



Progressive Web Apps

Declan Rek

WHAT IS A PWA

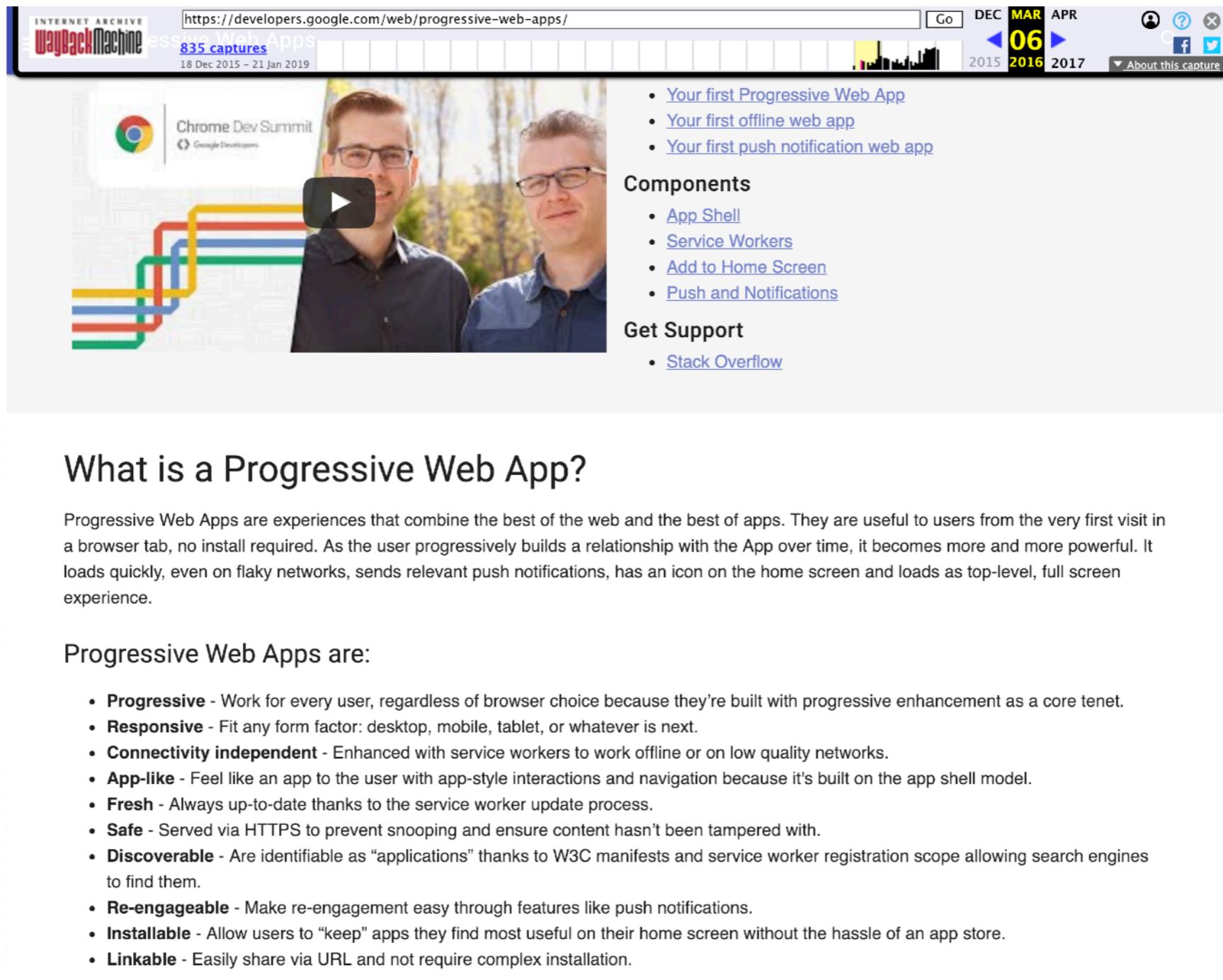


Reliable (network)

Fast (responsive, smooth)

Engaging (app-like)

2016



The screenshot shows a Wayback Machine capture of the Google Progressive Web Apps page. The URL is <https://developers.google.com/web/progressive-web-apps/>. The date is set to March 6, 2016. The page features a video player with two men in glasses, a Chrome Dev Summit logo, and a colorful pipe graphic. It includes sections for 'Components' (App Shell, Service Workers, Add to Home Screen, Push and Notifications) and 'Get Support' (Stack Overflow). A sidebar on the right shows a timeline from December 2015 to April 2017.

What is a Progressive Web App?

Progressive Web Apps are experiences that combine the best of the web and the best of apps. They are useful to users from the very first visit in a browser tab, no install required. As the user progressively builds a relationship with the App over time, it becomes more and more powerful. It loads quickly, even on flaky networks, sends relevant push notifications, has an icon on the home screen and loads as top-level, full screen experience.

Progressive Web Apps are:

- **Progressive** - Work for every user, regardless of browser choice because they're built with progressive enhancement as a core tenet.
- **Responsive** - Fit any form factor: desktop, mobile, tablet, or whatever is next.
- **Connectivity independent** - Enhanced with service workers to work offline or on low quality networks.
- **App-like** - Feel like an app to the user with app-style interactions and navigation because it's built on the app shell model.
- **Fresh** - Always up-to-date thanks to the service worker update process.
- **Safe** - Served via HTTPS to prevent snooping and ensure content hasn't been tampered with.
- **Discoverable** - Are identifiable as "applications" thanks to W3C manifests and service worker registration scope allowing search engines to find them.
- **Re-engageable** - Make re-engagement easy through features like push notifications.
- **Installable** - Allow users to "keep" apps they find most useful on their home screen without the hassle of an app store.
- **Linkable** - Easily share via URL and not require complex installation.

2016... LATER

The screenshot shows a Wayback Machine interface for the URL <https://developers.google.com/web/progressive-web-apps/>. The capture date is set to August 19, 2016. The page content includes a quote from Amar Nagaram: "that performs as well as our native app. We now feel we have the best of both worlds." Below the quote is a note from Amar Nagaram, an Engineering Director at Flipkart.



Instant Loading

Service workers allow your apps to load nearly instantly and reliably, no matter what kind of network connection your user is on.



Add to Home Screen

Web app install banners give you the ability to let your users quickly and seamlessly add your web app to their home screen, making it easy to launch and return to your app.



Push Notifications

Web push notifications makes it easy to re-engage with users by showing relevant, timely, and contextual notifications, even when the browser is closed.



Fast

Smooth animations, scrolling, and navigations keep the experience silky smooth.



Secure

HTTPS secures the connection between you and your users, ensuring your users information is protected and isn't tampered with.



Responsive

Modern users live on phones, tablets and laptops; your apps and websites should do the same. Learn how to structure and code your content to look great on screens of any size.

NOW



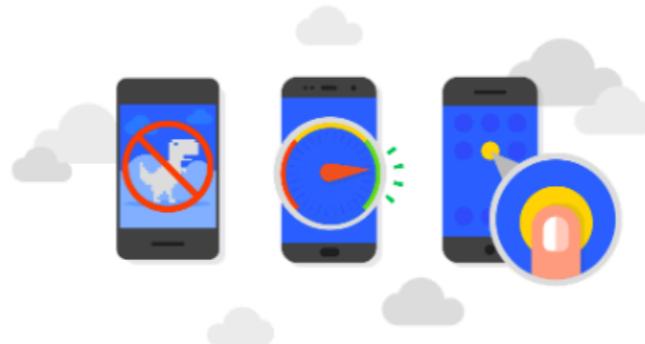
Progressive Web Apps

A new way to deliver amazing user experiences on the web.

Don't miss out on the action at this year's Chrome Dev Summit, [watch live now!](#)

Progressive Web Apps are user experiences that have the reach of the web, and are:

- **Reliable** - Load instantly and never show the downasaur, even in uncertain network conditions.
- **Fast** - Respond quickly to user interactions with silky smooth animations and no janky scrolling.
- **Engaging** - Feel like a natural app on the device, with an immersive user experience.

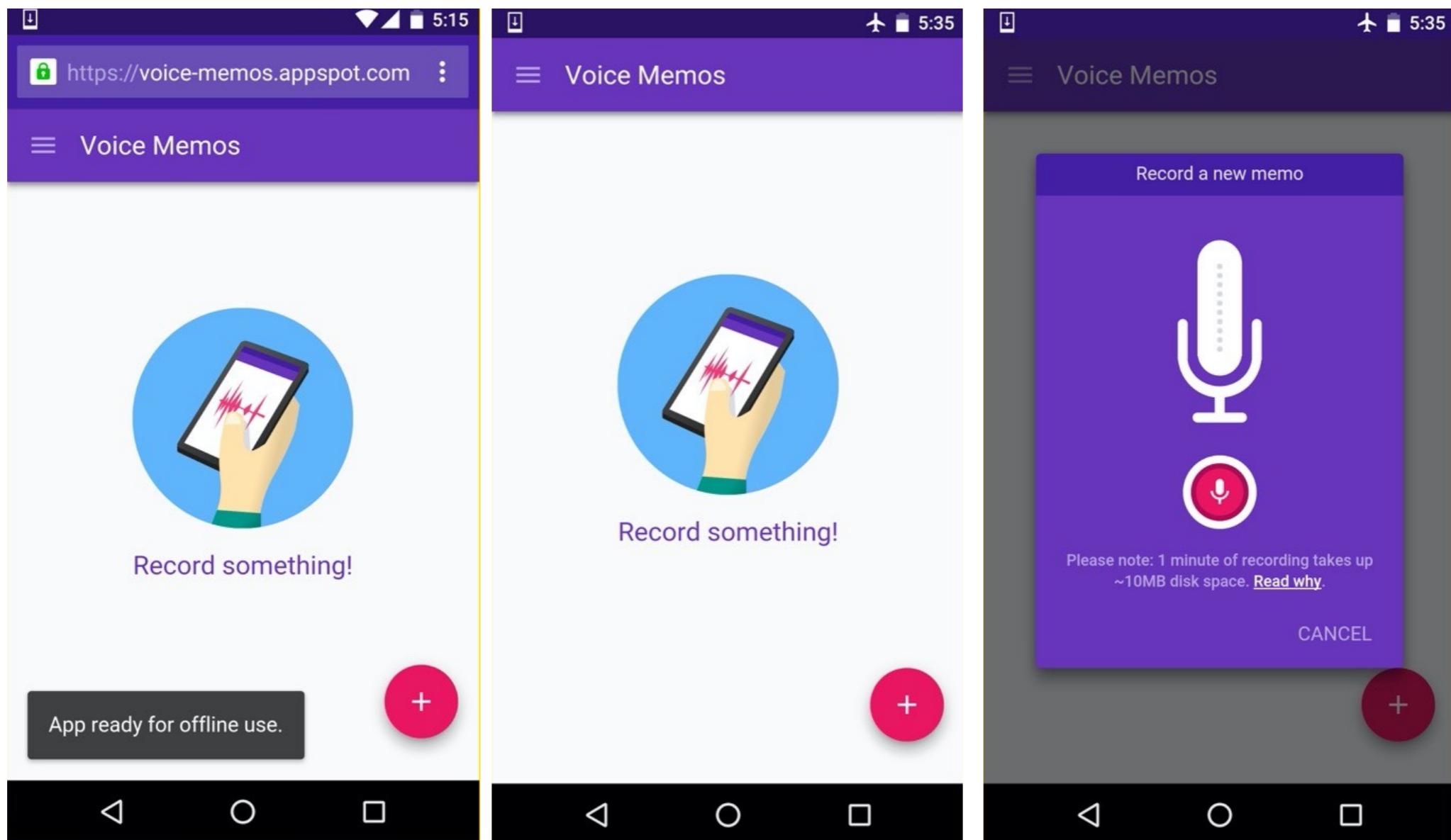


This new level of quality allows Progressive Web Apps to earn a place on the users home screen.

