The intersection of

Performance

Accessibility

#PerfMatters 2019

Let’s set the stage:

Performance

The manner in which a mechanism behaves

1.
2.
3.
4.

Make beautiful products, faster. Material is a design system – backed by open-source code – that helps teams build digital experiences

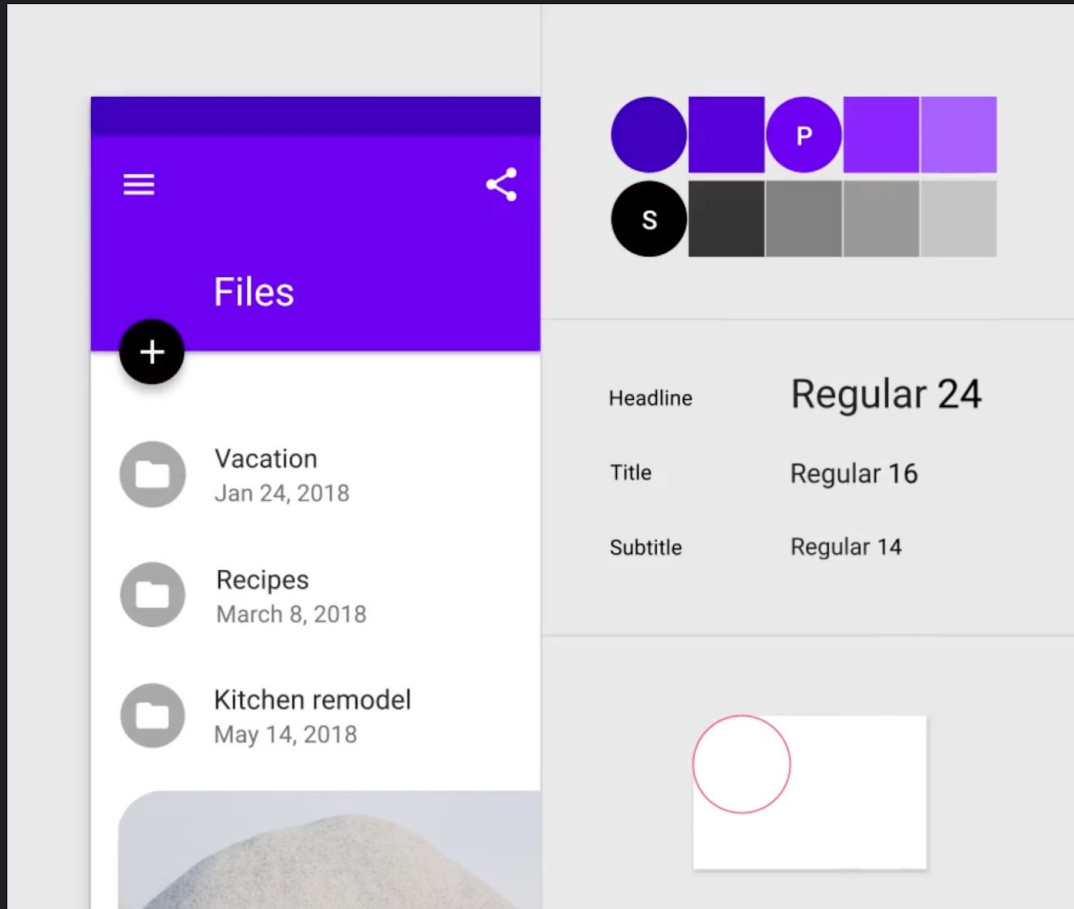
Design flexibly

Get started with detailed design guidance and create custom Material themes to make your product unique.

LEARN MORE

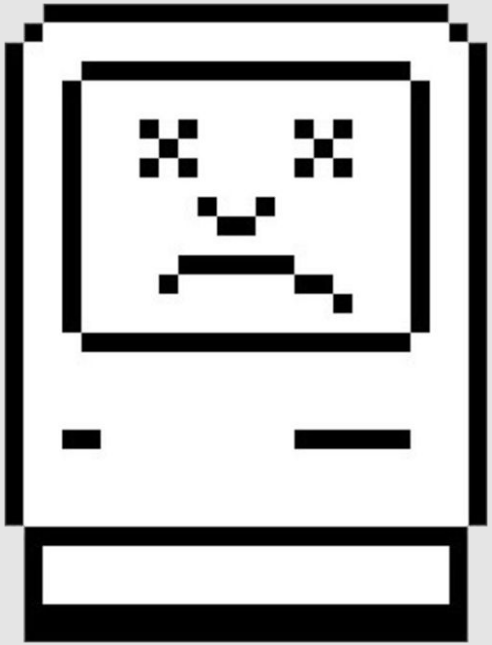
Develop across platforms

Collaborate seamlessly



Google made it? Oh sweet.

I don’t have to worry as much.



How do you describe an interface?

The Accessibility Tree

Name

Short identifier to designate purpose.

Name	Short identifier to designate purpose.
Role	How to interact with the object.

Name	Short identifier to designate purpose.
Role	How to interact with the object.
Properties	The object’s state.

Name	Short identifier to designate purpose.
Role	How to interact with the object.
Properties	The object’s state.
Description	Further information, if needed.

OS Alert Dialog

OS Alert Dialog

↳ Menubar

OS Alert Dialog

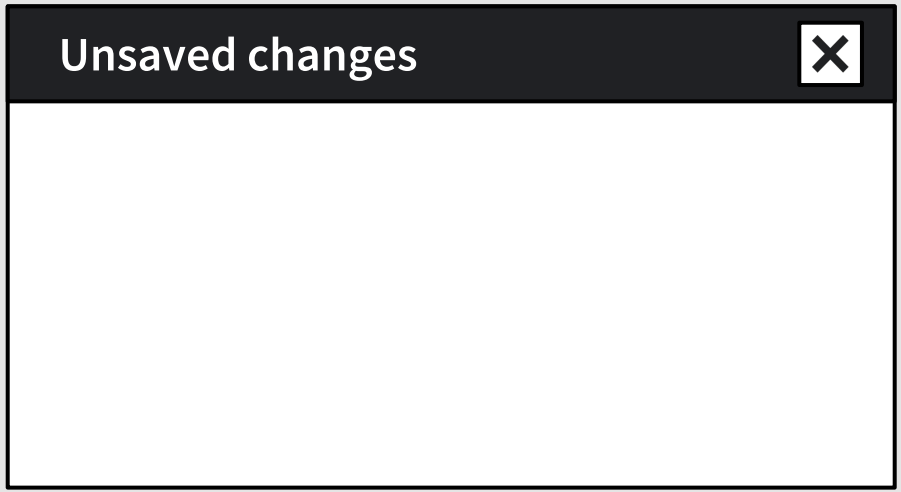
↳ Menubar

↳ Title

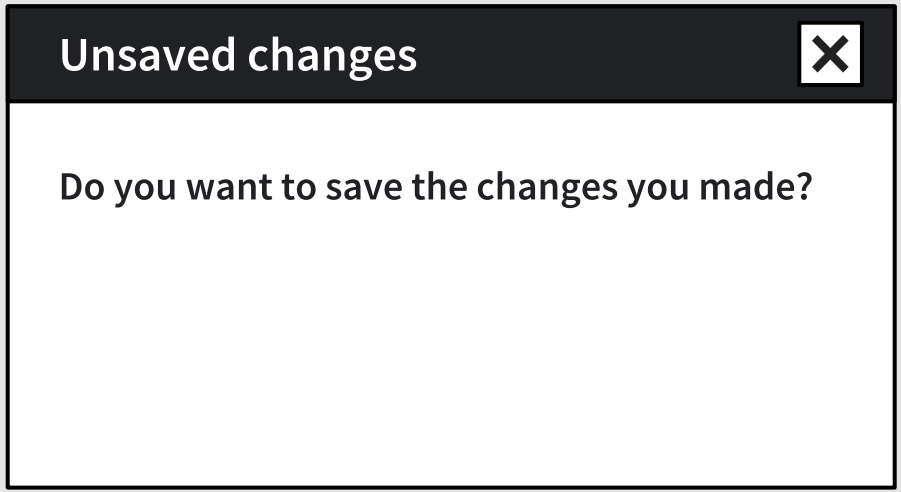
OS Alert Dialog

- Menubar
  - Title
  - Close Button

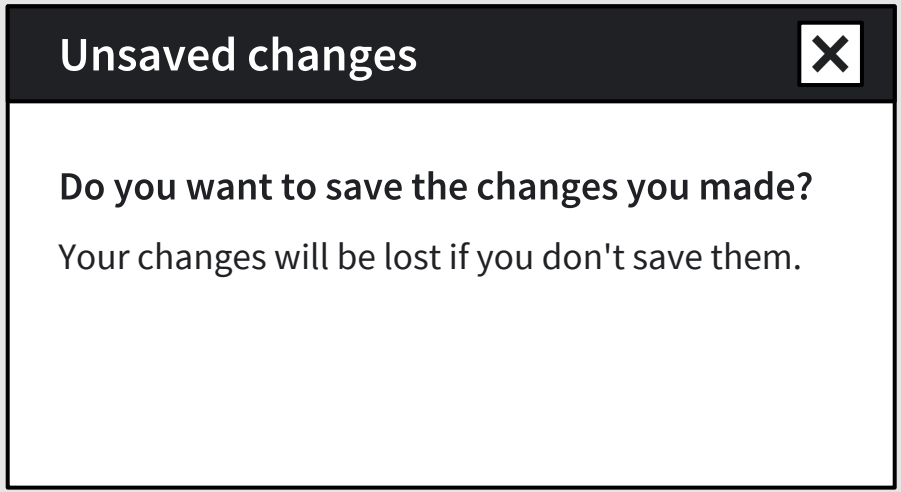
- OS Alert Dialog
  - Menubar
    - Title
    - Close Button
  - Body



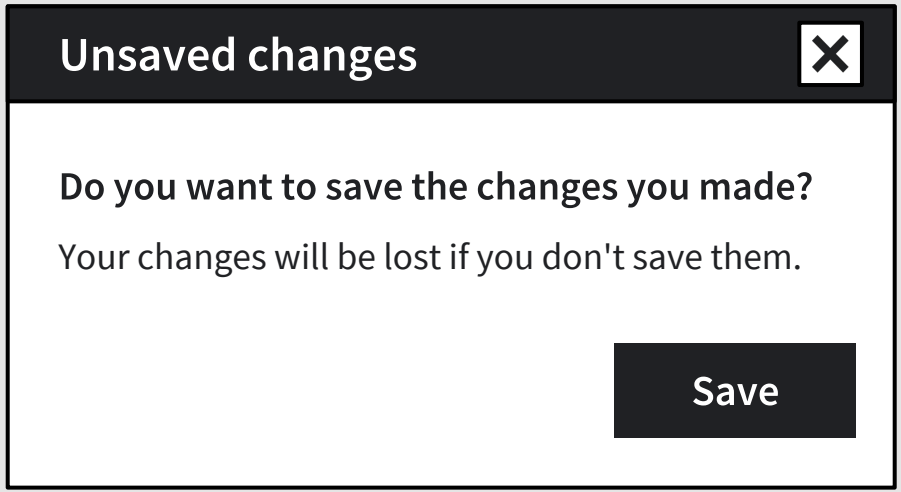
- OS Alert Dialog
  - Menubar
    - Title
    - Close Button
  - Body
    - Title



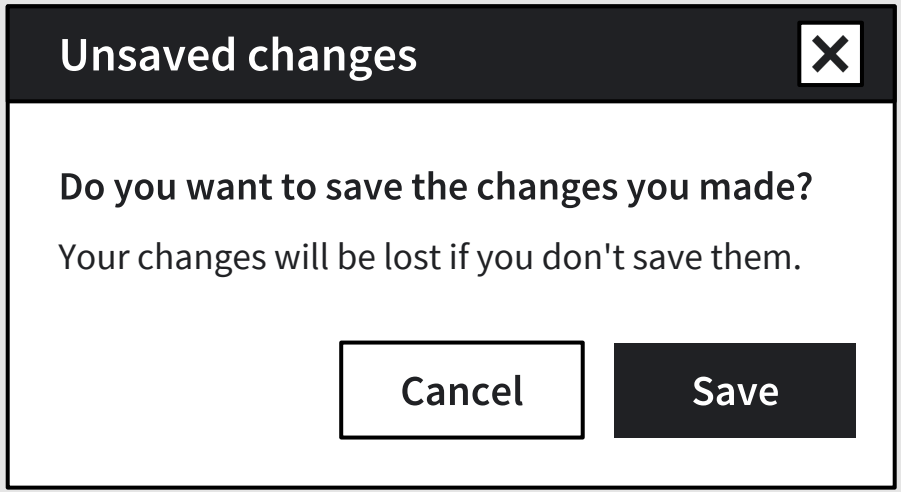
- OS Alert Dialog
  - Menubar
    - Title
    - Close Button
  - Body
    - Title
    - Text

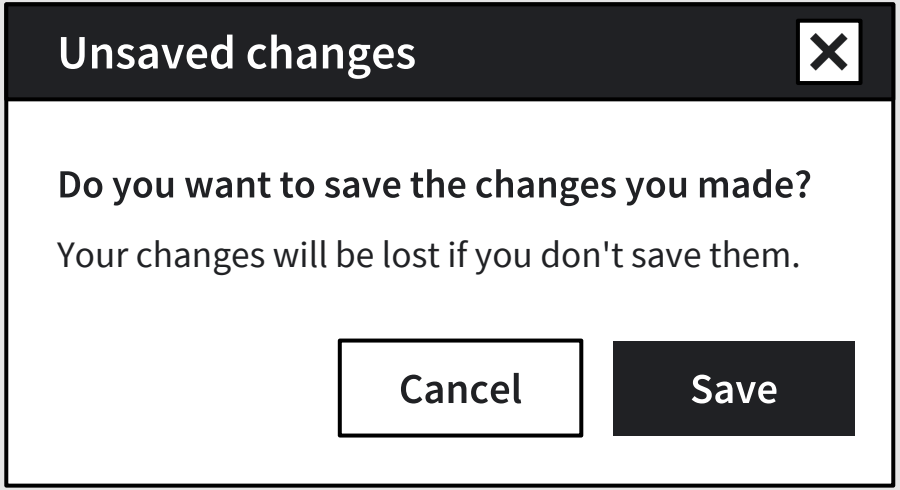


- OS Alert Dialog
  - Menubar
    - Title
    - Close Button
  - Body
    - Title
    - Text
    - Save Button

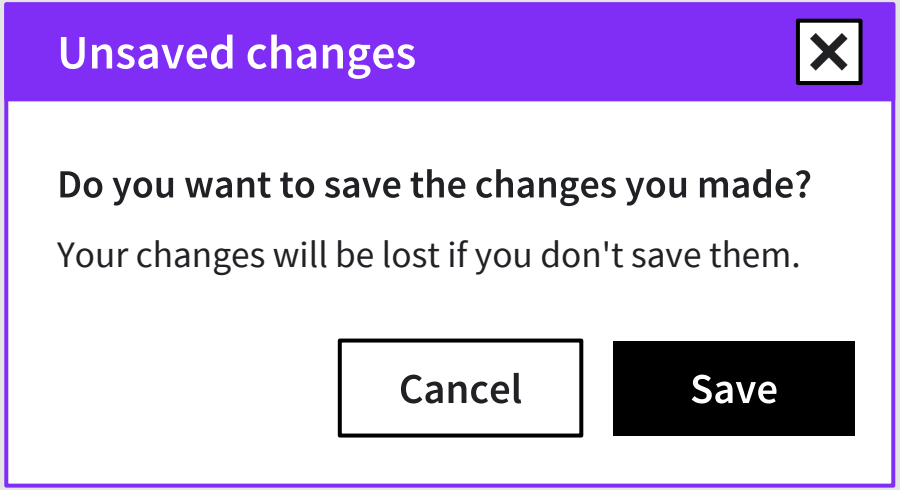


- OS Alert Dialog
  - Menubar
    - Title
    - Close Button
  - Body
    - Title
    - Text
    - Save Button
    - Cancel Button

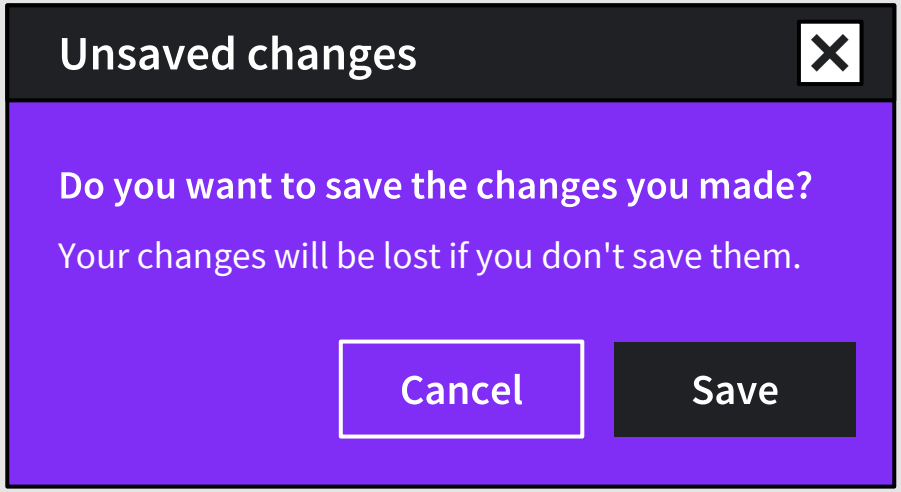



Unsaved changes
Do you want to save the changes you made?
Your changes will be lost if you don't save them.
Cancel
Save

