Delivering Critical Information & Services

Aaron Gustafson
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presented at An Event Apart: Front-End Focus

Access to the Internet is no longer a luxury, it's how we participate in the modern world.

> **We … declare our common desire and commitment to build a people-centred, inclusive … Information Society, where everyone can create, access, utilize and share information and knowledge … to achieve their full potential …
> and [improve] their quality of life.**

— World Summit on the Information Society

December 2003

perma.cc/WU9F-U54U

> **Given that the Internet has become an indispensable tool for realizing a range of human rights, combating inequality, and accelerating development and human progress, ensuring universal access to the Internet should be a priority for all states.**

— United Nations Human Rights Council

May 2011

perma.cc/MD4K-CK6A

Despite our best intentions, we have designed an inequitable system.

Where are we going wrong?

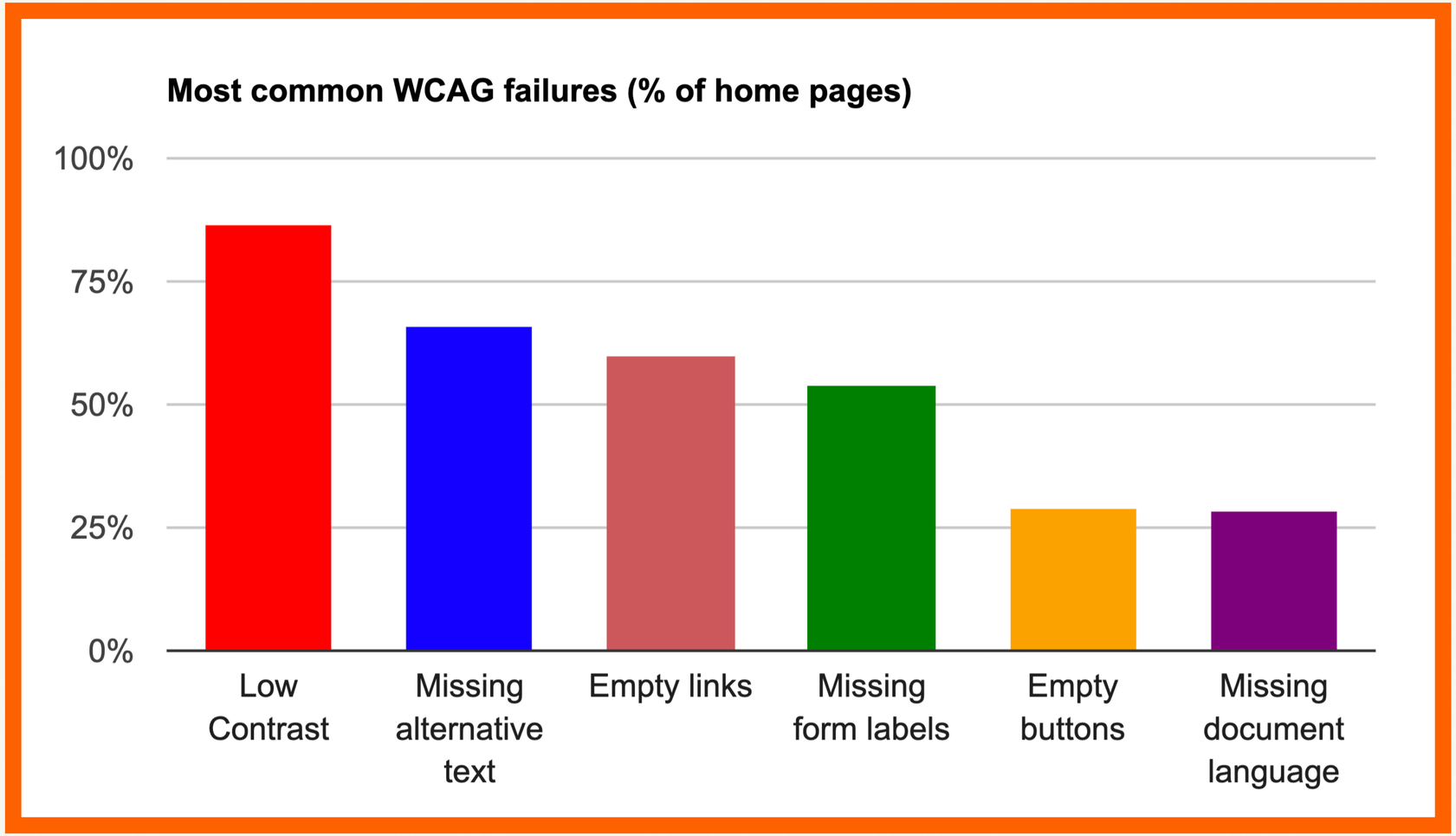
> 98.1% of home pages had detectable WCAG 2 failures! This was up from 97.8% in February 2019.

— The WebAIM Million

March 2020

perma.cc/V89U-73DP

The most common culprits?



perma.cc/V89U-73DP

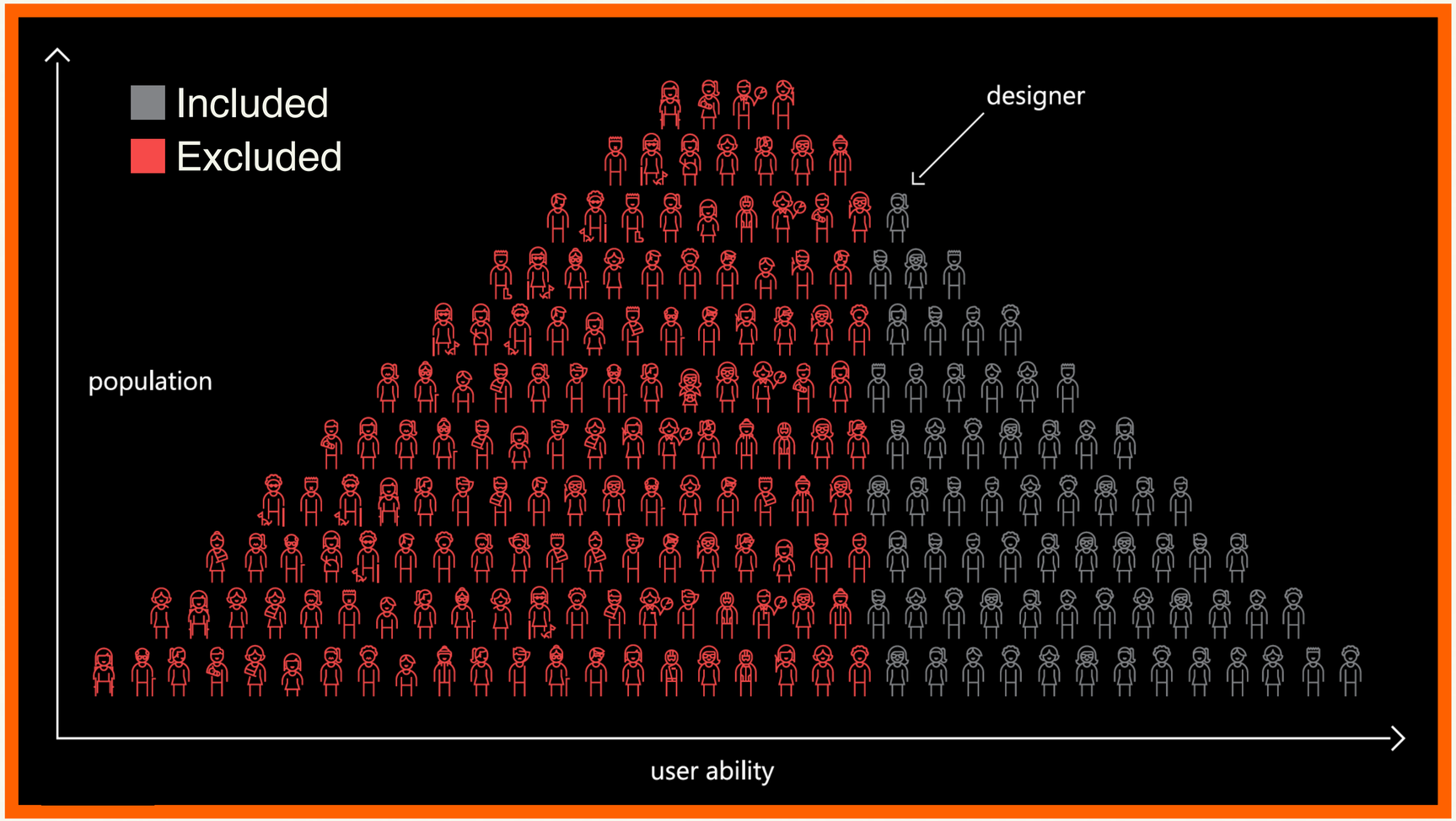
> **Even the most physically-based disability is impairing only to the extent that the culture allows it to be.**

— Disability Science Review

A disability is a mismatch between a person's abilities and their environment

perma.cc/97Z9-SB9A

Disabilities are designed

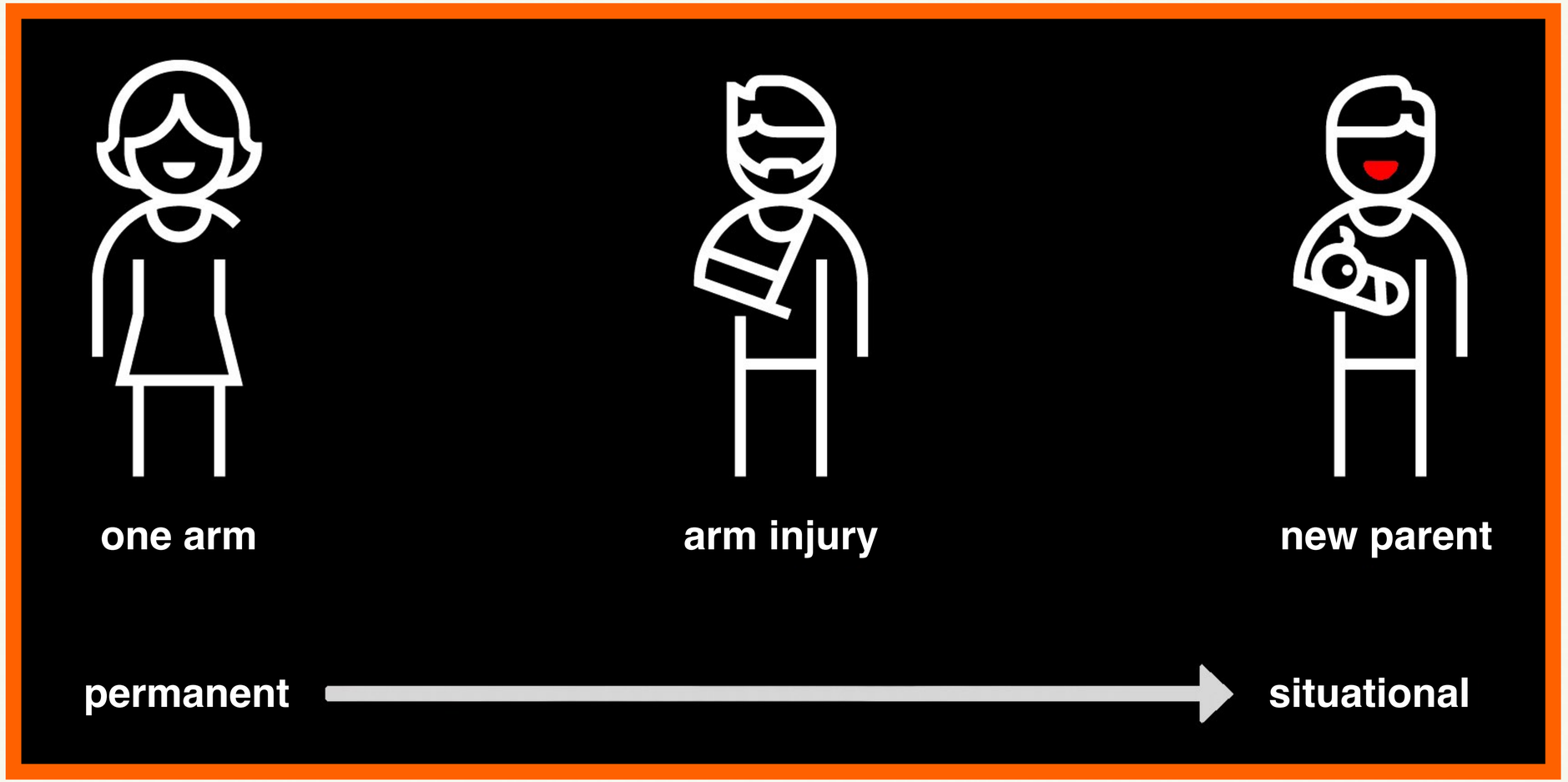


perma.cc/JKF6-8FQH

> **Exclusion happens when we solve problems using our own biases.**

— Microsoft inclusive design principals
perma.cc/JKF6-8FQH

The ripple effect



perma.cc/JKF6-8FQH

Where are we going wrong?