Progressive Web Apps are great
user experiences that have
the reach of the web

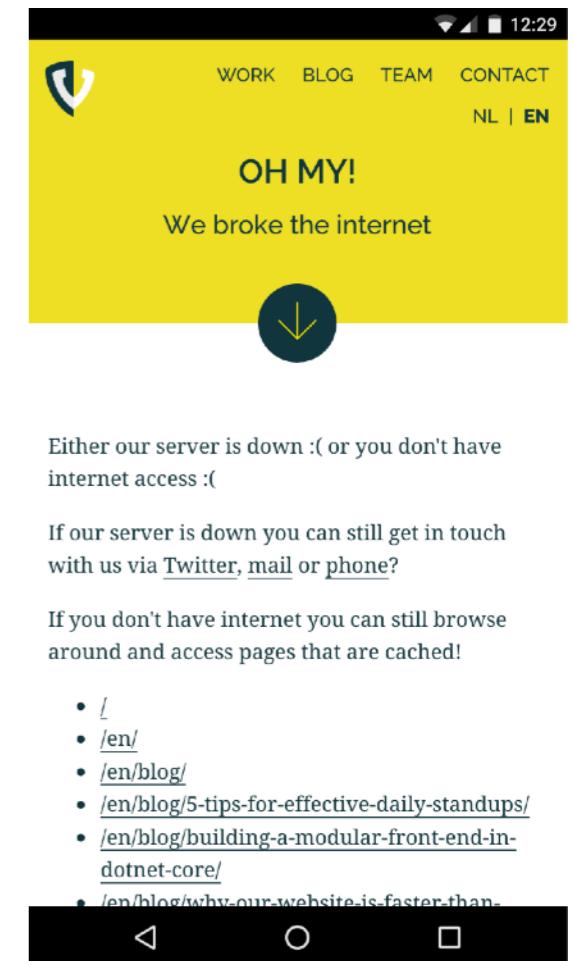
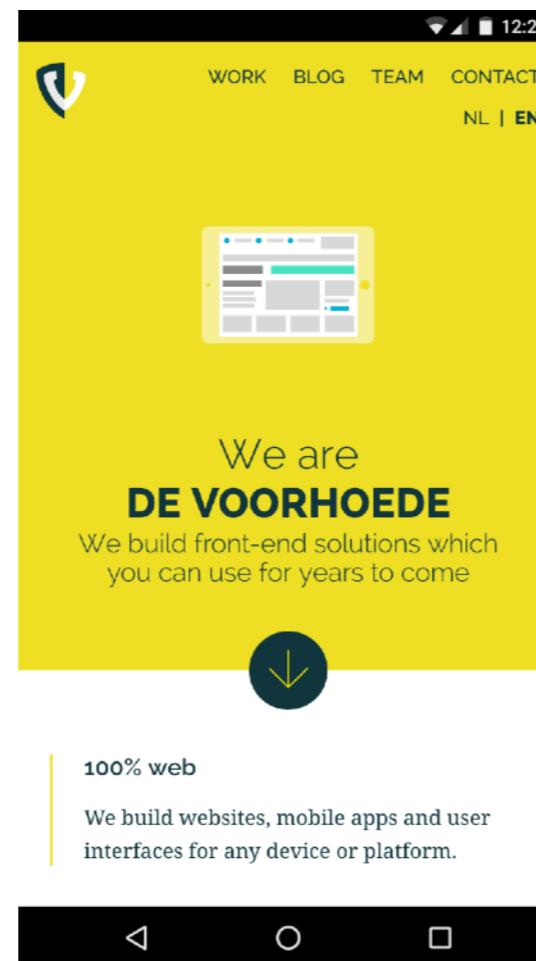
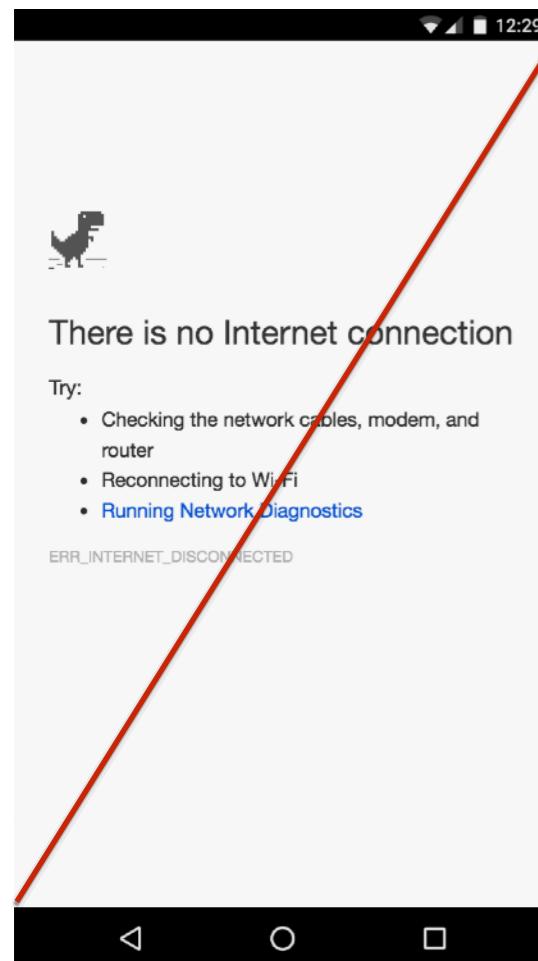
**HTTPS
Service worker
Manifest file**

OFFLINE SUPPORT



developers.google.com/web

OFFLINE SUPPORT



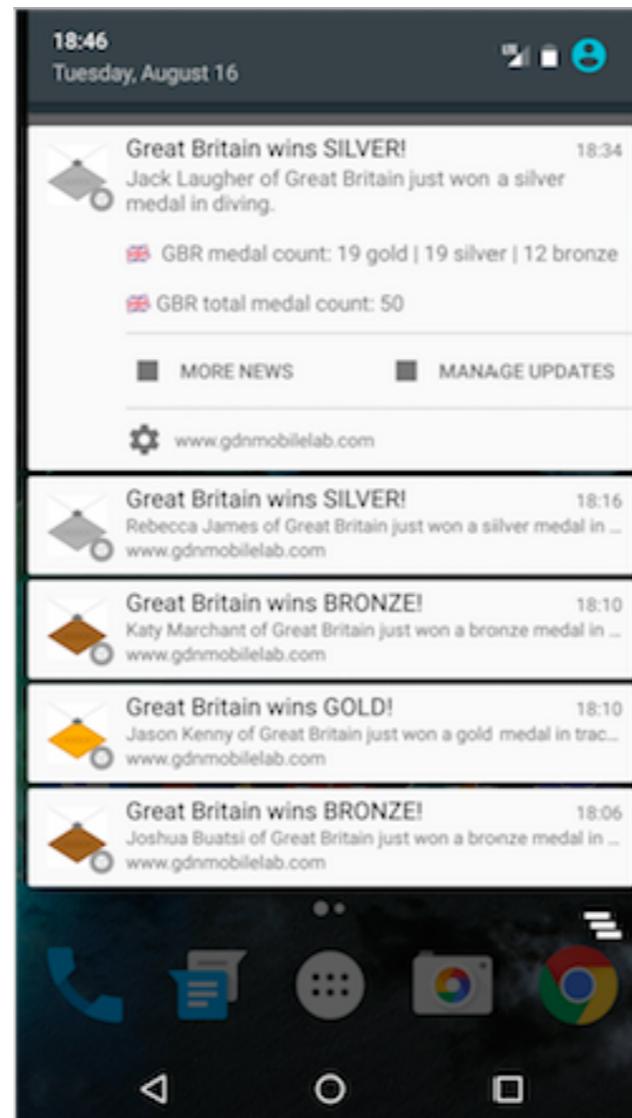
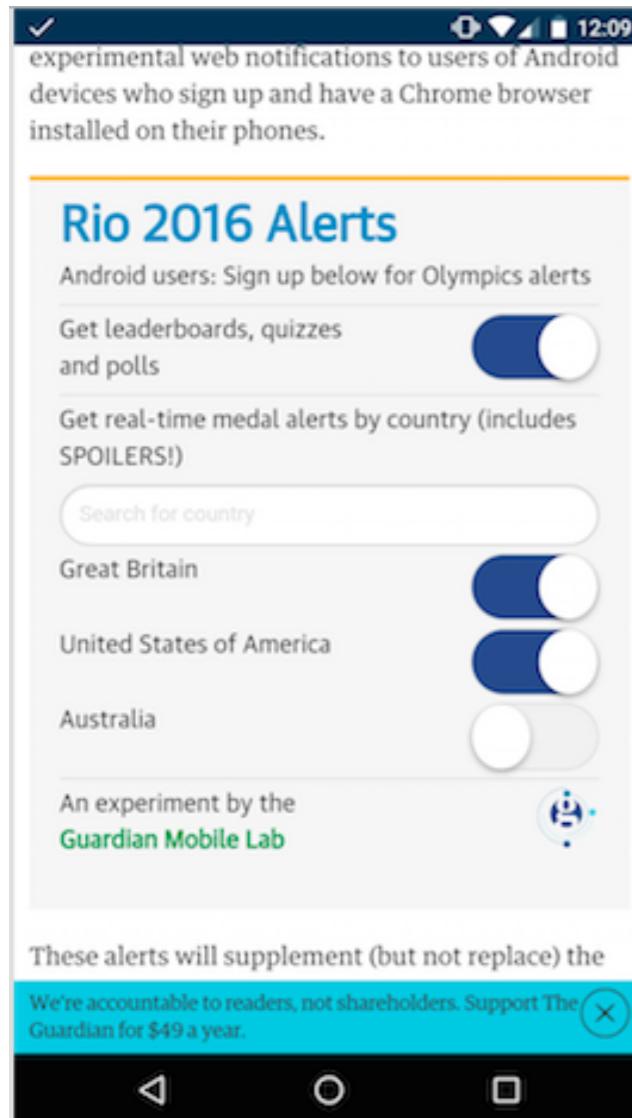
OFFLINE SUPPORT