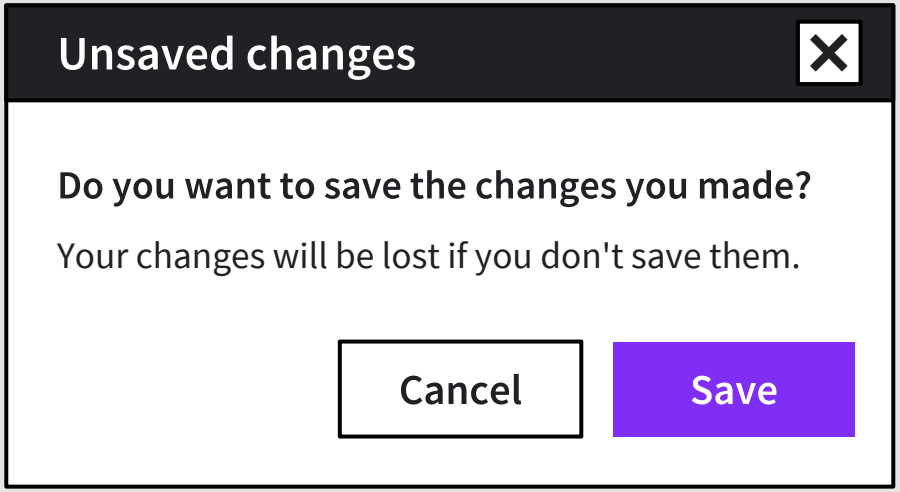
Go to the **Dialog**



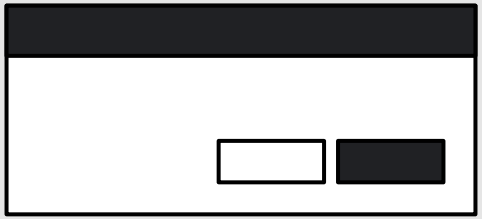
Go to the **Dialog**'s **Body**

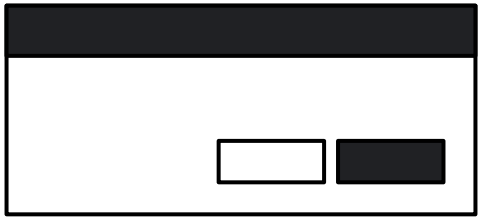


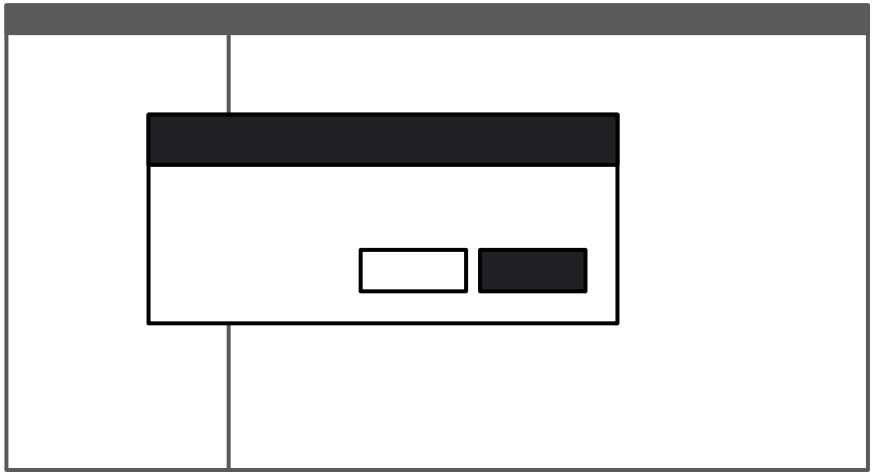
Go to the **Dialog**'s **Body** and **activate** the **Save Button**

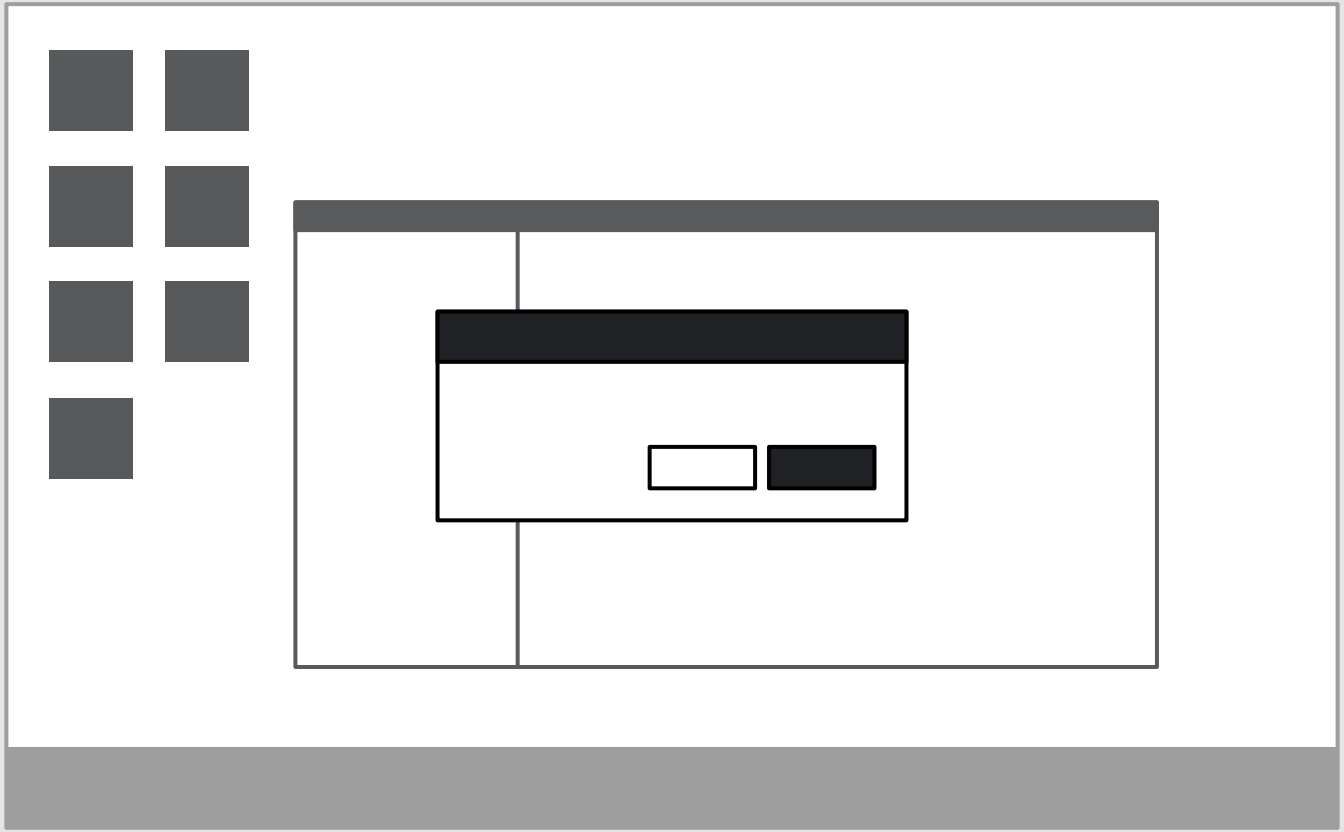


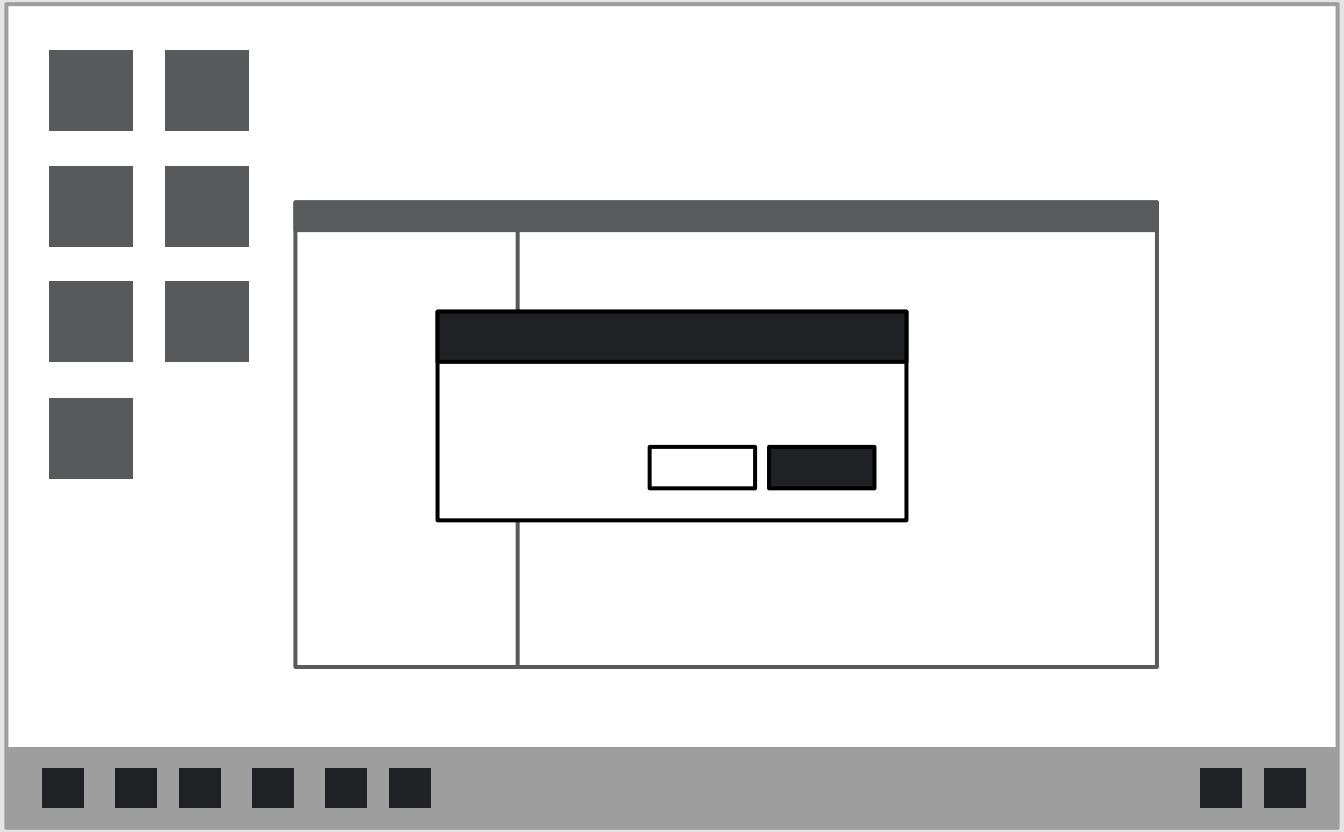
Bear with me a for a bit:

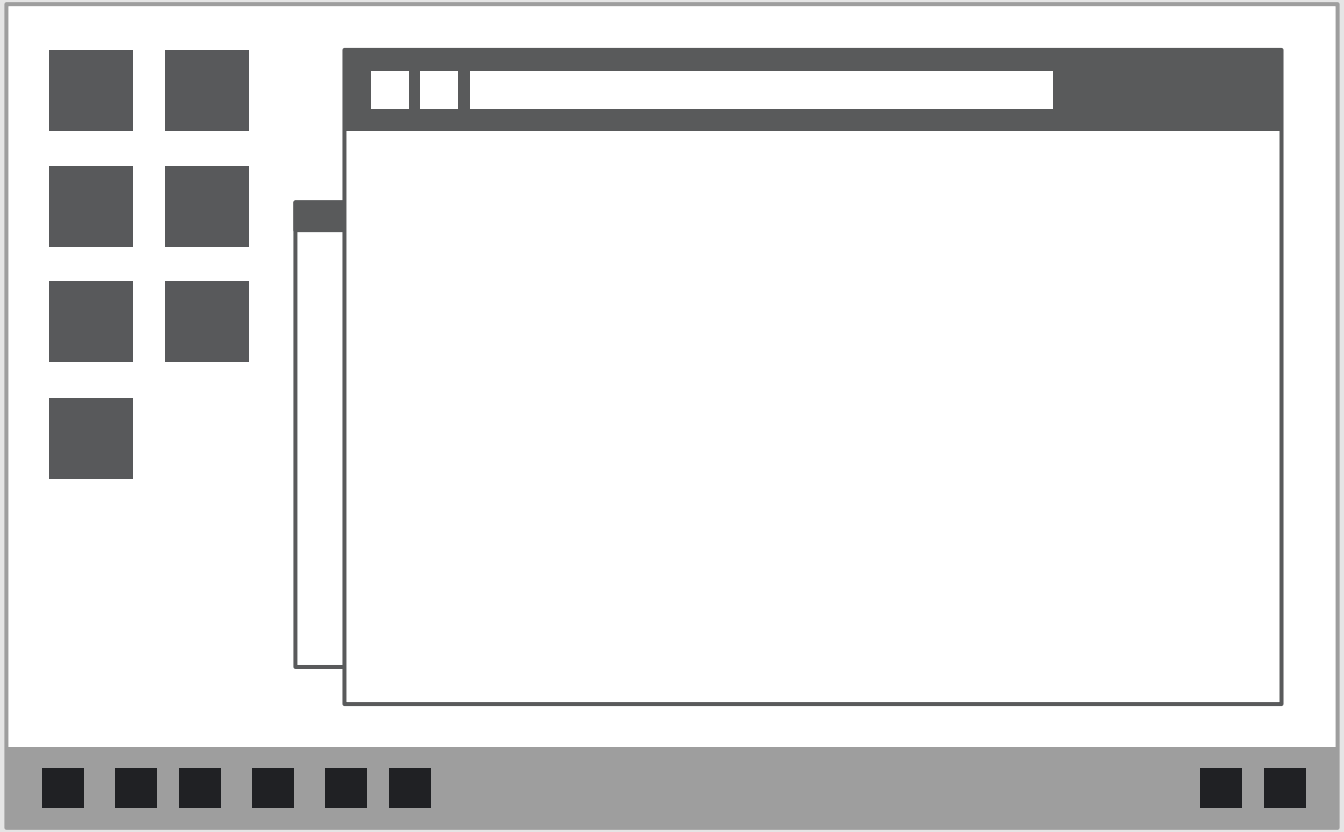










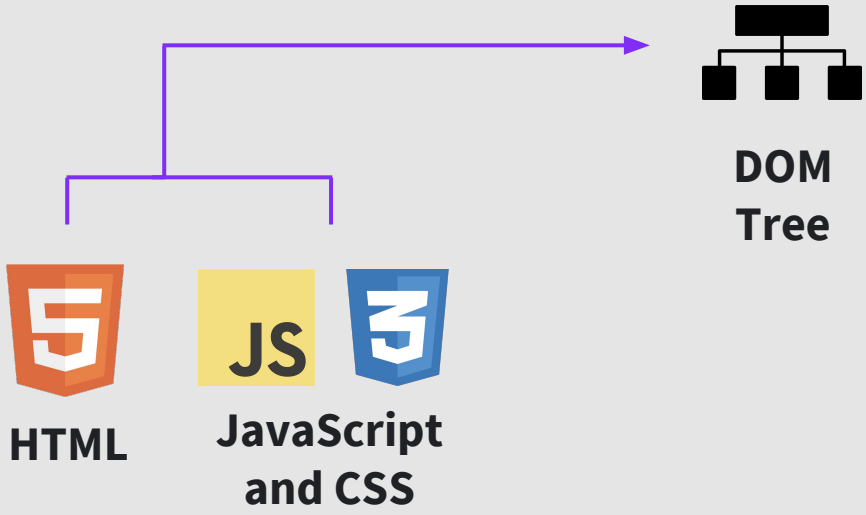


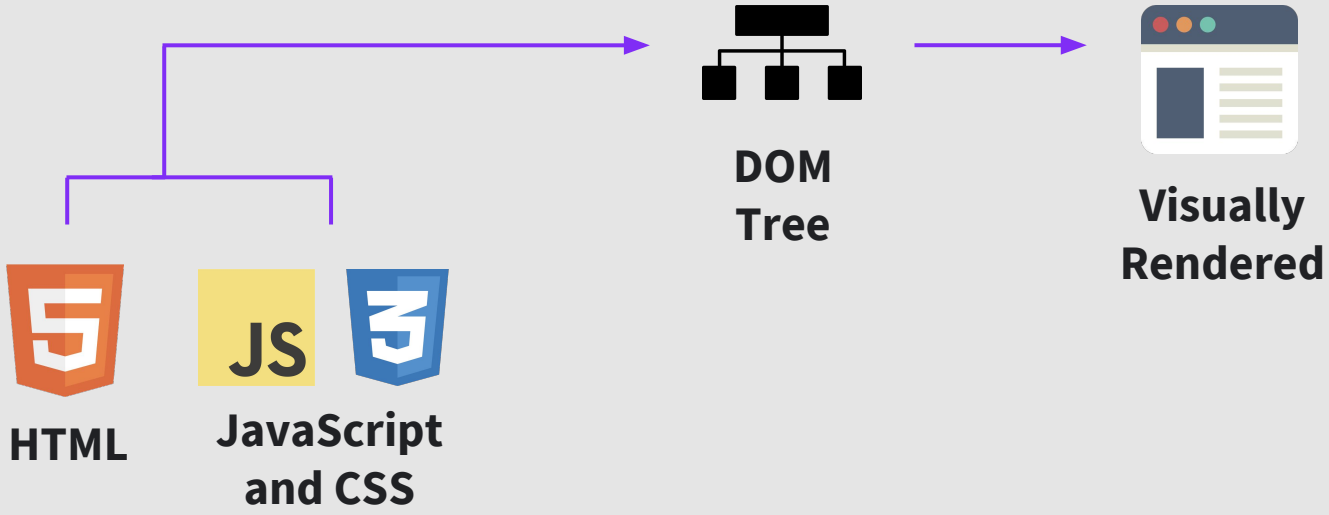
On the web:

