

Creating Faster Websites

AKA - A ComeUntoChrist.org performance case study

AKA - What it takes to move from rendering in 4s to <1s

What will we be covering?

(Should I get up and walk out now)

- What this is not
- ComeUntoChrist history
- Web Vitals
- ComeUntoChrist performance improvements play by play
- Live review if time/bandwidth allows
- Questions

What this is not

Servers

Micro-performance

ComeUntoChrist - A Case Study

ComeUntoChrist uniqueness

At least at the church

- Traffic is primarily non-member
- Traffic is largely ad driven
- Competing for eyeballs/attention
- If the user doesn't have a good experience, they go to the next ad, search, etc
- High bounce rate, so prioritize one to few page experience over many pages

[Frustration] is the path to the dark side.
[Frustration] leads to anger.
Anger leads to hate.
Hate leads to suffering.

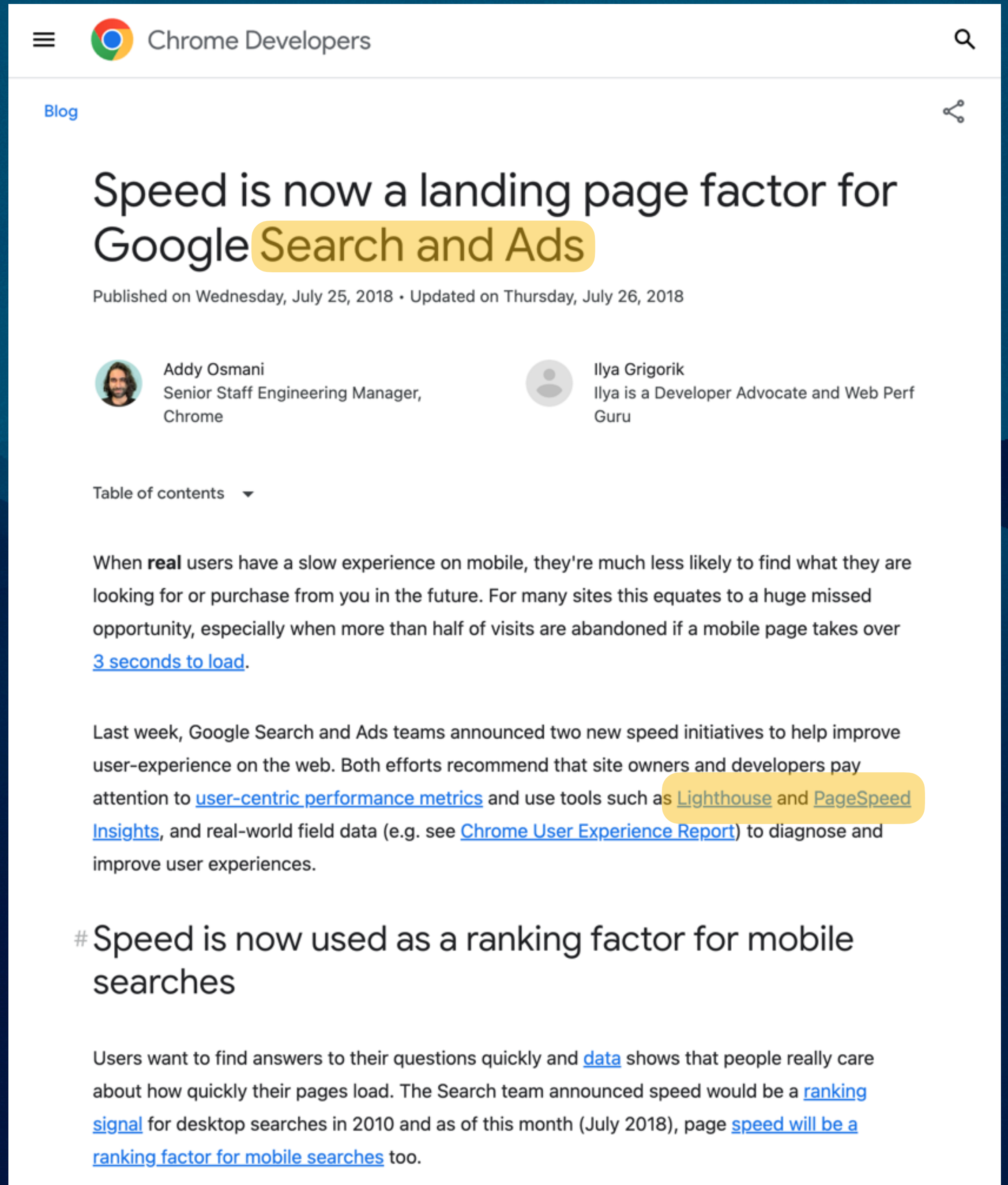
Yoda

Pre 2019

- Work done by previous devs to get page loading in the 3 second range on a Fast 3g connection
- When I got on team, there wasn't a push for better performance
- Leaders were not opposed to me working on it though

So I did :)

Where to focus?




The screenshot shows a Chrome Developers blog post. At the top, there is a navigation bar with the Chrome logo and the text 'Chrome Developers'. Below this, the word 'Blog' is visible. The main title of the post is 'Speed is now a landing page factor for Google Search and Ads', with 'Search and Ads' highlighted in yellow. Below the title, it says 'Published on Wednesday, July 25, 2018 • Updated on Thursday, July 26, 2018'. There are two authors listed: Addy Osmani, Senior Staff Engineering Manager, Chrome, and Ilya Grigorik, Developer Advocate and Web Perf Guru. A 'Table of contents' dropdown menu is visible. The main text of the post discusses how slow mobile experiences lead to missed opportunities, mentioning that more than half of visits are abandoned if a mobile page takes over 3 seconds to load. It also mentions that Google Search and Ads teams announced two new speed initiatives to improve user experience, recommending site owners and developers pay attention to user-centric performance metrics and use tools like Lighthouse and PageSpeed Insights, along with real-world field data from the Chrome User Experience Report. A section header '# Speed is now used as a ranking factor for mobile searches' is present, followed by text stating that users want quick answers and data shows they care about page load times, with the Search team announcing speed as a ranking signal for desktop searches in 2010 and as a ranking factor for mobile searches in July 2018.

Chrome Developers

Blog

Speed is now a landing page factor for Google Search and Ads

Published on Wednesday, July 25, 2018 • Updated on Thursday, July 26, 2018

 Addy Osmani
Senior Staff Engineering Manager,
Chrome


 Ilya Grigorik
Ilya is a Developer Advocate and Web Perf
Guru

Table of contents ▾

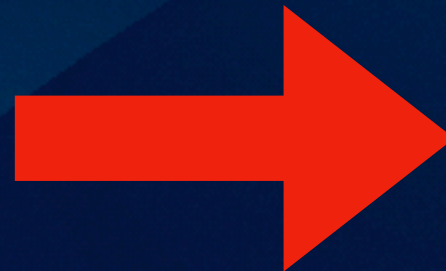
When **real** users have a slow experience on mobile, they're much less likely to find what they are looking for or purchase from you in the future. For many sites this equates to a huge missed opportunity, especially when more than half of visits are abandoned if a mobile page takes over [3 seconds to load](#).

Last week, Google Search and Ads teams announced two new speed initiatives to help improve user-experience on the web. Both efforts recommend that site owners and developers pay attention to [user-centric performance metrics](#) and use tools such as [Lighthouse](#) and [PageSpeed Insights](#), and real-world field data (e.g. see [Chrome User Experience Report](#)) to diagnose and improve user experiences.

Speed is now used as a ranking factor for mobile searches

Users want to find answers to their questions quickly and [data](#) shows that people really care about how quickly their pages load. The Search team announced speed would be a [ranking signal](#) for desktop searches in 2010 and as of this month (July 2018), page [speed will be a ranking factor for mobile searches](#) too.

Lighthouse Built in test suite



Network Elements Console Performance insights Sources Performance Lighthouse 3

3:44:13 PM - www.churchofje

https://www.churchofjesuschrist.org/comeuntochrist

80 Performance 91 Accessibility 100 Best Practices 99 SEO

80 Performance

Values are estimated and may vary. The [performance score is calculated](#) directly from these metrics. [See calculator.](#)

▲ 0-49 ■ 50-89 ● 90-100

METRICS Expand view

- First Contentful Paint 1.3 s
- ▲ Time to Interactive 13.8 s
- Speed Index 3.1 s
- Total Blocking Time 300 ms
- Largest Contentful Paint 2.6 s
- Cumulative Layout Shift 0.029