- We are failing when it comes to **accessibility**

The “Digital Divide”

Technology

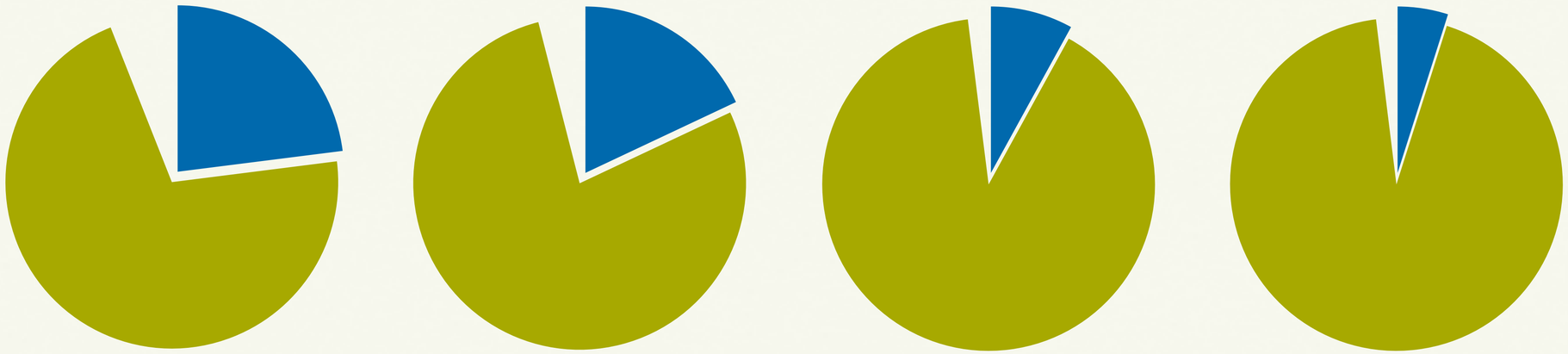
Device · Capabilities · Condition

Access

Availability · Quality · Affordability

U.S. Smartphone penetration

February 2019



< $30k	$30-50k	$50-75k	>$75k
71%	**78%**	**90%**	**95%**

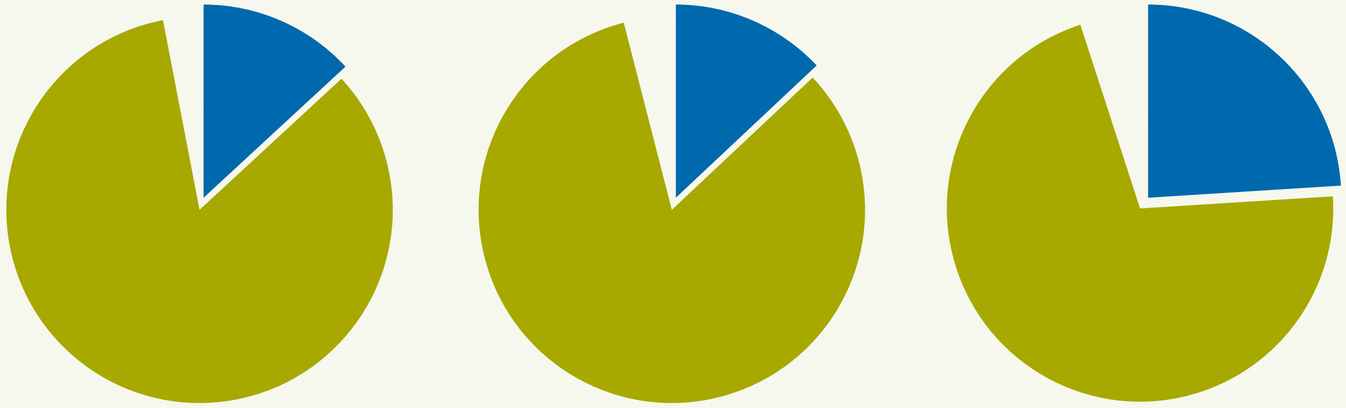
49.55% of the population

perma.cc/3X2K-BTS9

Smartphone
Feature phone

U.S. Smartphone penetration

February 2019



Urban
83%

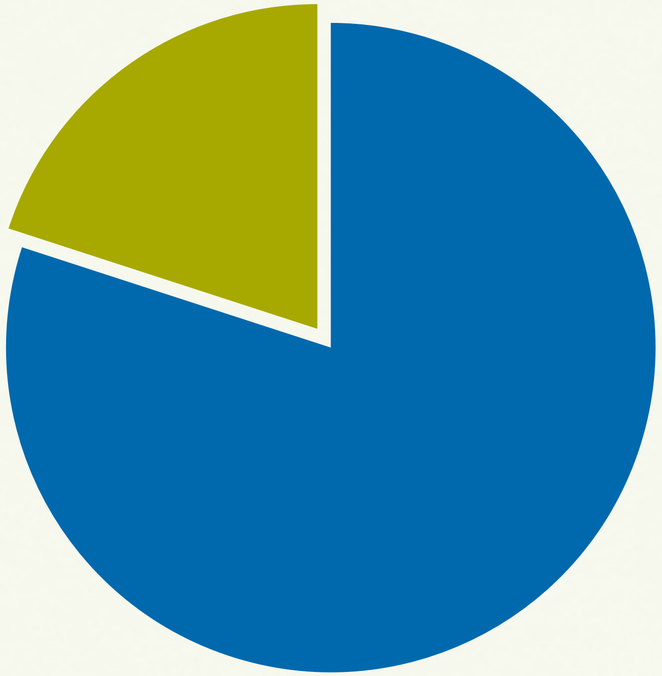
Suburban
83%

Rural
71%

Smartphone
Feature phone

perma.cc/3X2K-BTS9

One in 5 U.S. adults is a smartphone-only Internet user.



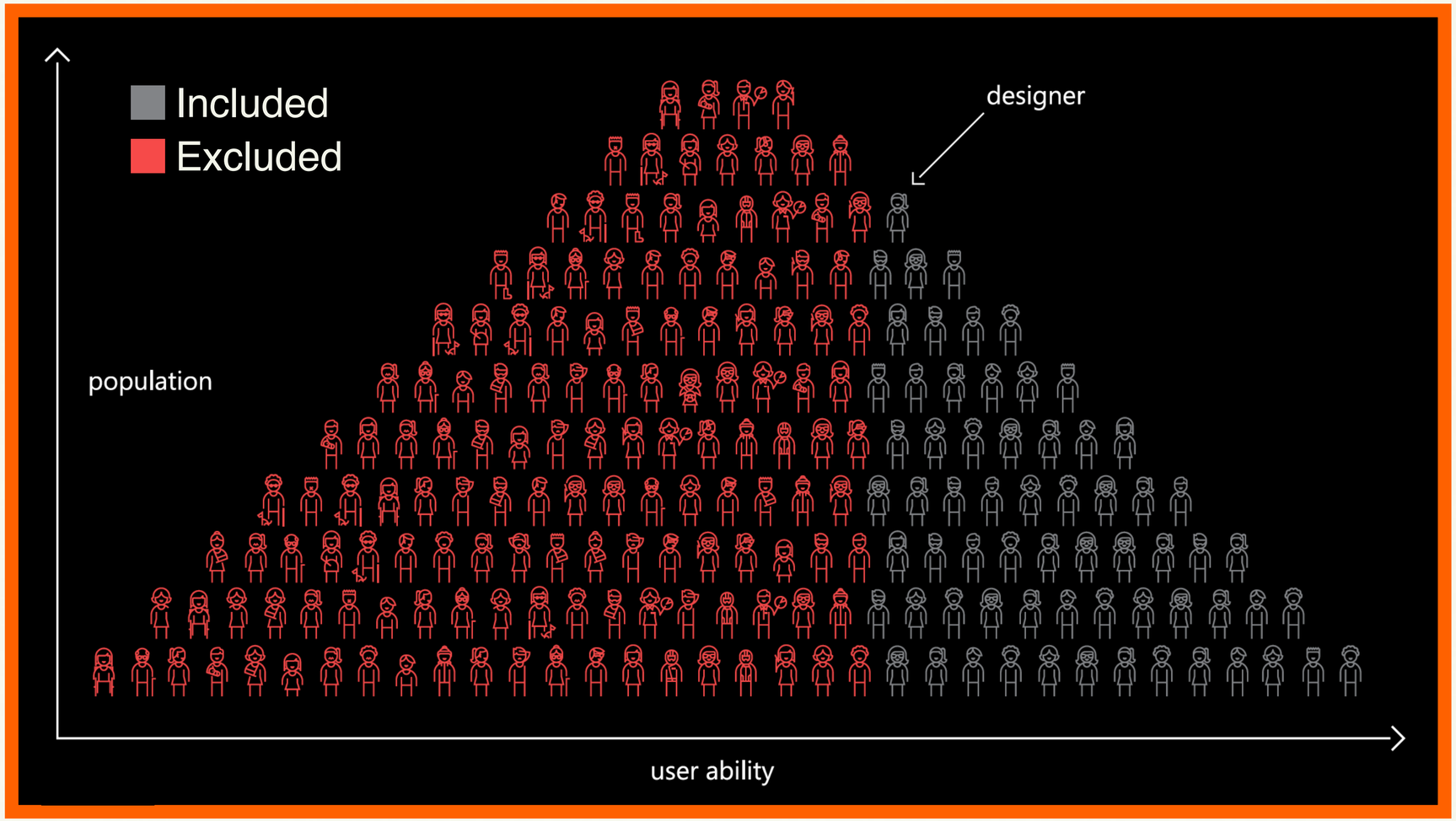
perma.cc/3X2K-BTS9

In the 2017 survey, smartphone users making < $30k/yr experienced app errors **52% of the time**

Fantasy

Reality

Disabilities are designed



perma.cc/JKF6-8FQH

The “Digital Divide”

Digital Literacy

Hardware · Software · Internet

Technology

Device · Capabilities · Condition

Access

Availability · Quality · Affordability

Digital Redlining

- Exclusion based on geography
- Exclusion based on opaque algorithms
- Exclusion based on personal traits or tendencies

Where are we going wrong?

- We are failing when it comes to **accessibility**
- We are failing when it comes to **managing access (or lack thereof) to the Internet**
- We are failing when it comes to **supporting broad categories of devices**
- We are failing when it comes to **recognizing that we are not our customers**

Crises have a way of turning these divisions into chasms.

