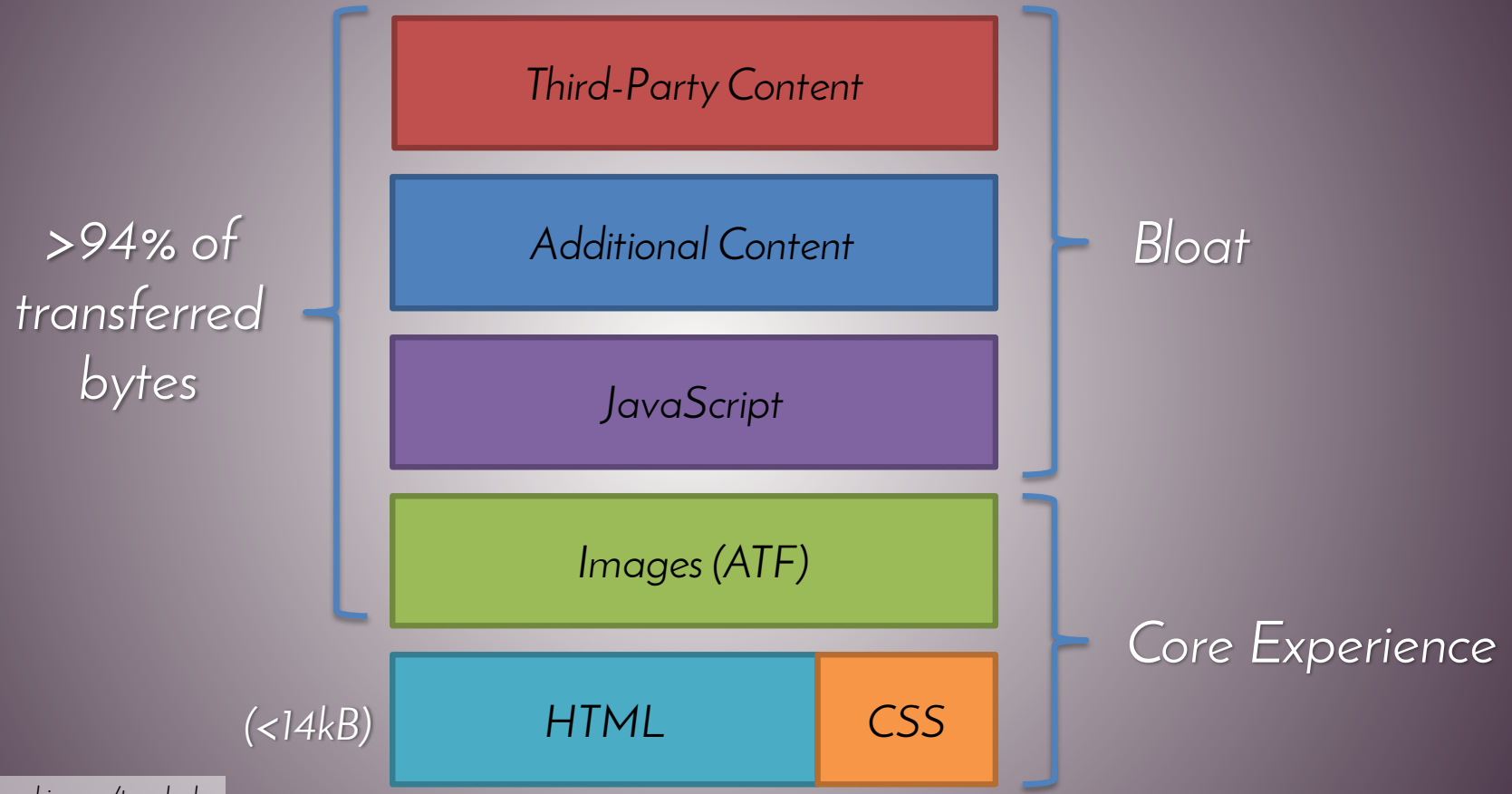
Enhancement

Progressive ~~Web Apps~~

To the Rescue

provide the best user experience possible, given the current conditions

Progressive Enhancement

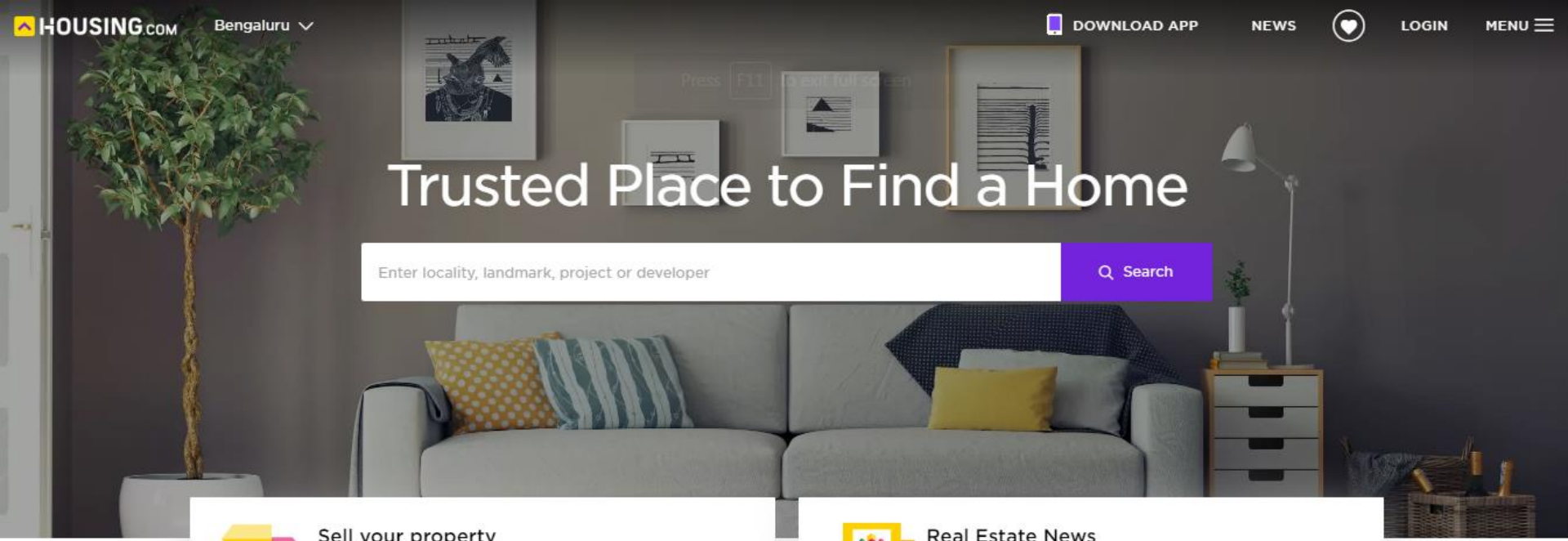


http://mobile.httparchive.org/trends.php

back to m.

back to m.

without the m.



TOP DEVELOPERS IN BENGALURU

NGINX

418 (if Mobile, Redirect)

Initial Request

420 (if no match go back to desktop app)