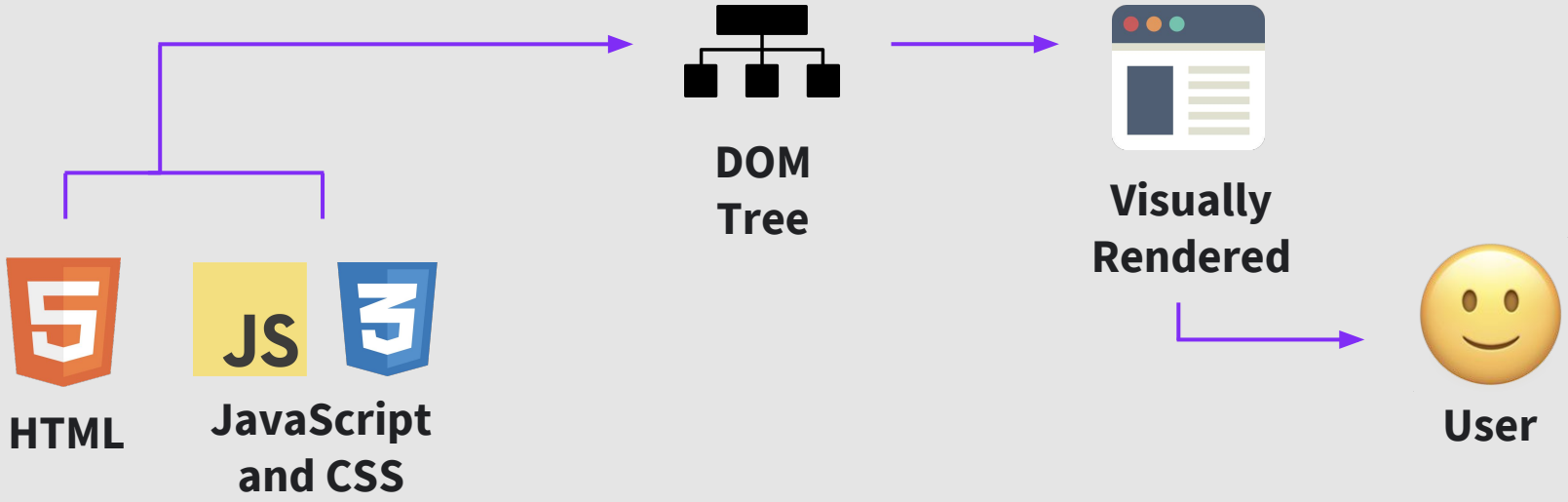
HTML

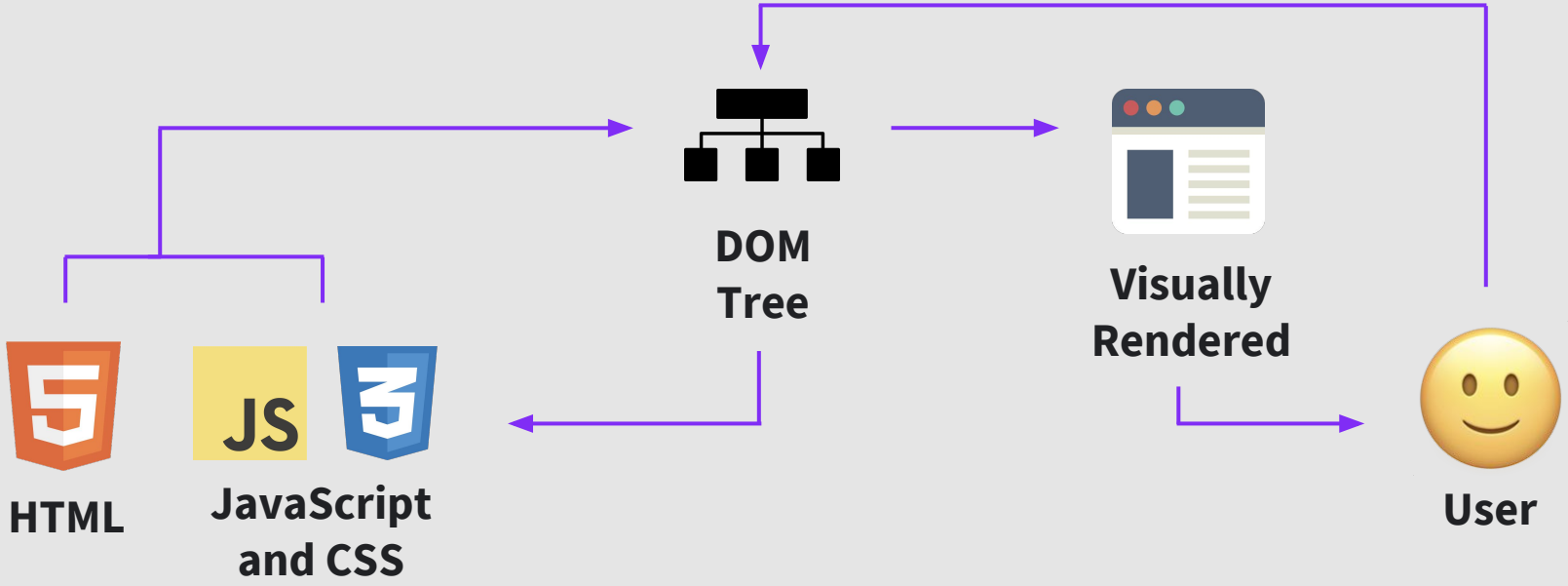
HTML

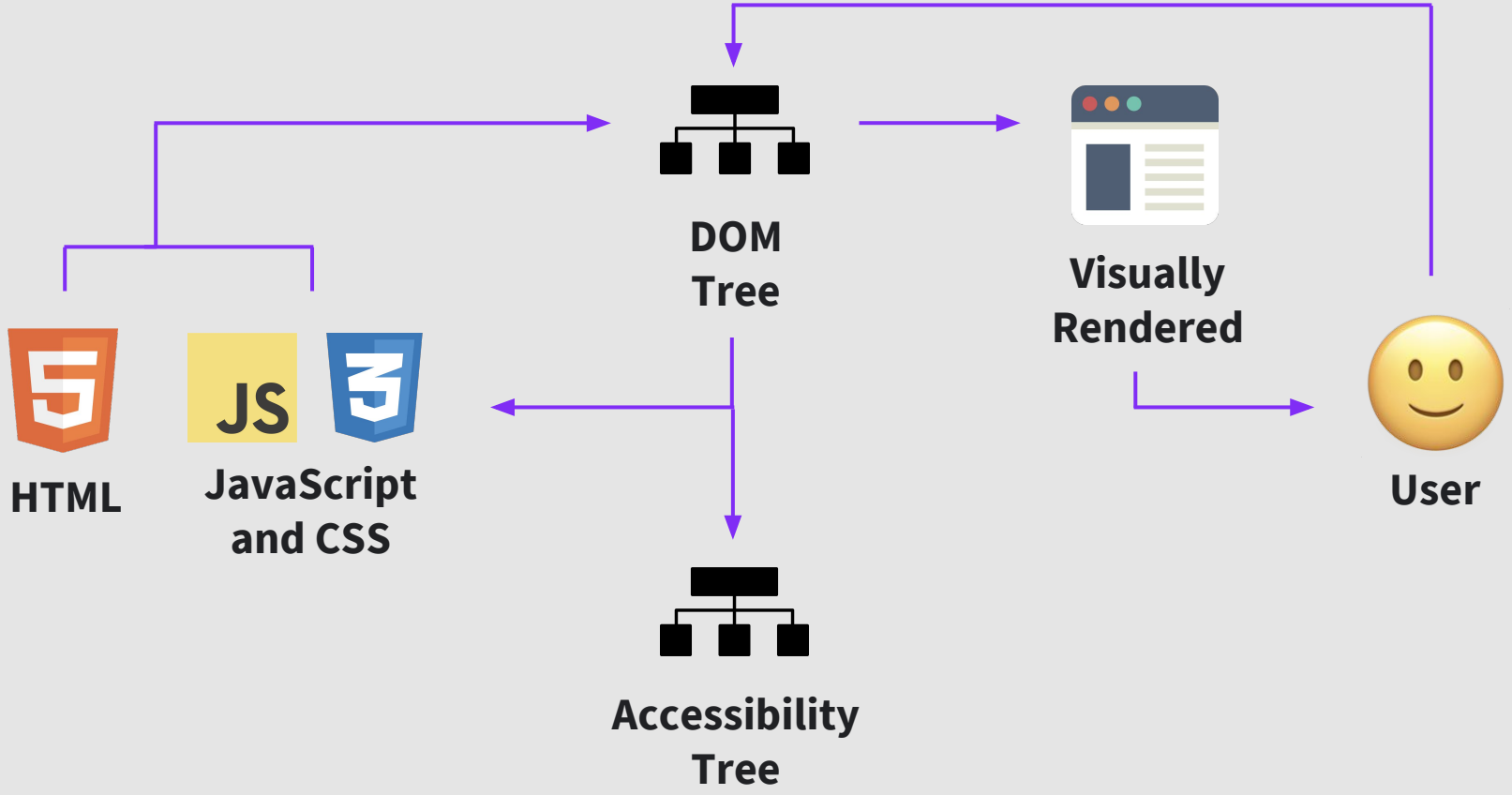
JavaScript
and CSS

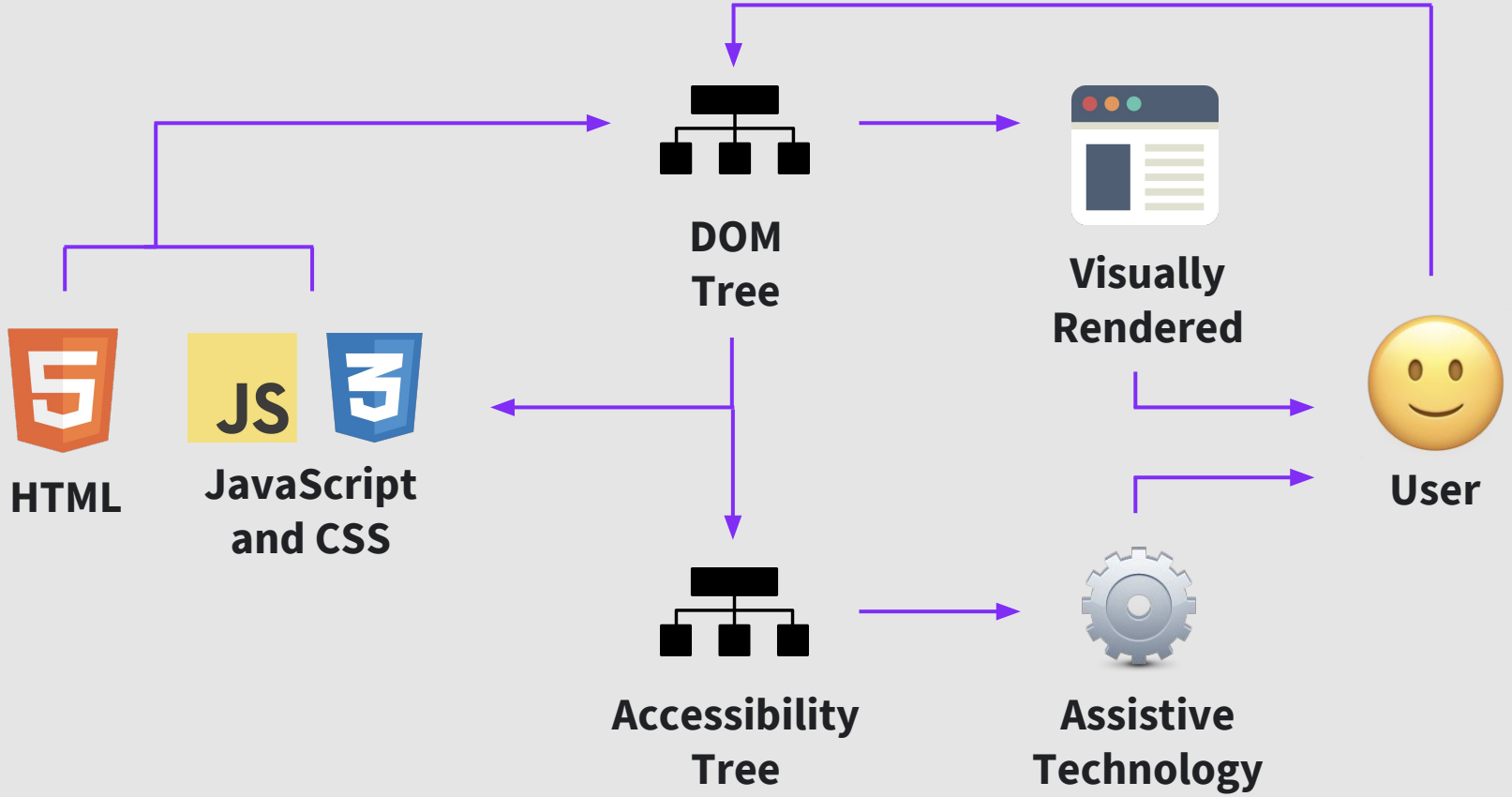

DOM
Tree
JS
HTML
JavaScript
and CSS

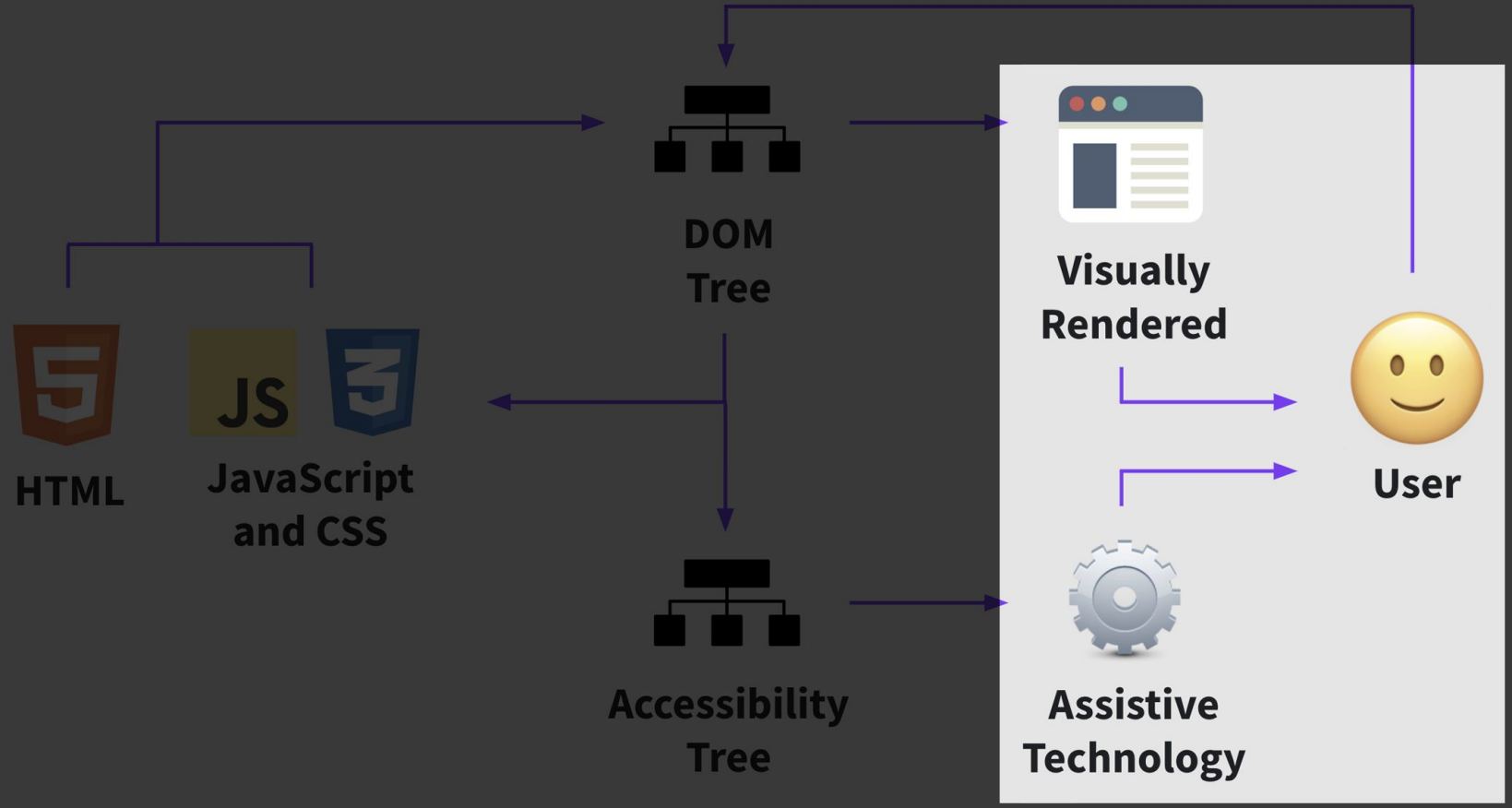

JS
HTML
JavaScript
and CSS
DOM
Tree
Visually
Rendered

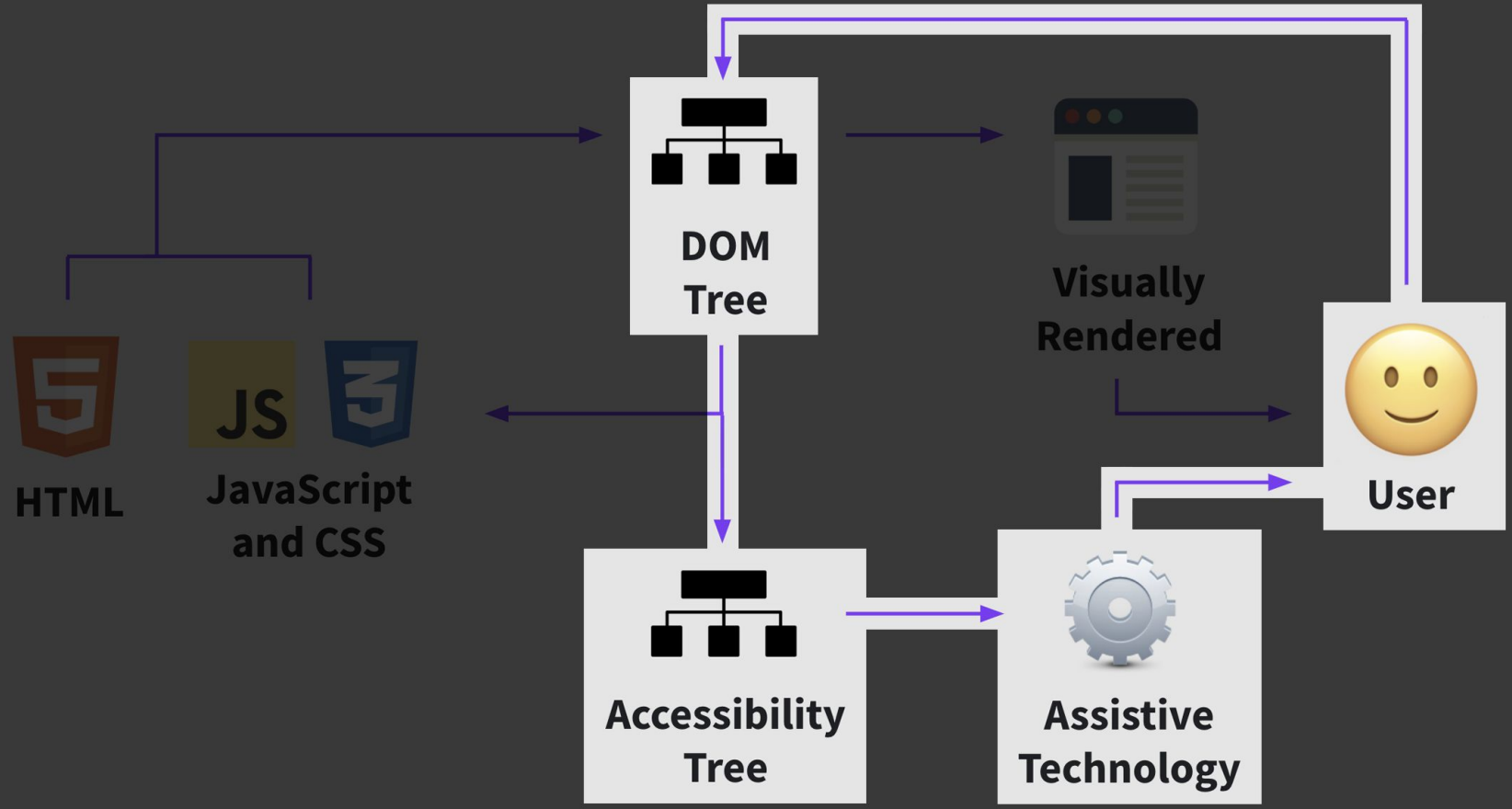

HTML
JS
JavaScript
and CSS
DOM
Tree
Visually
Rendered
User


DOM
Tree
Visually
Rendered
HTML
JS
JavaScript
and CSS
User


HTML
JS
JavaScript and CSS
DOM Tree
Visually Rendered
User
Accessibility Tree


HTML
JS
JavaScript and CSS
DOM Tree
Visually Rendered
User
Accessibility Tree
Assistive Technology