> **I attempted to reach the … website on my mobile browser to report the outage. I refreshed the page multiple times while my phone said I had data coverage and was on the network (one, maybe two bars at times), but the … page came up as offline. I finally managed to get the page to load to report the outage after about 5 minutes.**

— Stephanie Stimac

Location, Privilege and Performant Websites

perma.cc/5MBX-9GGD

> **Between 800 and 8,500 people lost their lives due to the damage and lack of basic services—including telecommunications—in the weeks and months following Hurricane Maria.**

— Nick Thieme

After Hurricane Maria, Puerto Rico's Internet Problems Go from Bad to Worse

perma.cc/E352-8BC7

What happens when the world grinds to a halt?

> **[I]n Kuala Lumpur, people are enjoying high-speed Internet up to 800Mbps per second. At the same time, in Sarawak (East Malaysia) speed is much slower [1Mbps up to 4Mbps], [while] some areas in the state do not have any access to Internet service.**

— Nuurrianti Jalli

Lack of internet access in Southeast Asia poses challenges for students to study online amid COVID-19 pandemic

perma.cc/D43V-28AS

> **In Phoenix, three high school students were found huddled under a blanket outside a closed elementary school, the president of the city's school board said. They couldn’t connect to the internet from home, so they camped out to access the school's Wi-Fi to do their homework.**

— Erin Mansfield and Shelly Conlon

Coronavirus for kids without internet: Quarantined worksheets, learning in parking lots

perma.cc/4ZA4-RUKK

> **The OECD average percentage of computer illiterate people hovers around 25%, meaning that a quarter of the population will have major trouble in accessing E-Learning as an educational method.**

— Sander Tamm

Disadvantages of E-Learning

perma.cc/TVN3-9DKS

> **In Humboldt County, average download speeds fell 8.67% and average upload speeds fell 11.99% from March 9 to March 29, according to internet speed testing company Ookla.**

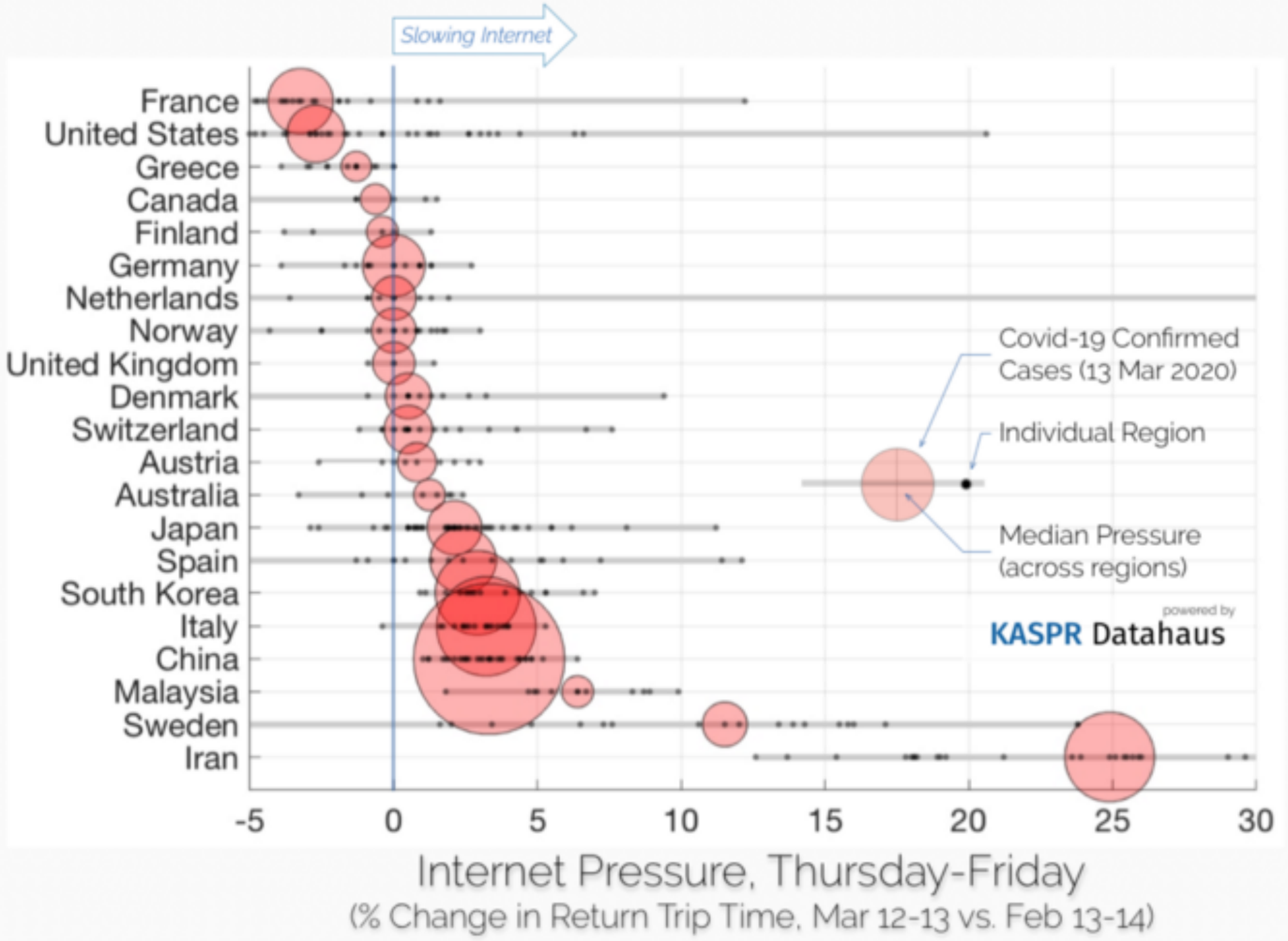
— Sonia Waraich

COVID-19: Internet speeds slow as more people work from home

perma.cc/KZ5R-FE5G

Internet Pressure in Major COVID-19 Countries

The impact of COVID-19 with **KASPR Datahaus** sub-national products



perma.cc/HQK2-F6TA

eLearning software and courses often fail to deliver materials accessibly.

If what we build is important, let’s treat it that way.

Crises are inevitable, but we can rise to meet the moment.

- Plan for network issues
- Empower our customers, neighbors, constituents…
- Eliminate waste
- Reduce complexity

Plan for network issues

- Rely on small, static files
- Make fewer requests
- Leverage defaults
- Use a Service Worker

Smaller files with less processing overhead are faster.

Small, static files…

- Download more quickly (over HTTP/1.1, HTTP/2, or HTTP/3)
- Cost our users less to download
- Take up less space on our users' devices
- Cost us less to serve
- Put less stress on our servers & infrastructure
- Can be moved to "edge" servers & CDNs more easily

> **In Hurricane #Irma's path with a weak phone connection? Stay up to date with the text-only version of our website http://lite.cnn.io**

— CNN

9 September 2017

twitter.com/CNN/status/906655810612232193

CNN | 7/24/2020 | Listen

Main Stories

- US surpasses 4 million reported coronavirus cases as hospitalizations near record
- At least 15 prisoners at a California prison have died of apparent complications from Covid-19
- University professors fear the risks of classroom teaching in pandemic hot spots
- Birx warns of concerning rise in coronavirus cases in 12 cities as Trump paints a rosy picture
- Opinion: In Covid-19 crisis, expand service options for young people
- As US and China force consulates to close, the risk of missteps and spiraling tensions rises
- China orders closure of US consulate in Chengdu in retaliation for Houston
- Global stocks tumble as China tensions escalate and the US economy struggles
- Pompeo blasts Beijing as deadline nears for China to shutter Houston consulate
- How the Lincoln Project's brutal anti-Trump ads could remake US politics
- The strongest storm on the planet moves toward Hawaii
- Two young brothers from Houston lost both parents to Covid-19
- A key miscalculation by officers contributed to the tragic death of Breonna Taylor
- Watch the entire CNN coronavirus town hall
- The 32 most bizarre lines from Donald Trump's latest interview with Sean Hannity
- AOC to Yoho: 'I am someone's daughter too'
- AOC 1, Ted Yoho 0
- This Florida Republican just delivered a master class in how *not* to apologize
- Ted Yoho apologizes after reportedly verbally accosting Ocasio-Cortez over stance on unemployment, crime in New York
- Covid-19 "will end up as a Top 10 leading cause of death" in 2020, CDC statisticians tell CNN
- Covid-19 mask safety: Two or three layers best to protect against virus, study finds
- Covid-19 and breastfeeding: Moms unlikely to pass virus if careful
- Another study finds hydroxychloroquine does not help Covid-19 patients

Text-Only NPR.org (go to full version)

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July 24, 2020

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- Terrific New Thrillers 'Amulet' And 'Relic' Explore Terrors Lurking Within The Home
- McDonald's Will Require Face Masks At Its More Than 14,000 U.S. Restaurants
- Susan Rice, Perhaps An Unlikely Contender, Lands On Biden's VP Shortlist
- Without A Vaccine, Researchers Say, Herd Immunity May Never Be Achieved
- To Help Keep New Orleans Safe, Musician Trades Kids Trumpets For Guns
- Trump's Favorite Coronavirus Metric, The Case Fatality, Is Unreliable
- Thoughts Of Suicide, Other Mental Health Struggles Still High For LGBTQ Youth

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National Hurricane Center

Top News of the Day... *view past news*

Last update Fri, 24 Jul 2020 19:26:25 UTC

- NHC issuing advisories for the Atlantic on TS Gonzalo and TS Hanna
- CPHC issuing advisories for the Central Pacific on Hurricane Douglas
- Key Messages regarding Tropical Storm Gonzalo (en Español: Mensajes Claves)
- Key Messages regarding Tropical Storm Hanna (en Español: Mensajes Claves)
- Key Messages regarding Hurricane Douglas
- **Hurricane Warning: Atlantic High Seas**
- **Tropical Storm Warning: Caribbean/SW Atlantic – Graphical Forecast**
- **Tropical Storm Warning: Gulf of Mexico – Graphical Forecast**
- **Tropical Storm Warning: Atlantic High Seas**

Mission / Vision
Page last updated Fri, 24 Jul 2020 19:26:25 UTC
Need help?
How to Read The Public Advisory
How to Read The Forecast/Advisory

Atlantic - Caribbean - Gulf of Mexico

Tropical Weather Outlook (en Español*)

Tropical Storm Gonzalo
Public Advisory #12A 200 PM AST
Aviso Publico* #12A 200 PM AST
Forecast Advisory #12 1500 UTC
Forecast Discussion #12 1100 AM AST
Wind Speed Probabilities #12 1500 UTC
Maps and Charts
Archive

Tropical Storm Hanna
Public Advisory #7A 100 PM CDT
Forecast Advisory #7 1500 UTC
Forecast Discussion #7 1000 AM CDT

Let’s compare*

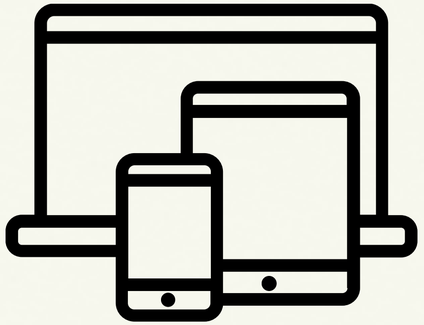
Site	Size	Requests	Starts Rendering	“Uncanny Valley”	Loaded	Cost
“Normal”	679 KB	57	2.7s	.2s	8.2s	$0.07
Text-only	39 KB	7	2.3s	.1s	6.2s	$0.00

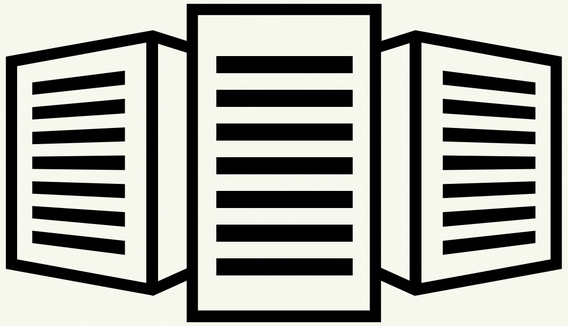
* Moto G4 over 3G

Fewer requests lead to a faster, more resilient experience.