The screenshot shows a web browser window with the following details:

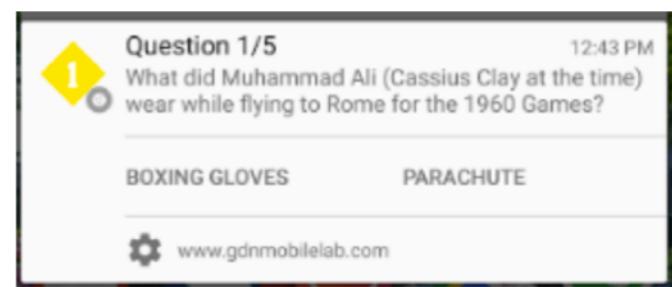
- Address Bar:** https://www.theguardian.com/info#1-across
- User Interface:** The page is in dark mode. Navigation includes "Person 1" (top right), back/forward buttons, and a search bar.
- Header:** "the guardian" logo, "free become a member", "sign in", "search", "jobs", "more", "UK edition".
- Breadcrumbs:** home > home
- Section:** UK world politics sport football opinion culture business
- Content:** A large heading "Unable to connect to the Internet" followed by the text "In the meantime, how about a quick crossword?".
- Section-Header:** Quick crossword No 14,188
- Crossword Grid:** A 10x10 grid with some letters filled in:
 - Row 1: A, L, B, I, O, N, (empty), (empty), (empty), (empty)
 - Row 2: (empty), (empty), I, (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 3: (empty), (empty), N, (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 4: (empty), (empty), C, (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 5: (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 6: (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 7: (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 8: (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 9: (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty)
 - Row 10: (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty), (empty)
- Clues:** Across:
 - 1 Poetic name for Britain (6)
 - 4 Unpowered aircraft (6)
 - 9 British royal house from 1714 (7)

smashingmagazine.com/2016/08/a-beginners-guide-to-progressive-web-apps/

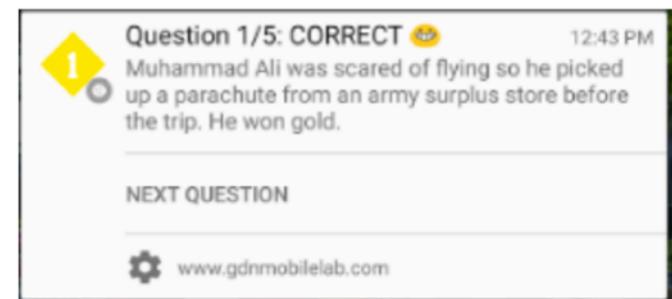
PUSH NOTIFICATIONS



Users tapped the action button to start the quiz



Users tapped on the action button with their answer



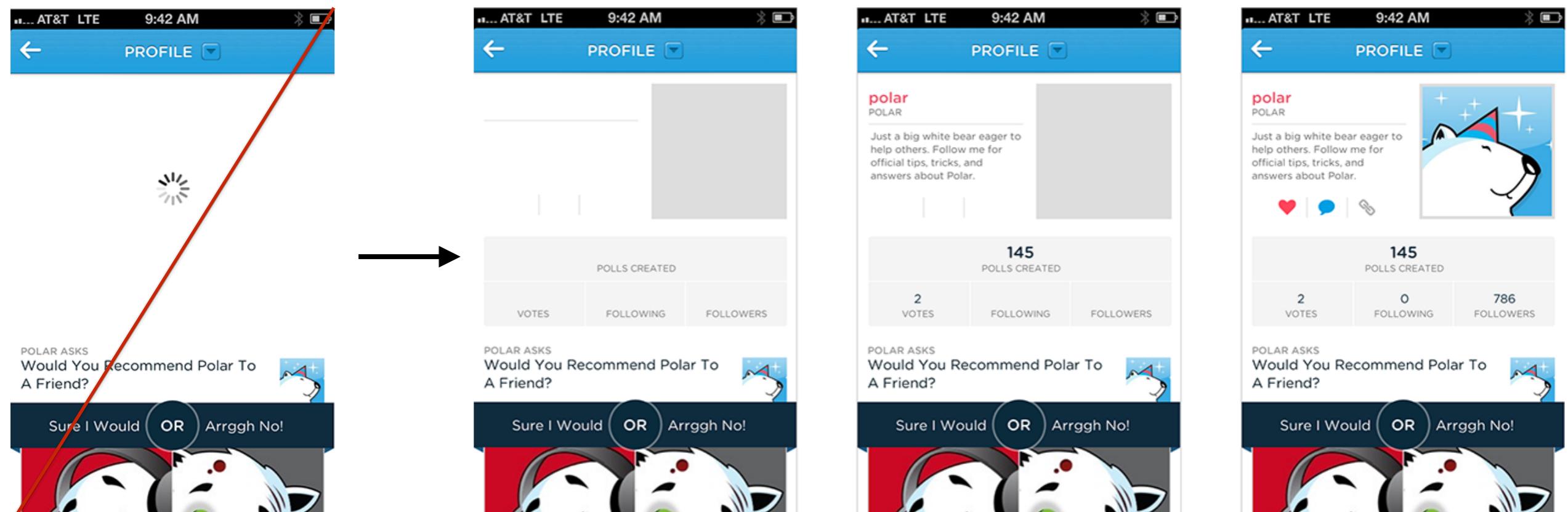
The answer was revealed before going to the next question