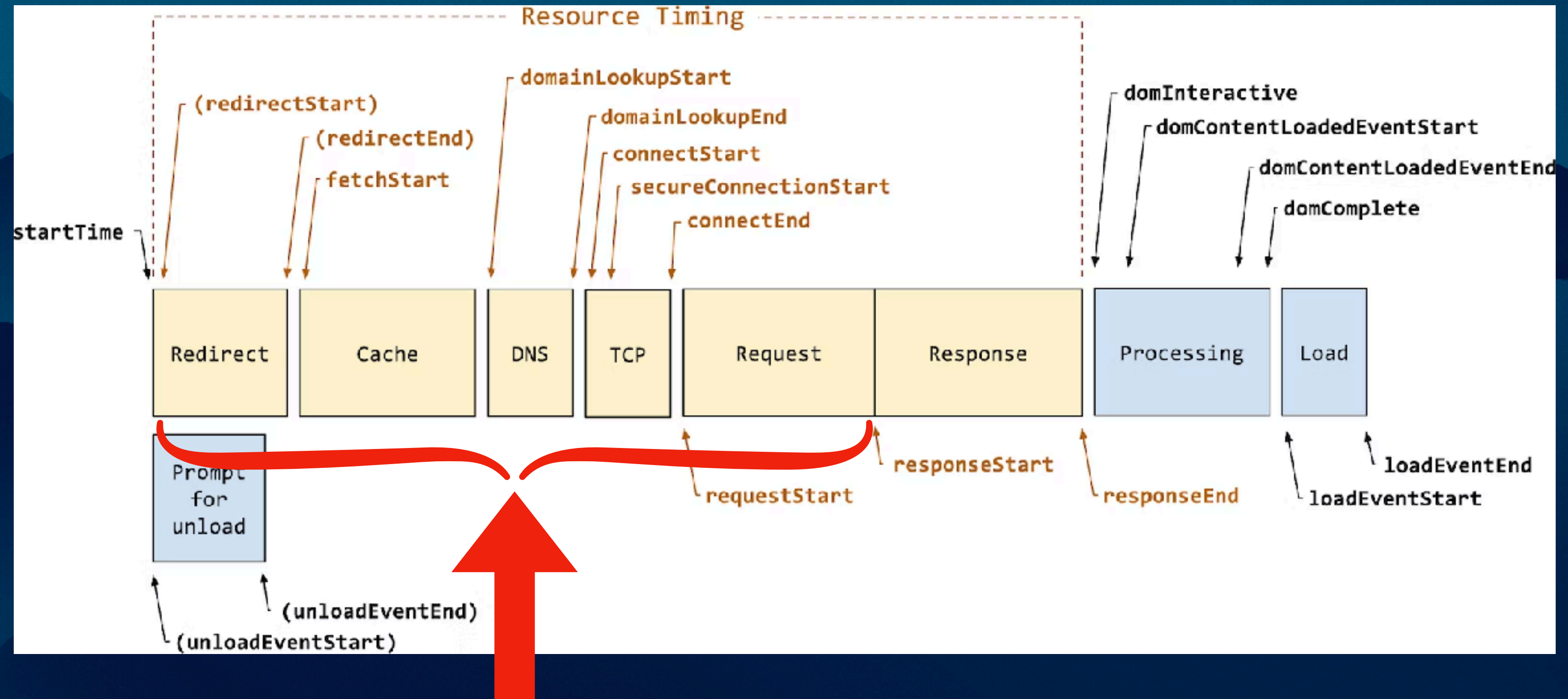
View Original Trace View Treemap

Show audits relevant to: All FCP TBT LCP CLS

Web Vitals

TTFB

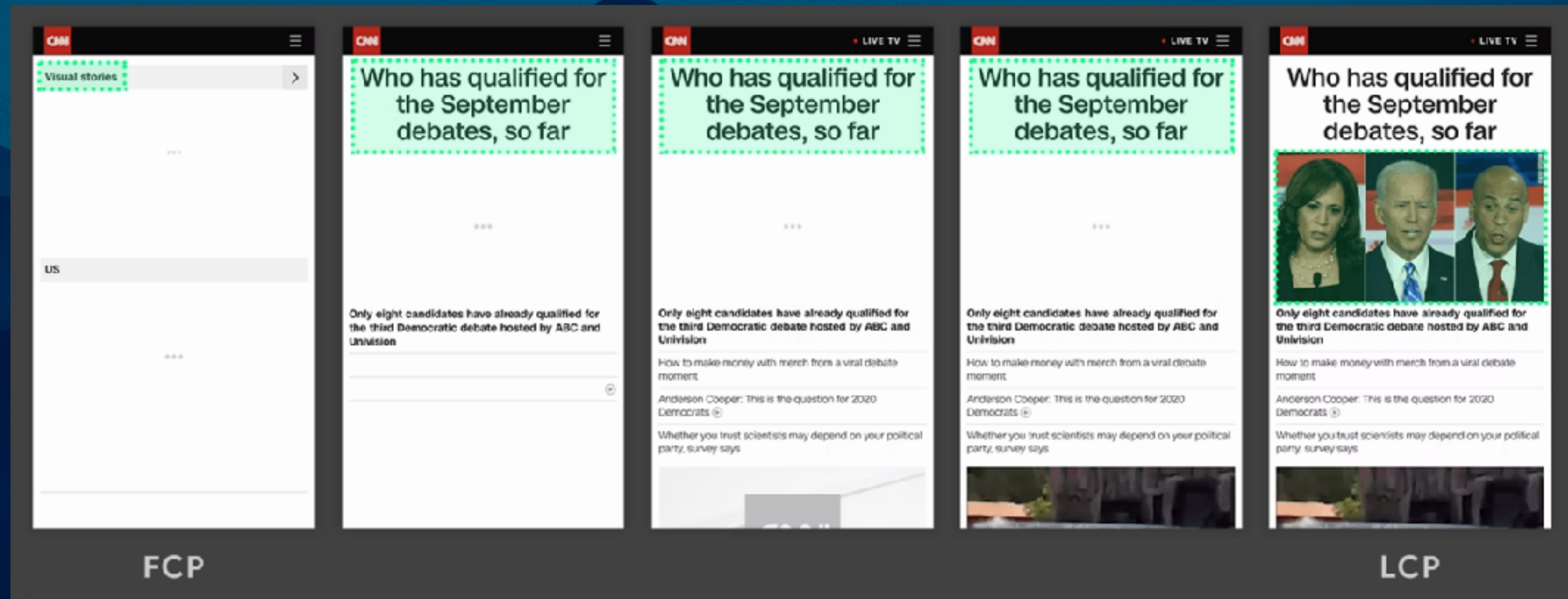
Time to First Byte



TTFB

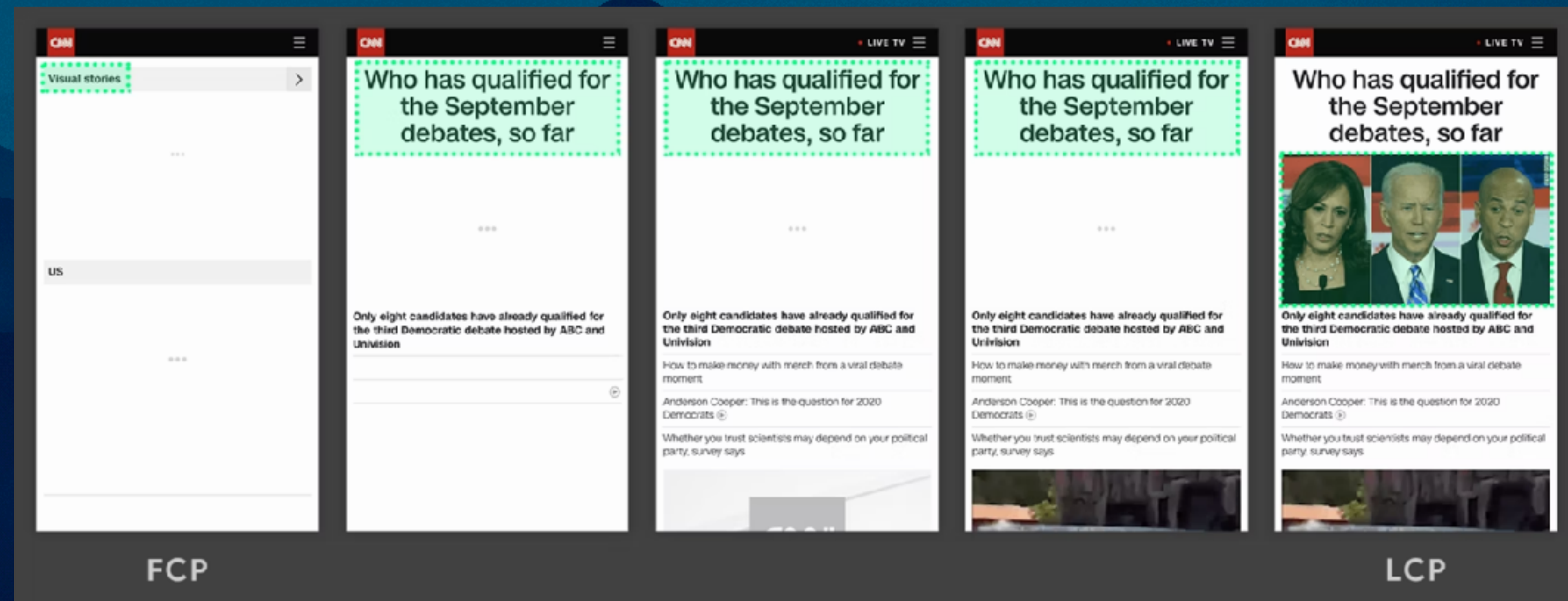
FCP

First Contentful Paint AKA - Start Render



LCP

Largest Contentful Paint



CLS

Cumulative Layout Shift

#protip check out faster using the app!

INSTALL

Order confirmation

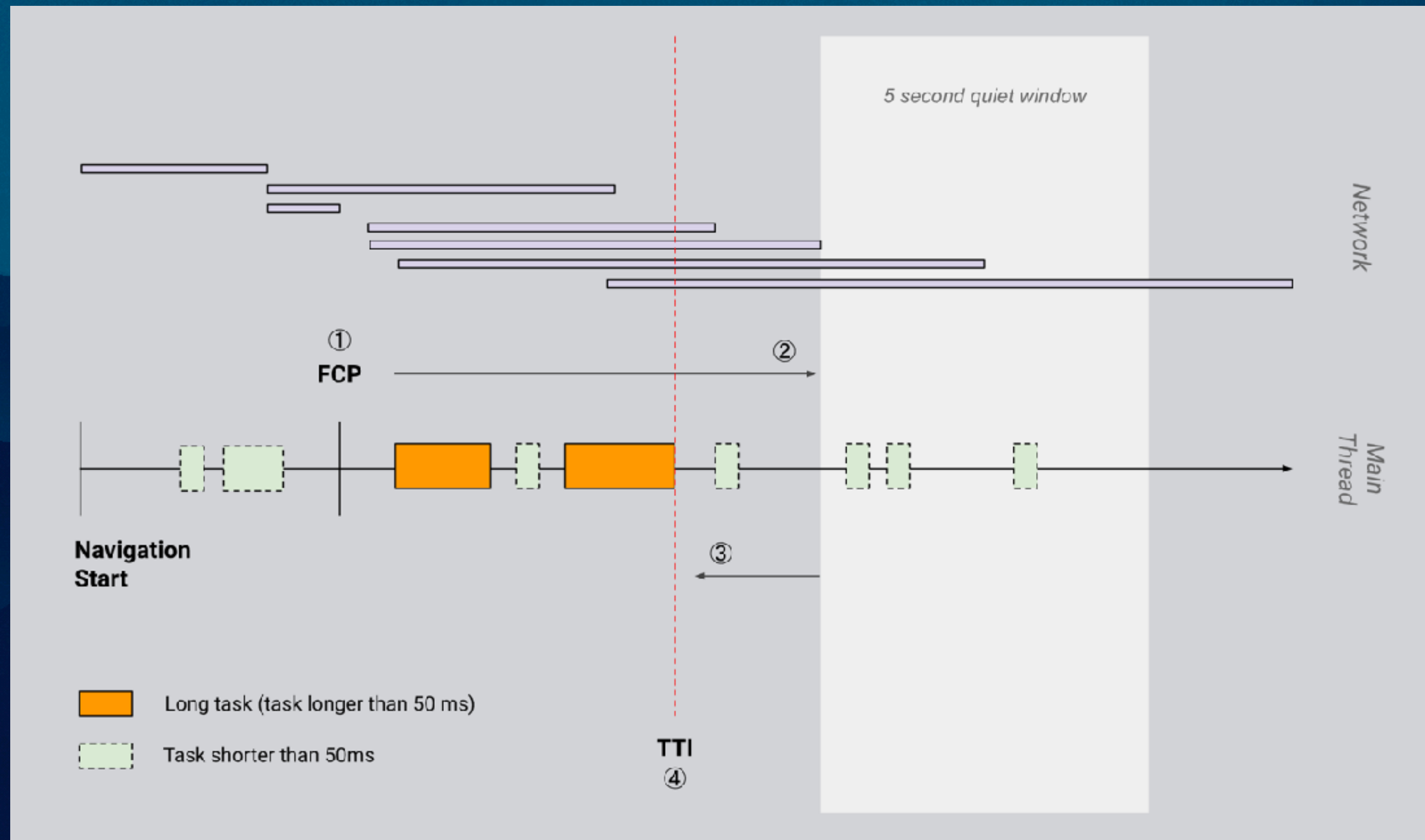
You have selected **56** items. Is this correct?

Submitting order...