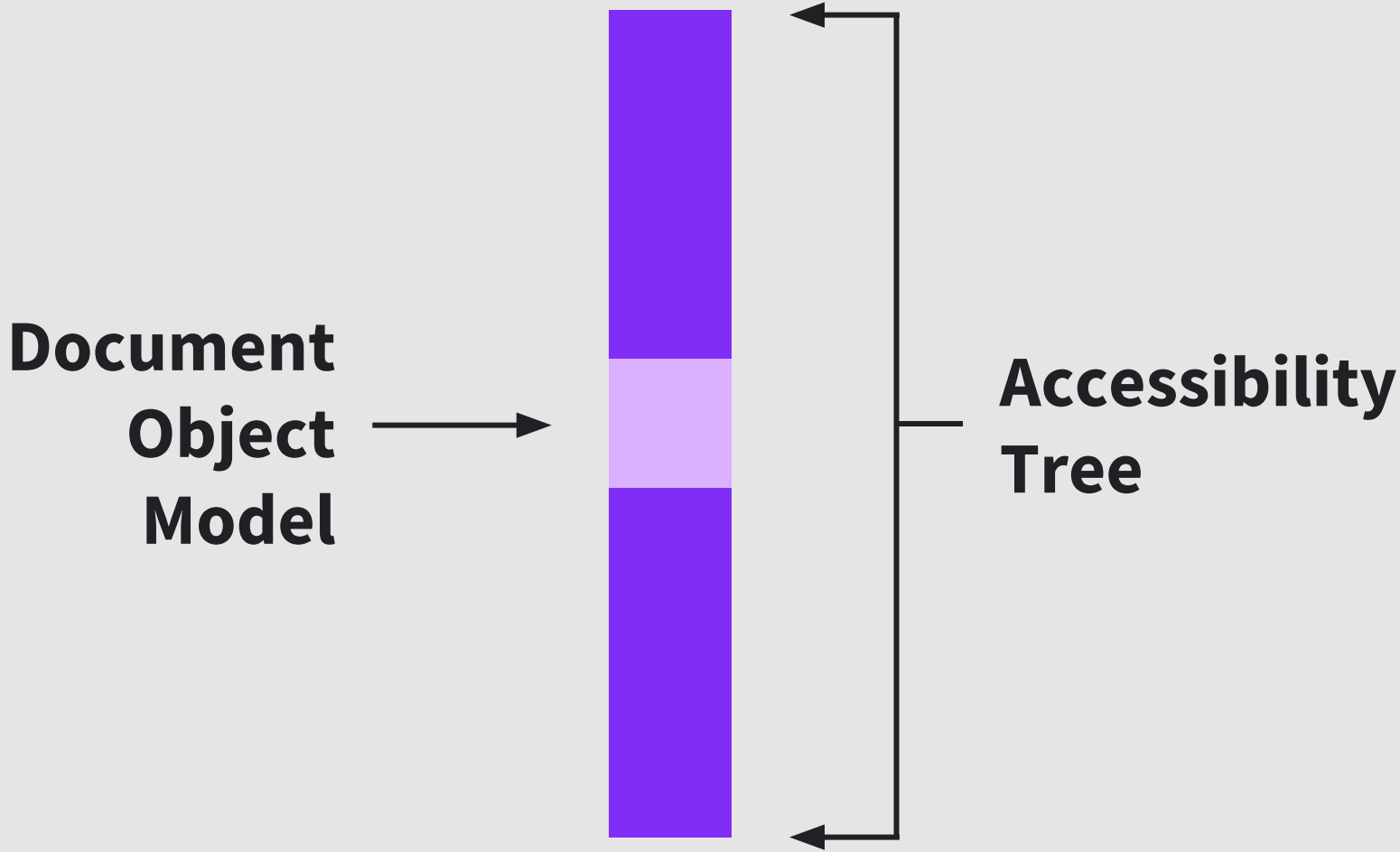

HTML
JS
JavaScript and CSS
DOM Tree
Accessibility Tree
Visually Rendered
User
Assistive Technology

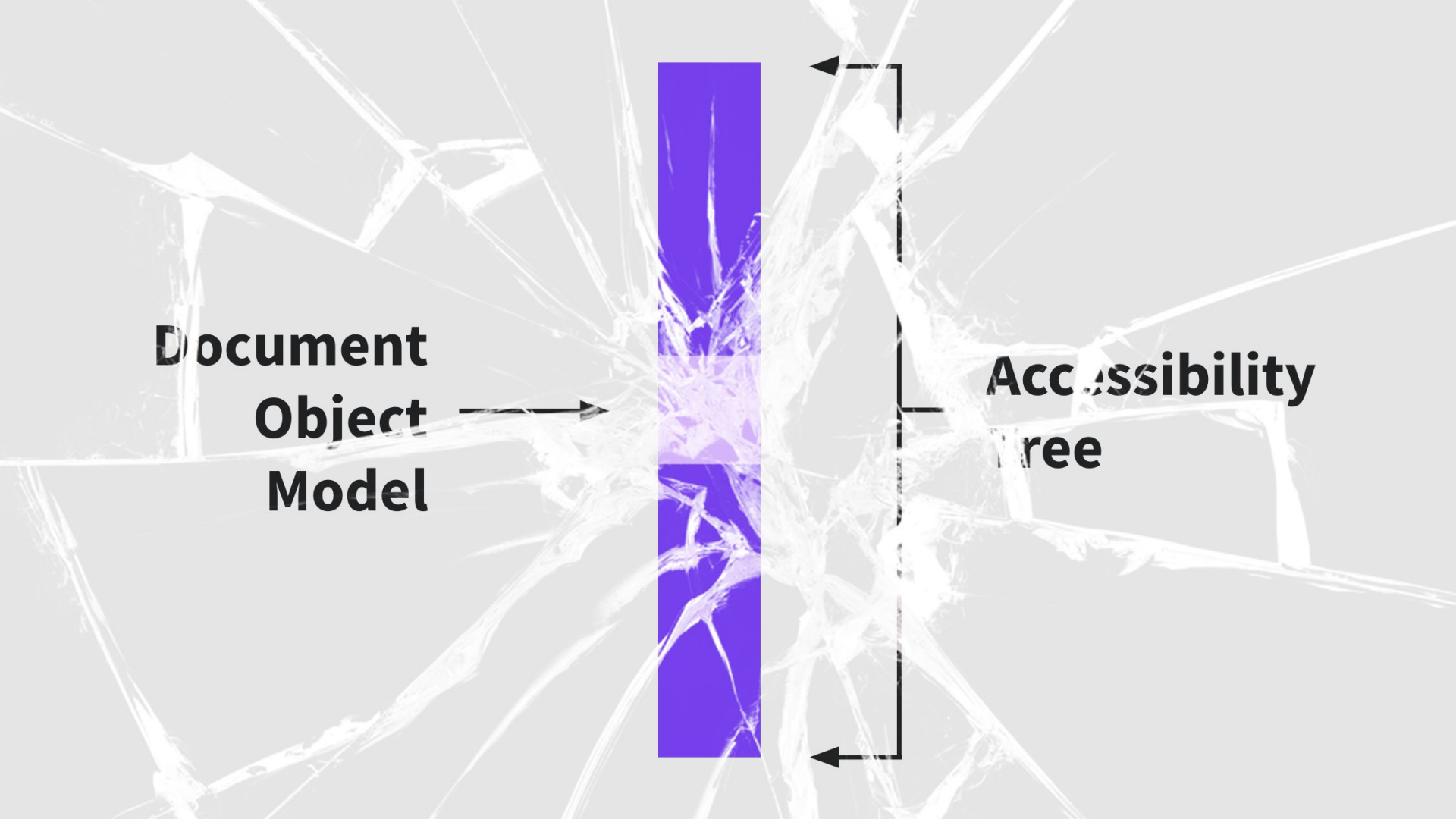

HTML
JS
JavaScript and CSS
DOM Tree
Visually Rendered
User
Accessibility Tree
Assistive Technology

There are multiple trees

Microsoft	• Microsoft Active Accessibility (MSAA), extended with IAccessible2 (IA2) • UI Automation (UIA)
MacOS	• NSAccessibility (AXAPI)
Linux	• Accessibility Toolkit (ATK) • Assistive Technology Service Provider Interface (AT-SPI)

Accessibility
Tree


Document
Object
Model
Accessibility
Tree


Document
Object
Model
Accessibility
Tree

SLOW

SLOW

Write semantic HTML.

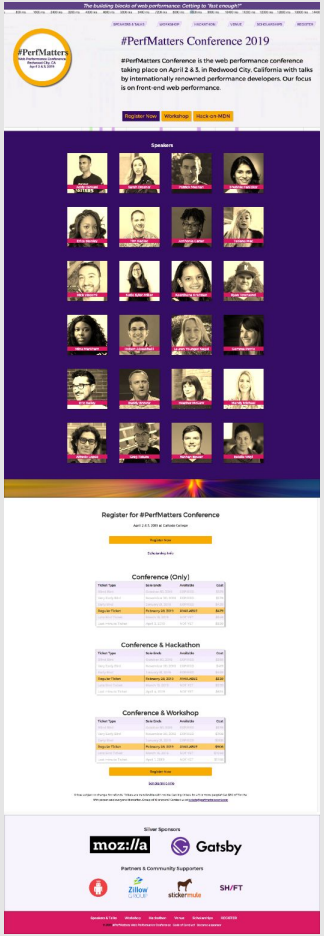
```
HTML
  HEAD
    LINK rel="stylesheet" href="css/styles.css"
  BODY id="home"
    #text:
    ASIDE
      #text: The building blocks of web performance: Getting to "fast enough?"
    #text:
    HEADER
      #text:
      HGROUP
        #text:
        UL
          #text:
          LI
            A href="/talks"
              SPAN
                #text: Speakers & Talks
          #text:
          LI
            A href="/workshop"
              SPAN
                #text: Workshop
          #text:
          LI
            A href="/hackathon"
              SPAN
                #text: Hackathon
          #text:
          LI
            A href="/venue"
              SPAN
                #text: Venue
          #text:
```

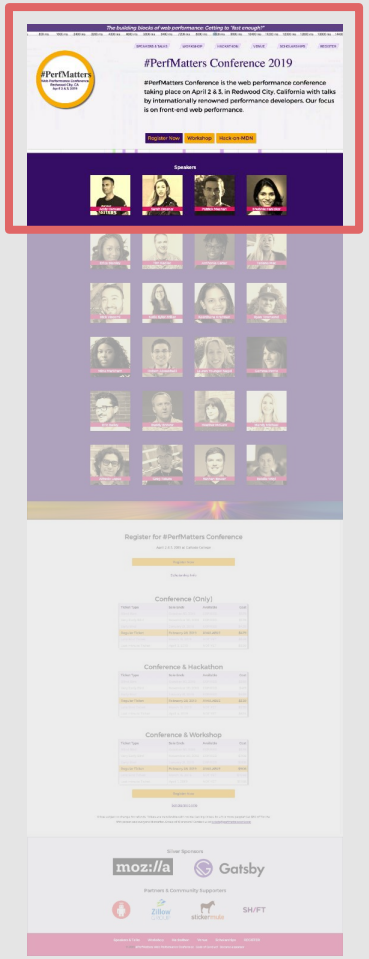
```
LI
  A href="/diversity"
    SPAN
      #text: Scholarships
  #text:
  LI class="cta"
    A href="https://perfmatters.lilregie.com" title="Register Now"
      SPAN
        #text: REGISTER
#text:
A href="/" class="circle"
  #text:
  H1
    #text: #PerfMatters
  #text:
  H2
    #text: Web Performance Conference
    BR
    #text: Redwood City, CA
    BR
    #text: April 2 & 3, 2019
  #text:
#text:
DIV class="about"
  #text:
  H2
    SPAN
      #text: #PerfMatters Conference 2019
  #text:
  P
    #text: #PerfMatters Conference is the web performance conference taking place on April 2 & 3, in Redwood City, California with talks by int
    performance.
  #text:
  DIV class="buttons"
```

```
#text:
A class="btn-cta" href="#reg"
  #text: Register Now
#text:
A href="workshop/" title="Find Out about our workshop" class="btn"
  #text: Workshop
#text:
A href="hackathon/" title="Find Out about our hackathon" class="btn"
  #text: Hack-on-MDN
#text:
#text:
#text:
#text:
MAIN
#text:
SECTION class="speakers" id="speakers"
#text:
H2
  #text: Speakers
#text:
UL
#text:
LI
#text:
FIGURE
A href="talks/#addy"
  IMG style="background-color: white" alt="Addy Osmani" src="avatars/addy.jpg"
#text:
FIGCAPTION
SPAN class="name"
  #text: Addy Osmani
SPAN class="bio"
  #text: Engineering Manager
```

```
            BR
            #text: Google
        #text:
    #text:
#text:
LI
    #text:
    FIGURE
        A href="talks/#sarah"
            IMG style="background-color: white" alt="Sarah Drasner" src="avatars/sarah.jpg"
        #text:
        FIGCAPTION
            SPAN class="name"
                #text: Sarah Drasner
            SPAN class="bio"
                #text: Lead
                BR
                #text: Microsoft
        #text:
    #text:
#text:
LI
    #text:
    FIGURE
        A href="talks/#pat"
            IMG style="background-color: white" alt="Patrick Meenan" src="avatars/pat.jpg"
        #text:
        FIGCAPTION
            SPAN class="name"
                #text: Patrick Meenan
            SPAN class="bio"
                #text: Software Engineer
                BR
                #text: Cloudflare
```

```
#text:
#text:
#text:
LI
#text:
FIGURE
A href="talks/#shubhie"
IMG style="background-color: white" alt="Shubhie Panicker" src="avatars/shubhie.jpg"
#text:
FIGCAPTION
SPAN class="name"
#text: Shubhie Panicker
SPAN class="bio"
#text: Staff Software Engineer
BR
#text: Google Chrome
#text:
#text:
LI
#text:
FIGURE
A href="talks/#erica"
IMG style="background-color: white" alt="Erica Stanley" src="avatars/erica.jpg"
#text:
FIGCAPTION
SPAN class="name"
#text: Erica Stanley
SPAN class="bio"
#text: Engineering Manager
BR
#text: SalesLoft
#text:
#text:
```


"The building blocks of web performance: Getting to 'fast enough'"
#PerfMatters
#PerfMatters Conference 2019
#PerfMatters Conference is the web performance conference taking place on April 2 & 3, in Redwood City, California with talks by internationally renowned performance developers. Our focus is on front-end web performance.
Register Now!
Workshop
Hack on MDN
Speakers
Register for #PerfMatters Conference
Conference (Only)
Conference & Hackathon
Conference & Workshop
Silver Sponsors
mozilla
Gatsby
Partners & Community Supporters
Zillow
stickermule
SHIFT