medium.com/the-guardian-mobile-innovation-lab/

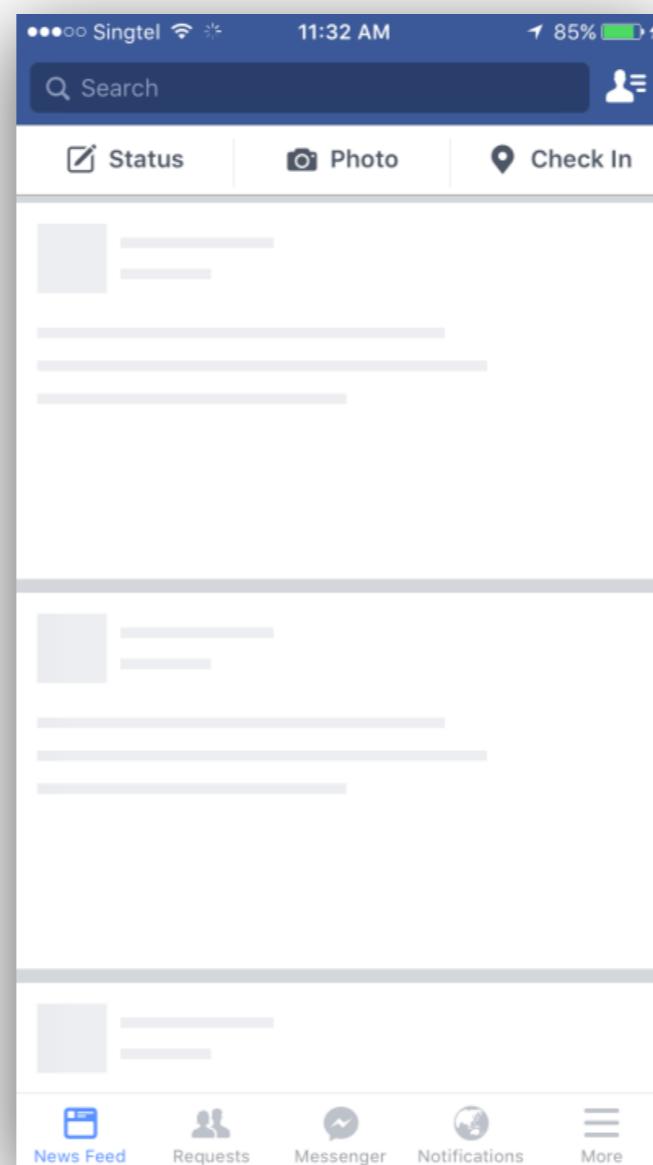
APP UX PATTERNS



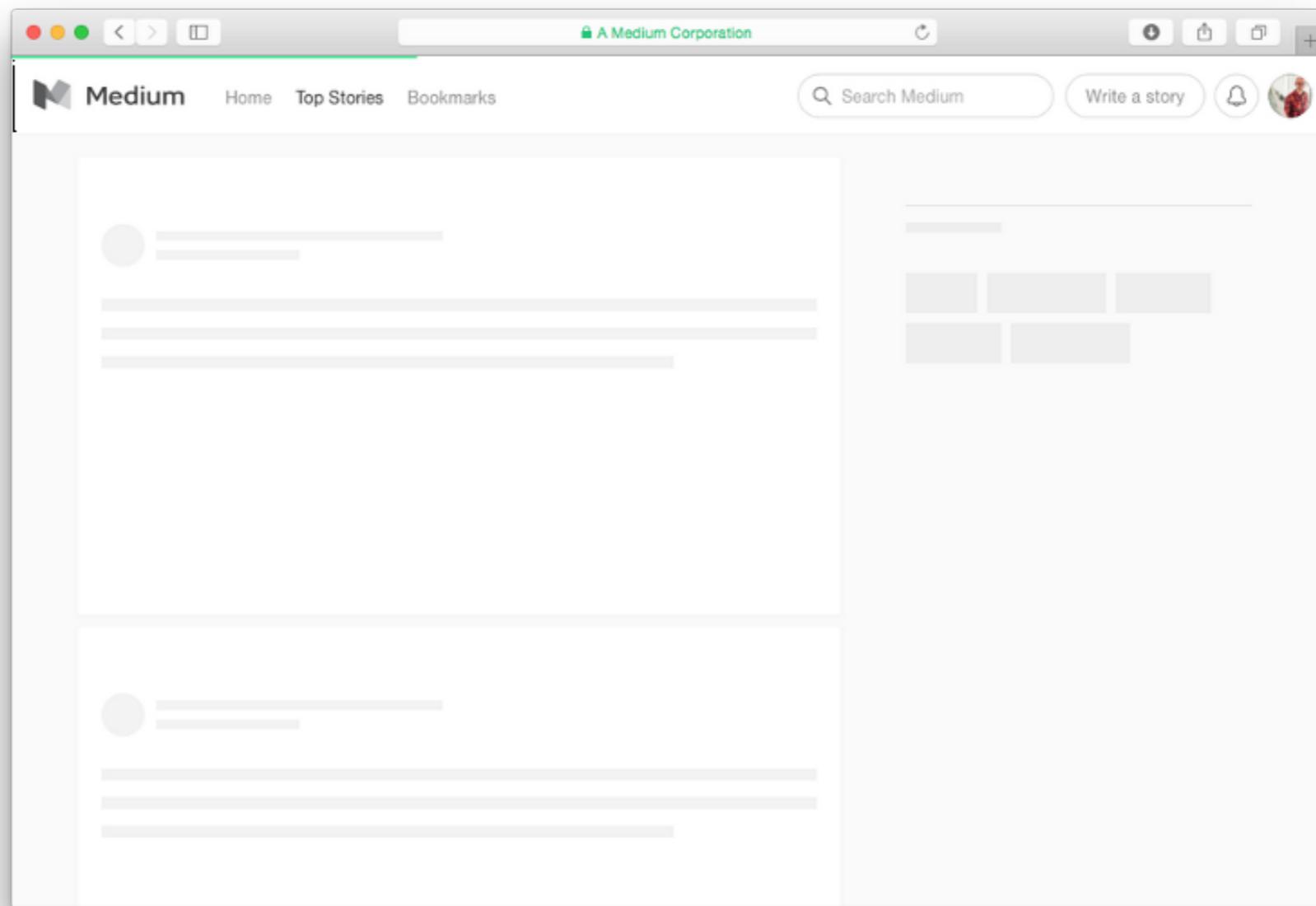
APPY SKELETON SCREENS



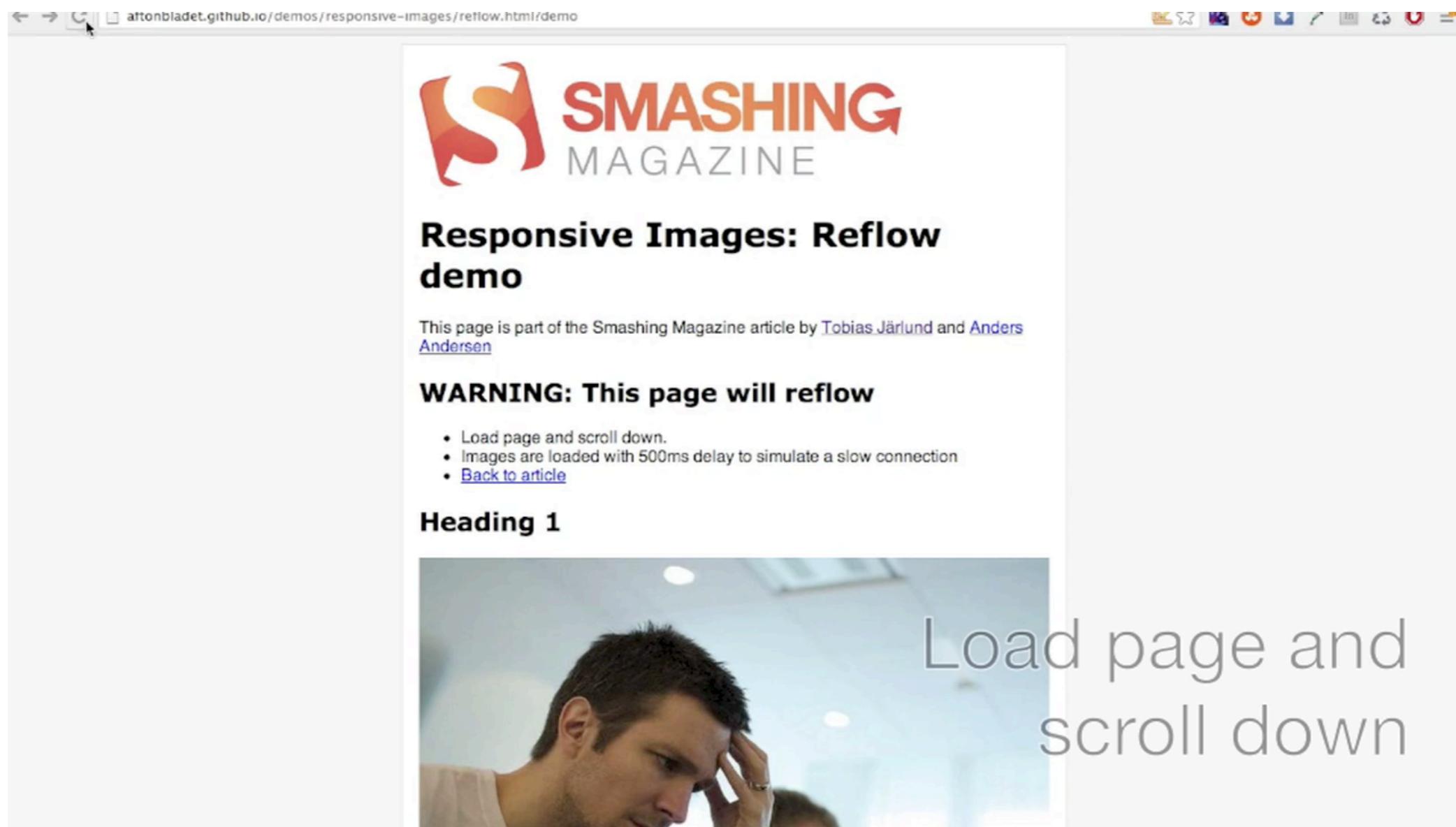
APPY SKELETON SCREENS



APPY SKELETON SCREENS



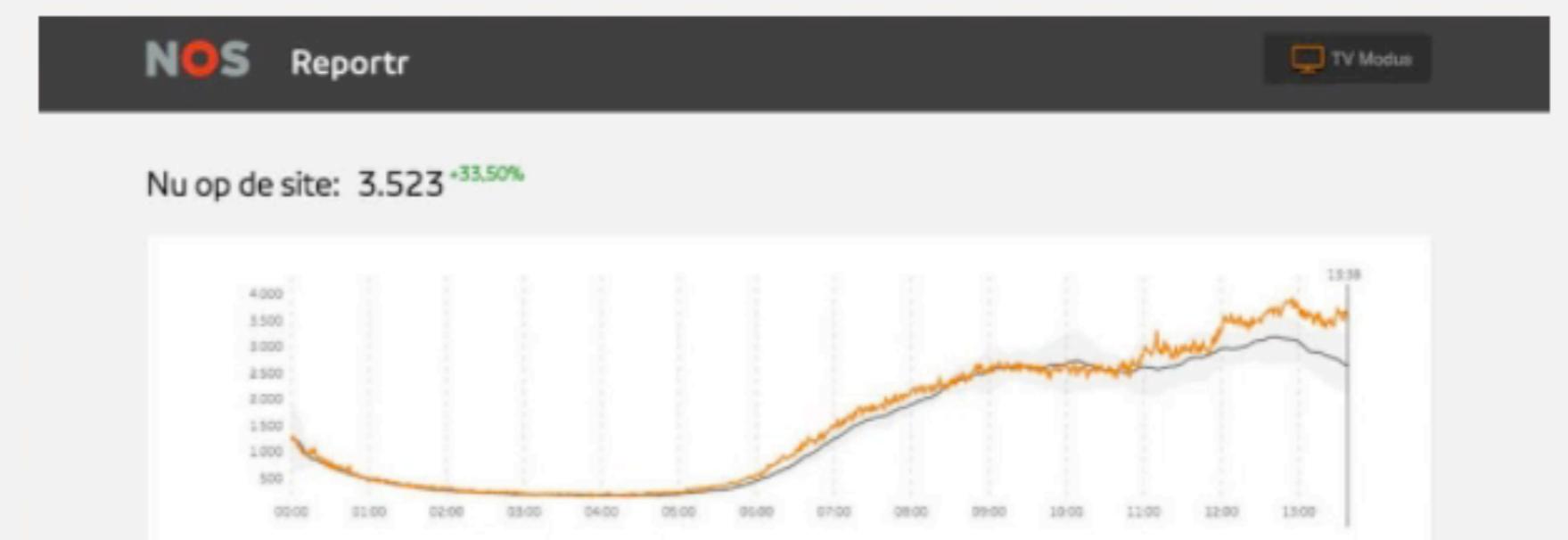
NON APPY REFLOWS



smashingmagazine.com/2013/09/responsive-images-performance-problem-case-study

FIXED RATIO IMAGES

Text above image.



Text below image.

Fixed image *ratio* prevent text reflow.

[Jasper says no to image reflow](#)