No, go back

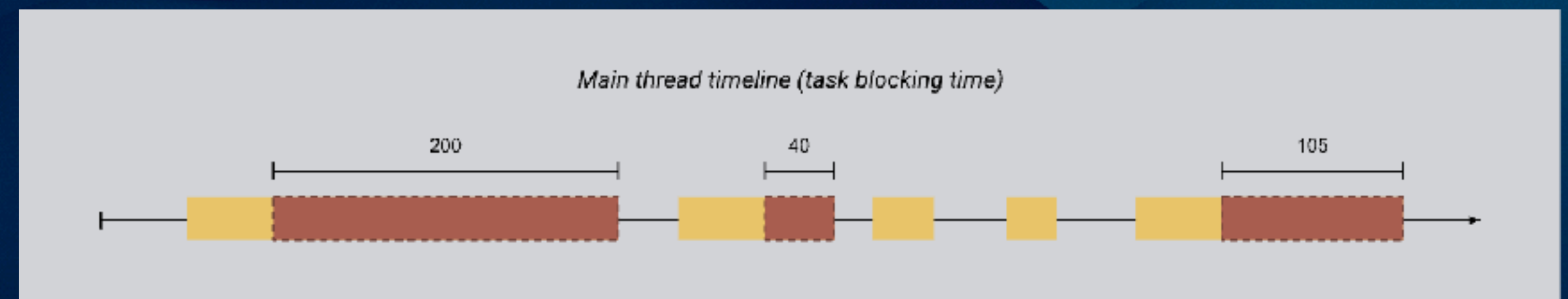
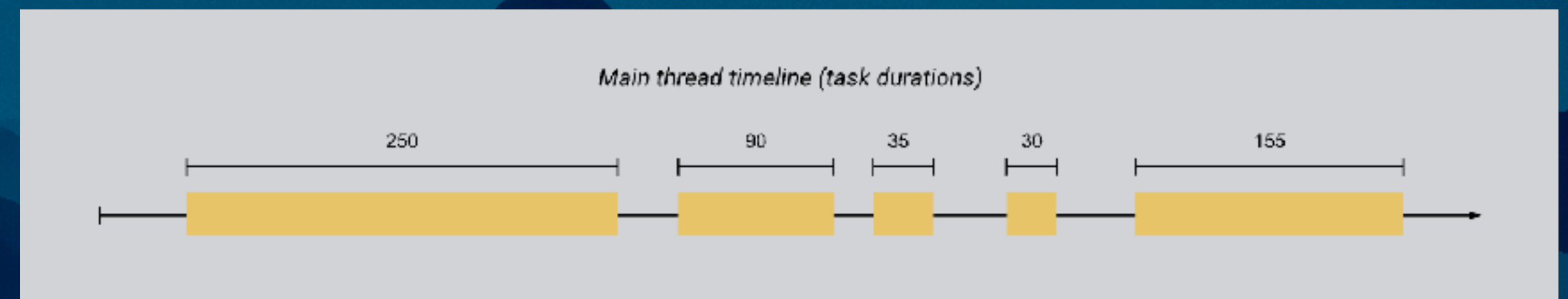
TTI

Time to Interactive



TBT

Total Blocking Time



WebPageTest.org

For public sites

The screenshot shows a WebPageTest.org performance report for the URL <https://www.churchofjesuschrist.org/comeuntochrist>, tested on 4/27/2022 at 1:37:35 PM. The test settings are Desktop, v101, 3GFast, and Virginia USA. The report is viewed as a Performance Summary and includes a thumbnail of the website's 'Welcome' page.

Performance Summary

Opportunities & Experiments [Explore All](#)

- Is it Quick?** ⚠️ Not bad...
This site was quick to connect and deliver initial code. It began rendering content very quickly. The largest contentful paint time was good.
- Is it Usable?** ⚠️ Not bad...
This site had minor layout shifts. It took a long time to become interactive. It had 2 accessibility issues, 1 critical.
- Is it Resilient?** ✅ Looks great!
This site had zero render-blocking 3rd party requests. It had no security issues detected.

Observed Metrics

(Based on Median Run by: [Speed, Index](#)) Note: Metrics offered will vary

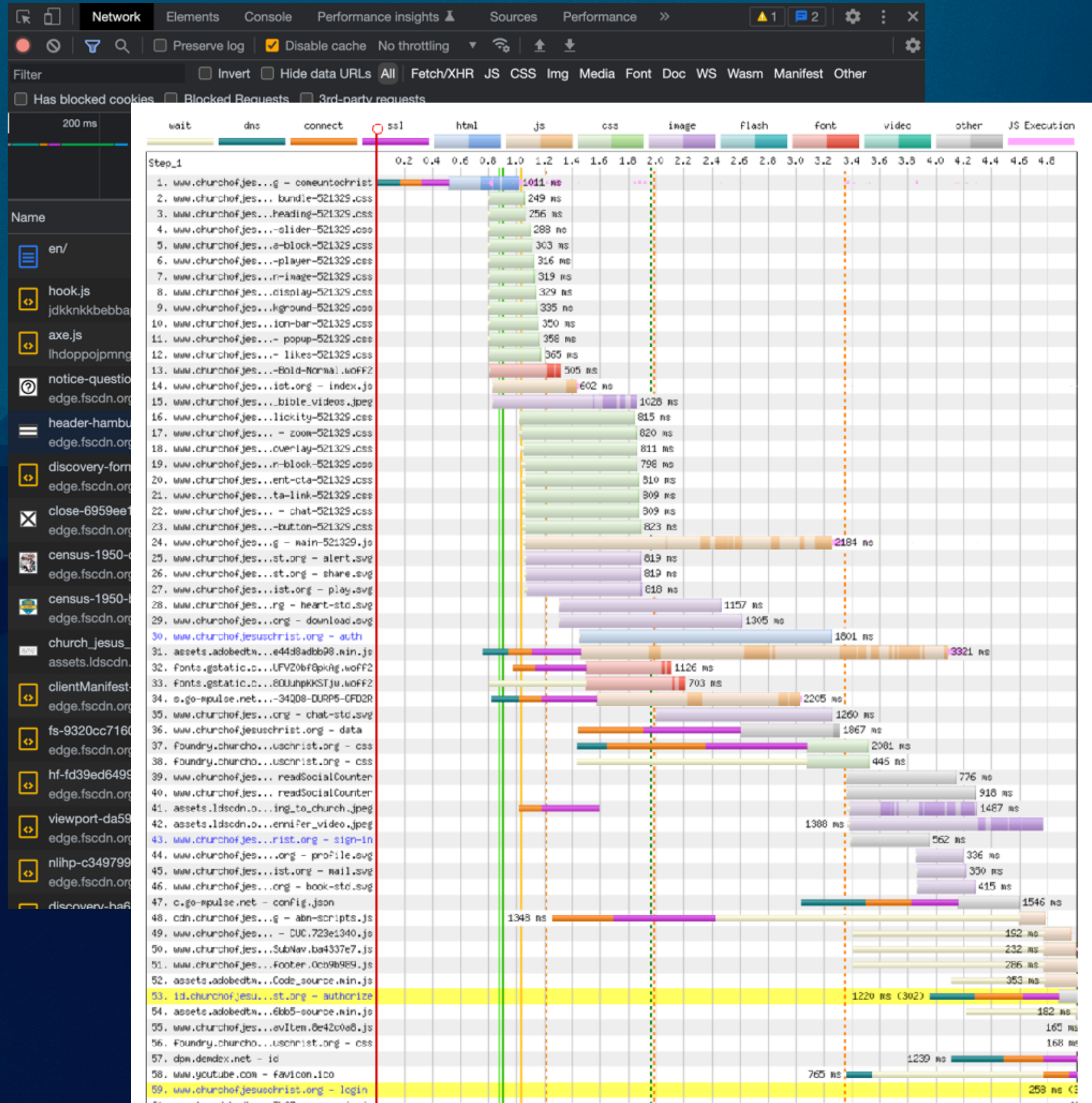
FIRST VIEW ([RUN 2](#))

| Metric | Value |
|--------------|--------|
| First Byte | .769s |
| Start Render | .900s |
| FCP | .894s |
| Speed Index | 2.382s |
| LCP | 1.795s |
| CLS | .015 |
| TBT | .120s |
| Total Bytes | 943 KB |

Visual Page Loading Process ([Explore](#))

Waterfall chart

What loads when, how long did it take, etc



History/Test Caveats

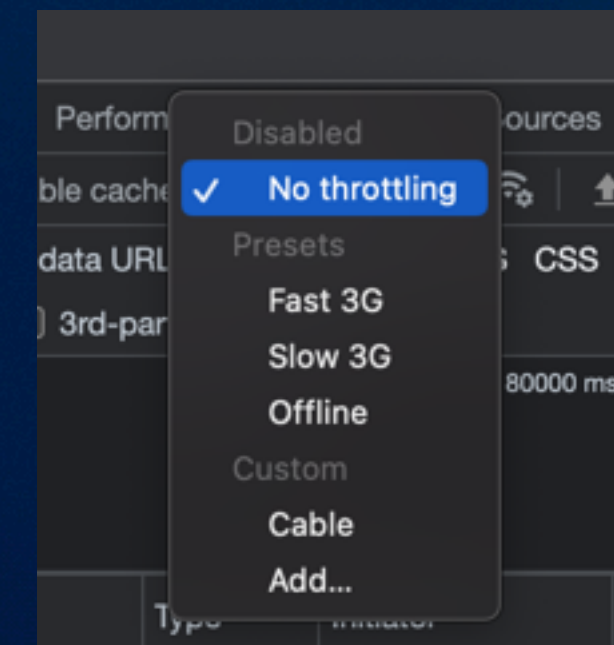
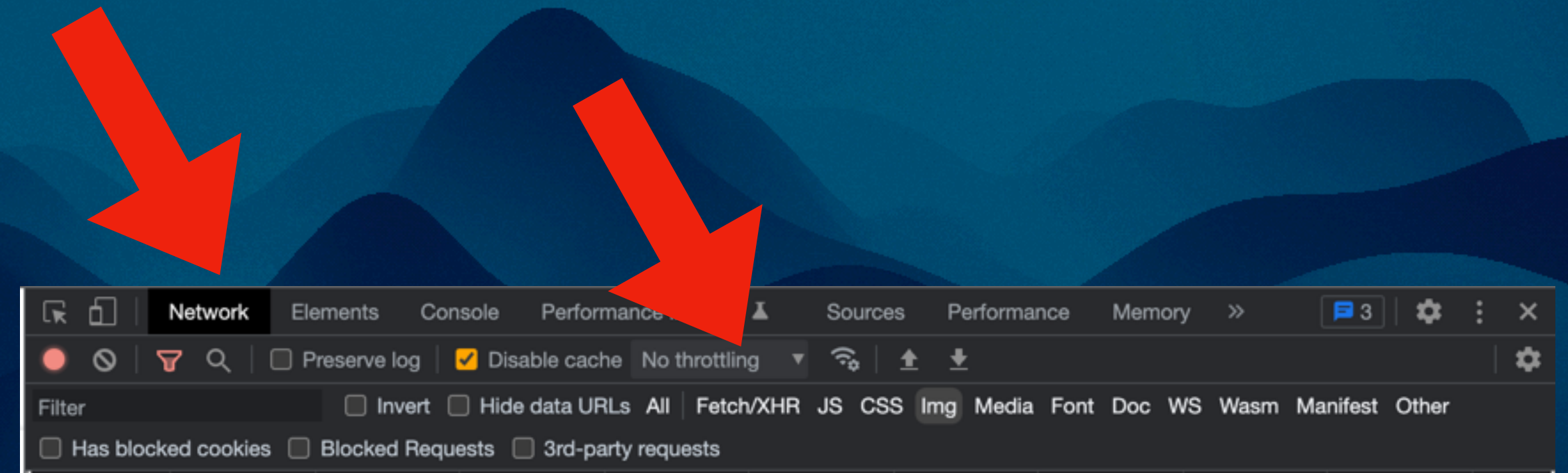
- 3 year old screenshots and they are small. But you'll get the idea of what is visible to the user
- I didn't take good notes at the start
- Tooling got updates so functionality and look will change
- ComeUntoChrist got updates so not always apples to apples
- Direct success is difficult to measure due to advertising/marketing tie
- Better performance was seen as a win by itself without measuring other things

Testing metrics

- All testing done on WebPageTest.org using the same settings
- Using Fast 3g connection
- Virginia
- Chrome on Desktop (more complex display than mobile)

Network Throttling

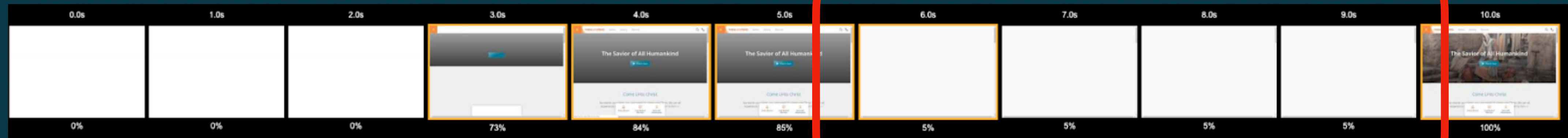
Fake slow connections



July 2019

Renders in 3, 4 or 10 seconds... depending on how you look at it

Something shows



Text shows



Page "complete"