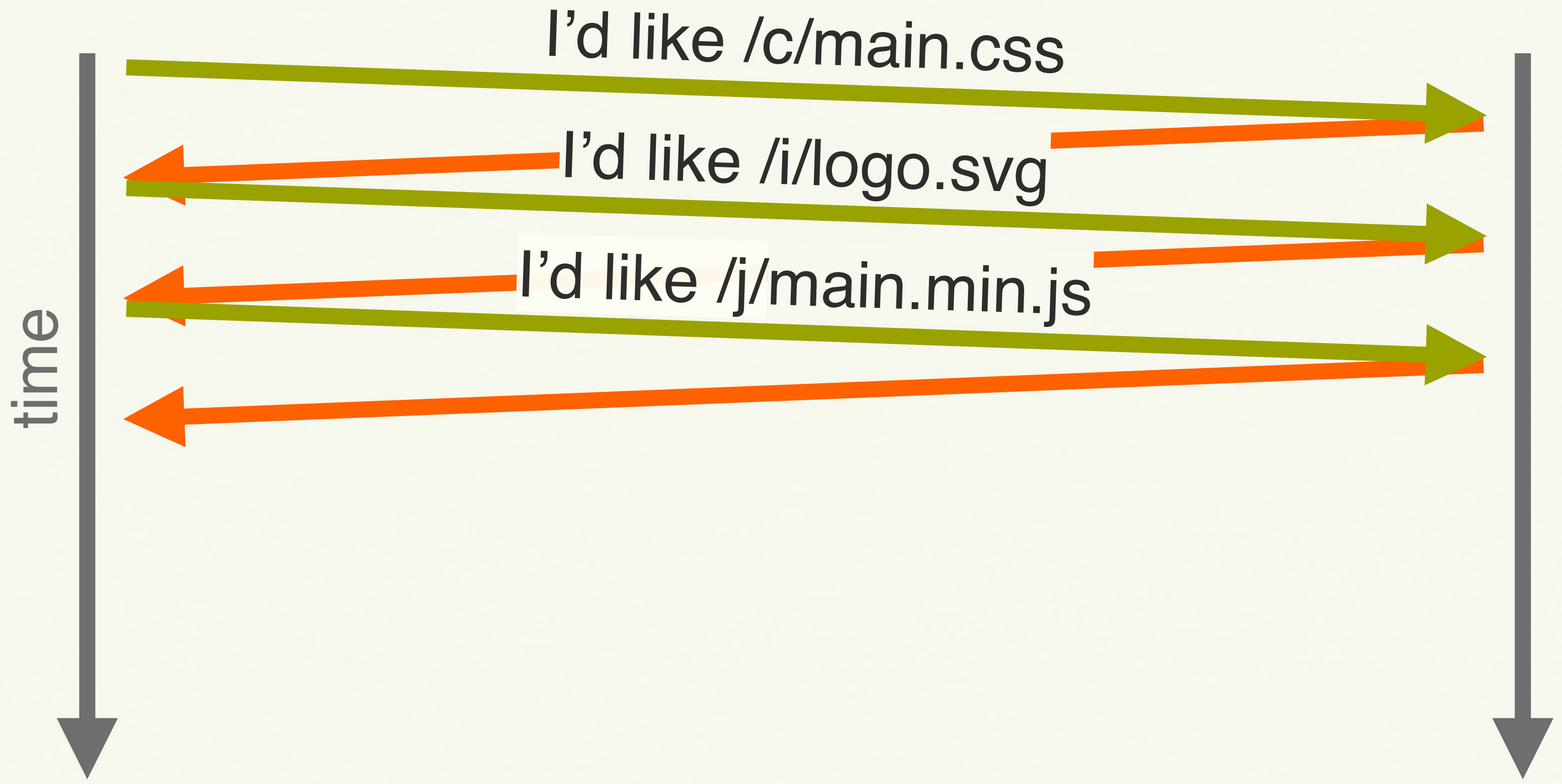
Your Users

Your Server





HTTP/1.1



Your Users

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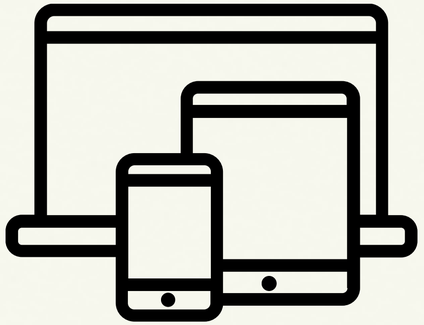
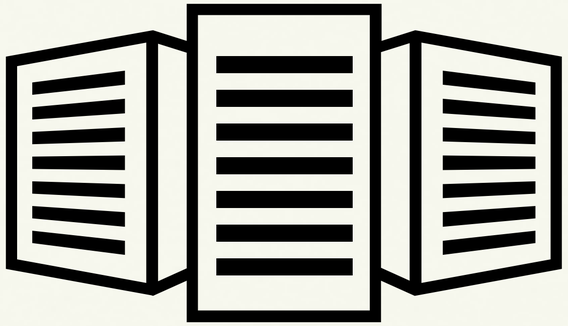
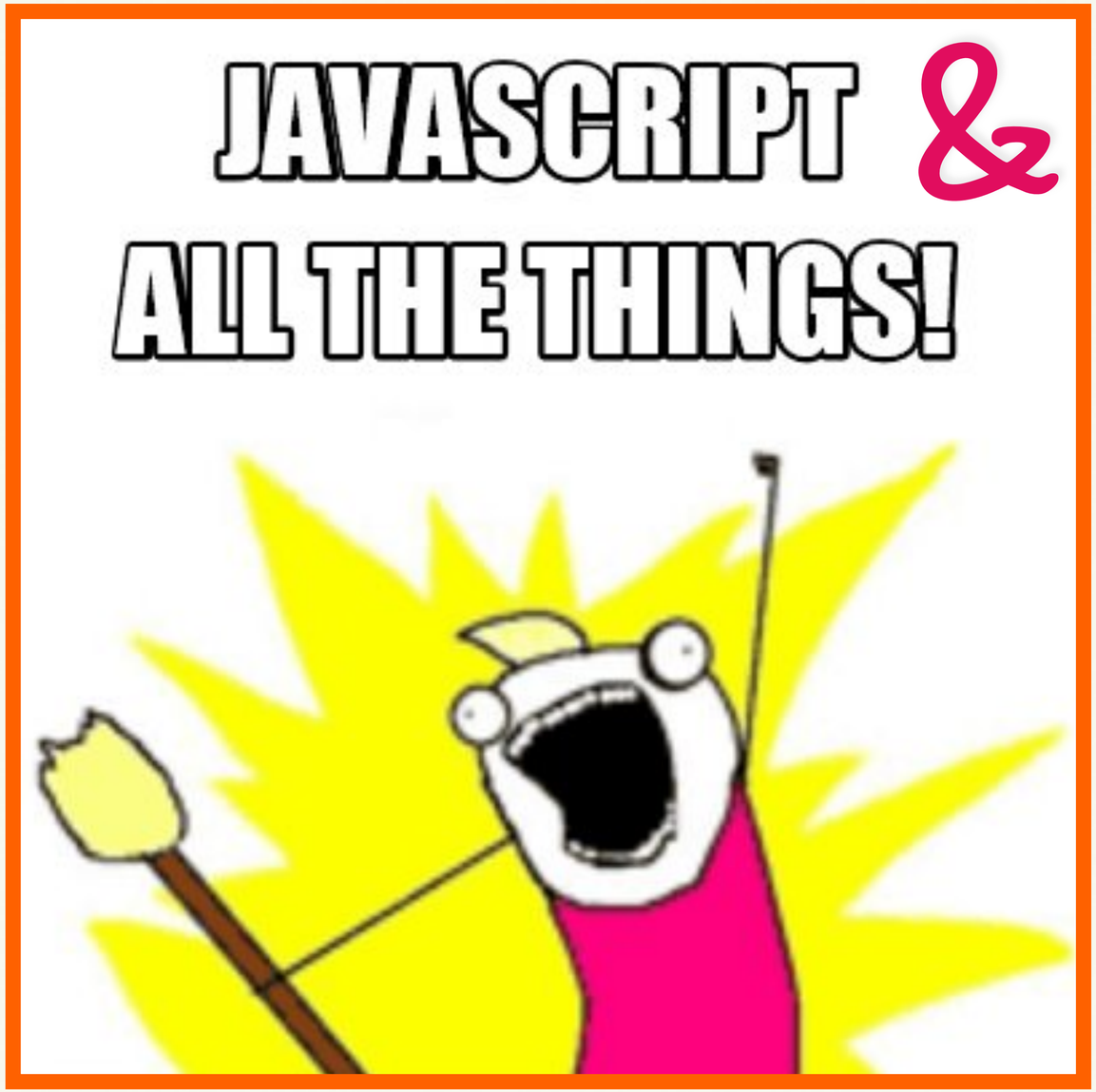


HTTP/2



Fewer requests benefit everyone.

Work with the browser, don’t replace the browser.



& CSS

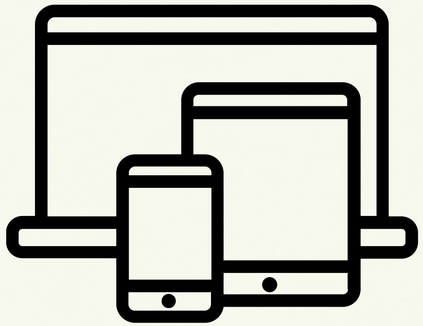
Use browser default styles, controls, interactions, and fonts whenever possible.

Hire a Service Worker to up your caching game.