PLACEHOLDER COLORS

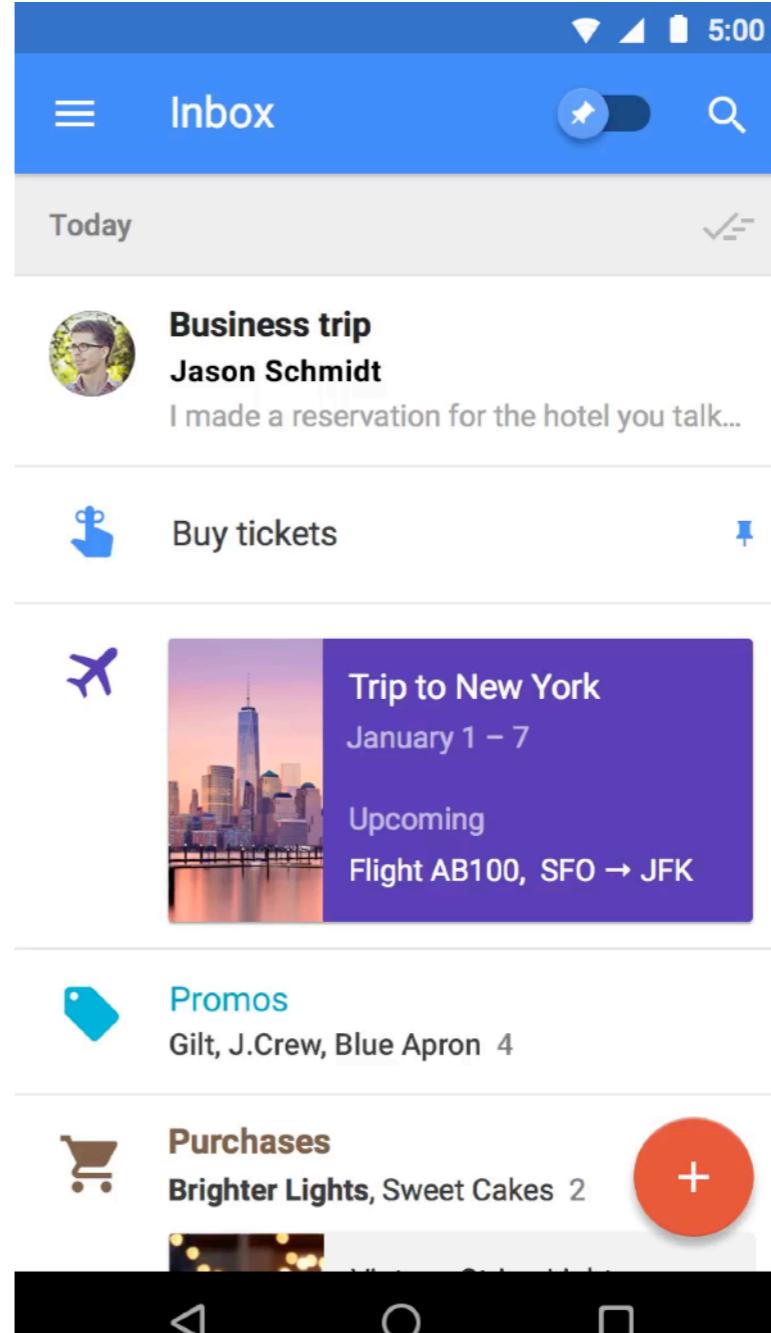
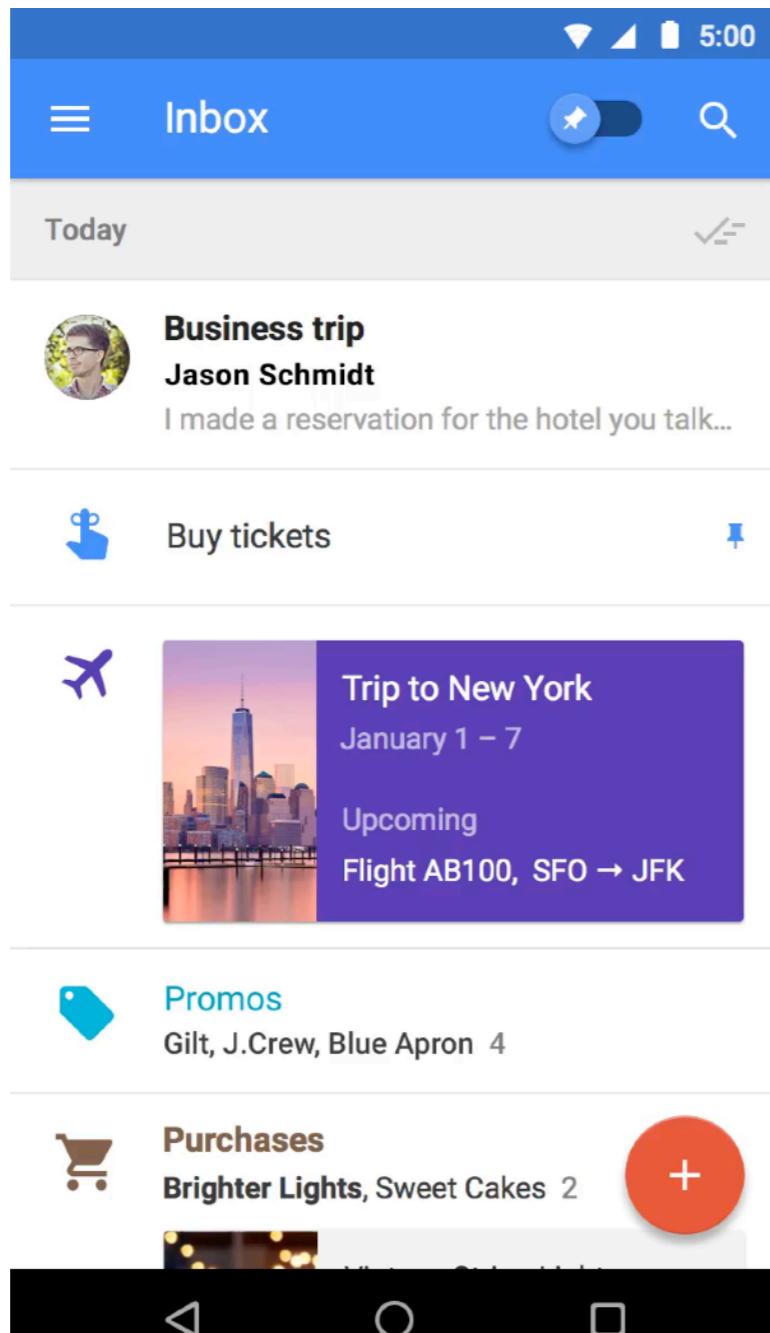
[A random Google images search](#)

PLACEHOLDER IMAGES

PLACEHOLDER IMAGES



[How to use SVG as a Placeholder, and Other Image Loading Techniques](#)



Motion material

SYSTEM FONTS

The quick brown fox jumps over the lazy dog.

Fira Sans Firefox OS

The quick brown fox jumps over the lazy dog.

Roboto Android and Chrome OS

The quick brown fox jumps over the lazy dog.

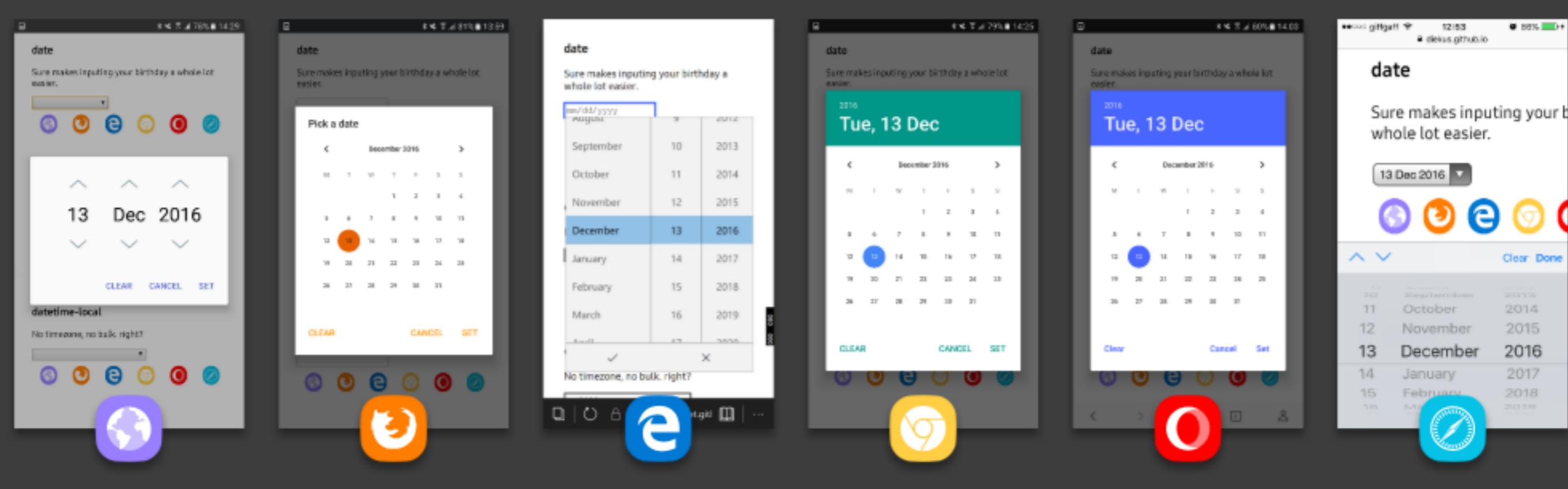
San Francisco iOS and Mac OS

The quick brown fox jumps over the lazy dog.