AB Testing

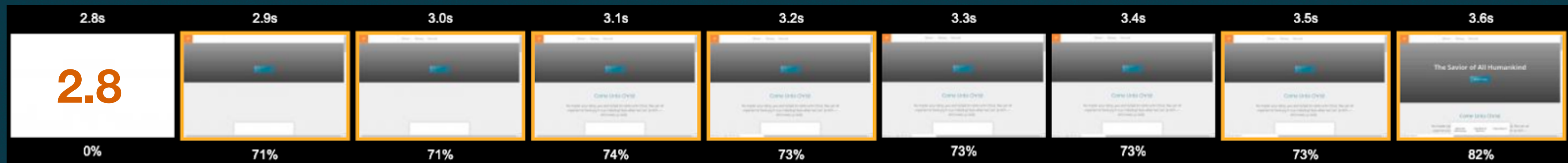
```
launch-fe44d8ad...n.js:formatted x
21449     settings: {
21450         source: '/*\n *Name: Adobe Target CS Integration\n *Version: 1.0\n */\nfun
21451         language: "javascript"
21452     },
21453     timeout: 2e3,
21454     delayNext: !0
21455 }, {
21456     modulePath: "adobe-target-v2/lib/firePageLoad.js",
21457     settings: {
21458         bodyHiddenStyle: "body {opacity: 0}",
21459         bodyHidingEnabled: !0
21460     },
21461     timeout: 2e3,
21462     delayNext: !0
21463 }
21464 }, {
21465     id: "RL496e89ff1cb14f799797a97a2f959b10",
21466     name: "7 - 3rd | CUC - Site/URL specific Facebook Pixel - Africa South Autonomous |
```

```
body[class][class] {
  /* trump the test and target flicker/blink/blanking of the page... grrr */
  opacity: 1 !important;
}
```

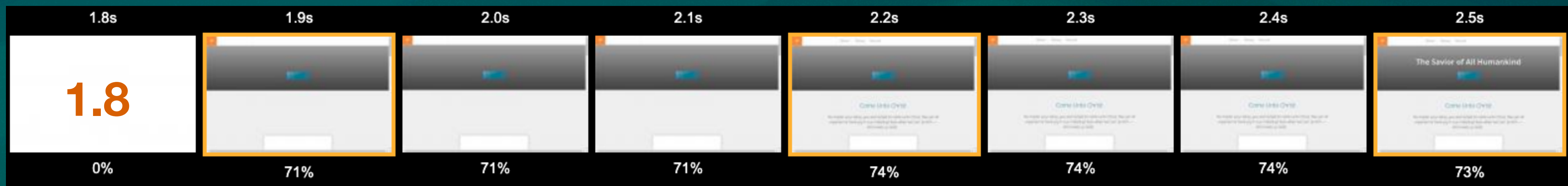
August 2019

Changed some JS to non-blocking, preconnect, remove unused fonts/components

Something shows



Text shows



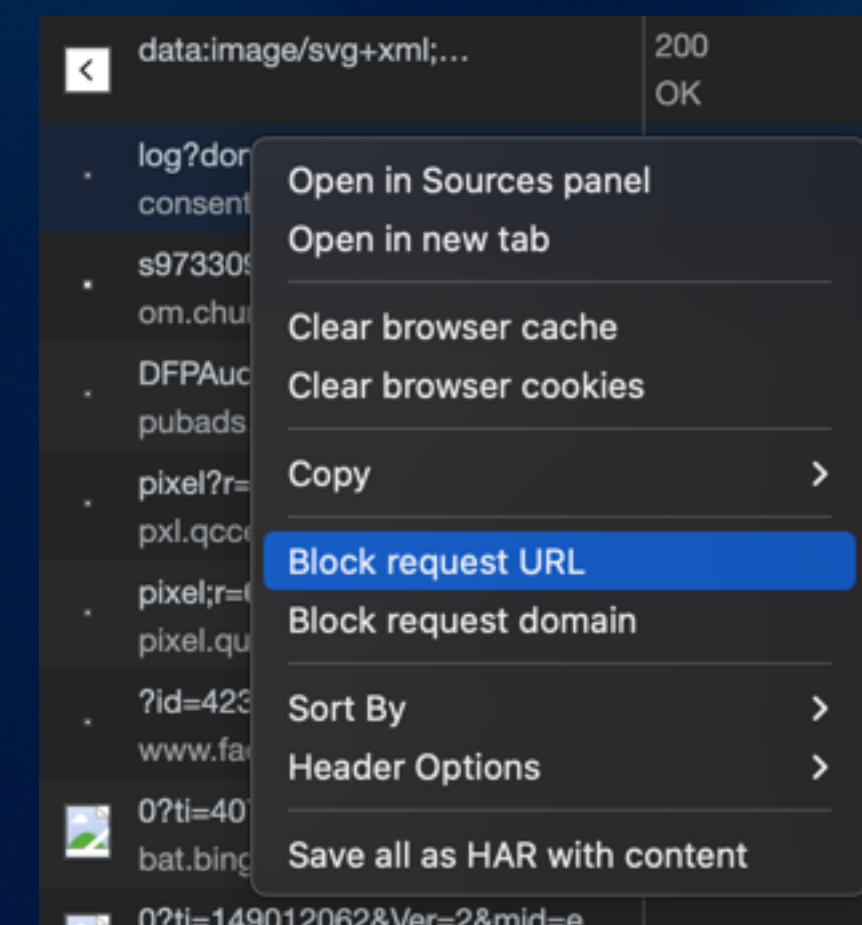
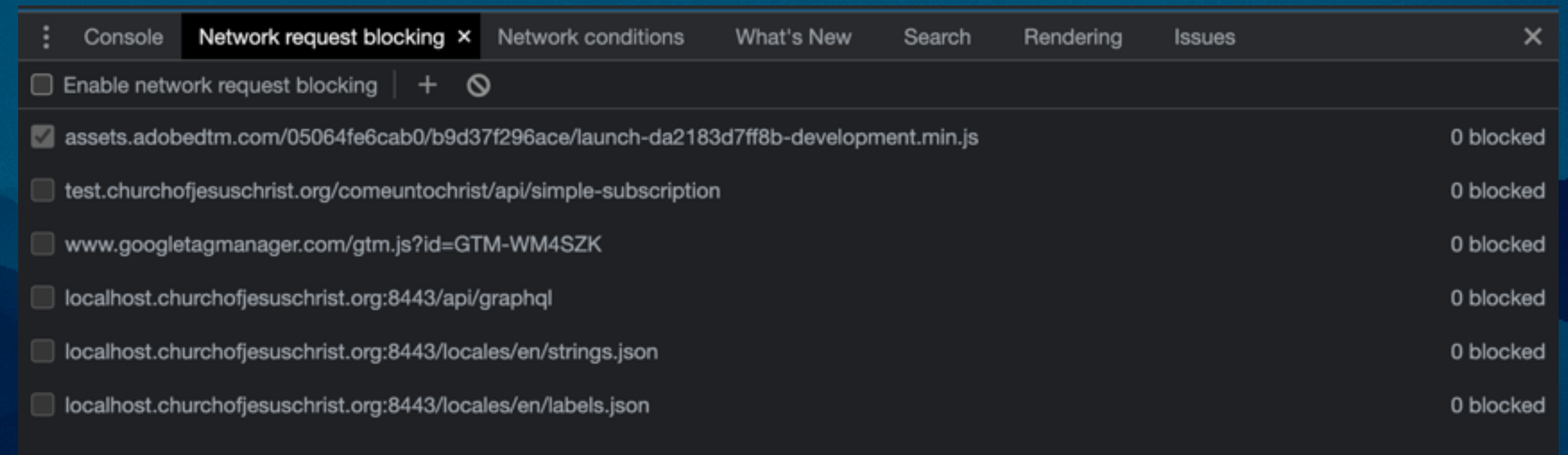
Network Request Blocking

Open dev tools

Hit esc to toggle bottom drawer

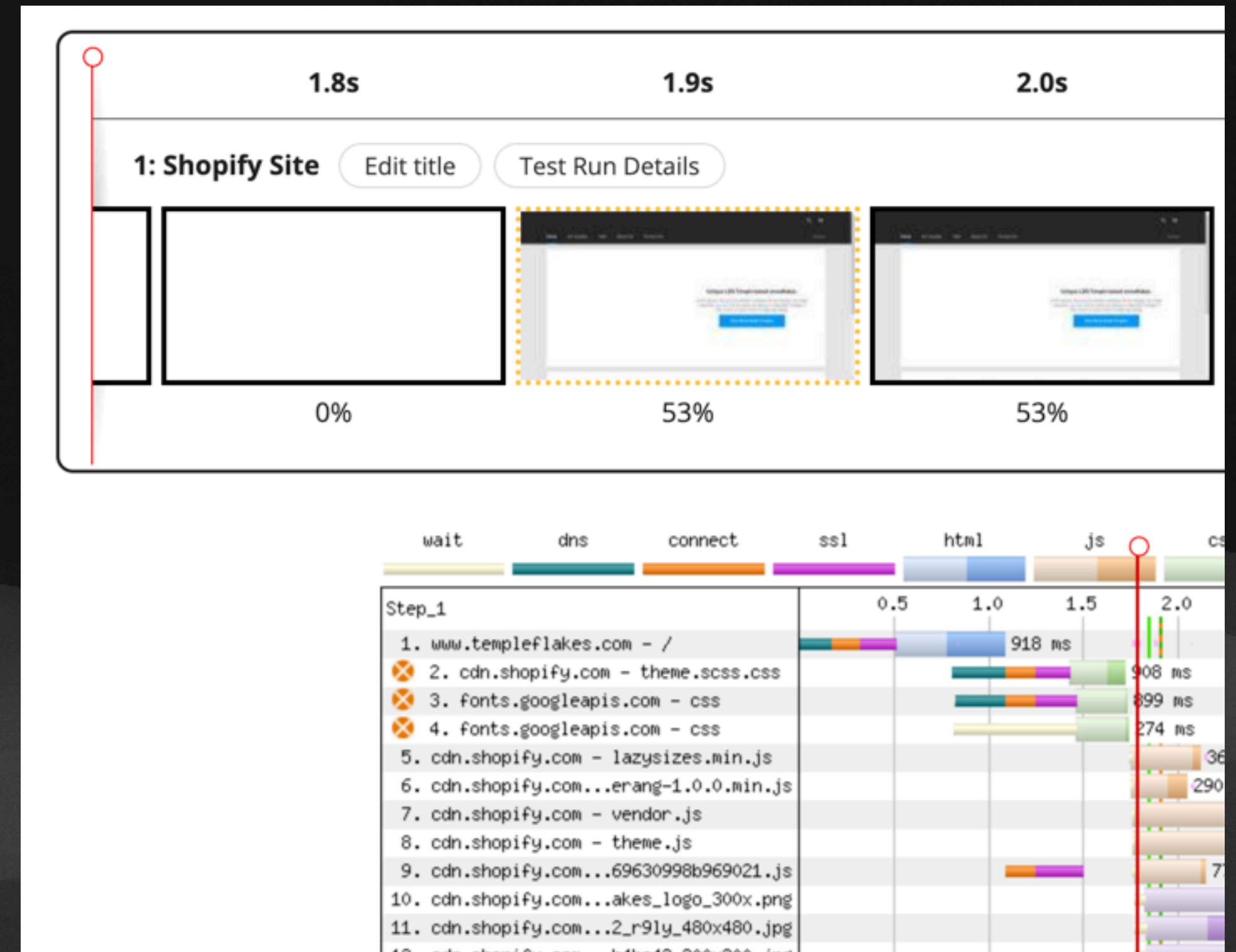
Or

Right click a resource



Render Blocking

- A `<script>` tag that:
 - Is in the `<head>` of the document.
 - Does not have a `defer` attribute.
 - Does not have an `async` attribute.
- A `<link rel="stylesheet">` tag that:
 - Does not have a `disabled` attribute. When this attribute is present, the browser does not download the stylesheet.
 - Does not have a `media` attribute that matches the user's device specifically. `media="all"` is considered render-blocking.