#PerfMatters Conference 2019
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Workshop
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Conference & Workshop
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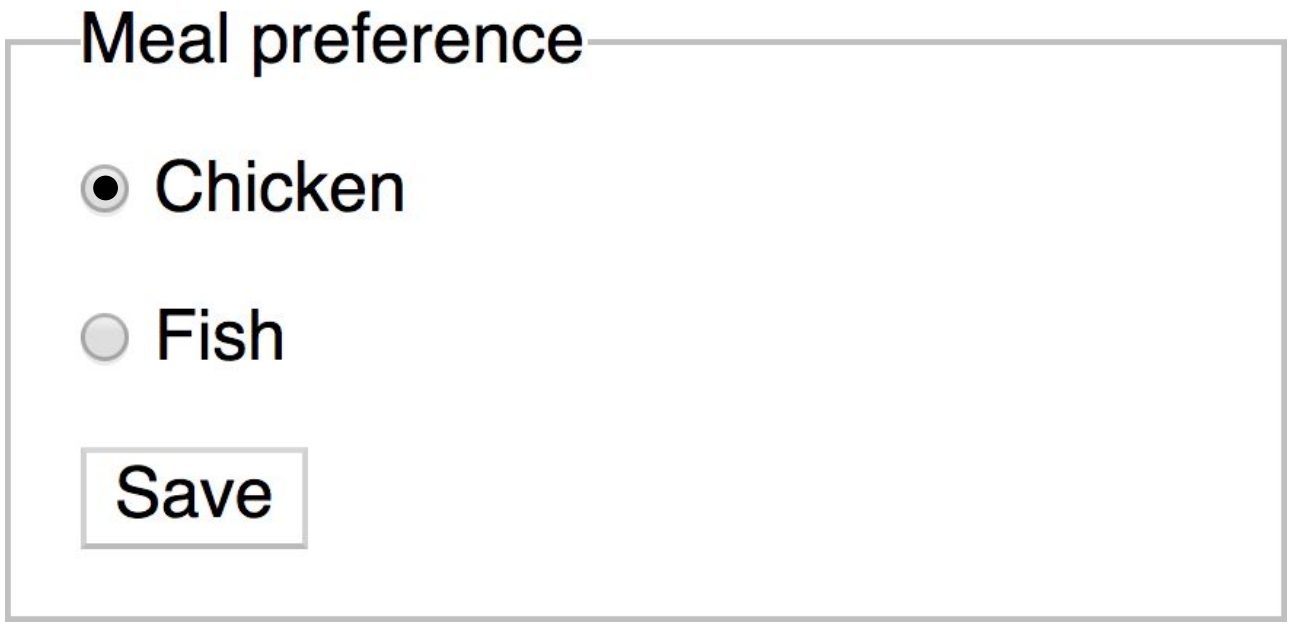
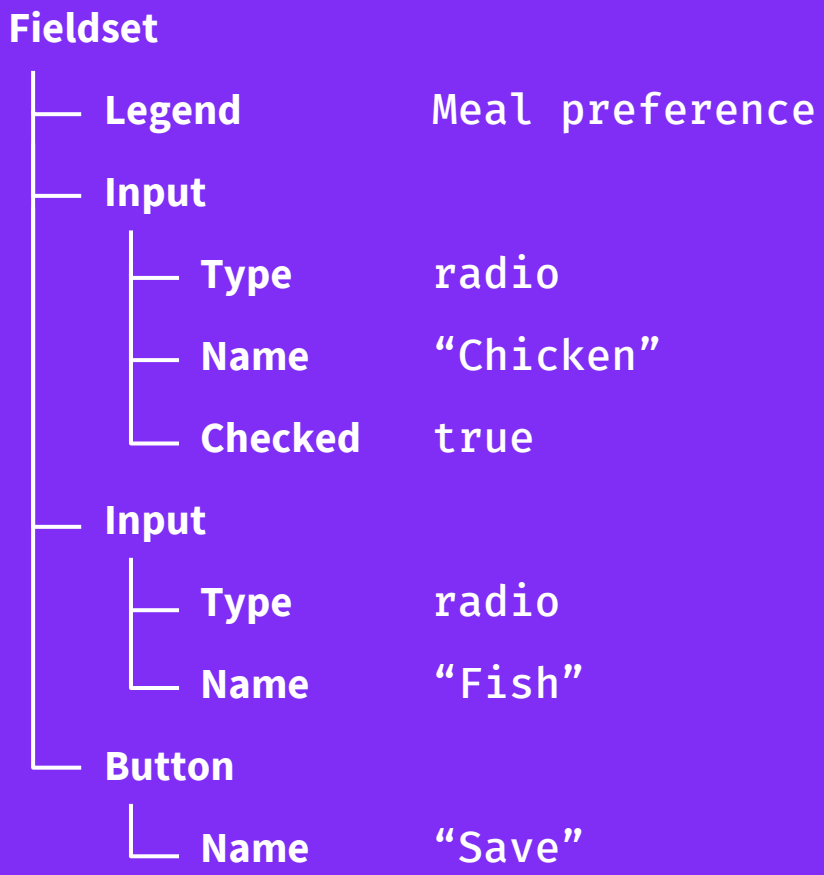
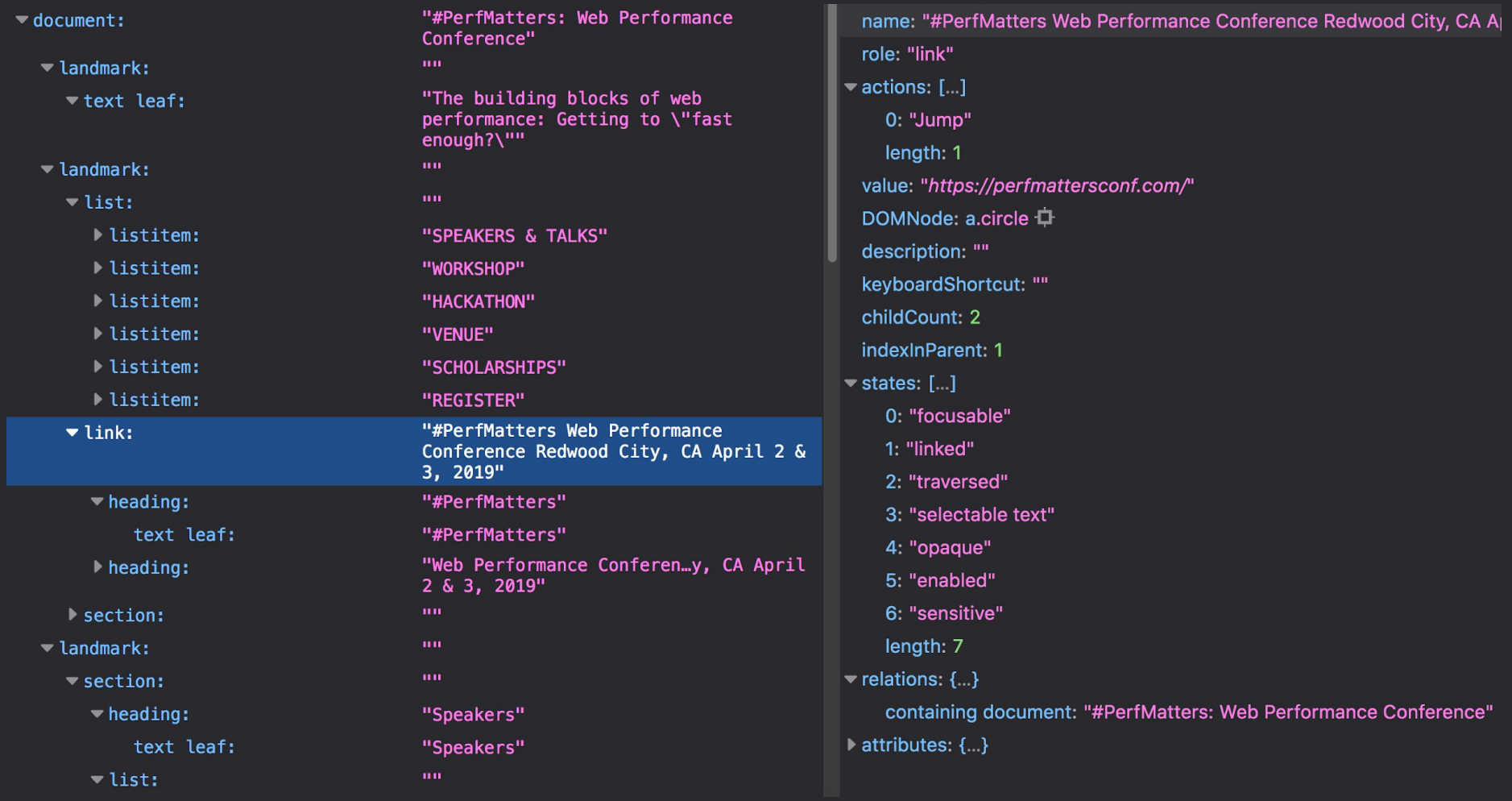
Gatsby
Partners & Community Supporters
SH/FT


Meal preference
Chicken
Fish
Save


Fieldset
Legend Meal preference
Input
Type radio
Name “Chicken”
Checked true
Input
Type radio
Name “Fish”
Button
Name “Save”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landmark: ""
text leaf: "The building blocks of web performance: Getting to \"fast enough?\""
landmark: ""
list: ""
listitem: "SPEAKERS & TALKS"
listitem: "WORKSHOP"
listitem: "HACKATHON"
listitem: "VENUE"
listitem: "SCHOLARSHIPS"
listitem: "REGISTER"
link: "#PerfMatters Web Performance Conference Redwood City, CA April 2 & 3, 2019"
heading: "#PerfMatters"
text leaf: "#PerfMatters"
heading: "Web Performance Conferen…y, CA April 2 & 3, 2019"
section: ""
landmark: ""
section: ""
heading: "Speakers"
text leaf: "Speakers"
list: ""
name: "#PerfMatters Web Performance Conference Redwood City, CA A
role: "link"
actions: [...]
0: "Jump"
length: 1
value: "https://perfmattersconf.com/"
DOMNode: a.circle
description: ""
keyboardShortcut: ""
childCount: 2
indexInParent: 1
states: [...]
0: "focusable"
1: "linked"
2: "traversed"
3: "selectable text"
4: "opaque"
5: "enabled"
6: "sensitive"
length: 7
relations: {...}
containing document: "#PerfMatters: Web Performance Conference"
attributes: {...}

```
AXWebArea AXRoleDescription='HTML content' AXTitle='#PerfMatters: Web Performance Conference' AXInvalid='false' AXEnabled='1' AXFocused='1' AXLoaded='1' AXURL='https://perfmattersconf.com/' AXVi
++AXGroup AXSubrole=AXLandmarkComplementary AXRoleDescription='complementary' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXWebArea #PerfMatters: Web Performance Conference' AXFocused='
++++AXStaticText AXRoleDescription='text' AXValue='The building blocks of web performance: Getting to "fast enough?"' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXWebArea #PerfMatters:
++AXGroup AXSubrole=AXLandmarkBanner AXRoleDescription='banner' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXWebArea #PerfMatters: Web Performance Conference' AXFocused='0' AXVisited='
++++AXList AXSubrole=AXContentList AXRoleDescription='list' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXWebArea #PerfMatters: Web Performance Conference' AXFocused='0' AXSelectedChild
++++++AXGroup AXRoleDescription='group' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXWebArea #PerfMatters: Web Performance Conference' AXFocused='0' AXVisited='0' position=(530, 98) si
++++++++AXLink AXRoleDescription='link' AXTitle='SPEAKERS & TALKS' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXLink SPEAKERS & TALKS' AXFocused='0' AXURL='https://perfmattersconf.com/
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++++++++++AXStaticText AXRoleDescription='text' AXValue='SPEAKERS & TALKS' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXLink SPEAKERS & TALKS' AXFocused='0' AXVisited='0' position=(5
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++++++++AXStaticText AXRoleDescription='text' AXValue='April 2 & 3, 2019' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXLink #PerfMatters Web Performance Conference Redwood City, CA Apri
++++AXHeading AXRoleDescription='heading' AXTitle='#PerfMatters Conference 2019' AXInvalid='false' AXEnabled='1' AXFocusableAncestor='AXWebArea #PerfMatters: Web Performance Conference' AXFocused
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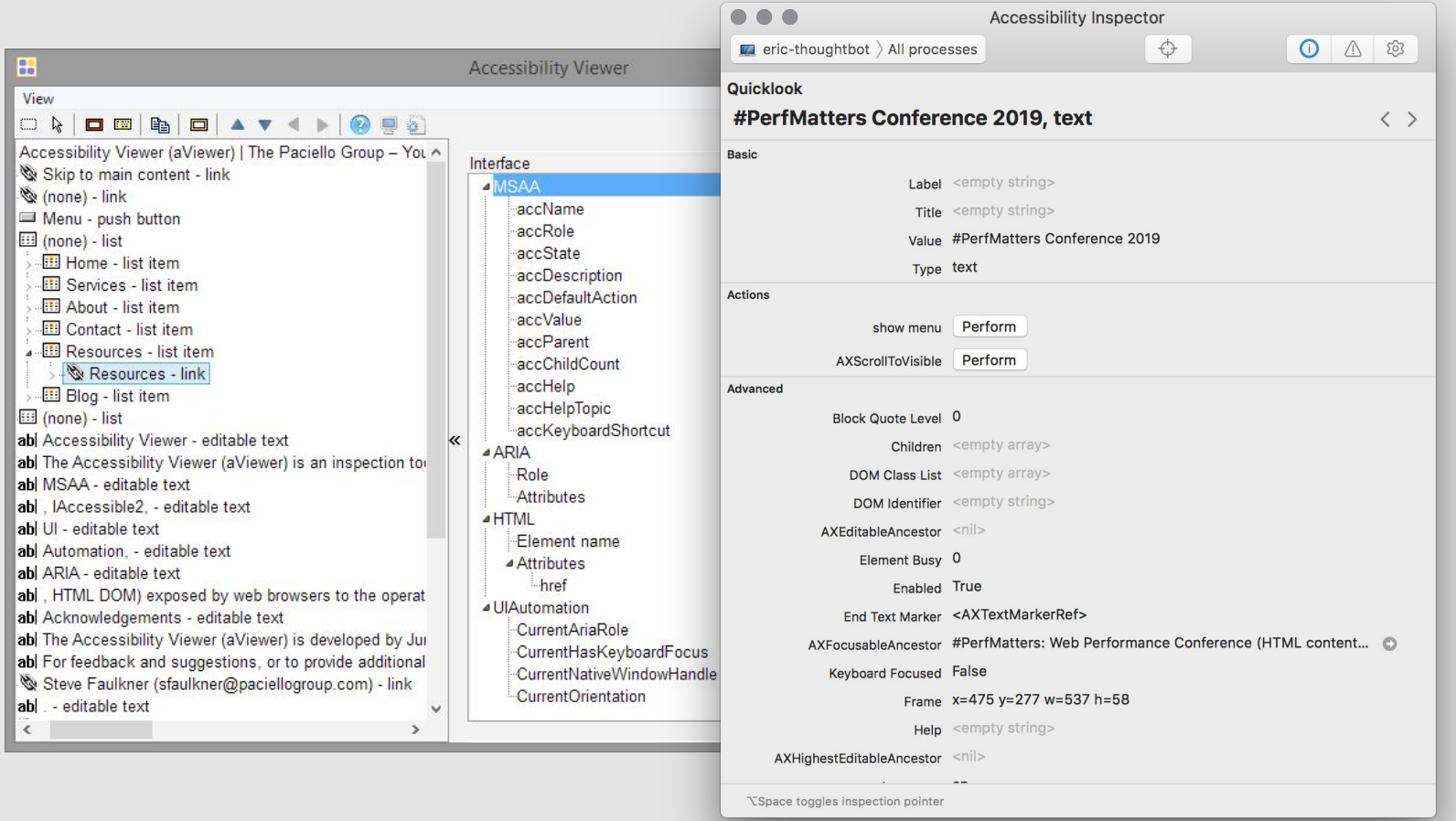
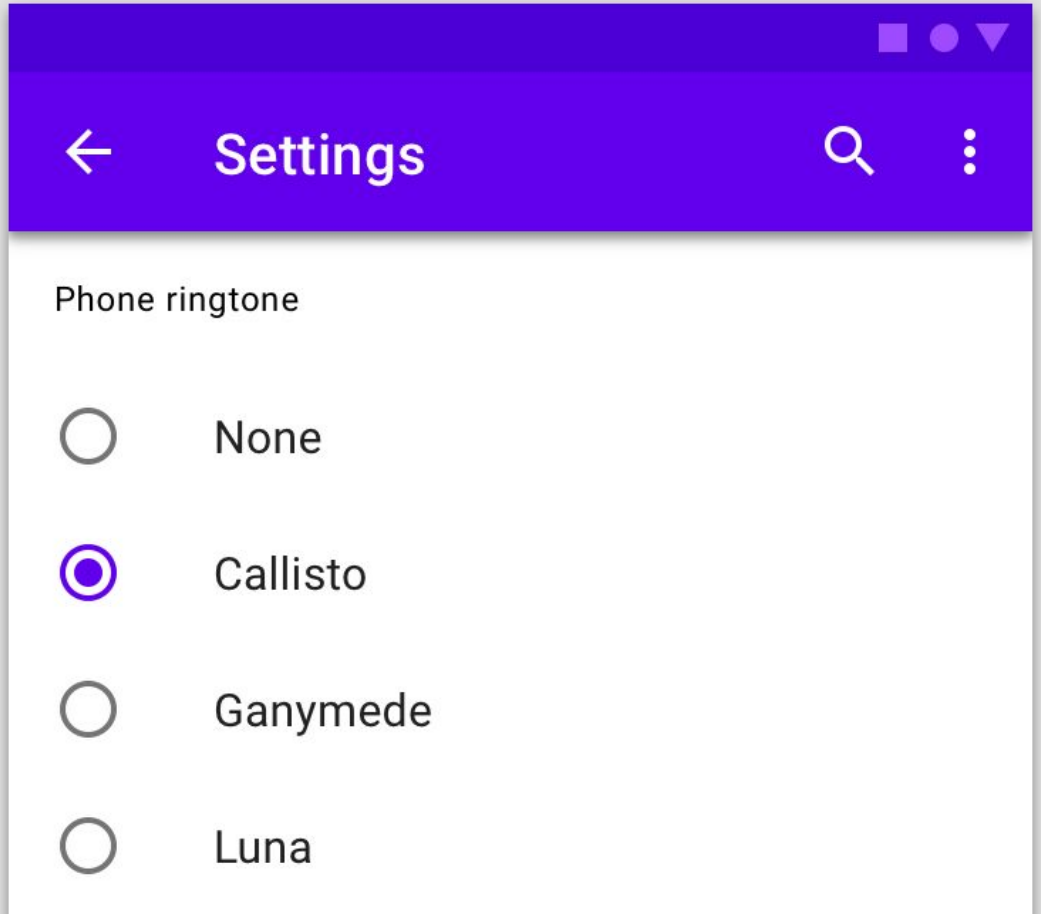

Accessibility Viewer
View
Accessibility Viewer (aViewer) | The Paciello Group – You
Skip to main content - link
(none) - link
Menu - push button
(none) - list
Home - list item
Services - list item
About - list item
Contact - list item
Resources - list item
Resources - link
Blog - list item
(none) - list
Accessibility Viewer - editable text
The Accessibility Viewer (aViewer) is an inspection to
MSAA - editable text
, IAccessible2, - editable text
UI - editable text
Automation, - editable text
ARIA - editable text
, HTML DOM) exposed by web browsers to the operat
Acknowledgements - editable text
The Accessibility Viewer (aViewer) is developed by Ju
For feedback and suggestions, or to provide additional
Steve Faulkner (sfaulkner@paciellogroup.com) - link
. - editable text
Interface
MSAA
accName
accRole
accState
accDescription
accDefaultAction
accValue
accParent
accChildCount
accHelp
accHelpTopic
accKeyboardShortcut
ARIA
Role
Attributes
HTML
Element name
Attributes
href
UIAutomation
CurrentAriaRole
CurrentHasKeyboardFocus
CurrentNativeWindowHandle
CurrentOrientation
Accessibility Inspector
eric-thoughtbot 〉All processes
Quicklook
#PerfMatters Conference 2019, text
Basic
Label <empty string>
Title <empty string>
Value #PerfMatters Conference 2019
Type text
Actions
show menu Perform
AXScrollToVisible Perform
Advanced
Block Quote Level 0
Children <empty array>
DOM Class List <empty array>
DOM Identifier <empty string>
AXEditableAncestor <nil>
Element Busy 0
Enabled True
End Text Marker <AXTextMarkerRef>
AXFocusableAncestor #PerfMatters: Web Performance Conference (HTML content...
Keyboard Focused False
Frame x=475 y=277 w=537 h=58
Help <empty string>
AXHighestEditableAncestor <nil>
⌥Space toggles inspection pointer

Let’s make the abstract immediate.


Settings
Phone ringtone
None
Callisto
Ganymede
Luna

ELEMENTS MARKUP