Segoe UI Windows and Windows Phone

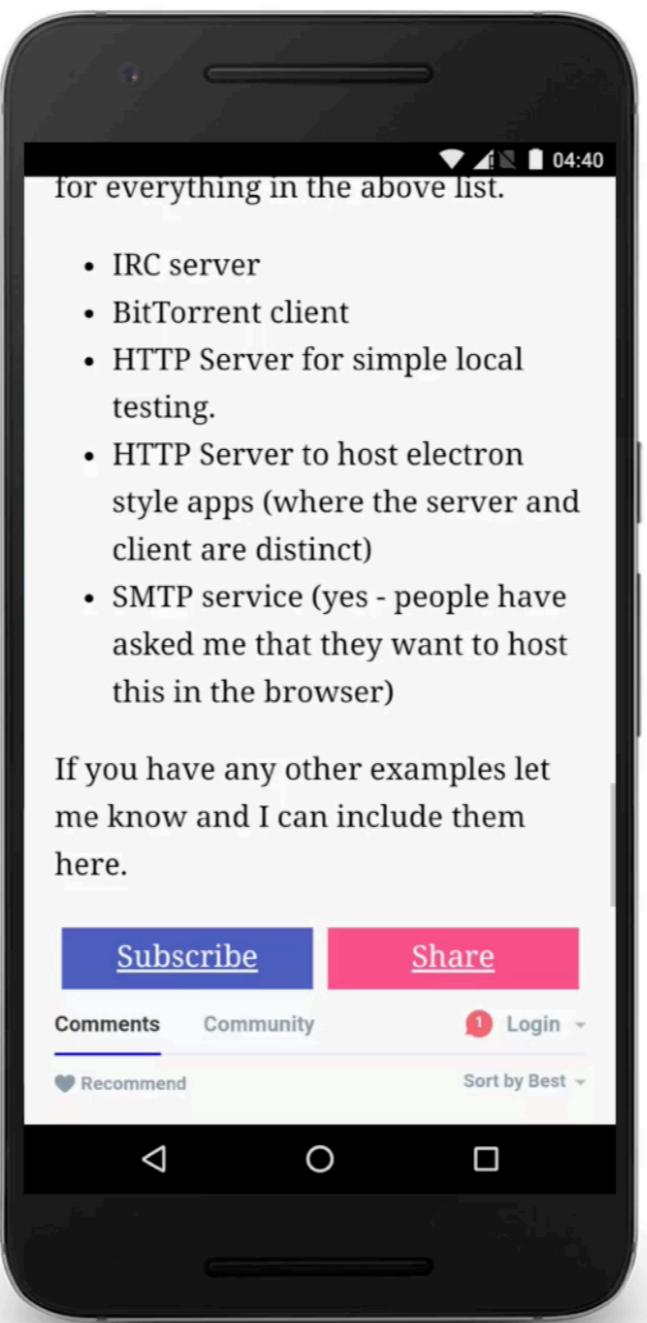


NATIVE INPUT TYPES



Making input type=date complicated - Peter Paul Koch

NATIVE SHARE



paul.kinlan.me/navigator.share

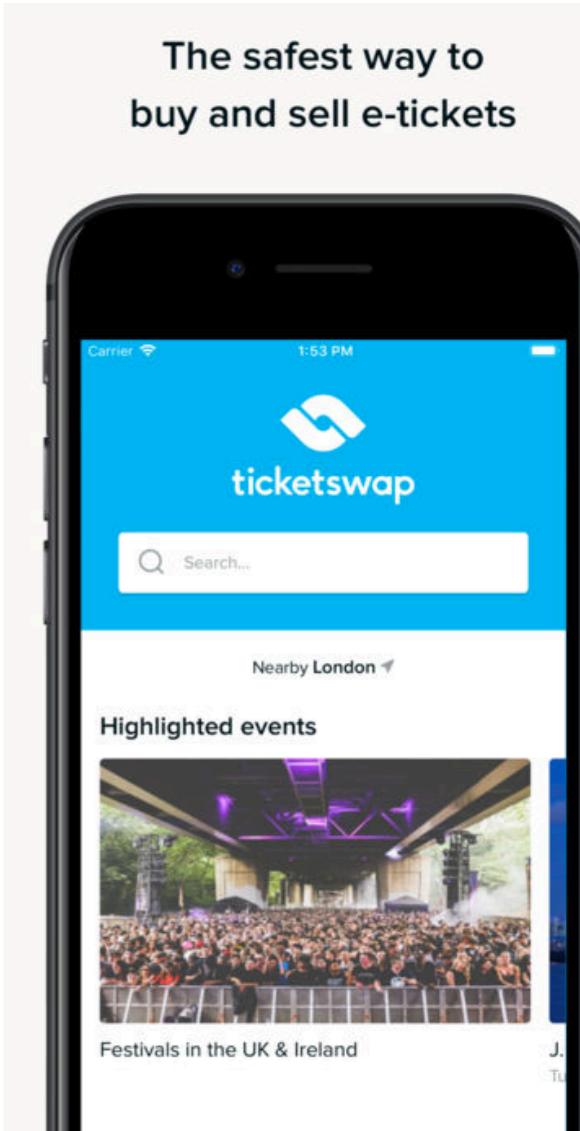
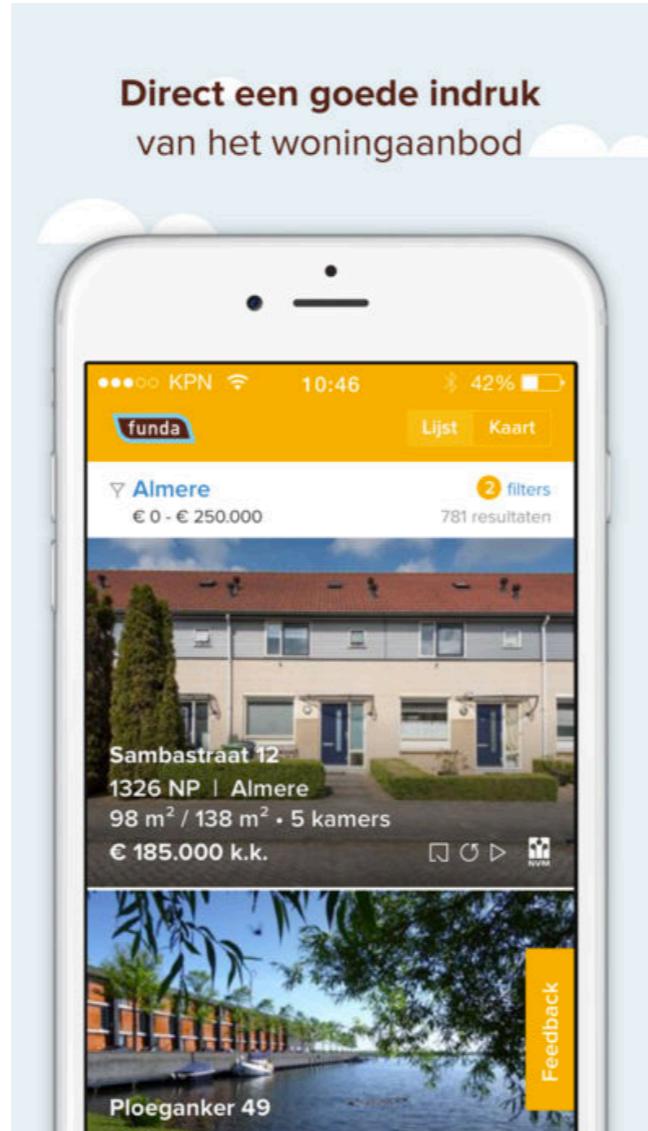
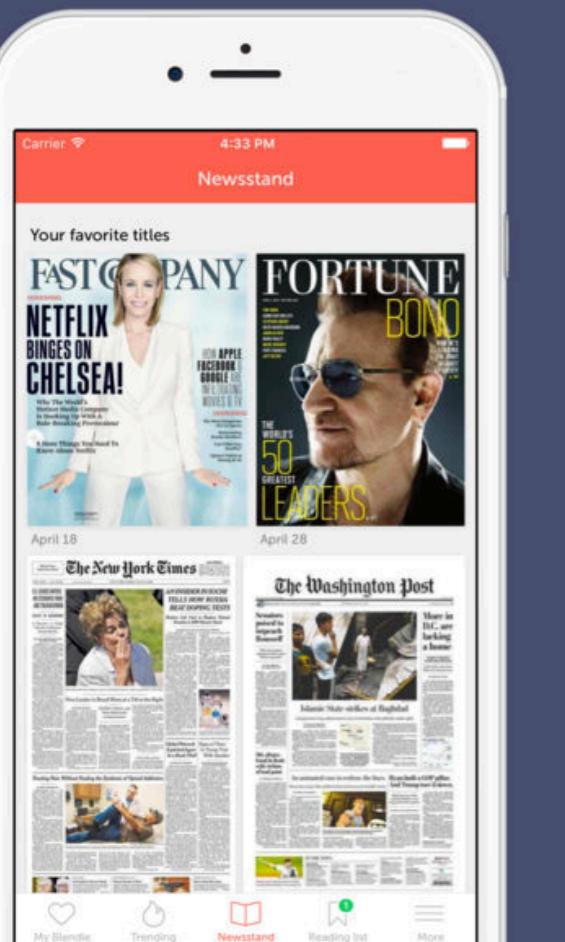
WHY PWA



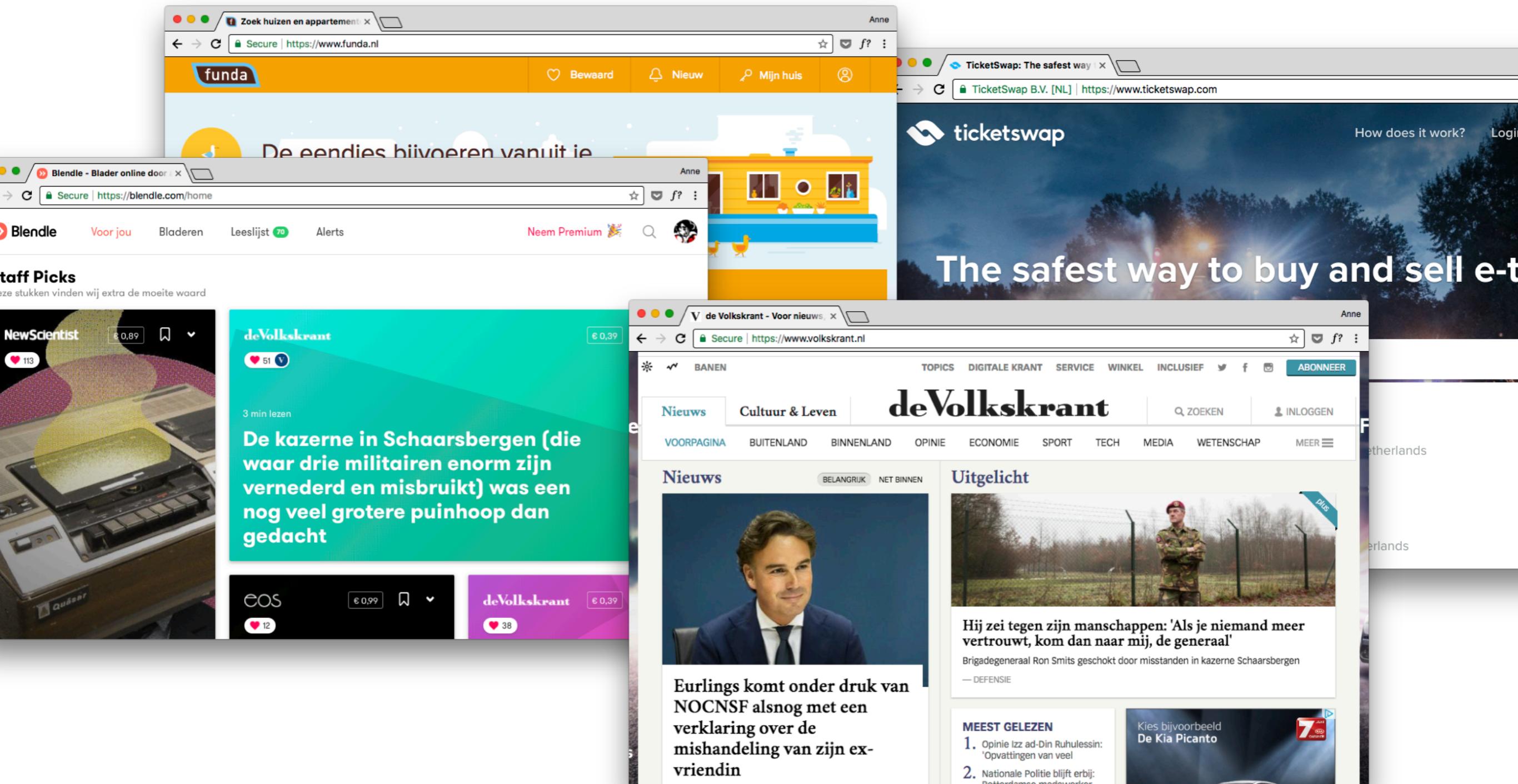
The web won on desktop

APPS ON MOBILE

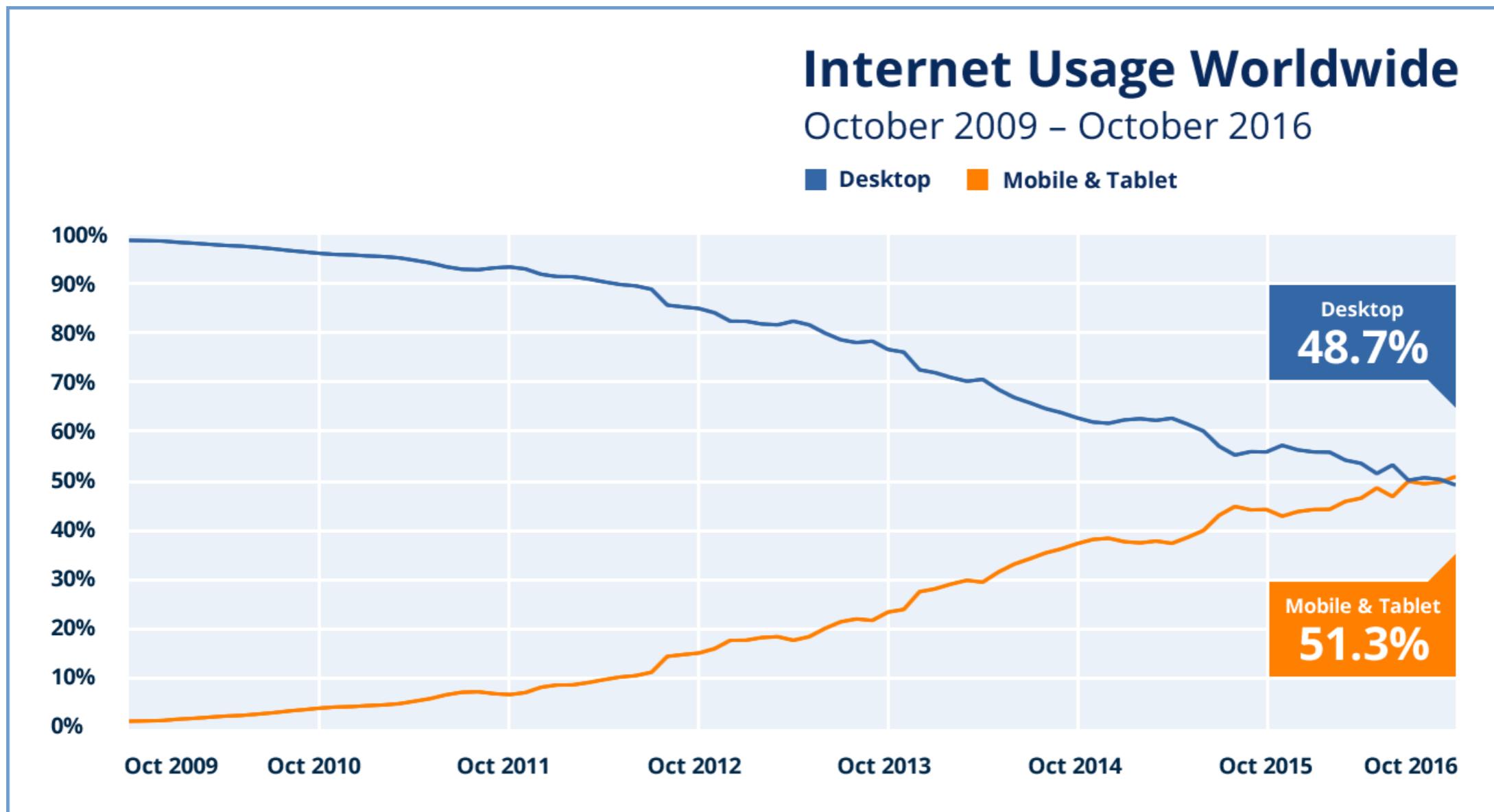
The best newspapers and magazines,
in your pocket.