async and defer

async attribute for external scripts - LS

Usage % of all users ?
Global 98.54% + 0.01% = 98.55%

☆ Current aligned Usage relative Date relative Filtered All ⚙

| Chrome | Edge* | Safari | Firefox | Opera | IE | Chrome for Android | Safari on iOS* | Samsung Internet | Opera Mini* | Opera Mobile* | UC Browser for Android | Android Browser* | Firefox for Android | QQ Browser | Baidu Browser | KaiOS Browser |
|---------|--------|----------|---------|---------|-----|--------------------|----------------|------------------|-------------|---------------|------------------------|------------------|---------------------|------------|---------------|---------------|
| | | 3.1-4 | | | | | | | | | | | | | | |
| 4-7 | | 5 | 2-3.5 | 10-12.1 | 6-9 | | 3.2-4.3 | | | | | 2.1-2.3 | | | | |
| 8-104 | 12-104 | 5.1-15.6 | 3.6-103 | 15-89 | 10 | | 5-15.6 | 4-17.0 | | 12-12.1 | | 3-4.4.4 | | | | |
| 105 | 105 | 16.0 | 104 | 90 | 11 | 105 | 16.0 | 18.0 | all | 64 | 12.12 | 105 | 104 | 10.4 | 7.12 | 2.5 |
| 106-108 | | TP | 105-106 | | | | | | | | | | | | | |

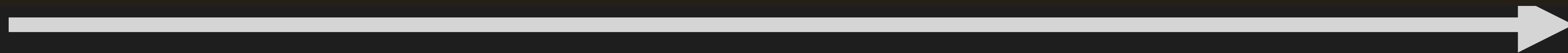
HTMLScriptElement API: defer

Usage % of all users ?
Global 97.51%

☆ Current aligned Usage relative Date relative Filtered All ⚙

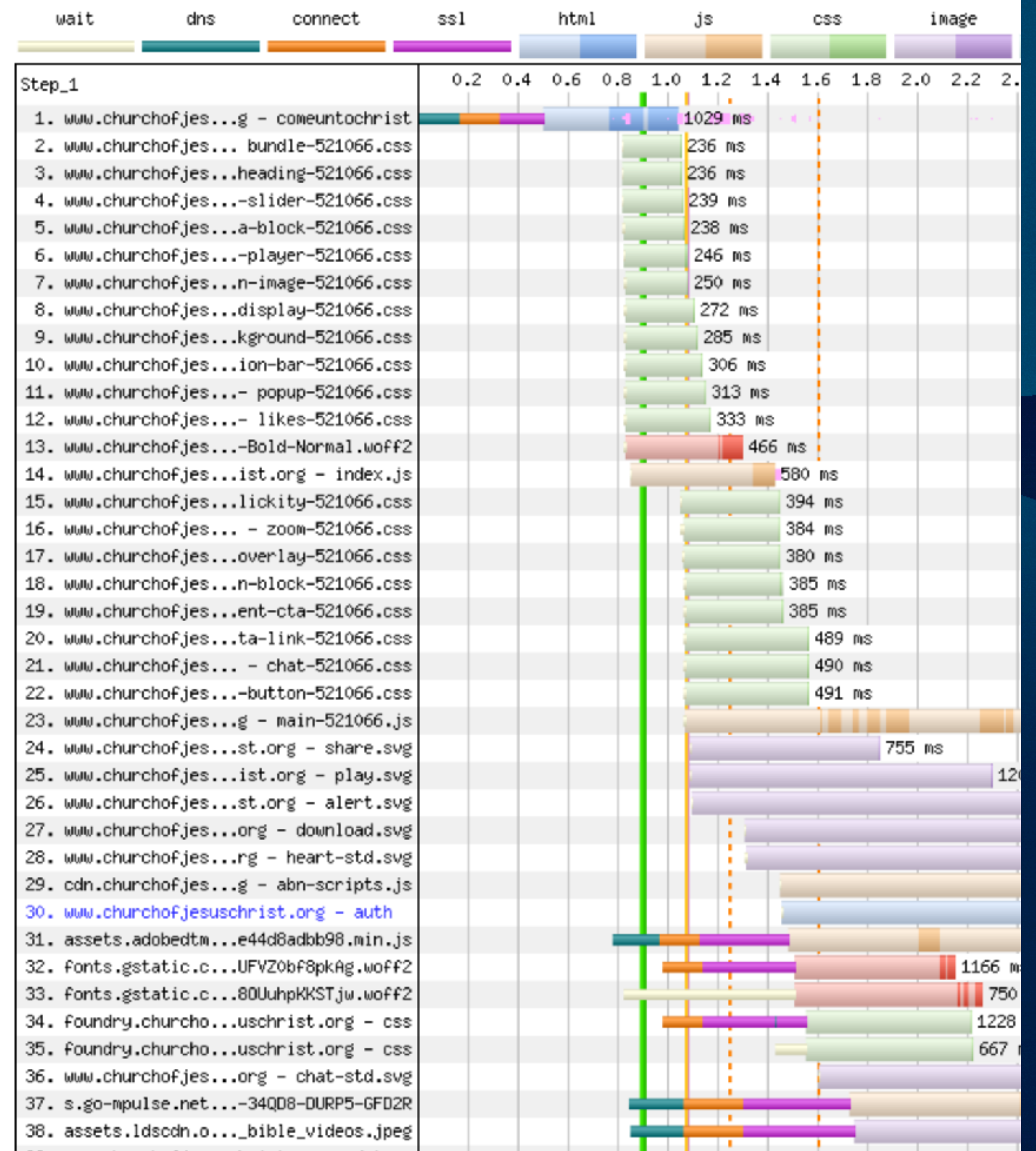
| Chrome | Edge* | Safari | Firefox | Opera | IE | Chrome for Android | Safari on iOS* | Samsung Internet | Opera Mini* | Opera Mobile* | UC Browser for Android | Android Browser* | Firefox for Android | QQ Browser | Baidu Browser | KaiOS Browser |
|---------|--------|----------|---------|---------|-----|--------------------|----------------|------------------|-------------|---------------|------------------------|------------------|---------------------|------------|---------------|---------------|
| | | | 2-3 | 10-11.5 | 6-9 | | | | | | | | | | | |
| 4-104 | 12-104 | 3.1-15.6 | 3.5-103 | 12.1-89 | 10 | | 3.2-15.6 | 4-17.0 | | 12 | | 2.1-4.3 | | | | |
| 105 | 105 | 16.0 | 104 | 90 | 11 | 105 | 16.0 | 18.0 | all | 64 | 12.12 | 105 | 104 | 10.4 | 7.12 | 2.5 |
| 106-108 | | TP | 105-106 | | | | | | | | | | | | | |

Time



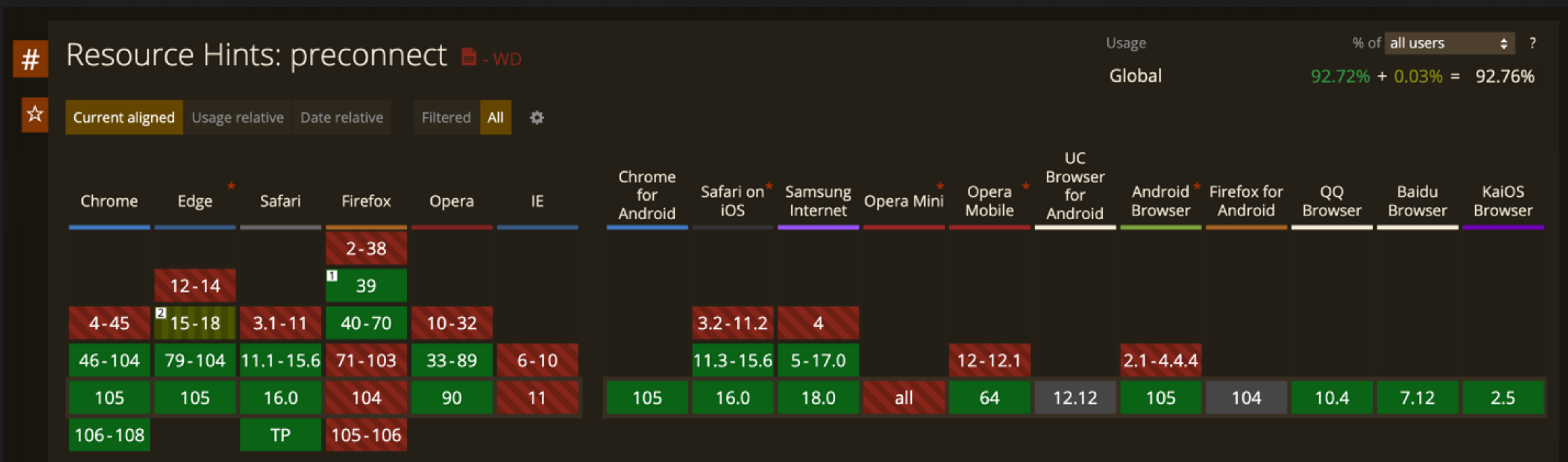
Preconnect

Make origin connections in advance



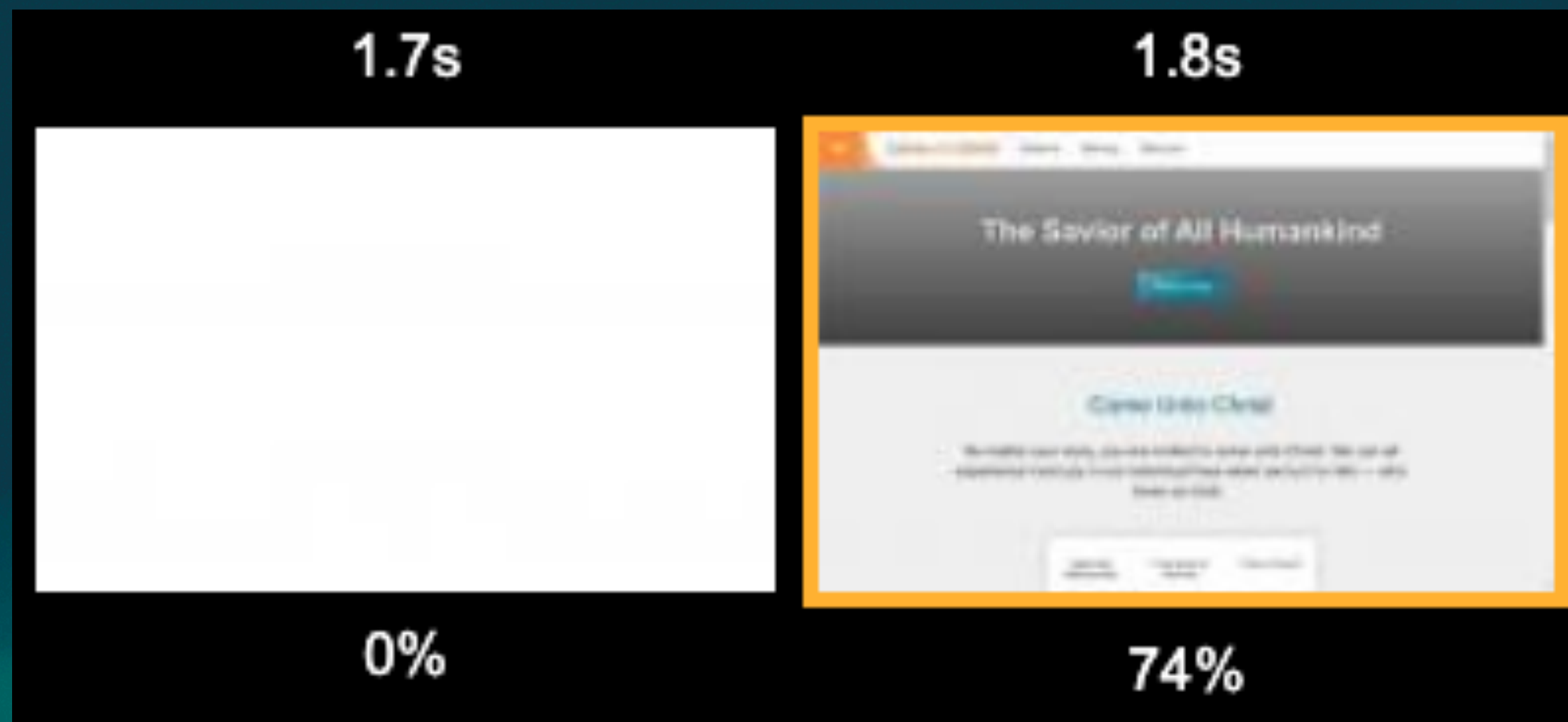
Preconnect

```
<link rel="preconnect" href="https://example.com">
```