```
1  <div class="mdc-radio">
2    <input
       class="mdc-radio__native-control"
       type="radio"
       id="ganymede"
       name="moons">
3    <div class="mdc-radio__background">
4      <div class="mdc-radio__outer-circle"></div>
5      <div class="mdc-radio__inner-circle"></div>
     </div>
   </div>
6  <label for="ganymede">Ganymede</label>
```

To make this you need:

HTML

6 elements

9 attributes

DOM depth of 3

Includes the Material ripple effect

To make this you need:

HTML

6 elements

9 attributes

DOM depth of 3

CSS

66 selectors

141 properties

10k minified

Includes the Material ripple effect

To make this you need:

HTML

6 elements

9 attributes

DOM depth of 3

CSS

66 selectors

141 properties

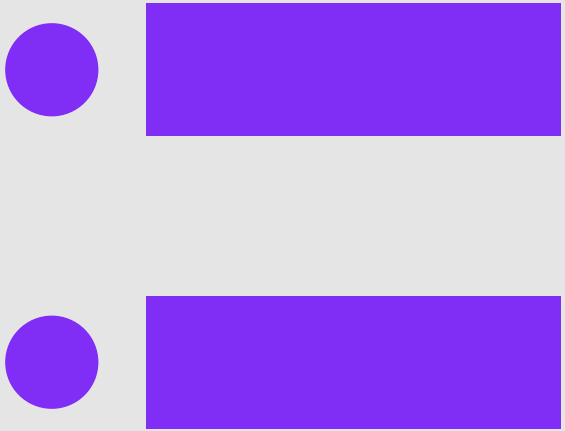
10k minified

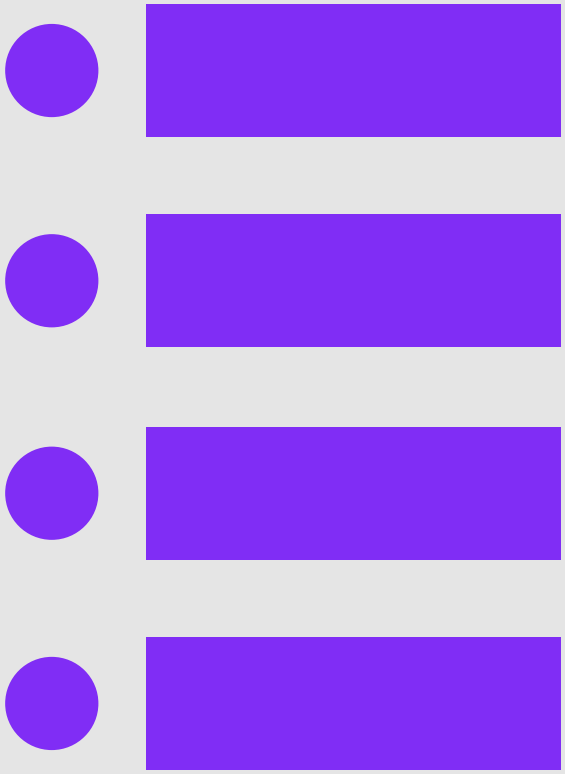
JavaScript

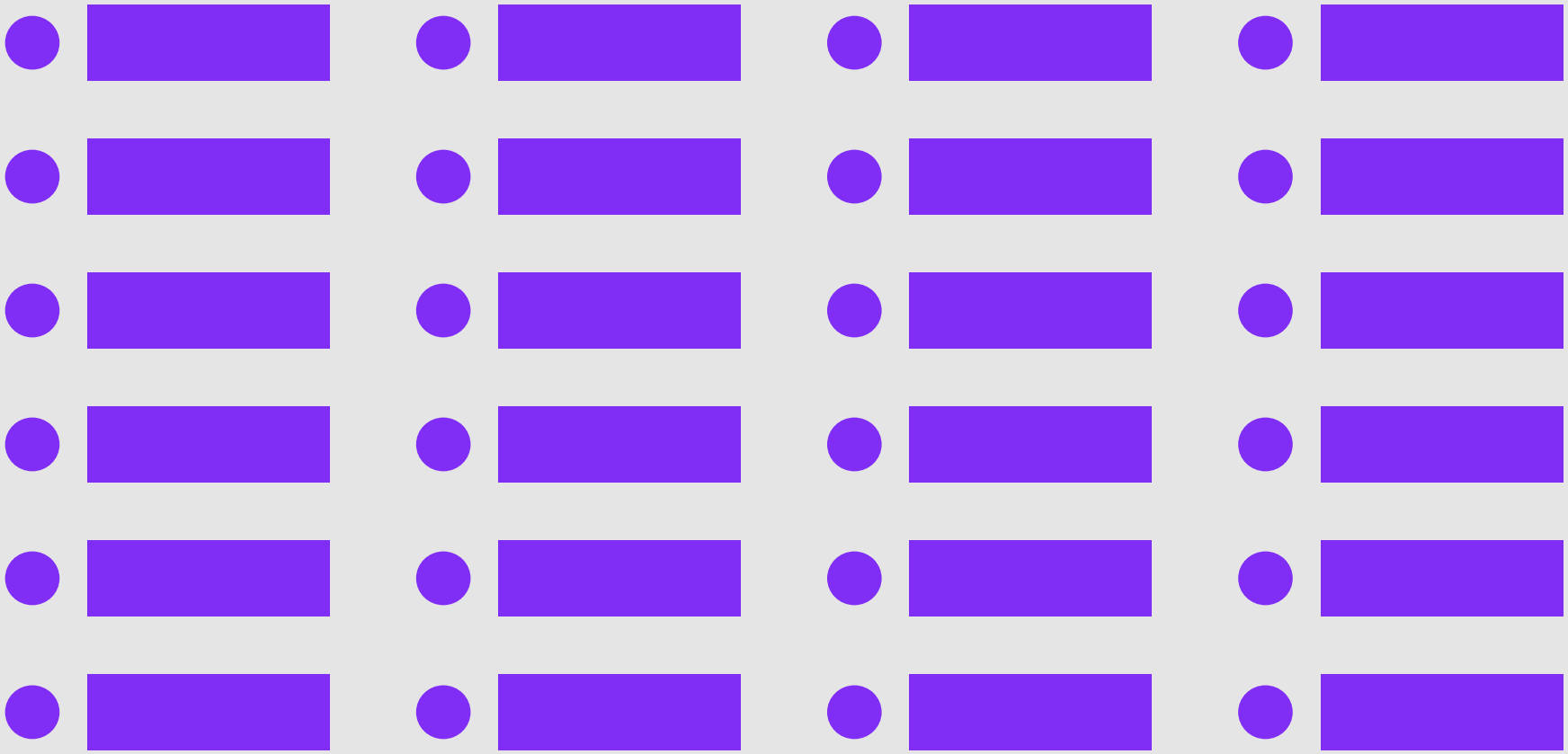
2,374 lines unminified

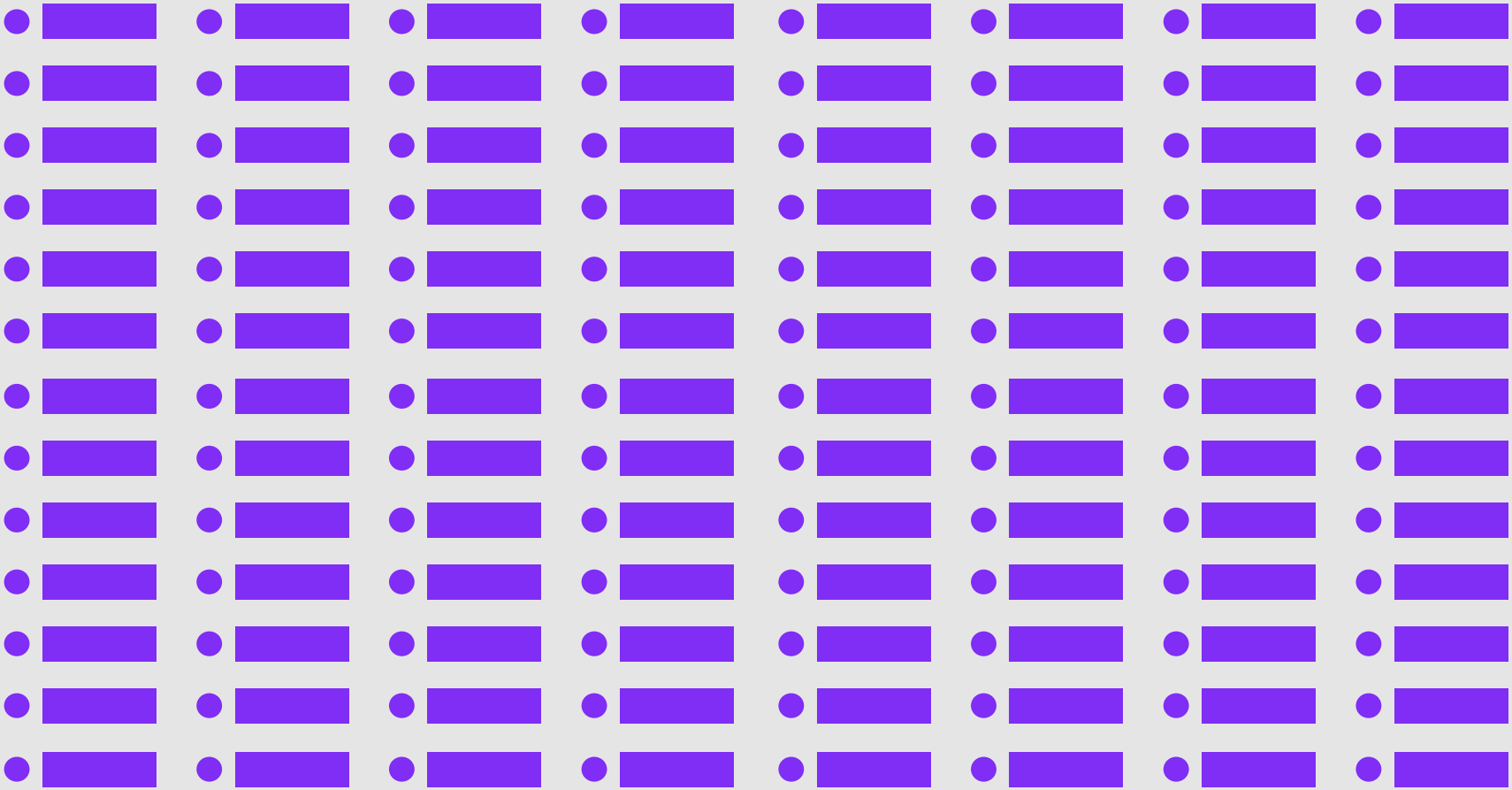
30k minified

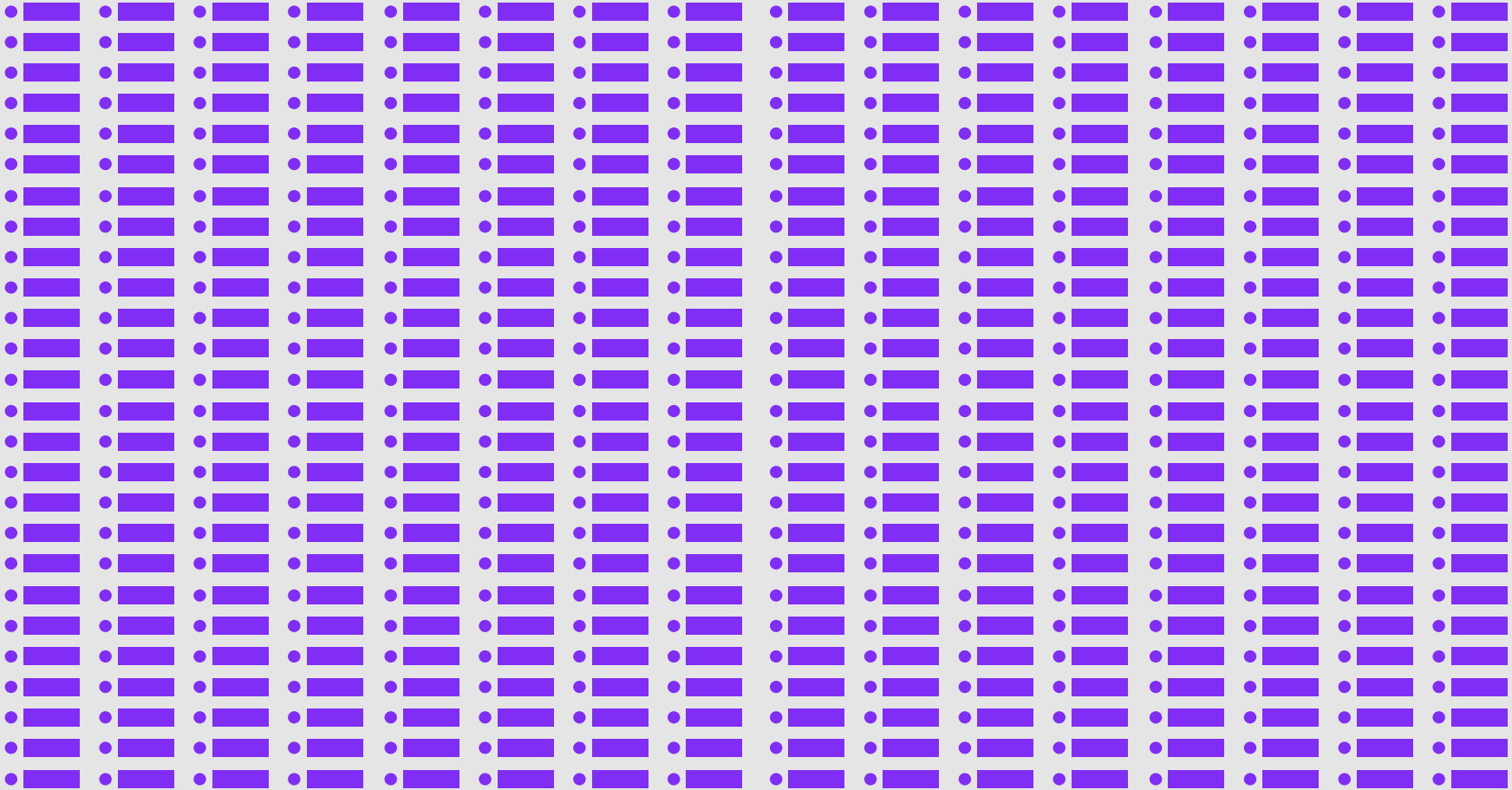
Includes the Material ripple effect











This all adds up.

An optimal DOM tree

Less than 1,500 nodes

Max depth of 32 nodes

No parent node with more than 60 child nodes

An optimal DOM tree

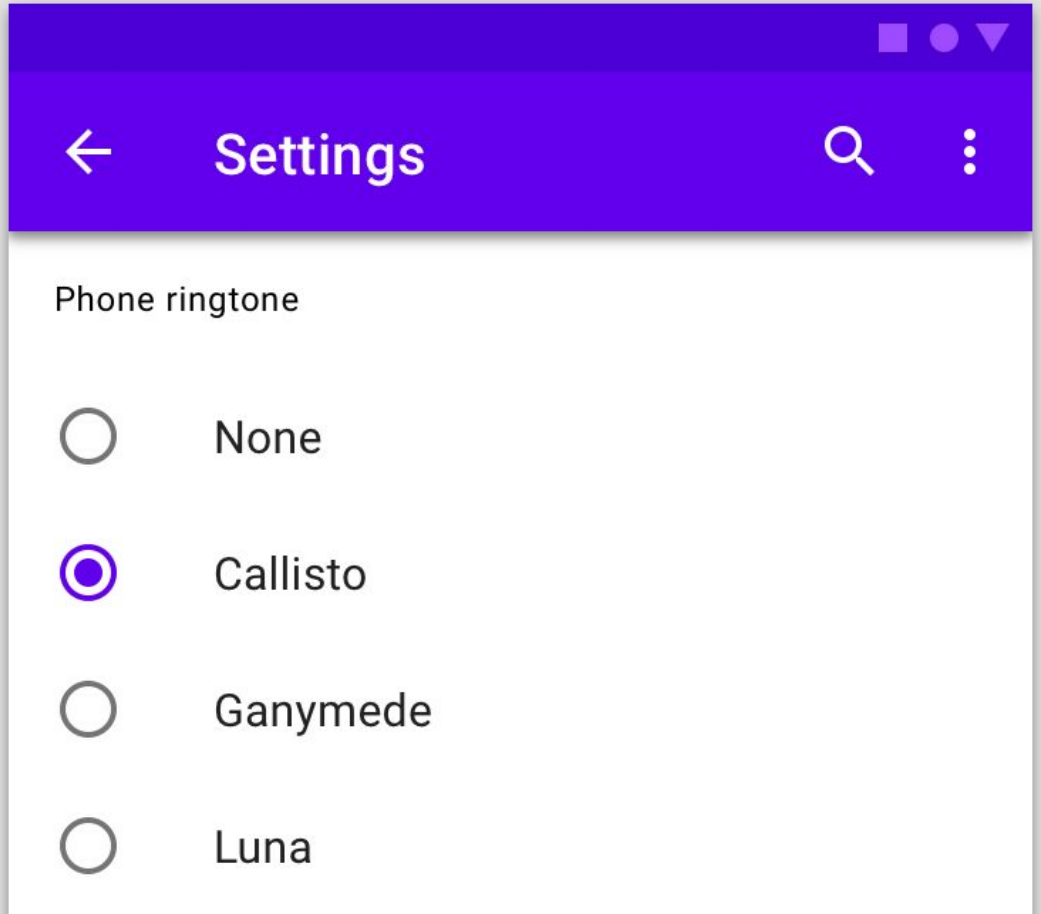
Max depth of 32 nodes

ELEMENTS MARKUP

```
1  <div class="c-radio">
2    <input
       type="radio"
       name="moons"
       id="ganymede">
3    <label for="ganymede">Ganymede</label>
   </div>
```

ELEMENTS MARKUP