A Service Worker

- Runs in its own thread
- Runs in the background
- Sits between your users and the network

Your Users



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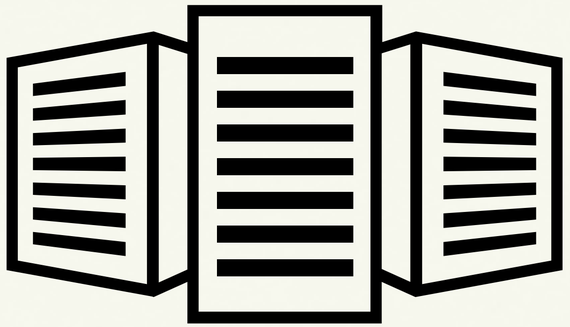
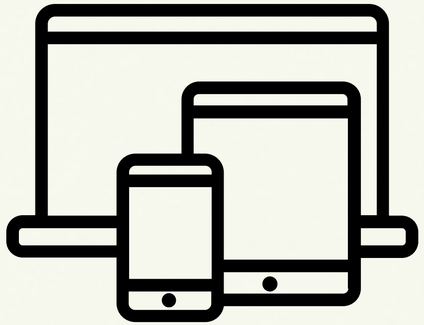
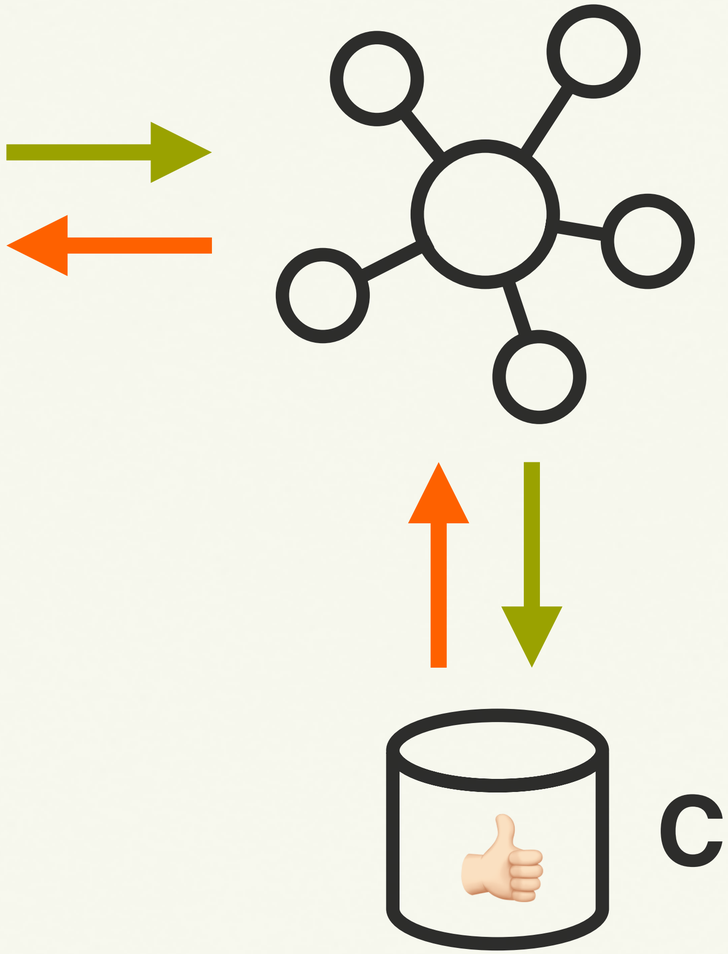


Your Users





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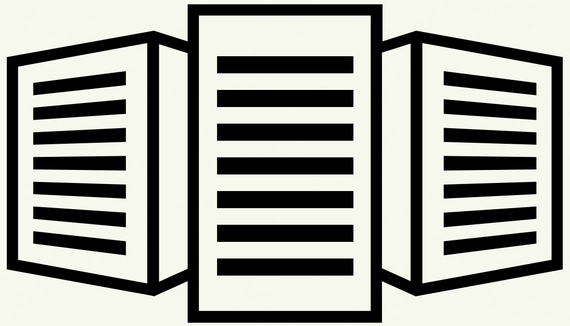
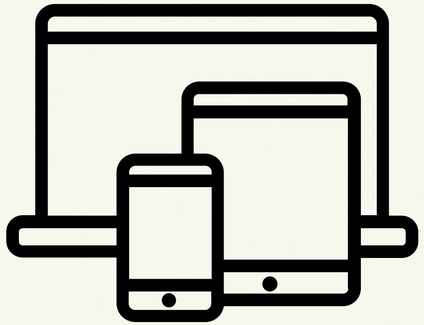
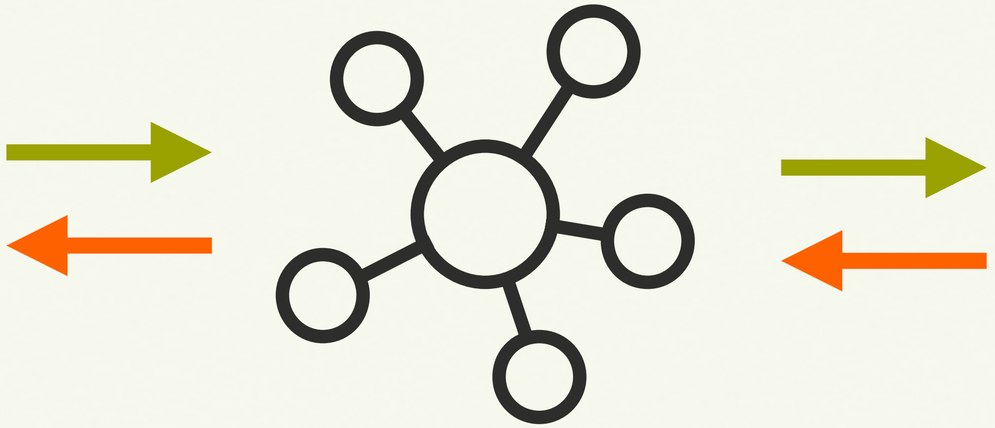


Cache

Your Users





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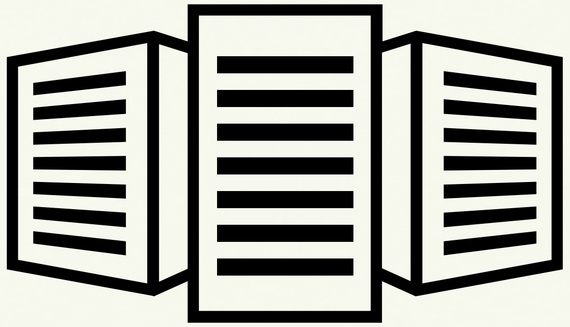

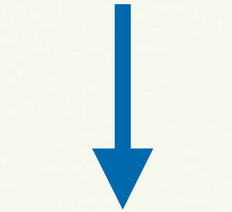

Cache

Better experiences:

- Offline pages
- Provide stale content while you look for new content
- Provide alternate content to save bandwidth

Plan for network issues

- Rely on small, static files
- Make fewer requests
- Leverage defaults
- Use a Service Worker

Empower everyone

- Write clearly and concisely
- Make accessible markup choices
- Ensure our designs adapt
- Don’t let JavaScript get in the way

When people are in crisis, their personal compute power is reduced.

Nicely Said recommends we

- Be clear.
- Be concise.
- Be honest.
- Be considerate.
- Write how we speak.
- Avoid technical and legal jargon.

We should choose our markup as carefully as our words.

What are we saying here?

```
<div class="entry">
  <div class="entry__title">
    Progressive Web Apps and the Windows Ecosystem
  </div>
  <div class="entry__meta">
    <div><b>Published</b> 24 May 2017</div>
    <div><b>Reading Time</b> 25 minutes</div>
  </div>
  <div class="entry__content">
    I had the great pleasure of delivering a talk…
    <br><br>
    I do a lot of traveling and it’s…
  </div>
</div>
```

Markup can convey meaning

```
<div class="entry">
  <div class="entry__title">
    Progressive Web Apps and the Windows Ecosystem
  </div>
  <div class="entry__meta">
    <div><b>Published</b> 24 May 2017</div>
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    I had the great pleasure of delivering a talk…
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    I do a lot of traveling and it’s…
  </div>
</div>
```

Alterna-`divs`

- `p` - a paragraph
- `ol` - a list of items whose order matters
- `ul` - an list of items whose order doesn’t matter
- `li` - an item in a list
- `dl` - a list of items and their associated descriptions
- `dt` - terms to be described within a dl
- `dd` - description data within in a dl
- `figure` - referenced content (images, tables, etc.)
- `figcaption` - caption for a figure

Alterna-`divs`

- `article` - a piece of content that can stand on its own
- `section` - a section of a document or article
- `header` - preamble content for a document, article, or section
- `footer` - supplementary information for a document, article, or section
- `main` - the primary content of a document
- `nav` - navigational content
- `aside` - complementary content

Which of these is more readable?

Progressive Web Apps and the Windows Ecosystem
Published 24 May 2017
Reading Time 25 minutes
I had the great pleasure of delivering a talk…

I do a lot of traveling and it's…

Progressive Web Apps and the Windows Ecosystem

Published
24 May 2017
Reading Time
25 minutes

I had the great pleasure of delivering a talk…

I do a lot of traveling and it's…

Useful landmarks

- `role="banner"`
  Also: first `header` element not inside a sectioning element
- `role="navigation"`
  Also: `nav`
- `role="search"`
- `role="main"`
  Also: `main`
- `role="complementary"`
  Also: `aside`
- `role="contentinfo"`
  Also: first `footer` element not inside a sectioning element

Our designs should remain open to interpretation.

A LIST APART

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Issue № 306

Responsive Web Design

A LIST APART

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A Dao of Web Design

by **John Allsopp** · April 07, 2000

Published in Accessibility, CSS, Layout & Grids, Typography & Web Fonts

What Zen was to the 70's (most famously with motorcycle maintenance), the *Tao Te Ching* was to the 90's. From Piglet and Pooh to Physics and back, many have sought sense in applying the *Tao Te Ching* to something (the *Tao of Physics*), or something to the *Tao Te Ching* (the *Tao of Pooh*). It can be a cheap trick, but lately it has struck me that there is more than a little to be understood about web design by looking through the prism of the Tao.

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Daoism is a philosophy, like Buddhism, a way of living, of being in the world, which stems from a text of great antiquity, the *Tao Te Ching*, whose 81 "chapters" enigmatically sweep across human experience, but with a strong common theme, that of harmony.

For the last couple of years, for better or worse, my life has revolved more than a little around style sheets. I write software, tutorials, and guides for them; I've answered too

no comments yet
Share this:

Scale as necessary

```
h1 {
  font-size: 3rem;
}

@media (min-width: 43em) {
  …
}
```

Don’t rely on color alone

Don’t rely on color alone

Ensure proper contrast

contrast-ratio.com

Bake in good performance

- Selectively deliver advanced styles using media queries
- Isolate large CSS images in min-width media queries
- Don’t hide `img` using CSS
- Use responsive images
- Prefer system fonts
- Use `font-display: optional`

JavaScript can enable great experiences or undermine them.

Love ES2015?

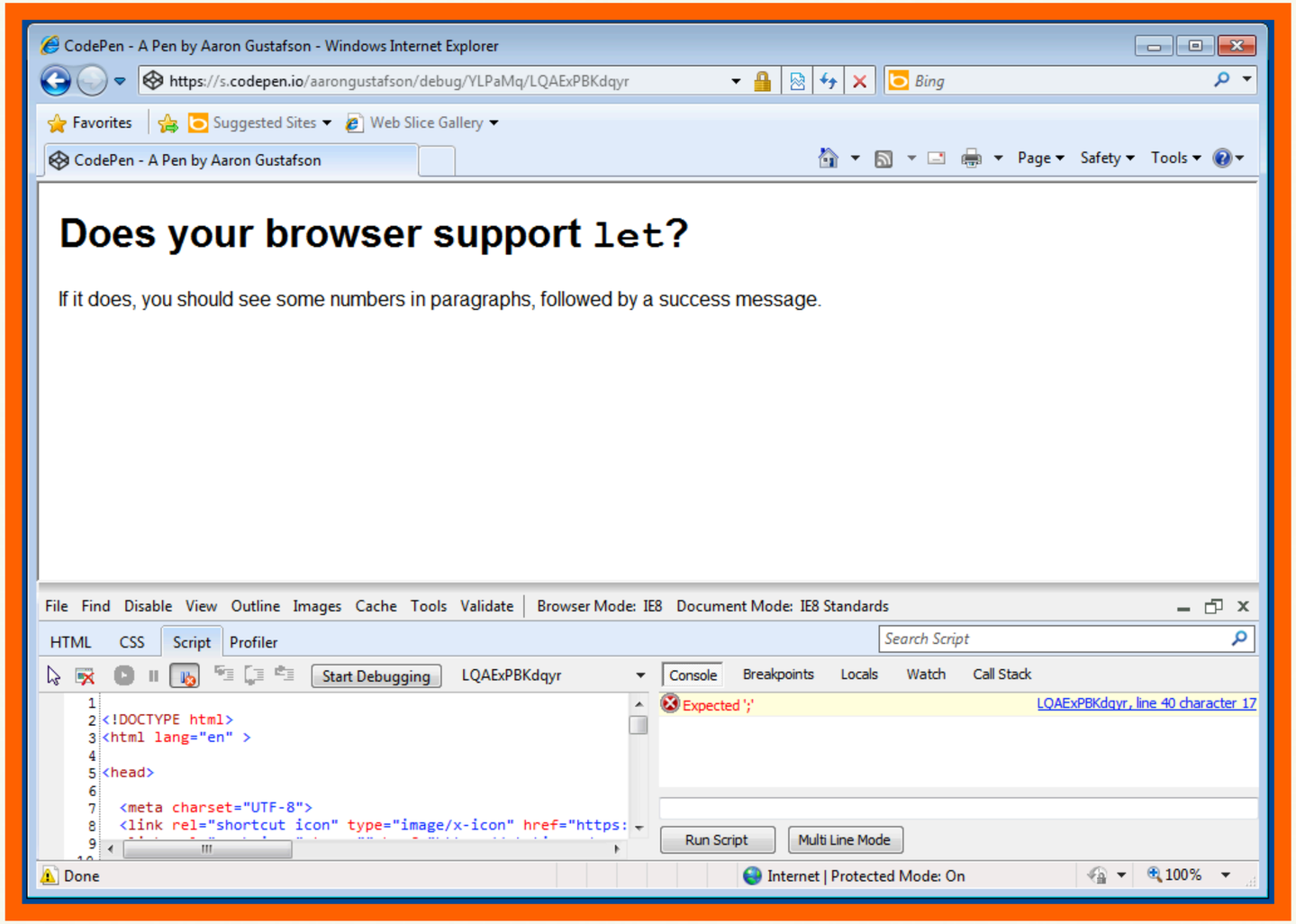
```
document.body.innerHTML += '<p>Can I count to four?</p>';

for ( let i=1; i<=4; i++ )
{
  document.body.innerHTML += '<p>' + i + '</p>';
}

document.body.innerHTML += ‘<p>Success!</p>';
```