October 2019

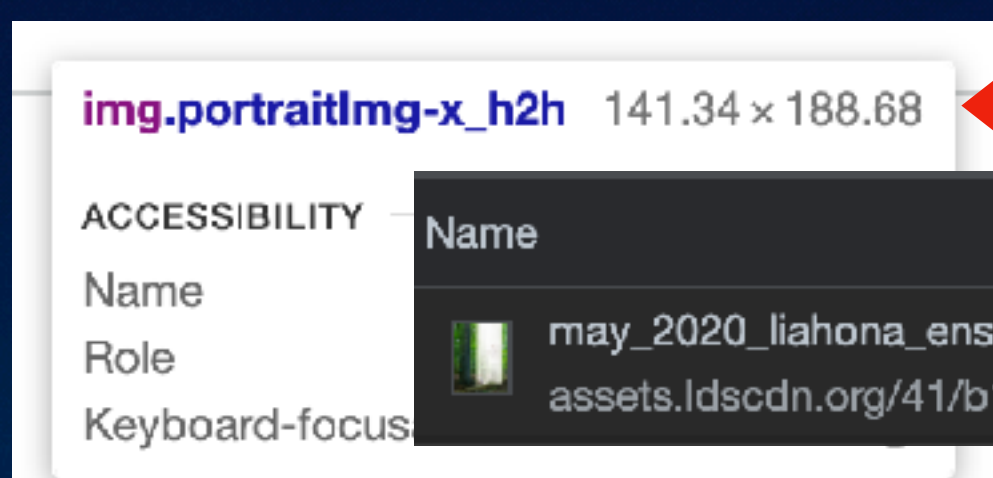
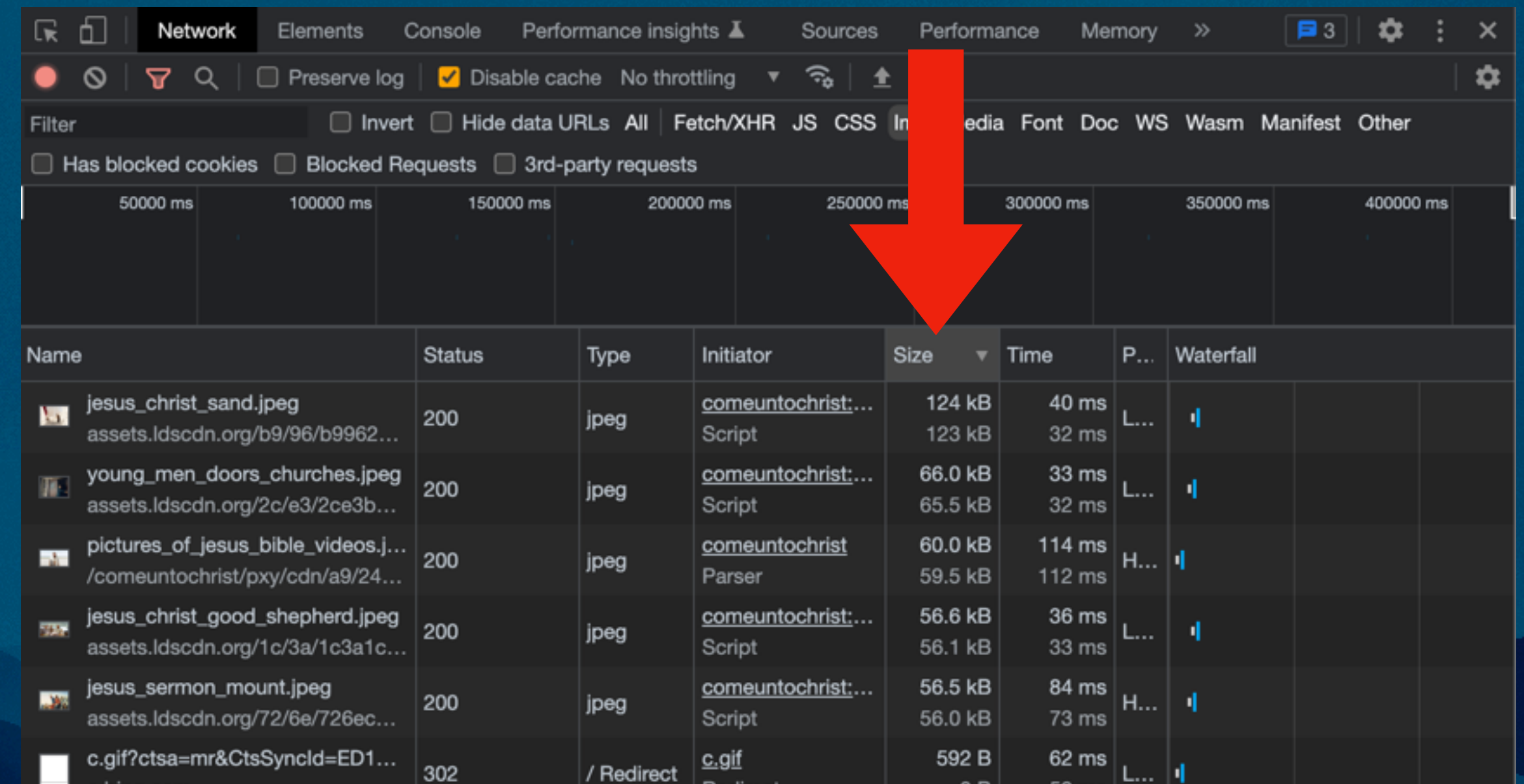
Mostly rendered in 1.8s



- CSS from 87k > 65k
- JS from 173K > 100K
- JS parsing time from 2.4s to 1.3s
- Homepage hero start load from 4.6s to 3.8s
- Changed to use font-display:swap

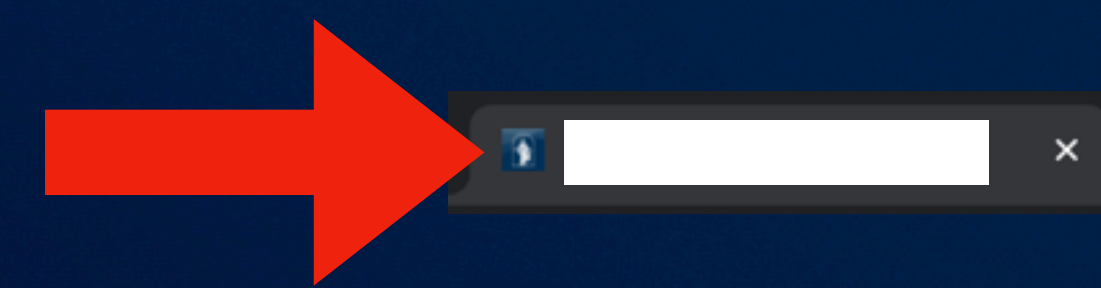
Network tab sorted by file size

Find large files



| Name | Status | Type | Initiator | Size |
|---------------------------------------|--------|------|----------------------|--------|
| may_2020_liahona_ensign_conferenc... | 200 | png | react-dom.product... | 922 kB |
| assets.ldscdn.org/41/b1/41b1a0ca90... | | | Script | 920 kB |

| Size | T |
|--------|---|
| 692 kB | |
| 943 kB | |



| Name | Status | Type | Initiator | Size |
|------------------------|--------|--------|----------------|--------|
| bitmovin-player.min.js | 200 | script | bitmovin.js:55 | 2.4 MB |
| | | | Script | 2.4 MB |

Network tab sorted by file size



Find large files

The screenshot shows a web browser window with the address bar displaying `churchofjesuschrist.org`. The browser has several tabs open, including "Introduct...", "eden-vid...", "Start Page", "Players /...", "iframe.ht...", "Bitmovin...", and "bitmovin...". The "Disabilities" panel is open on the left, showing a list of content sections under "Disability Services: Resources", including "Introduction", "All Children Are Alike Unto God and Created in His Image", "We Should Recognize and Celebrate Our Unique Gifts", "Disability Is Not a Punishment", "All of God's Children Are to Be Taught the Gospel", and "As Disciples of Jesus Christ We Must Care for the Poor and Needy". The "Videos" section is highlighted with a mouse cursor. The Network tab is active on the right, showing a list of resources sorted by file size. The table has columns for Name, Domain, T, Tr..., and Time. The resources listed include `introduction` (578ms), `index.js` (77.2ms), `css` (126ms), `style_global-template-mobile_lesson_s...` (598ms), `reader.1f6f269756626366e910.css` (78.1ms), `overrides.58839c60d165a70b5f74.css` (77.6ms), `app.58555ccf2991d12d5fd8.css` (128ms), `react.18.2.0.69370cab51417c08c2d5.js` (226ms), `eden--app.5e15571e2b4a78a0915f.js` (226ms), `modules--app.0e6406ae8be710a286e...` (276ms), `app.295f4fab97873e13f62f.js` (322ms), `overrides.32ef34510cad6e27c494.js` (312ms), `eden--home~library~reader.eafecc7ae...` (322ms), and `eden--reader.a7600d71ebabfac855ca...` (336ms). The bottom status bar shows 15 icons, 91 files, 4.01 MB, 1.55 MB, 4 icons, and 5.79s.

| Name | Domain | T | Tr... | Time |
|--|--------|----|-------|--------|
| introduction | ww... | d | 2... | 578ms |
| index.js | ww... | js | 2... | 77.2ms |
| css | fou... | c | 1... | 126ms |
| css | fou... | c | 1... | 126ms |
| css | fou... | c | 1... | 126ms |
| css | fou... | c | 1... | 130ms |
| css | fou... | c | 1... | 130ms |
| css | fou... | c | 1... | 130ms |
| css | fou... | c | 1... | 131ms |
| style_global-template-mobile_lesson_s... | ips... | c | 3... | 598ms |
| reader.1f6f269756626366e910.css | ww... | c | 11... | 78.1ms |
| overrides.58839c60d165a70b5f74.css | ww... | c | 6... | 77.6ms |
| app.58555ccf2991d12d5fd8.css | ww... | c | 5... | 128ms |
| react.18.2.0.69370cab51417c08c2d5.js | ww... | js | 6... | 226ms |
| eden--app.5e15571e2b4a78a0915f.js | ww... | js | 9... | 226ms |
| modules--app.0e6406ae8be710a286e... | ww... | js | 51... | 276ms |
| app.295f4fab97873e13f62f.js | ww... | js | 3... | 322ms |
| overrides.32ef34510cad6e27c494.js | ww... | js | 1... | 312ms |
| eden--home~library~reader.eafecc7ae... | ww... | js | 5... | 322ms |
| eden--reader.a7600d71ebabfac855ca... | ww... | js | 12... | 336ms |