```
1  <div class="c-radio">
2    <input
       type="radio"
       name="moons"
       id="ganymede">
     <label for="ganymede">Ganymede</label>
   </div>
```


Settings
Phone ringtone
None
Callisto
Ganymede
Luna

To compare:

HTML

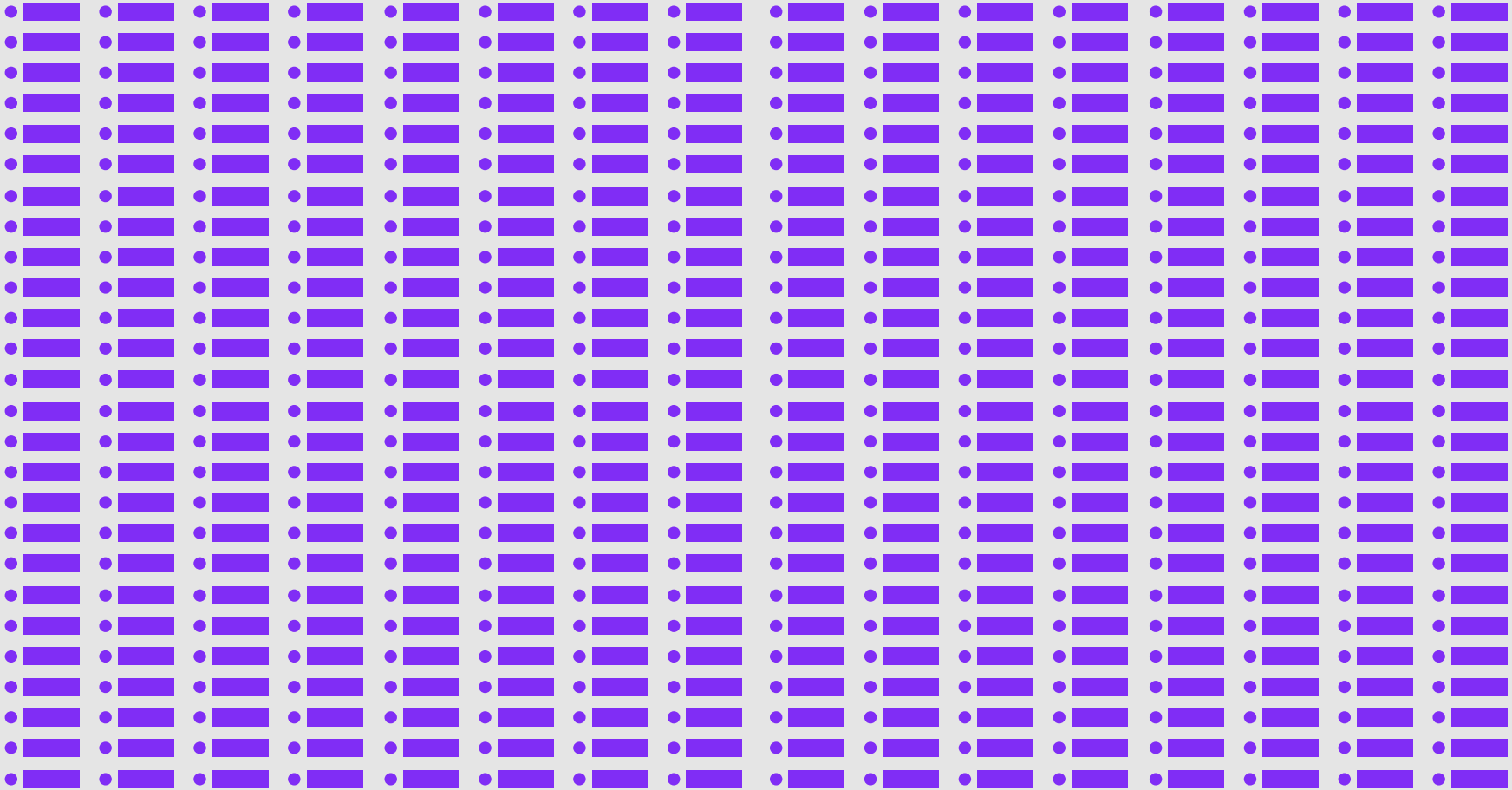
Material Design	A11Y Styled Form Controls
6 elements	3 elements
9 attributes	5 attributes
DOM depth of 3	DOM depth of 2

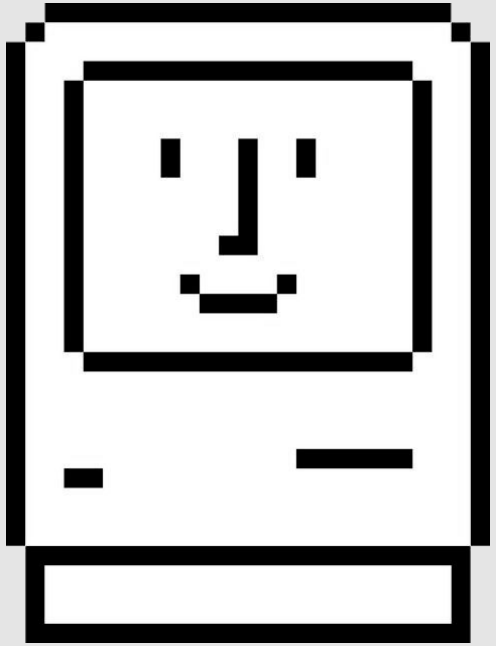
CSS

Material Design	A11Y Styled Form Controls
66 selectors	20 selectors
141 properties	42 properties
10k minified	1k minified

JavaScript

Material Design	A11Y Styled Form Controls
2,374 lines unminified	None
30k minified	0k





Why is this our problem?

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▼<div class="rn-1oszu61 rn-1efd50x rn-14skgim rn-rull8r rn-mm0ijv rn-13yce4e rn-fnigne rn-ndvcnb rn-gxnn5r rn-deolkf rn-6koalj rn-1qe8dj5 rn-1mlwlqe rn-eqz5dr rn-1mnahxq rn-61z16t rn-p1pxzi rn-11wrixw rn-ifefl9 rn-bcqeeo rn-wk8lta rn-9aemit rn-1mdbw0j rn-gy4na3 rn-bnwqim">

▼<div class="rn-1oszu61 rn-bie543 rn-1efd50x rn-14skgim rn-rull8r rn-mm0ijv rn-13yce4e rn-fnigne rn-ndvcnb rn-gxnn5r rn-deolkf rn-6koalj rn-1qe8dj5 rn-1mlwlqe rn-eqz5dr rn-1mnahxq rn-61z16t rn-p1pxzi rn-11wrixw rn-ifefl9 rn-bcqeeo rn-wk8lta rn-9aemit rn-1mdbw0j rn-gy4na3 rn-bnwqim rn-136ojw6">

▼<div class="rn-1oszu61 rn-1efd50x rn-14skgim rn-rull8r rn-mm0ijv rn-13yce4e rn-fnigne rn-ndvcnb rn-gxnn5r rn-deolkf rn-6koalj rn-1qe8dj5 rn-1mlwlqe rn-eqz5dr rn-1h3ijdo rn-1mnahxq rn-61z16t rn-p1pxzi rn-11wrixw rn-ifefl9 rn-bcqeeo rn-wk8lta rn-9aemit rn-1mdbw0j rn-gy4na3 rn-bnwqim rn-136ojw6">

▼<div class="rn-1oszu61 rn-1efd50x rn-14skgim rn-rull8r rn-mm0ijv rn-13yce4e rn-fnigne rn-ndvcnb rn-gxnn5r rn-deolkf rn-6koalj rn-1qe8dj5 rn-1mlwlqe rn-eqz5dr rn-1mnahxq rn-61z16t rn-p1pxzi rn-11wrixw rn-ifefl9 rn-bcqeeo rn-wk8lta rn-9aemit rn-1mdbw0j rn-gy4na3 rn-bnwqim rn-1lgpqti">

ie543 rn-1efd50x rn-14skgim rn-rull8r rn-mm0ijv rn-13yce4e
r rn-deolkf rn-6koalj rn-1qe8dj5 rn-1mlwlqe rn-eqz5dr rn-
1h3ijdo rn-1mnahxq rn-61z16t rn-p1pxzi rn-11wrixw rn-ifefl9 rn-bcqeeo rn-wk8lta rn-

https://twitter.com/sindresorhus/status/1089075390327316480

And then…

Ads

Scorecard Research
Criteo
Taboola
AppNexus
Yahoo Ads
Pubmatic
Market GID
MGID
Integral Ads
Google/Doubleclick
Sizmek
Yandex Ads
DoubleVerify
Moat
OpenX
MediaVine
Media Math
33 Across
Popads
WordAds

Ads

Scorecard Research
Criteo
Taboola
AppNexus
Yahoo Ads
Pubmatic
Market GID
MGID
Integral Ads
Google/Doubleclick
Sizmek
Yandex Ads
DoubleVerify
Moat
OpenX
MediaVine
Media Math
33 Across
Popads
WordAds

Analytics

Alexa
Baidu
Mixpanel
Google Analytics
Hotjar
Crazy Egg
Adobe Analytics
Tealium
Segment
Optimizely
Salesforce
Histats
Yandex Metrica
Lucky Orange

Ads

Scorecard Research
Criteo
Taboola
AppNexus
Yahoo Ads
Pubmatic
Market GID
MGID
Integral Ads
Google/Doubleclick
Sizmek
Yandex Ads
DoubleVerify
Moat
OpenX
MediaVine
Media Math
33 Across
Popads
WordAds

Analytics

Alexa
Baidu
Mixpanel
Google Analytics
Hotjar
Crazy Egg
Adobe Analytics
Tealium
Segment
Optimizely
Salesforce
Histats
Yandex Metrica
Lucky Orange

Social/Marketing

VK
Pinterest
Facebook
Yandex Share
Twitter
LinkedIn
ShareThis
AddThis
Tumblr
PIXNET
Disqus
Hubspot
OptinMonster
Beeketing
Drift
Mailchimp
Sumo
Albacross
LiveChat
Freshdesk
Help Scout

Ads

Scorecard Research
Criteo
Taboola
AppNexus
Yahoo Ads
Pubmatic
Market GID
MGID
Integral Ads
Google/Doubleclick
Sizmek
Yandex Ads
DoubleVerify
Moat
OpenX
MediaVine
Media Math
33 Across
Popads
WordAds

Analytics

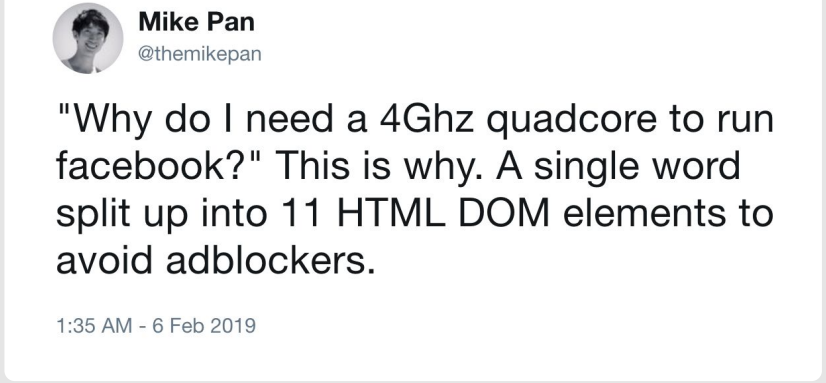
Alexa
Baidu
Mixpanel
Google Analytics
Hotjar
Crazy Egg
Adobe Analytics
Tealium
Segment
Optimizely
Salesforce
Histats
Yandex Metrica
Lucky Orange

Social/Marketing

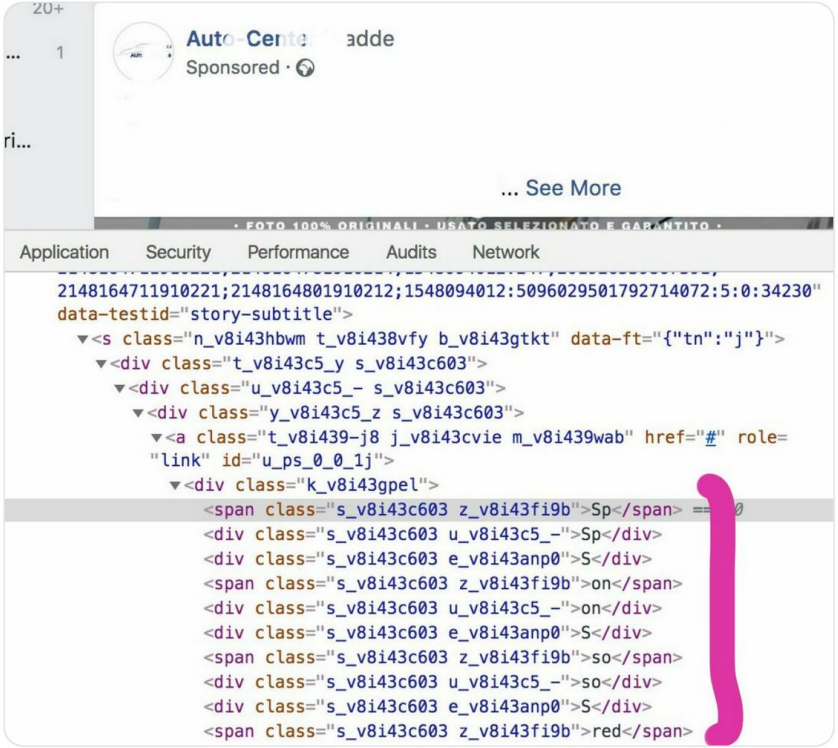
VK
Pinterest
Facebook
Yandex Share
Twitter
LinkedIn
ShareThis
AddThis
Tumblr
PIXNET
Disqus
Hubspot
OptinMonster
Beeketing
Drift
Mailchimp
Sumo
Albacross
LiveChat
Freshdesk
Help Scout

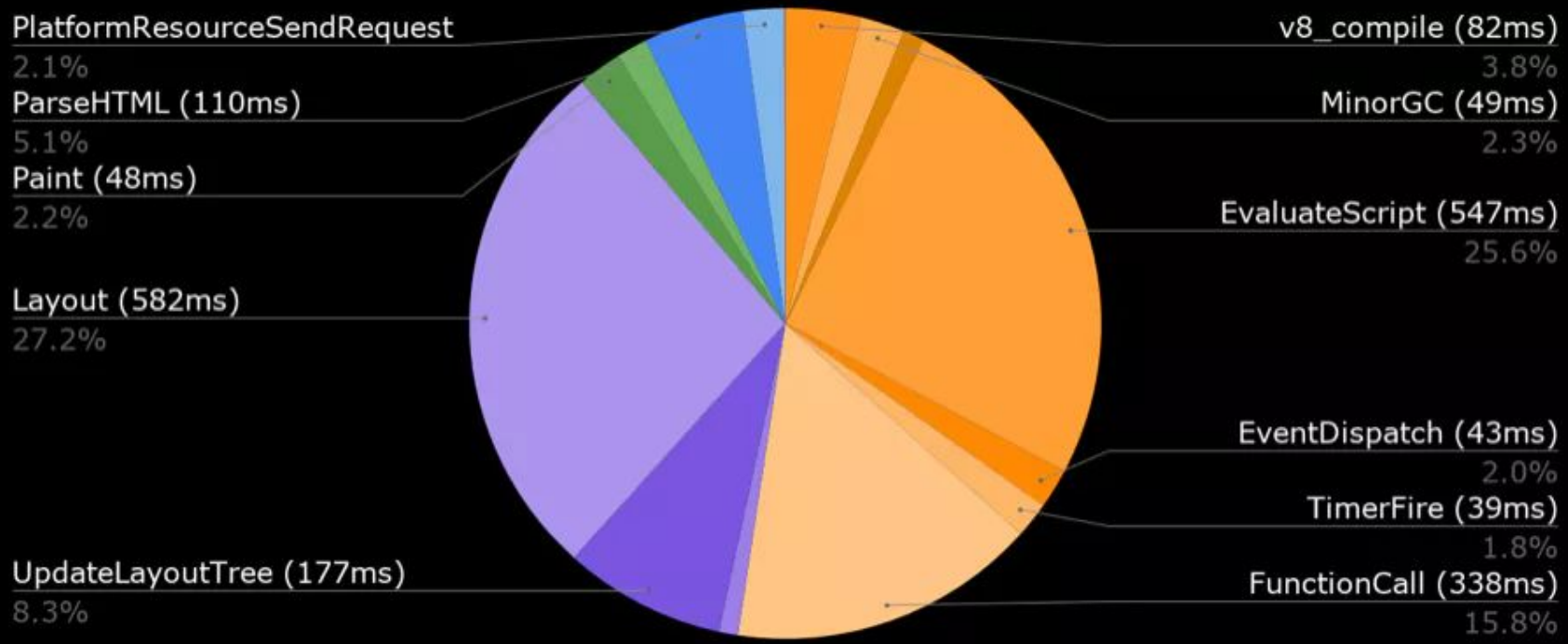
Developer Utils

New Relic
Stripe
OneSignal
Google APIs/SDK
App Dynamics
Cloudflare
PayPal
Yandex APIs
Distil Networks
Sentry



https://twitter.com/themikepan/status/1093035372186034176





https://speedcurve.com/blog/javascript-dominates-browser-cpu/

Yikes.

Marco Zehe

@MarcoInEnglish

Nibbling away at those milliseconds it takes for information to reach assistive technologies when requested. My current task is to reduce the number of accessible objects we create for html:div elements. This is to reduce the size of the accessibility tree.

10:40 PM - 26 Jan 2019

https://twitter.com/MarcoInEnglish/status/1089412779625402368

Marco Zehe

@MarcoInEnglish

This reduces the amount of data being transferred across process boundaries. Part of what makes Firefox accessibility slower on Windows since Firefox Quantum is the fact that assistive technologies now no longer have direct access to the original accessible tree of the document.

10:40 PM - 26 Jan 2019

https://twitter.com/MarcoInEnglish/status/1089412781152129024

Marco Zehe

@MarcoInEnglish

A lot of it needs to be fetched across a process boundary. So the amount of data that needs to be fetched actually matters a lot now. Reducing that by filtering out objects we don't need is a good way to reduce the time it takes for information to reach assistive technologies.

10:40 PM - 26 Jan 2019

https://twitter.com/MarcoInEnglish/status/1089412783576367104

Marco Zehe

@MarcoInEnglish