SITES ON DESKTOP

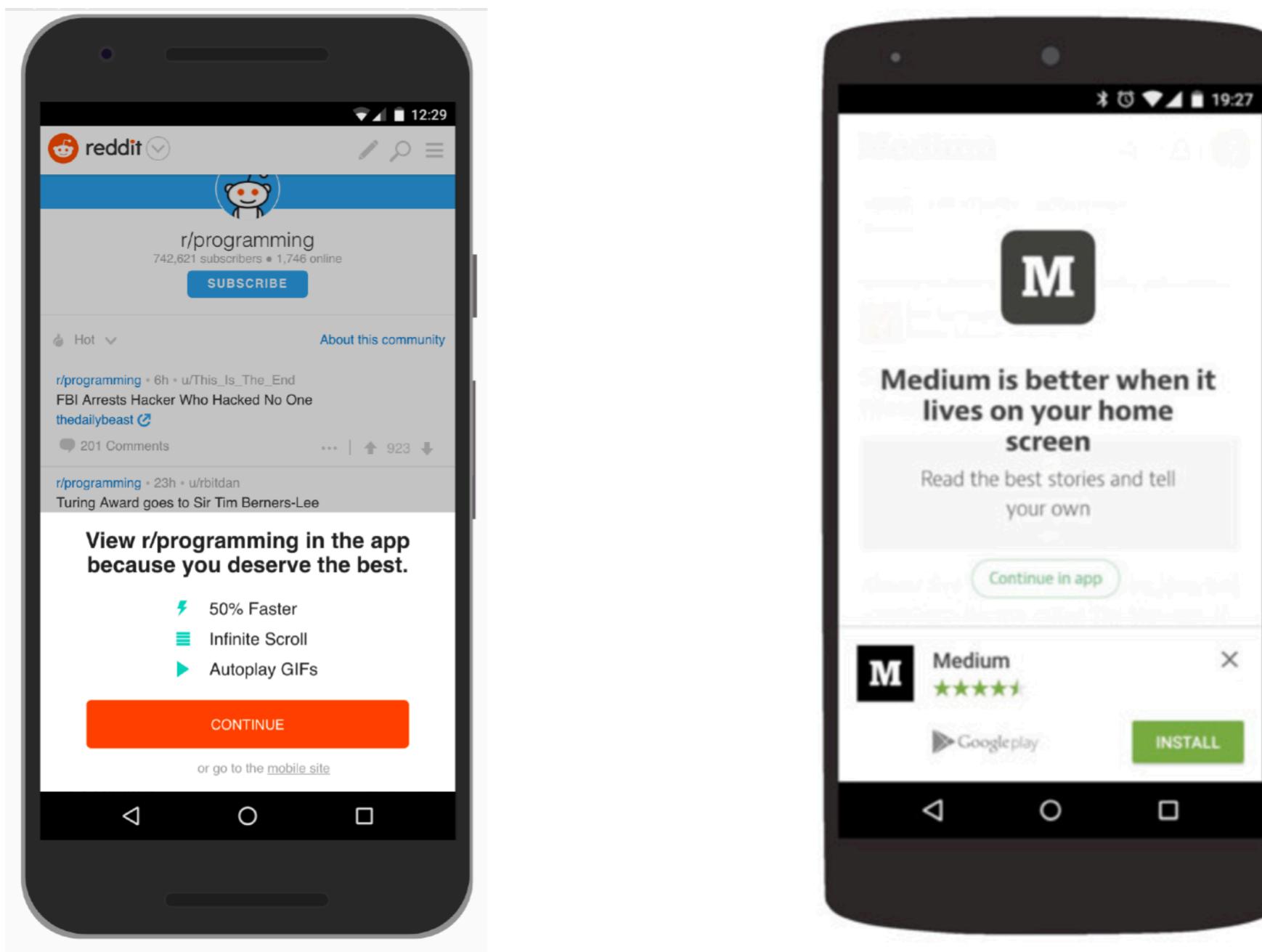


IN THE MEANTIME



Mobile and tablet internet usage exceeds desktop for first time worldwide

“DON’T USE ME”