Use incognito when you are serious

Browser extensions can load extra files

| Name | Status | Type | Initiator | Size | Time | P... |
|--|--------|--------|-------------------------------------|--------|-------|------|
|  axe.js | 200 | script | content.bundle.j... | 436 kB | 54 ms | H... |
| lhdoppojpmngadmndnejfpok... | OK | | 436 kB | 39 ms | H... | |
|  hook.js | 200 | script | tab.js:1 | 189 kB | 83 ms | H... |
| jdkknkkbebbapilgoecciglkfbm... | OK | | 189 kB | 71 ms | H... | |

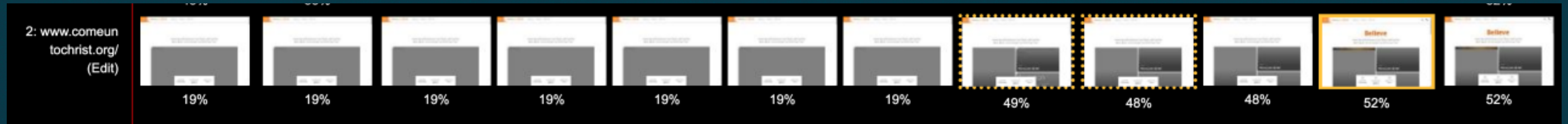
July 2020

Critical JS

Image Loading



Before



After

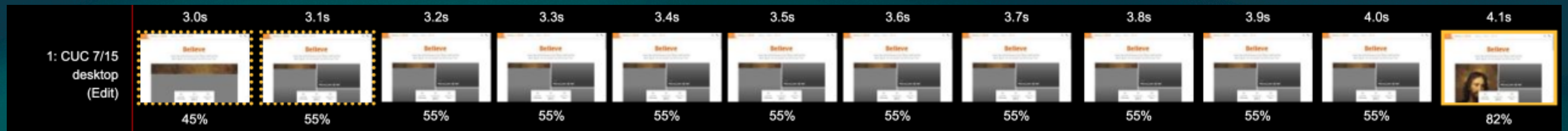


Image Loading



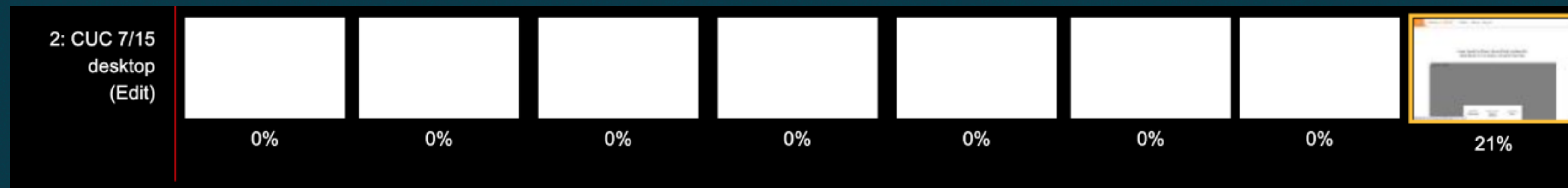
First render is still 1.8s

Critical JS

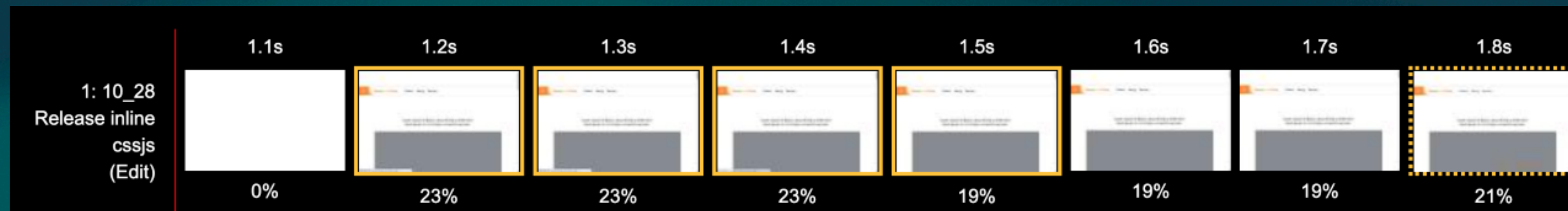
Oct 2020 Critical CSS

FCP ↓

Before



After

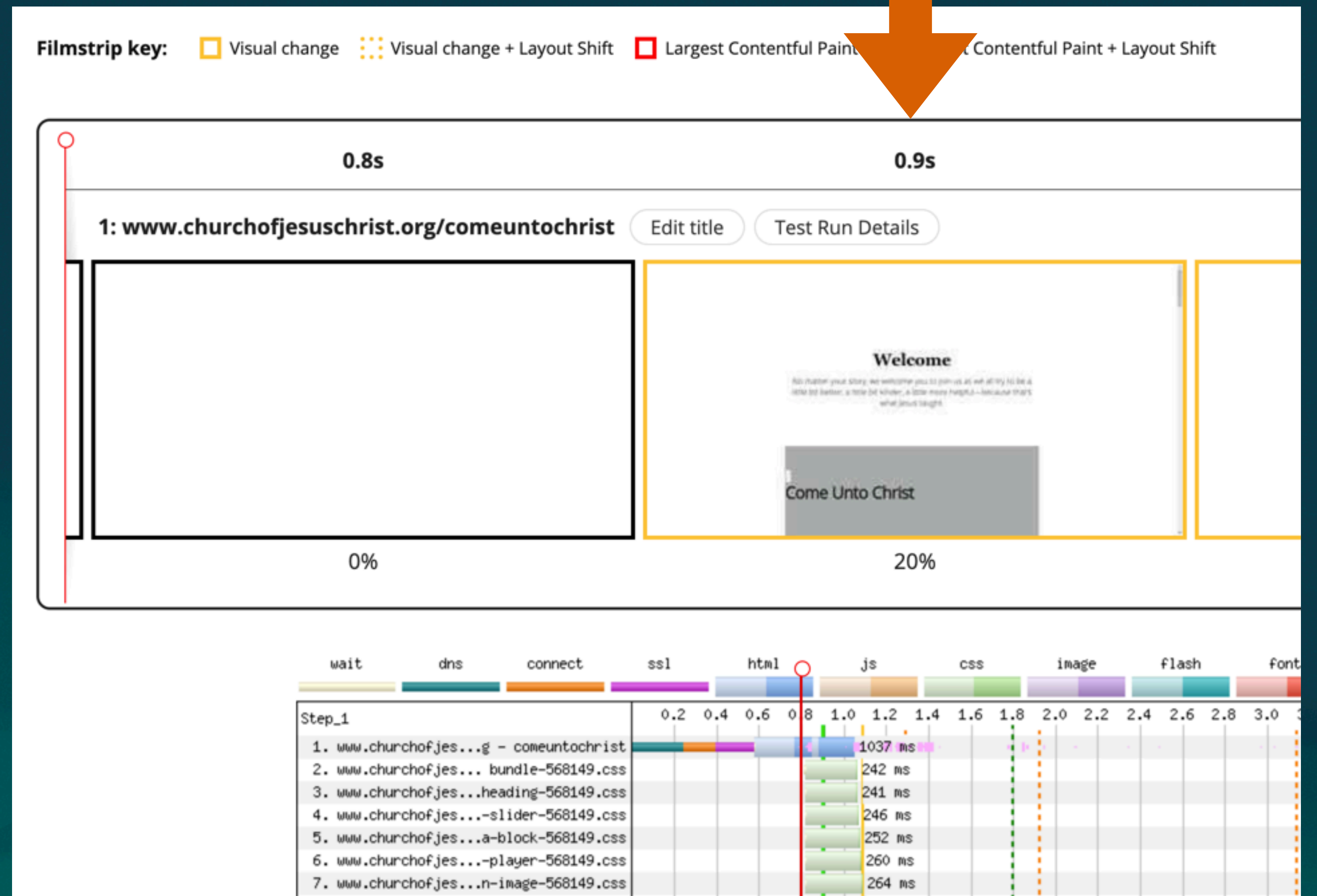


FCP ↑

Critical CSS

June 2021 CSS/JS Parts

Critical CSS ++ Critical JS ++



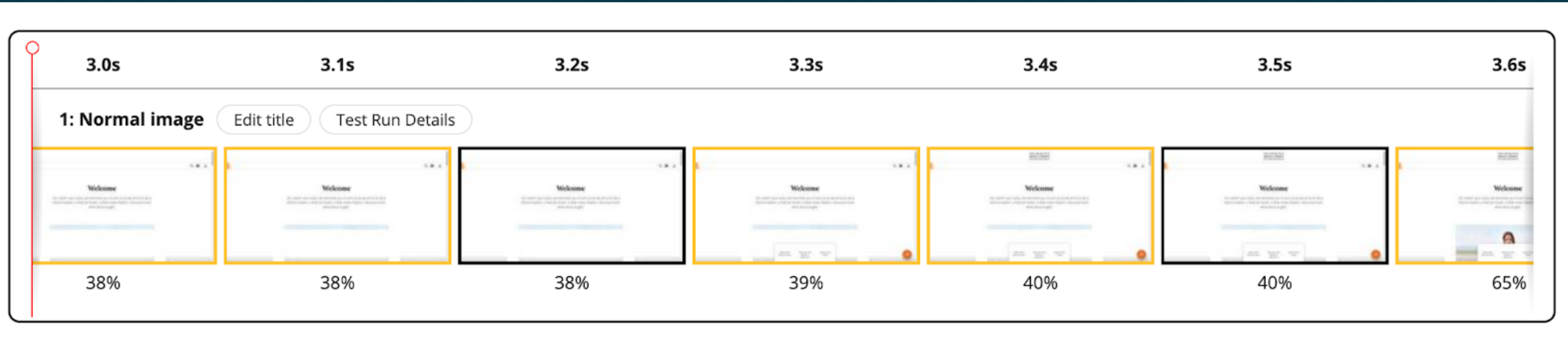
CSS/JS Parts

1. Change bundler to output a CSS/JS file per component instead of combined
2. Update logic to determine first 10 components on page, load related files
3. Inline Critical CSS/JS (inline doesn't render block)
4. Lazy load other CSS/JS files as the user scrolls down the page