This is particularly true in dynamically updating environments like Gmail, Twitter, or Mastodon. My current patch, slatted to land early in the Firefox 67 cycle, shaves off about 10 to 20% of the time it takes for certain calls to return.

10:40 PM - 26 Jan 2019

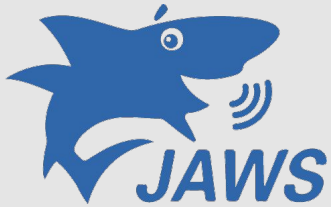
https://twitter.com/MarcoInEnglish/status/1089412785128247296

This is only for one browser

There are a lot of
browsers out there

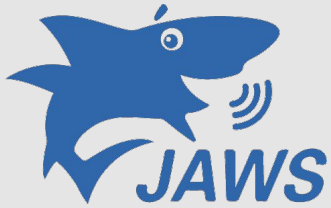
ORBIT
READER 20

Someone should do something!



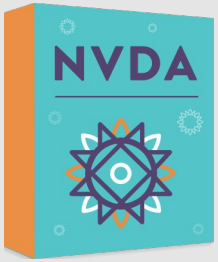
Freedom Scientific

JAWS



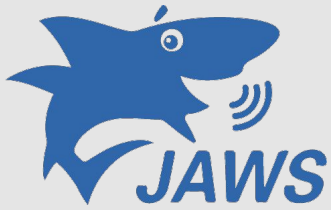
Freedom Scientific

JAWS



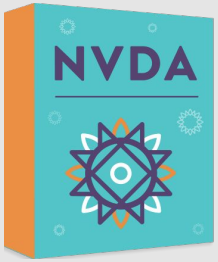
NV Access

NVDA



Freedom Scientific

JAWS

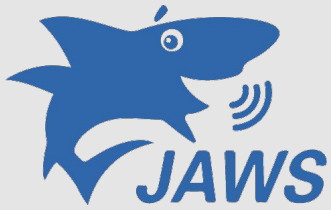


NV Access

NVDA

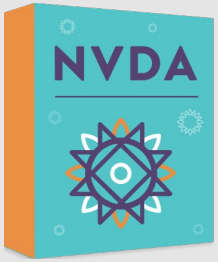
Apple

VoiceOver



Freedom Scientific

JAWS



NV Access

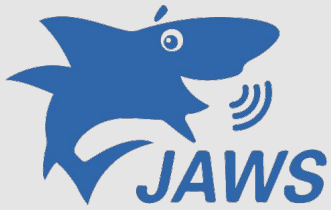
NVDA

Apple

VoiceOver

Google

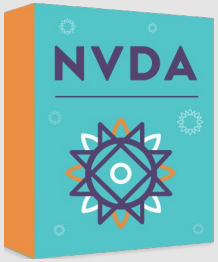
Talkback



Freedom Scientific

JAWS

Open Issue Tracker



NV Access

NVDA

Open Issue Tracker

Apple

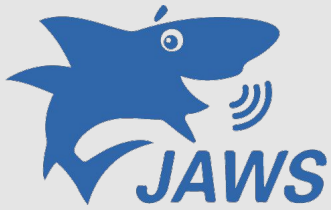
VoiceOver

Closed Issue Tracker

Google

Talkback

Open Issue Tracker

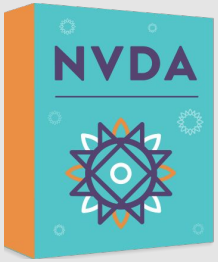


Freedom Scientific

JAWS

Open Issue Tracker

Closed Source Code



NV Access

NVDA

Open Issue Tracker

Open Source Code

Apple

VoiceOver

Closed Issue Tracker

Closed Source Code

Google

Talkback

Open Issue Tracker

Open Source Code

Pruning trees

Marco Zehe

@MarcoInEnglish

Reducing the number of milliseconds it takes for a screen reader to start speaking after a key press from about 140 to 100 here, or from 120 to 100 there, doesn't matter much on a fast machine. On a slow machine, that reduction is from about 230 to 250 down to 200 or 190.

10:40 PM - 26 Jan 2019

https://twitter.com/MarcoInEnglish/status/1089412786558513152

52x/32x/52x
Low Radiation

10:10 AM
Google
10:10
AM
Thu
Oct 01 2015
Add a location
Play Games
Voice Search
Photos
Camera
Google
My Account Downloader
Browser
PlayStore

Be pragmatic.

The stakes are high.

Be patient.

Things move slow.

Screen Reader	NVDA		JAWS		VoiceOver		Win-Eyes	Dolphin	SaToGo
Browser	IE	FF	IE	FF	Mac	iOS	IE	IE	IE
Reliability when used correctly (82% average)	75%	77%	92%	87%	79%	70%	89%	83%	83%
A "click here" link with TITLE attribute	✗	✓	✓	✓	✓	✓	✗	✗	✓
A link containing only an IMG with TITLE	✓	✓	✓	✓	✓	✓	✓	✓	✓
ABBR with title	✓	✓	✓	✓	✗	✗	✓	✓	✗
AREA with TITLE attribute	✗	✗	✓	✗	✓	✗	✓	✗	✓
BUTTON containing only an IMG with TITLE attribute	✓	✓	✓	✓	✗	✗	✓	✓	✓
BUTTON with TITLE containing only an IMG with null ALT	✓	✓	✓	✓	✓	✓	✓	✓	✓
IMG with TITLE	✓	✓	✓	✓	✓	✓	✓	✓	✓
INPUT type=image with TITLE attribute	✓	✓	✓	✓	✓	✓	✓	✓	✗
`iframe` with `title` attribute	✗	✗	✓	✓	✓	✓	✓	✓	✓
`input type=text` with `title` attribute	✗	✗	✓	✓	✓	✓	✓	✓	✗
A link with TITLE containing only an IMG with no ALT	✓	✓	✓	✓	✓	✓	✓	✓	✓
ACRONYM with title	✗	✗	✗	✗	✗	✗	✗	✗	✗
APPLET with TITLE attribute	✗	✓	✗	✗	✗	✗	✗	✗	✗
AUDIO with TITLE attribute	✗	✗	✗	✗	✗	✗	✗	✗	✗
BUTTON with TITLE containing only an IMG with no ALT	✓	✓	✗	✓	✓	✓	✓	✓	✓
EMBED with TITLE attribute	✗	✗	✗	✓	✗	✗	✗	✗	✗
IFRAME with blank title	✓	✗	✓	✓	✓	✓	✓	✓	✓
IFRAME with title matching frame filename	✗	✗	✓	✗	✗	✓	✗	✓	✓
IMG with null ALT and non-null TITLE attributes	✗	✗	✗	✗	✗	✗	✗	✗	
OBJECT with TITLE attribute	✗	✗	✗	✗	✗	✗	✗	✗	✗
VIDEO with TITLE attribute	✓	✗	✗	✗	✗	✗	✗	✗	✗

If you do one thing,

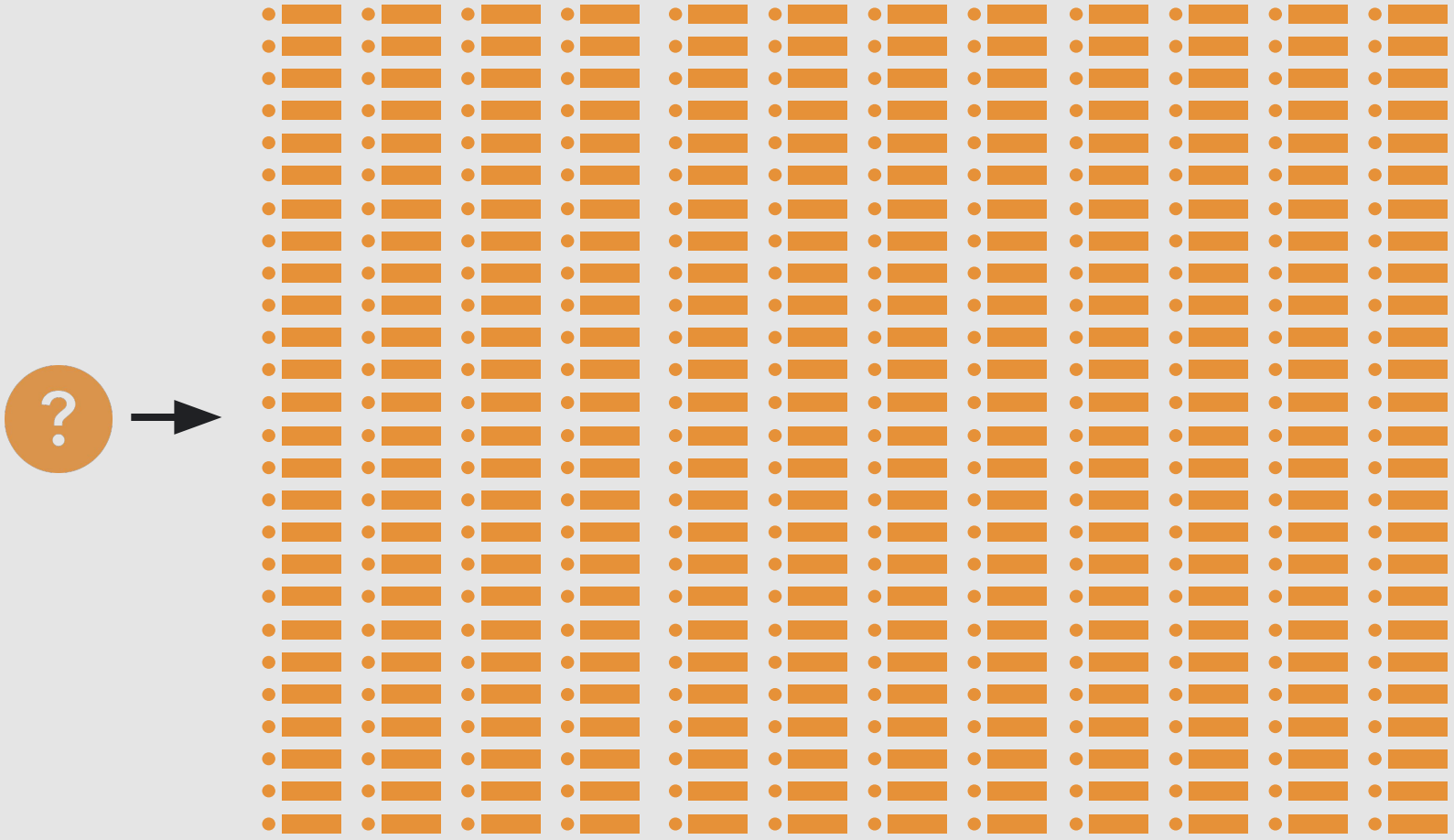
test

Whoa!

Whoa!

Performance

The ability to perform



Memory

Memory **Problem-solving**

Memory **Problem-solving** **Attention**

Memory

Problem-solving

Attention

Reading comprehension

Memory

Problem-solving

Attention

Reading comprehension

Math comprehension

Memory

Problem-solving

Attention

Reading comprehension

Math comprehension

Visual comprehension

Figure 8.6

NASA Task Load Index

Hart and Staveland's NASA Task Load Index (TLX) method assesses work load on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

Name	Task	Date

Mental Demand — How mentally demanding was the task? — Very Low — Very High

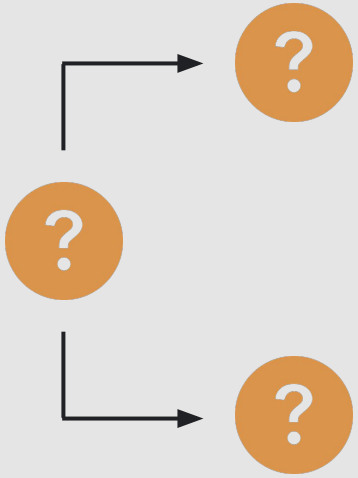
Physical Demand — How physically demanding was the task? — Very Low — Very High

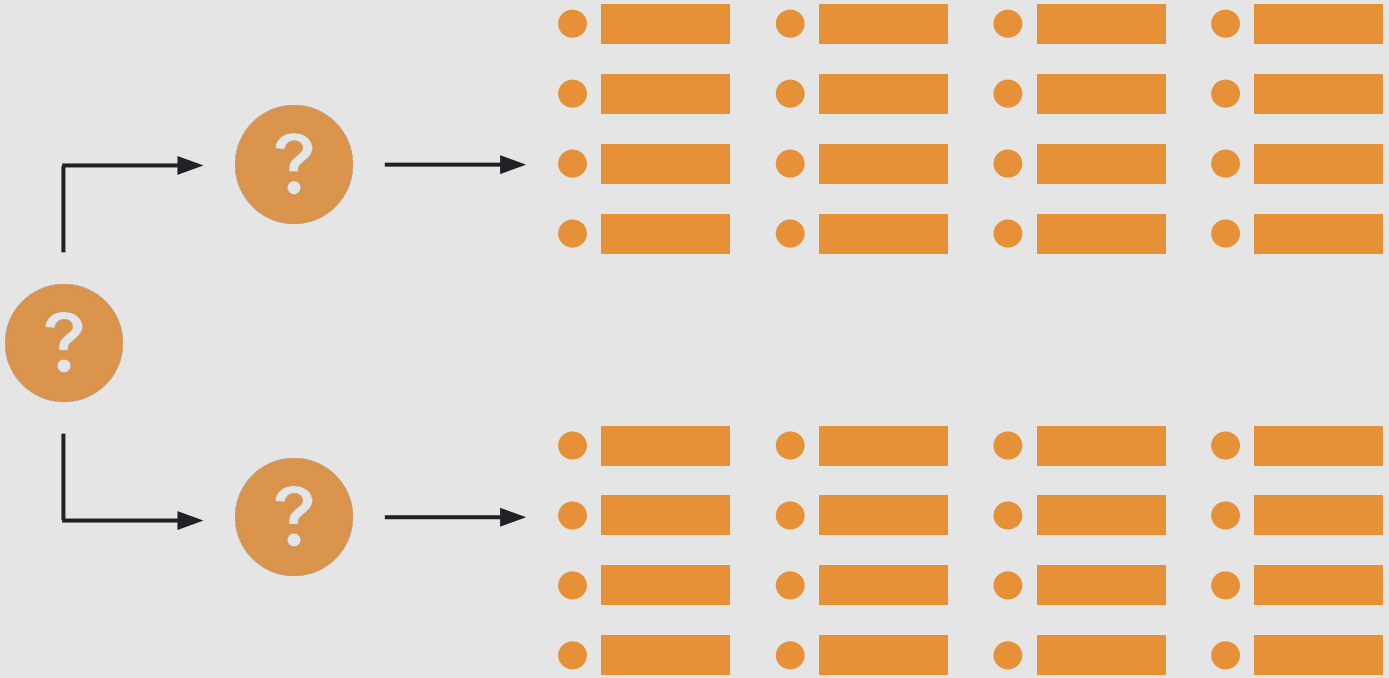
Temporal Demand — How hurried or rushed was the pace of the tas — Very Low — Very

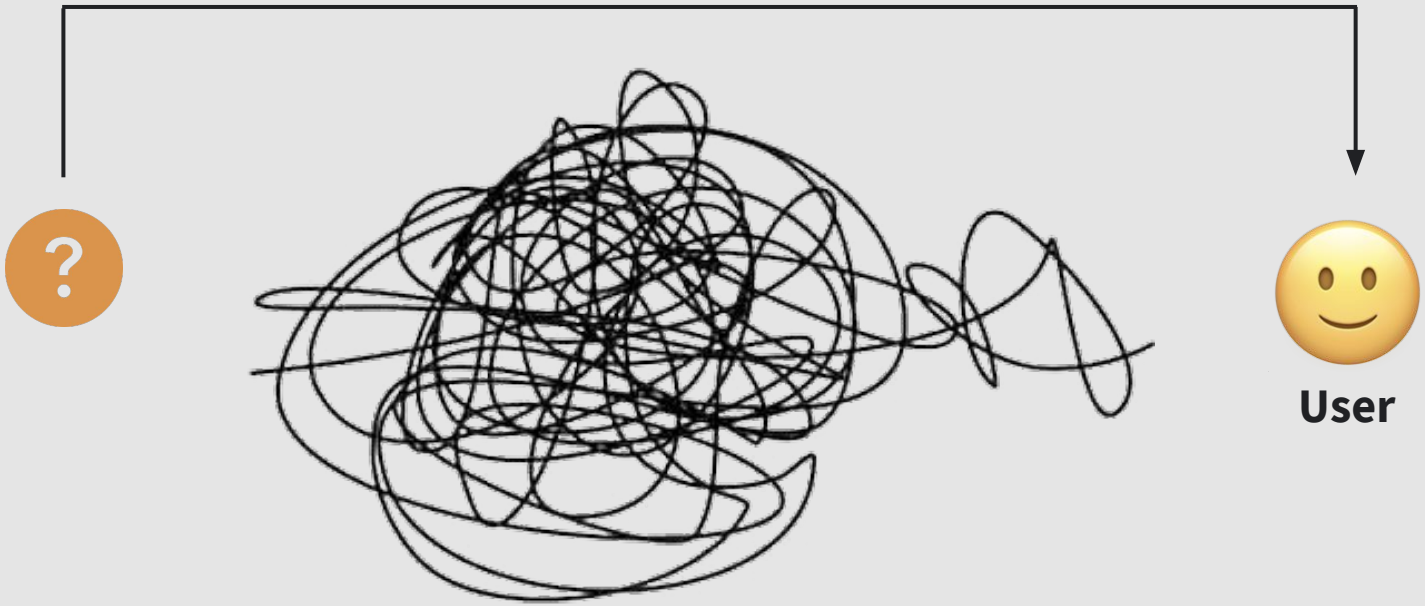
Performance — How successful were you in accomplishing you were asked to do? — Perfect — Fa

Effort — How hard did you have to work to accomplish your level of performance? — Very Low — Very High

Frustration — How insecure, discouraged, irritated, stressed and annoyed wereyou? — Very Low — Very High






?
User

“Surprisingly very few companies conduct qualitative user research”

2018 Design In Tech report

“Surprisingly very few companies conduct qualitative user research”

12%

Early-stage startups

32%

Mid-stage startups

46%

Late-stage startups

2018 Design In Tech report

Survivorship bias

or:

Who isn’t present?

I used to think I knew things.

Now I test.

Thank you!

thoughtbot.com
ericwbailey.design
noti.st/ericwbailey
@ericwbailey

Selection Controls: Usage - Material Design

https://material.io/design/components/selection-controls.html#usage

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Table A-6. Employment status of the civilian population by sex, age, and disability status, not seasonally adjusted - United States Bureau of Labor Statistics

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2018 Design In Tech report

https://johnmaeda.github.io/#1