Works on my machine 👍

Elsewhere…?


CodePen - A Pen by Aaron Gustafson - Windows Internet Explorer
https://s.codepen.io/aarongustafson/debug/YLPaMq/LQAExPBKdqyr
Bing
Favorites
Suggested Sites
Web Slice Gallery
CodePen - A Pen by Aaron Gustafson
Page
Safety
Tools
Does your browser support let?
If it does, you should see some numbers in paragraphs, followed by a success message.
File Find Disable View Outline Images Cache Tools Validate
Browser Mode: IE8
Document Mode: IE8 Standards
HTML CSS Script Profiler
Search Script
Start Debugging
LQAExPBKdqyr
Console Breakpoints Locals Watch Call Stack
Expected ';'
LQAExPBKdqyr, line 40 character 17
<!DOCTYPE html>
<html lang="en" >
<head>
<meta charset="UTF-8">
<link rel="shortcut icon" type="image/x-icon" href="https:
Run Script
Multi Line Mode
Done
Internet | Protected Mode: On
100%

One teensy, little problem

```
document.body.innerHTML += '<p>Can I count to four?</p>';

for ( let i=1; i<=4; i++ )
{
  document.body.innerHTML += '<p>' + i + '</p>';
}

document.body.innerHTML += ‘<p>Success!</p>';
```

If a browser doesn’t grok our JavaScript, it won’t run it.

> **Surprisingly, the proportion of people that have explicitly disabled JavaScript or use a browser that doesn't support JavaScript, only makes up a small slice of people that don't run JavaScript.**

— Peter Herlihy

How many people are missing out on JavaScript enhancement?

perma.cc/6RPU-8UDA

Use JavaScript, but understand its limitations.

Empower everyone

- Write clearly and concisely
- Make accessible markup choices
- Ensure our designs adapt
- Don’t let JavaScript get in the way

Eliminate waste

- Get rid of unnecessary imagery
- Grant users some control
- Minimize our RAM footprint
- Reduce our energy consumption

> I want to share with you my simple two-step secret to improving the performance of any website.
>
> 1. Make sure that the most important elements of the page download and render first.
> 2. Stop there.
>
> — Maciej Cegłowski
>
> *The Website Obesity Crisis*
>
> perma.cc/L89N-2E3T

Images aren’t always worth 1,000 words.

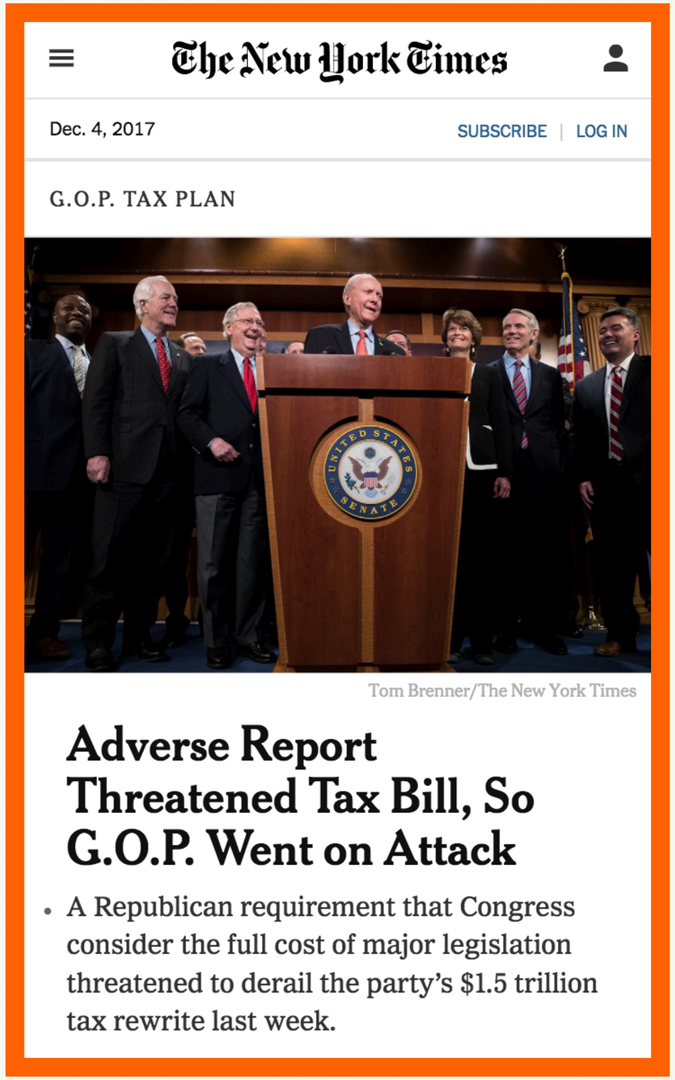
> **The Web is smothering us in useless images that create lots of pollution. These clichéd, stock images communicate absolutely nothing of value, interest or use. They are one of the worst forms of digital pollution and waste, as they cause page bloat, making it slower for pages to download, while pumping out wholly unnecessary pollution. They take up space on the page, forcing more useful content out of sight, making people scroll for no good reason.**

— Gerry McGovern

World Wide Waste: How Digital is Killing Our Planet—and What We Can Do About It

Images can add value

But they don’t always



The New York Times

Dec. 4, 2017

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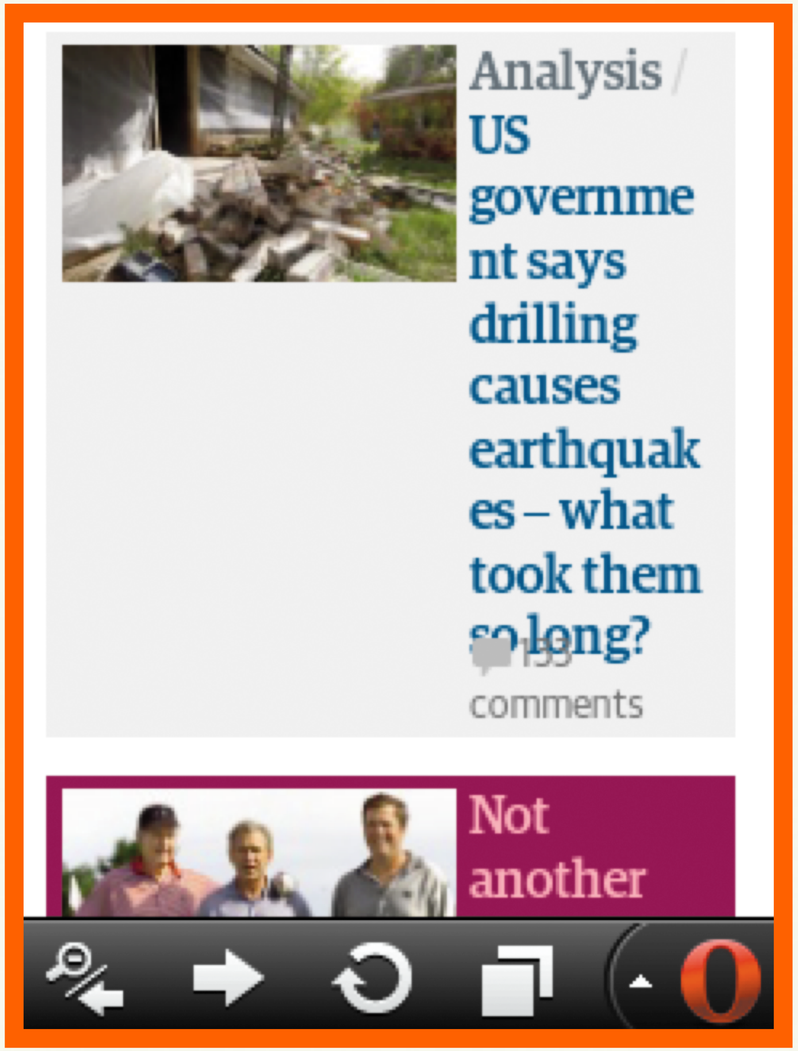
G.O.P. TAX PLAN

Tom Brenner/The New York Times

Adverse Report Threatened Tax Bill, So G.O.P. Went on Attack

- A Republican requirement that Congress consider the full cost of major legislation threatened to derail the party’s $1.5 trillion tax rewrite last week.