Desktop App

Mobile App

T2.Large

T2.Large

https://medium.com/engineering-housing/progressing-mobile-web-fac3efb8b454

```
<IfModule mod_rewrite.c>
RewriteEngine on

# Check for mobile
# Android is only being used below 2.3 and "Mobile" above to ignore android tablets
RewriteCond %{HTTP_USER_AGENT} "iPhone|Android|BlackBerry|Windows CE|IEMobile|Alcatel-OT|Opera Mobi|Opera Mini|DoCoMo.*N905i|DoCoMo.*P900i|Obigo|Wapsilon|WinCE|YourWap|Motorola|Samsung-|SAMSUNG-|portalmmm|Telit_Mobile_Terminals|MobilePhone|SIE-|SCH-|SGH-|GoodAccess|NEC-|Mitsu|Ericsson|AUDIOVOX-|LGE-|Sanyo-|Nokia|Alcatel-B|KDDI-|WAPman|WapRunner|WinWAP|ACS-NF\/3.0 NEC-|Vodafone|ZTE-|LG-|Sendo|SHARP-|TSM-|SAGEM-|MOT-|WIG Browser|Amoi|Symbian|J2ME|HTC|SPV|MOTO|Moto|SEC-SGH|Xda|XDA|iPAQ|MDA_vario|MDA Vario|MDA Touch|MDA_Vario|MDA_compact|MDA compact|MDA_Touch|MDA_vario|Novarra|webOS"
RewriteRule .* - [E=device:simplephone]

# check for smartphones
# WebKit: Iphone 4+ (& iPod), Android 2.3+, Blackberry 6+
RewriteCond %{HTTP_USER_AGENT} "((iPhone(.* )OS( +)(([4-9])|([0-9]+[0-9]))[^0-9])|(Android( *)((2[^0-9][1-9])|([4-9][^0-9])|([0-9]+[0-9][^0-9]))|(BlackBerry( *)(([6-9])|([0-9]+[0-9]))[^0-9]))(.*)AppleWebKit"
RewriteRule .* - [E=device:smartphone]

# Check for devices that look like phones but are really tablets
# That's Android 3.x - all of which are tablets
RewriteCond %{HTTP_USER_AGENT} "Android( ?)3\."
RewriteRule .* - [E=device:default]

# Override settings by cookie for device switchers
RewriteCond %{HTTP_COOKIE} device=([^;]+) [NC]
RewriteRule .* - [E=device:%1]

# Override setting with query string for testing
RewriteCond %{QUERY_STRING} "^(.+&)?device=([^&]+)(&.+)?"
RewriteRule .* - [E=device:%2]

# Set environment variable mobile=1 in case smart or simple phone
# set query string fragment: qs4device  in case smart or simple phone
RewriteCond %{ENV:device} ^(.*phone)$
RewriteRule .* - [E=mobile:1,E=qs4device:device\=%1]

# otherwise it's desktop
RewriteCond %{ENV:device}  "^(default)?$"
RewriteRule .* - [E=device:default,E=qs4device:layout=desktop]
</ifModule>

# Setting the Vary: User-Agent
# Make sure proxies and google crawl the pages with different UserAgents
# See also: https://developers.google.com/webmasters/smartphone-sites/details
<ifModule mod_headers.c>
Header set Vary "User-Agent"
</ifModule>
```

Adapting for the Times @steveworkman #perfmatters

https://speakerdeck.com/steveworkman/adapting-for-the-times?slide=22

RULE 6

Split Your Codebase When Necessary

SUMMARY

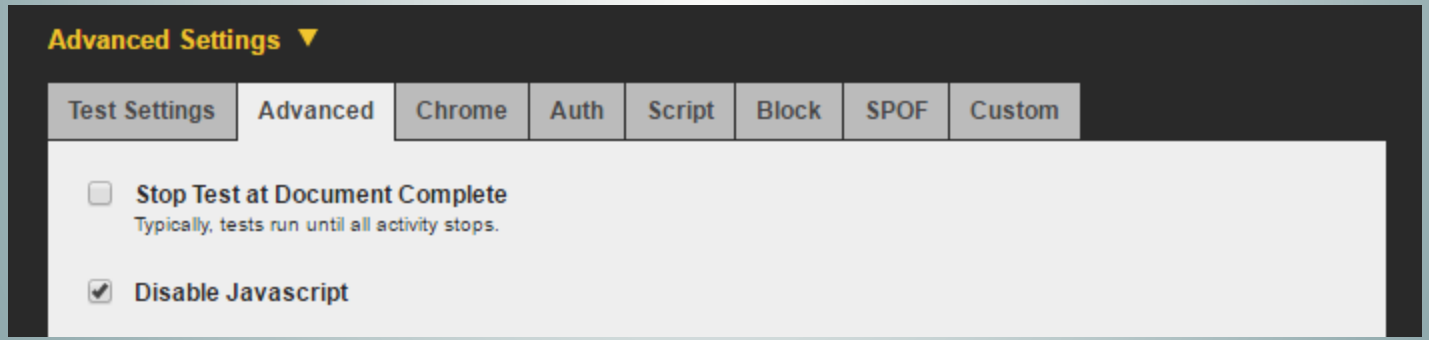
1. *Responsive Web Design is Not Enough*
2. *Question the Use of JavaScript Frameworks - yes, even jQuery*
3. *Test on Low-End Hardware – It's Cheap!*
4. *Measure and Monitor CPU Usage - Including page interactions!*
5. *Understand the Data & Invest in a Mobile Lab*
6. *Split the Codebase When Necessary*

WE HAVEN'T COVERED IT ALL

1. *Mobile networks – 5G is coming*
2. *Third-Party Content*
3. *AMP*
4. *Image Performance*

ONE THING

Test your mobile site in WebPageTest with JavaScript disabled



(using emulation as it doesn't work on devices)

Thank You

Stay in touch!

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webperf.ninja/