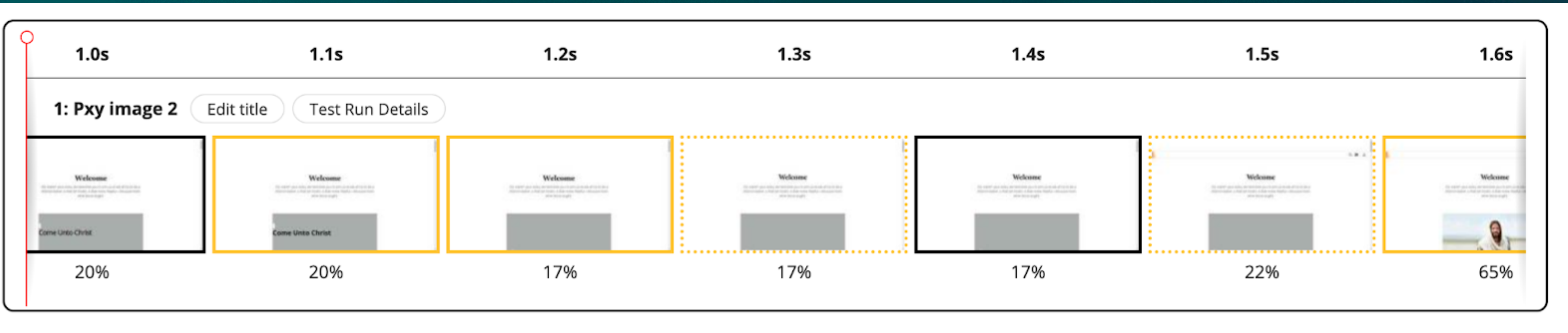
Mar 2022

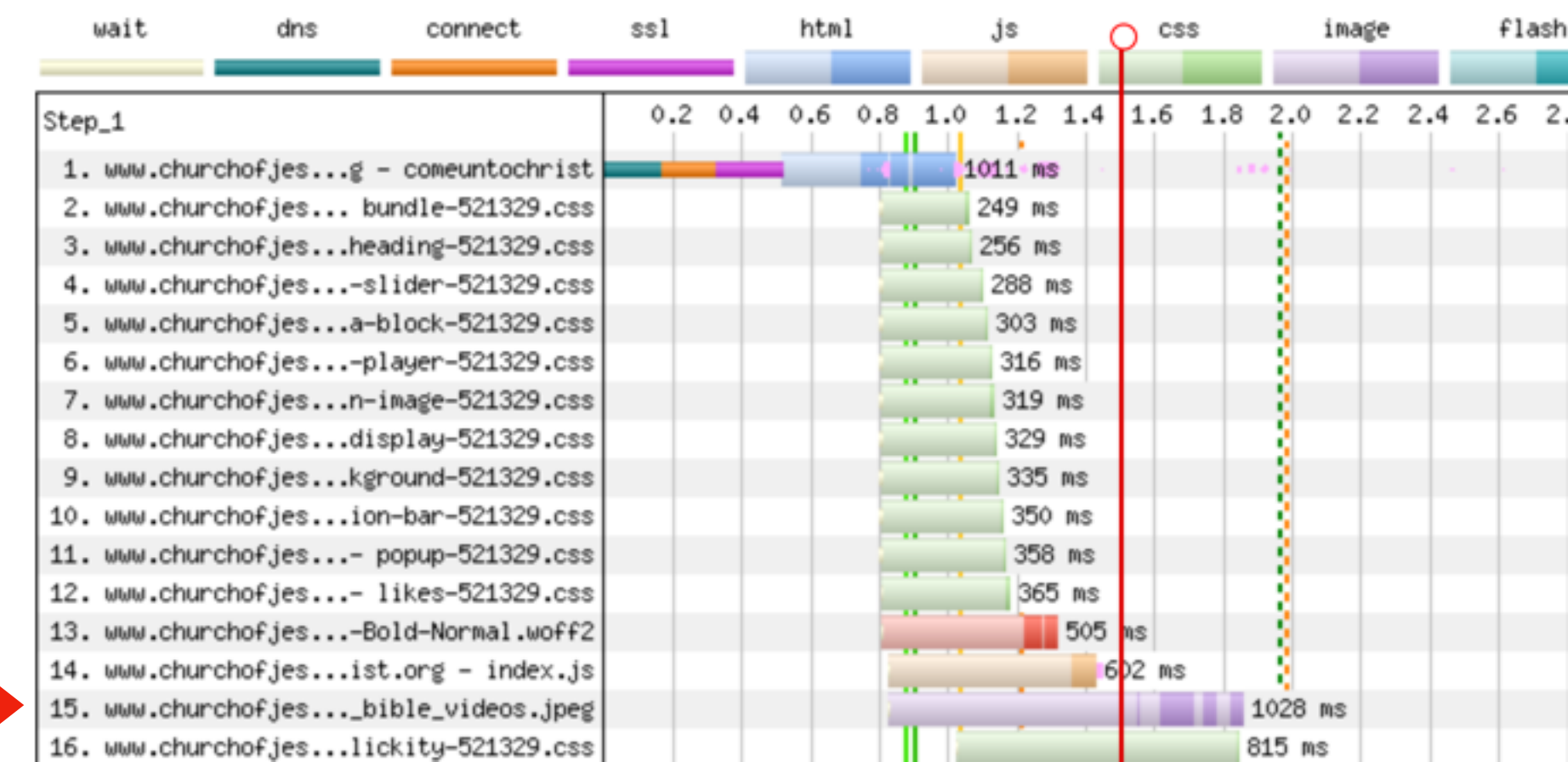
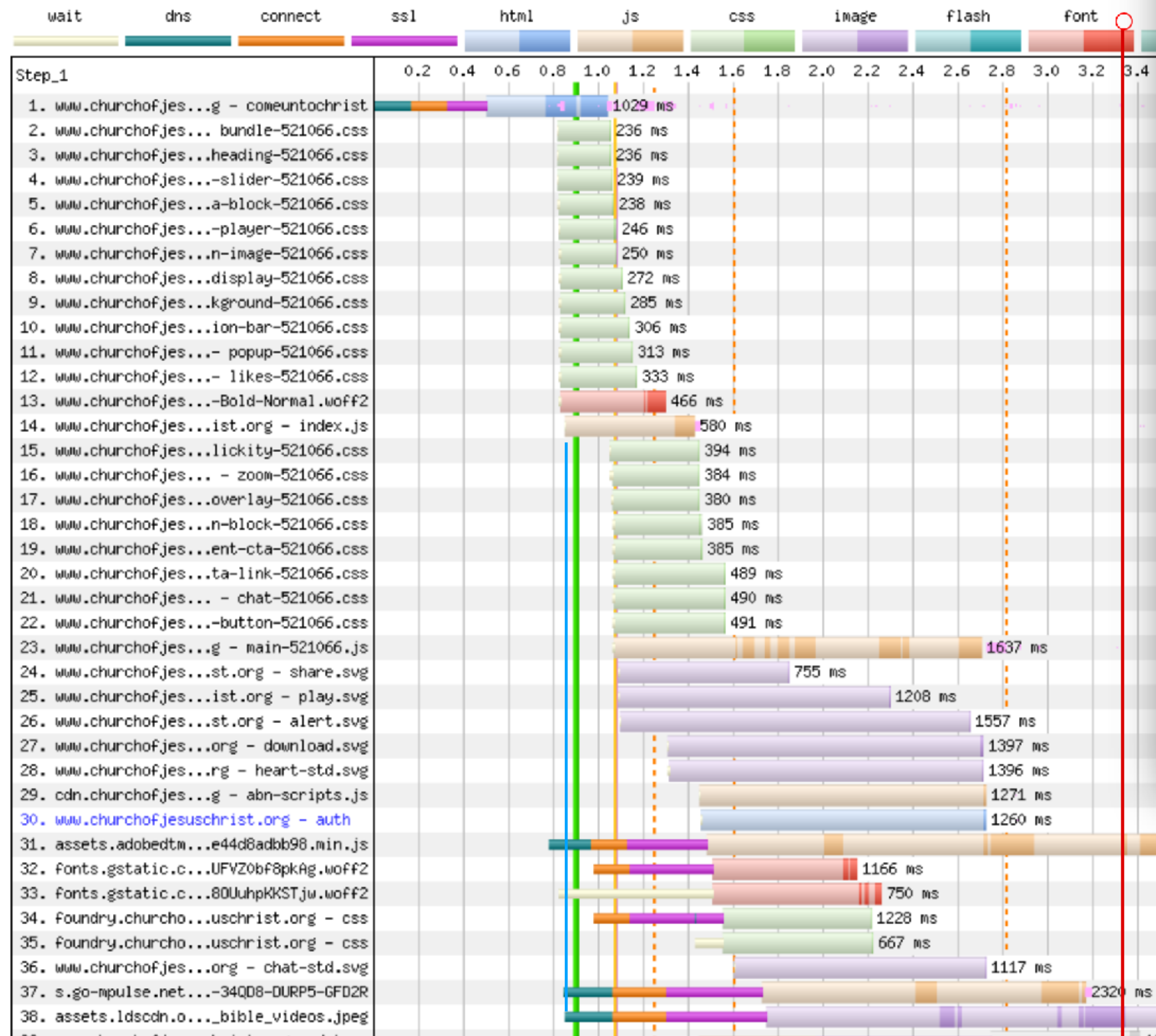
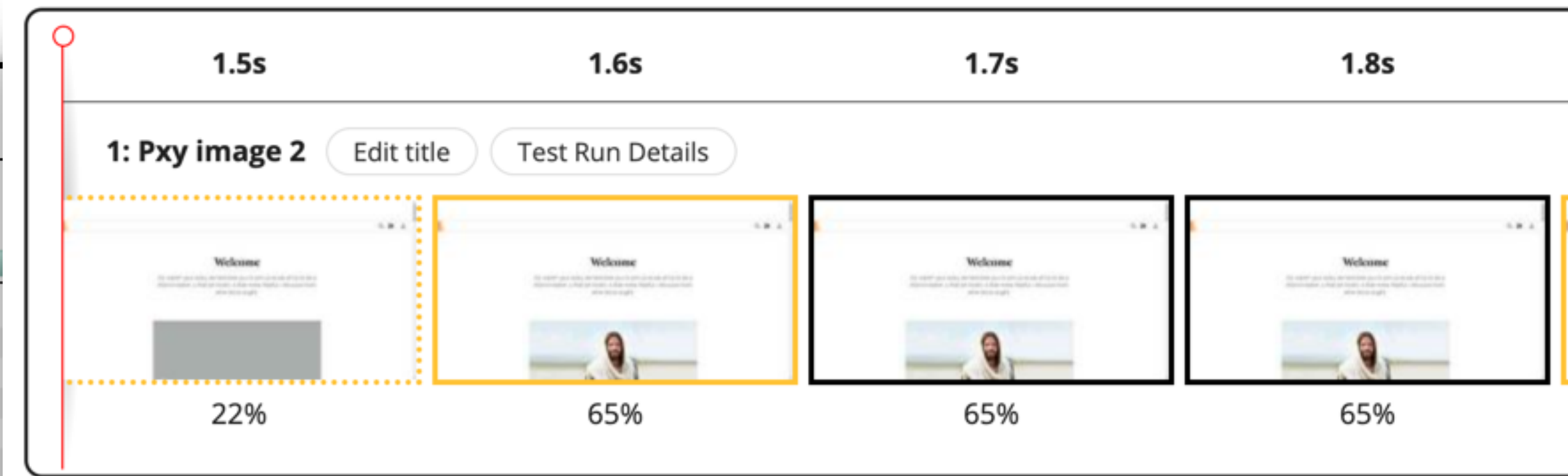
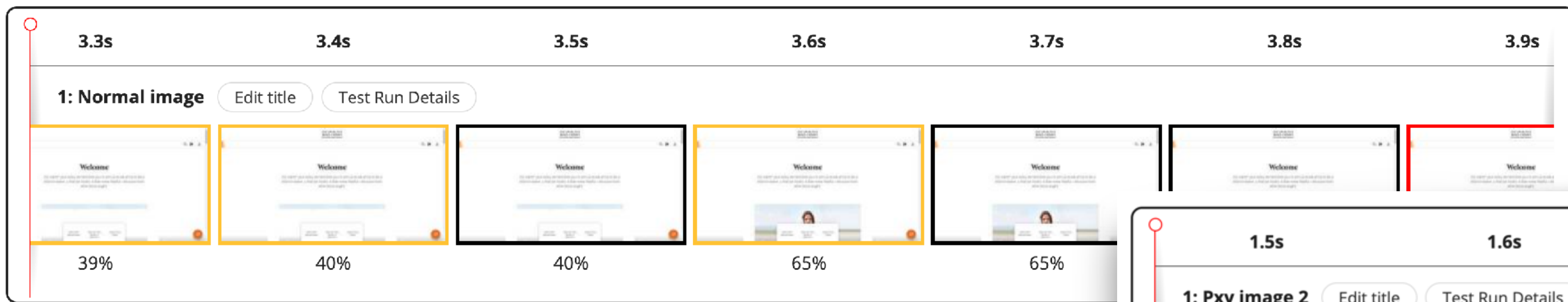
Image Proxy

Before



After





Live WPT.org review if time and
bandwidth allow...

Questions?

aaron@churchofjesuschrist.org