They can also cause problems



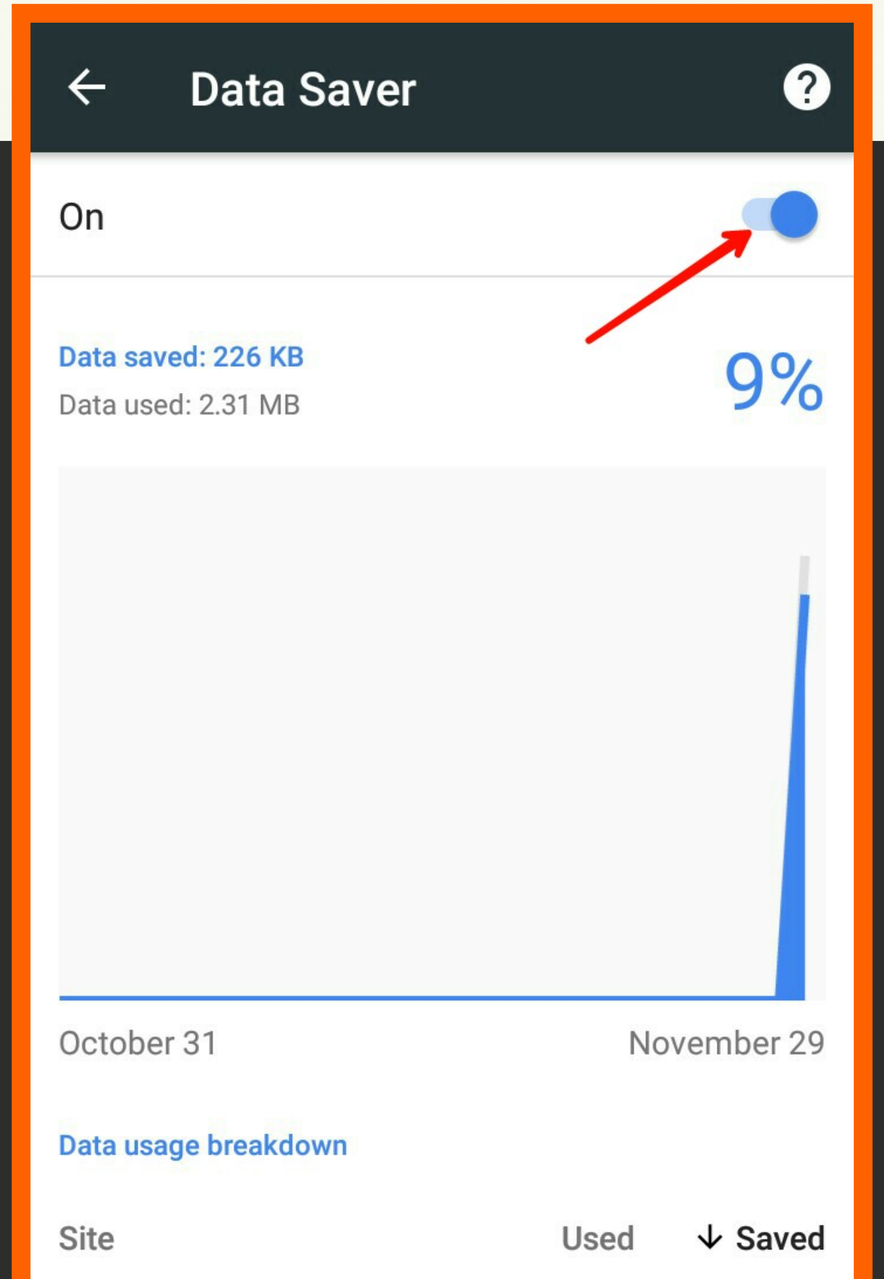
Be selective (and realistic)

- Does the image reiterate information found in the surrounding text?
- Is the image necessary to understand the surrounding content?
- Does the image contain text?
- Is the image a graph, chart, or table?
- Could the content of the image be presented in a different format that would not require an image?
- Is the image purely presentational?

Users should be in control of their data.

Let them save data!

```
GET /image.jpg HTTP/1.0
Host: example.com
Save-Data: on
```



A Service Worker can see this…

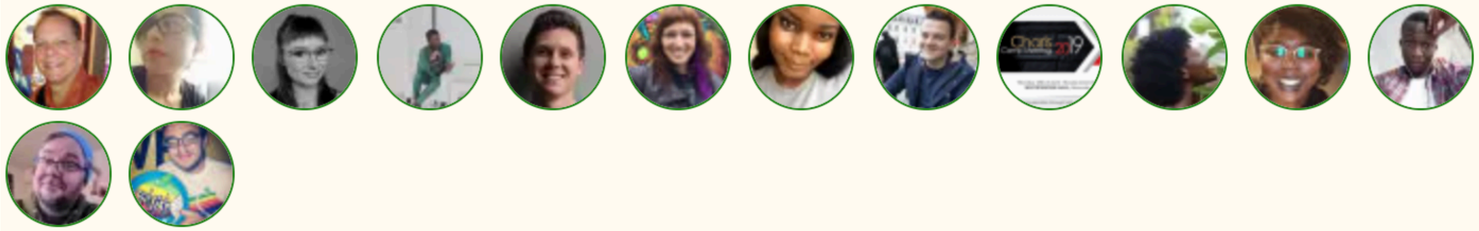
```
let save_data = false;
if ( 'connection' in navigator ) {
  save_data = navigator.connection.saveData;
}
```

And respond accordingly

```
self.addEventListener( "fetch", event => {
  const request = event.request,
        url = request.url;
  if ( request.headers.get("Accept").includes("image") ) {
    event.respondWith(
      if ( save_data ) {
        return respondWithFallbackImage( url );
      }
      // …
    );
}
```

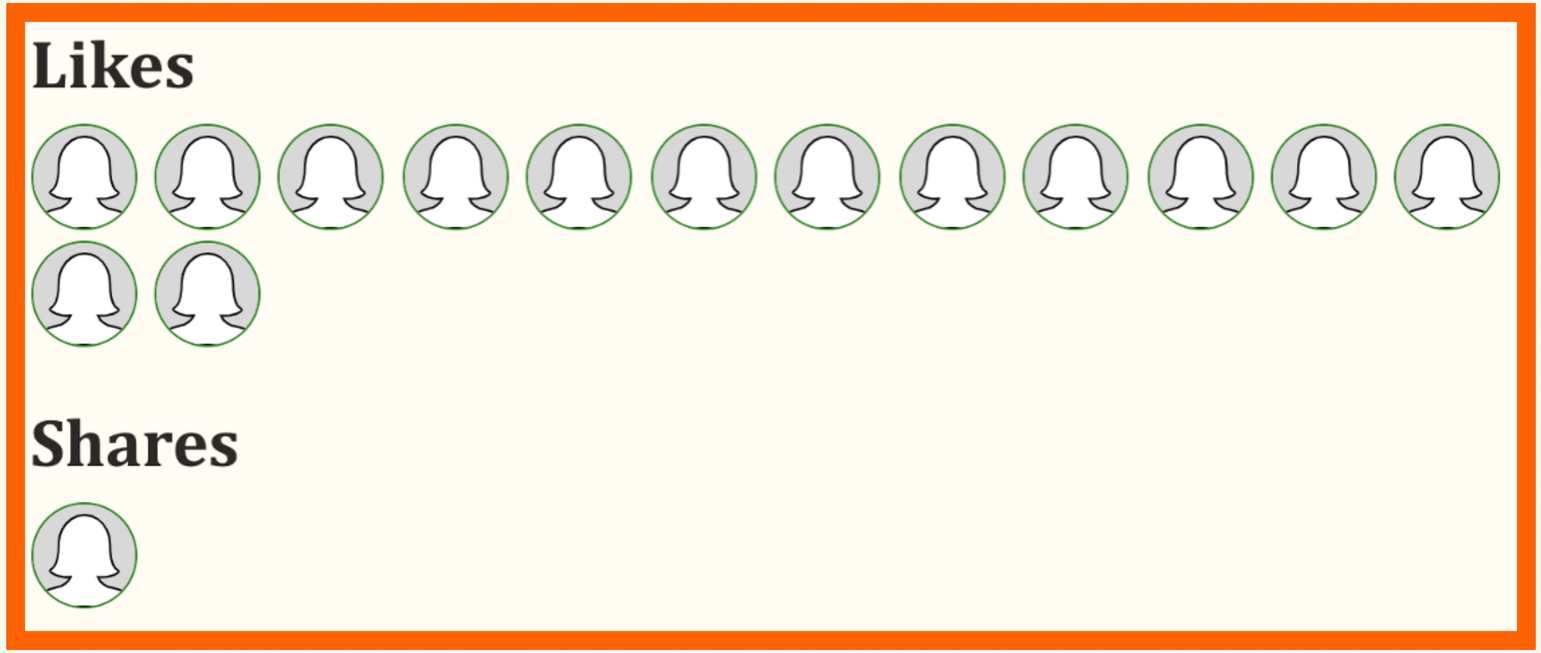
Result

Likes



Shares

Result



Result

Emily Grossman

Bingbot is crawling the web for “quality PWAs” to ingest in the Windows Store (aaron-gustafson.com/notebook/progr…). Here’s what Microsoft looks for:

12 October 2017 | Permalink

RAM is a finite resource.

RAM-conscious websites…

- Ship less code.
- Restrict global variables.
- Clean up their timers and callbacks.
- Are careful with closures.
- Monitor memory use in DevTools.

Electricity is a luxury.

Sip, don’t gulp.

Smartphone charging times

- **Electrical grid:** 2-3 hours
- **Diesel generator:** 2-3 hours
- **Solar panel:** 8-10 hours*
- **Hand crank:** 3-10 min for 12-20 minutes of use
- **Bicycle crank:** 2-3 hours
- **Kinetic energy:** 1 hour for ~1 hour
- **Thermo power:** ~2 hours

*Depending on weather

Energy-efficient websites…

- Ship less code.
- Serve properly-sized images in the best format.
- Optimize & minify all files (code & graphics).
- Don’t auto-play videos.
- Use system fonts.
- Deliver less JavaScript.
- Integrate as little 3rd party code as possible.
- Implement Service Worker.

> **We were told that the Internet would “dematerialise” society and decrease energy use. Contrary to this projection, it has become a large and rapidly growing consumer of energy itself.**

— Kris De Decker

How to Build a Low-tech Website?

perma.cc/FA9X-Z58P

Eliminate waste

- Get rid of unnecessary imagery
- Grant users some control
- Minimize our RAM footprint
- Reduce our energy consumption

Reduce complexity

- Develop dependency awareness
- Reach for the right tools for the job
- Consider going “static”

> **Use the least powerful language suitable for expressing information, constraints or programs on the World Wide Web.**

— Tim Berners-Lee

The Rule of Least Power

perma.cc/MXE6-EG3L

Consider the humble button

Consider the humble button

```
<input type="submit" value="Sign In">

<button type="submit">Sign In</button>

<a href="#" class="button">Sign In</a>

<div class="button">Sign In</div>
```

Consider the humble button

Element	Appearance	Non-visibly	Focusable	Activates	Submits Forms
`input`	Button	Button	Yes	Yes	Yes
`button`	Button	Button	Yes	Yes	Yes
`a`	Underlined Text	Named generic	Yes	Kinda	No
`div`	Block Text	Not exposed	No	No	No

Not all buttons are equal

Element	Appearance	Non-visibly	Focusable	Activates	Submits Forms
`input`	Button	Button	Yes	Yes	Yes
`button`	Button	Button	Yes	Yes	Yes
`a`	Underlined Text	Named generic	Yes	Kinda	No
`div`	Block Text	Not exposed	No	No	No

Bring on the dependencies

Sign In

Element	Appearance	Non-visibly	Focusable	Activates	Submits Forms
`input`	Button	Button	Yes	Yes	Yes
`button`	Button	Button	Yes	Yes	Yes
`a`	CSS Button Styles	ARIA `role="button"`	Yes	JavaScript interaction events	JavaScript form events
`div`			HTML `tabindex="0"`		

Take the freebies

Sign In

Element	Appearance	Non-visibly	Focusable	Activates	Submits Forms
`input`	Button	Button	Yes	Yes	Yes
`button`	Button	Button	Yes	Yes	Yes
`a`	CSS Button Styles	ARIA `role="button"`	Yes	JavaScript interaction events	JavaScript form events
`div`			HTML `tabindex="0"`		

When is CSS unavailable?

- The browser doesn’t support CSS.
- The user disabled CSS for performance reasons.
- The user is applying a user style sheet (which trumps your rules) to improve accessibility or for some other personal preference.
- A networking issue caused the external CSS to be unavailable.
- The selector you are using is too advanced for the browser.
- The rules are contained in a media query and the browser doesn’t support them or the query doesn’t apply.

When is JavaScript unavailable?

- The browser doesn’t support JavaScript.
- JavaScript was disabled by the user.
- A networking issue caused the JavaScript to be unavailable.
- A firewall blocked requests for JavaScript.
- A browser plugin blocked the JavaScript download or execution.
- A third-party JavaScript error caused the JavaScript program to stop.
- A bug in your code caused the JavaScript program to stop.
- The browser failed a feature detection test and exited the program early.
- The user is still waiting for the browser to download, parse, and execute your JavaScript program.

But ARIA is safe, right?

- The browser & assistive tech combo must **both** support the feature.
- Users can experience a mismatch of expectation if an element appears to be something, but fails to act like it.

> If you *can* use a native HTML element or attribute with the semantics and behavior you require already built in, instead of re-purposing an element and adding an ARIA role, state or property to make it accessible, then do so.
>
> — First Rule of ARIA Use

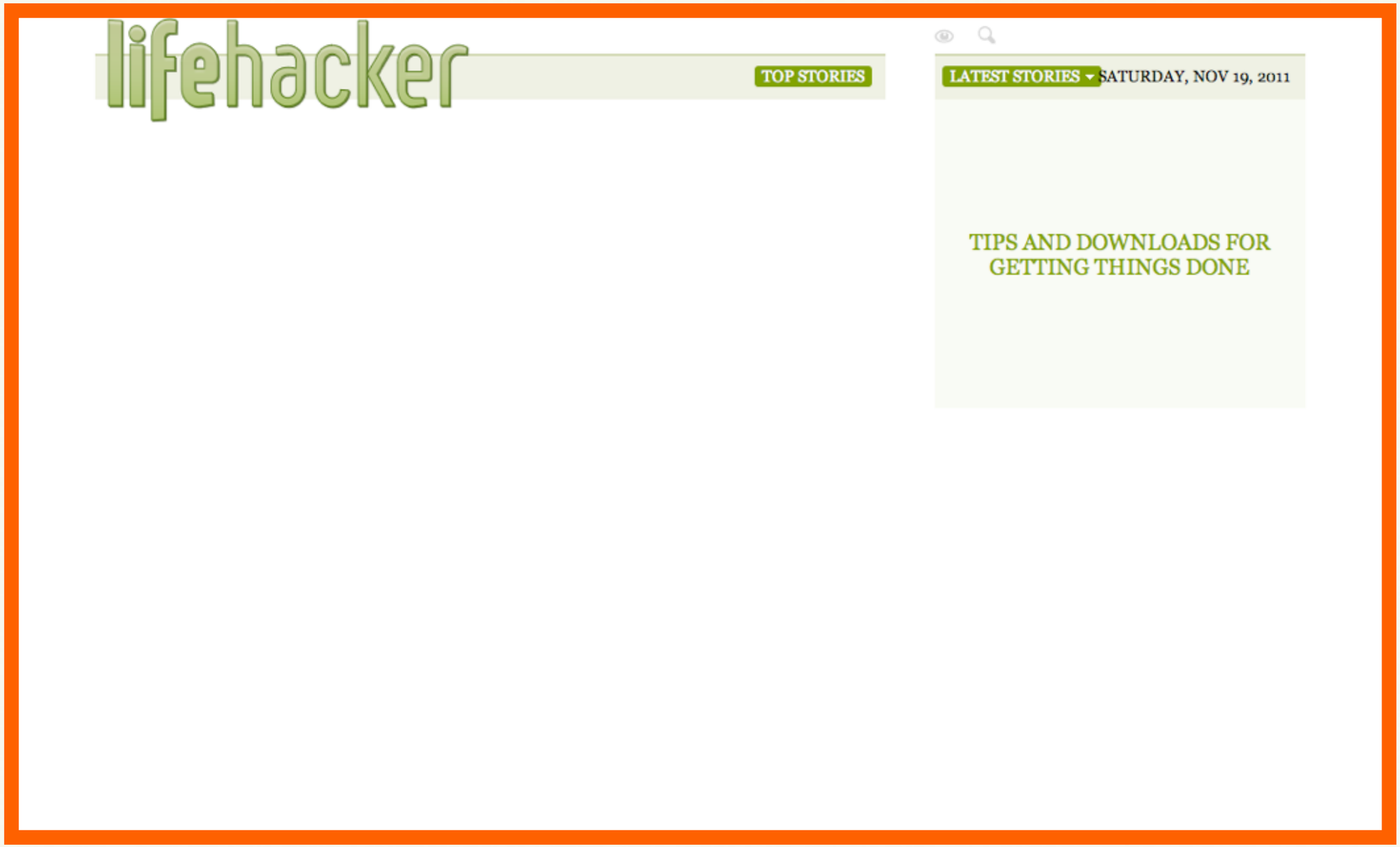
Reality Check

This example was a button.

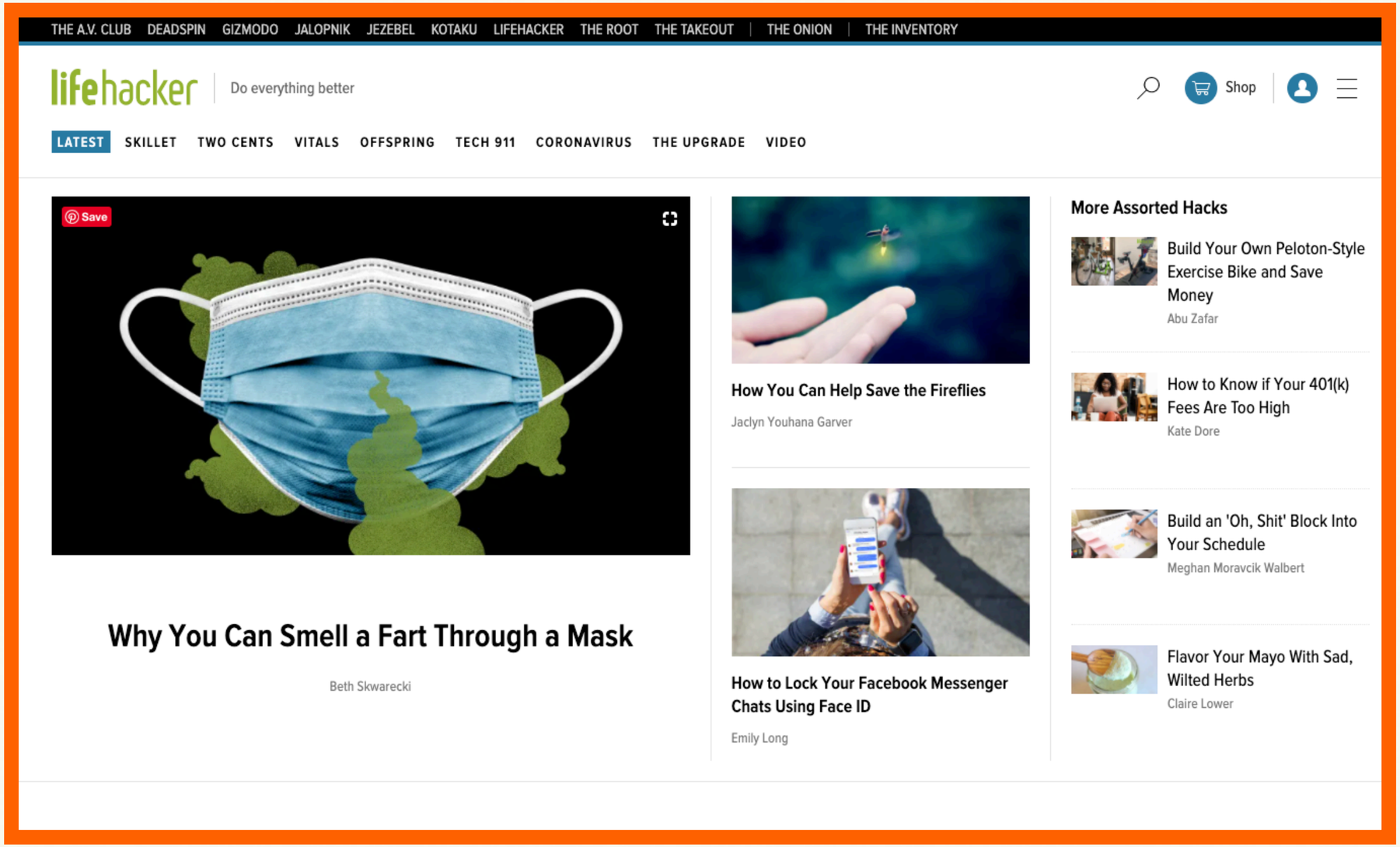
Dependency awareness needs to extend to networking as well.

Learn from the past

Learn from the past



Learn from the past



Make sure our critical tasks can’t be undermined by a failed request.

If we make mission-critical API calls, we should do that before sending pages to the browser.

We must choose the right tools for the job.

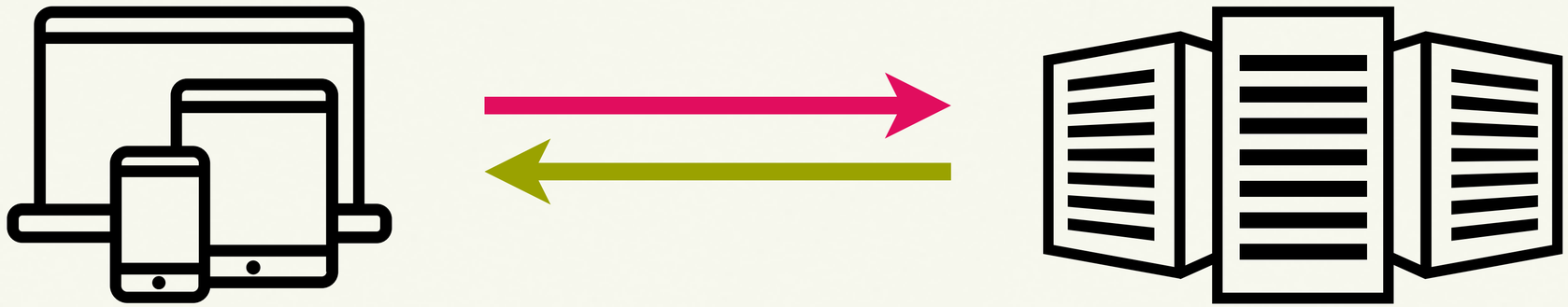
Just because a popular company built or is using a tool does not mean that it’s a good fit for our project.

We should focus on the technical requirements of our project and evaluate the options through that lens.

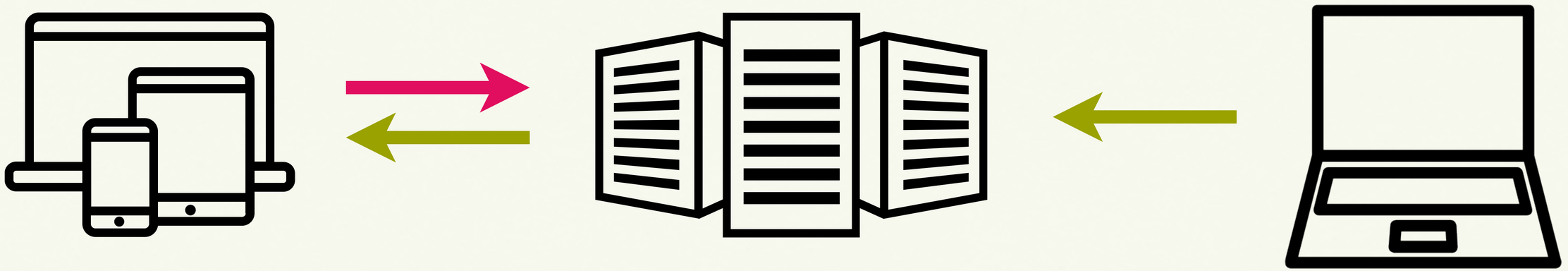
We shouldn’t experiment on critical projects.

We should consider going “static.”

Server-rendered



“Static” sites



JAM: JavaScript, APIS, and Markup

Reduce complexity

- Develop dependency awareness
- Reach for the right tools for the job
- Consider going “static”

Let’s rise to meet every moment.

- Plan for the worst
- Empower our customers, neighbors, constituents…
- Eliminate waste
- Reduce complexity

Thank you!

@AaronGustafson

aaron-gustafson.com
noti.st/aarongustafson

Questions?

Or tweet me: @AaronGustafson