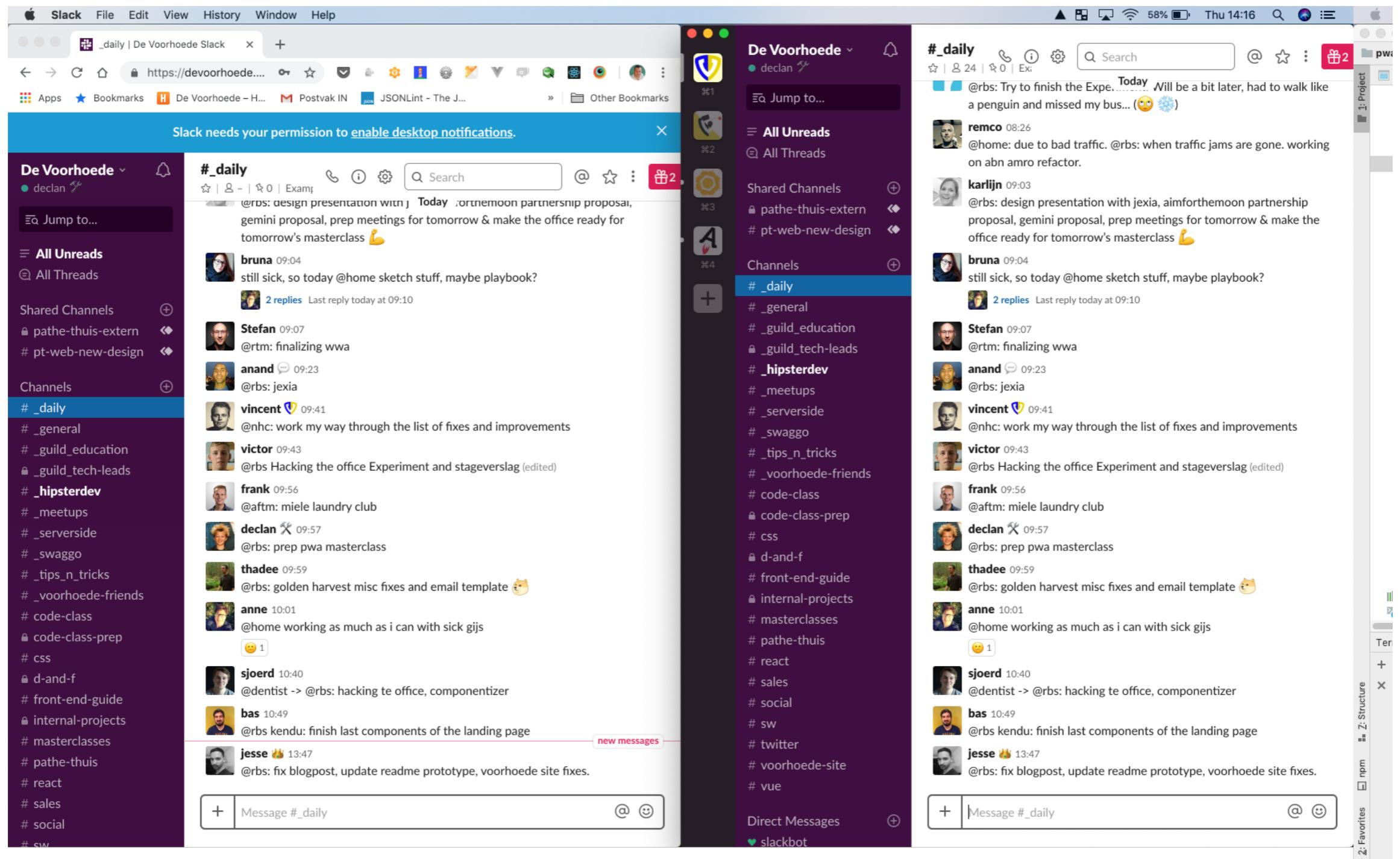


WEB APPS ON MOBILE



Jobs' original vision for the iPhone: No third-party native apps

DESKTOP APPS



My apps

Shop

Games

Family

Editors' Choice

Account

Payment methods

My subscriptions

Redeem

Buy gift card

My wishlist

My Play activity

Parent Guide



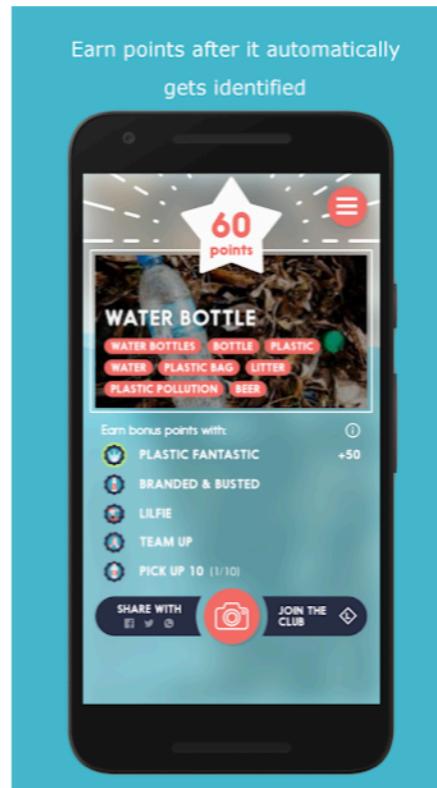
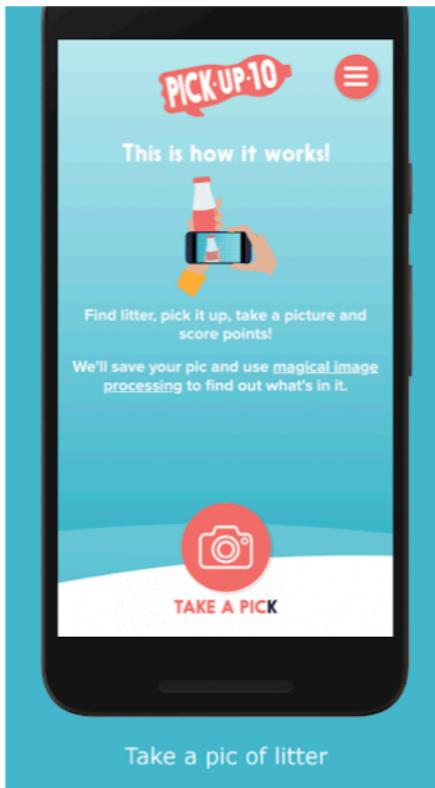
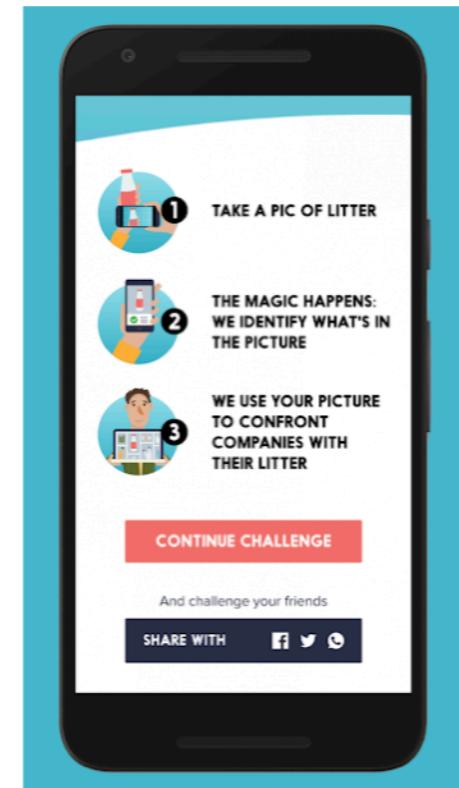
Pick Up 10

De Voorhoede • Lifestyle

3 PEGI 3

This app is compatible with your device.

Installed

The state of installability - Declan Rek

[Startpagina](#) Games Entertainment Productiviteit Deals

Search



44



This product is installed.

[Launch](#)

Pick Up 10

Free

De Voorhoede • Lifestyle

[Share](#) [Wish list](#)

Plastic litter turns into plastic soup and threatens our oceans. The good news: continuing his fight for a plastic-free ocean, this summer the Plastic Soup Surfer will go adventuring with his 3D-printed foil SUP board made of recycled plastic. And you can help! The Plastic Soup Surfer invites everyone to join in his "Pick Up 10" campaign. You pick up

[More](#)

PEGI 3



Type here to search

14:07
17/01/2020 ENGThe state of installability - Declan Rek

Deze app is alleen beschikbaar in de App Store voor iPhone en iPad.



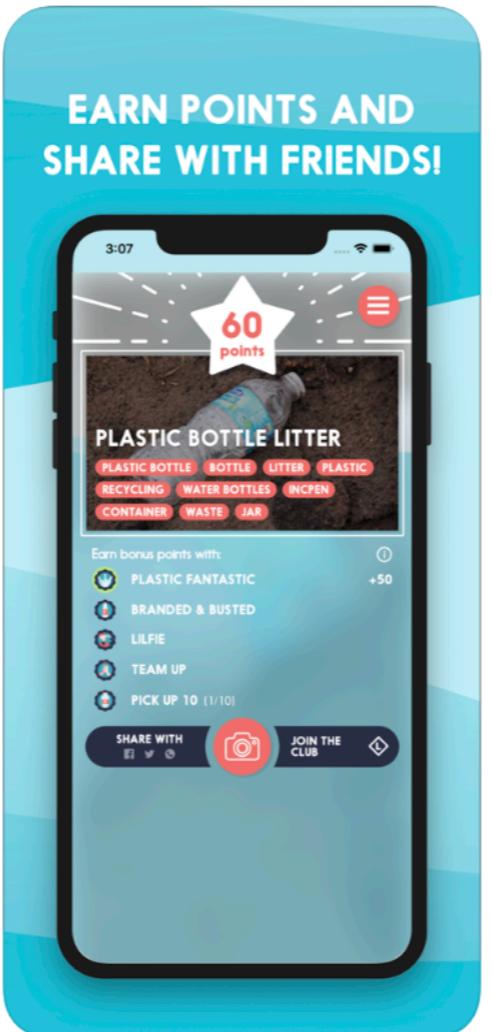
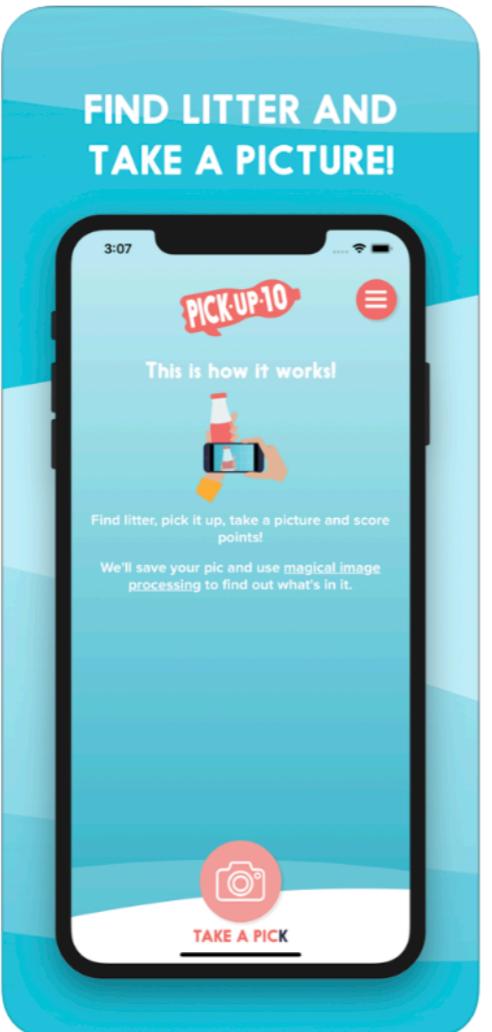
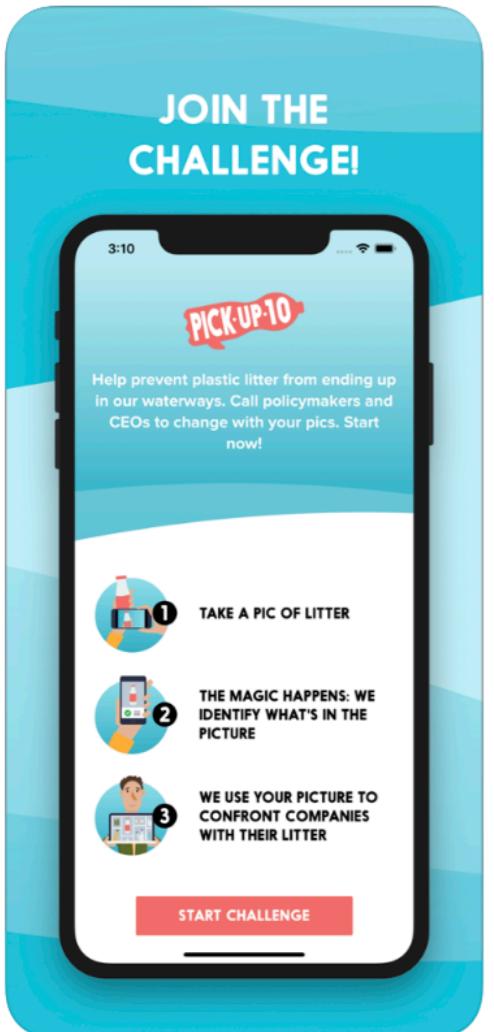
Pick Up 10 4+

De Voorhoede B.V.

★★★★★ 5,0, 1 beoordeling

Gratis

iPhone-schermafbeeldingen



The state of installability - Declan Rek

PWA Stats

A community-driven list of stats and news related to [Progressive Web Apps](#)
brought to you by  [Cloud Four](#)

Treebo launched a PWA and saw a **4x** increase in conversion rate year-over-year. Conversion rates for repeat users saw a **3x** increase and their median interactive time on mobile dropped to **1.5s.**



#Conversions #Offline #Performance
#Service Worker #Travel



The **Best Western River North Hotel** sees **300%** increase in revenue with new Progressive Web App.



#Conversions #Home Screen #Offline
#Service Worker #Travel



OpenSooq's new PWA is only **28.3KB** and has improved engagement with a **25%** increase in average time on page resulting in **260%** more leads.



#App Shell #Classified #Engagement
#Home Screen #Notifications
#Service Worker



Petlove's PWA resulted in a **2.8x** increase in conversion and a **2.8x** increase in time spent on site. Using simplified signup and auto sign back in, **2x** more users go to checkout already signed in.



#Conversions #Credential Management

Grand Velas Riviera Maya resort increased its Black Friday conversion rate by **53%** due to its progressive web app's speed and notifications.



Tinder cut load times from 11.91 seconds to **4.69 seconds** with their new PWA. The PWA is **90%** smaller than Tinder's native Android app. User engagement is up across the board on the PWA.



#Conversions #Credential Management

PINTEREST CASE STUDY

Comparing old mobile web to new mobile web



Time Spent > 5 minutes	User-generated Ad \$	Ad Clickthroughs	Core Engagements
+40%	+44%	+50%	+60%

Comparing across web/native

Time Spent > 5 minutes	User-generated Ad \$	Ad Clickthroughs	Core Engagements
+5%	+2%	+0%	+2-3%

A Pinterest Progressive Web App Performance Case Study

MANIFEST.JSON



LOAD MANIFEST

```
<link rel="manifest" href="/manifest.json">
```

MANIFEST.JSON

```
{  
  "name": "Websap! Chat on the web!",  
  "short_name": "Websap!",  
  "theme_color": "#1a4e57",  
  "background_color": "#1a4e57",  
  "display": "standalone",  
  "orientation": "portrait",  
  "start_url": "/?homescreen=true",  
  "icons": [  
    {  
      "src": "/assets/images/icon-72x72.png",  
      "sizes": "72x72",  
      "type": "image/png"  
    },  
    {  
      "src": "/assets/images/icon-96x96.png",  
      "sizes": "96x96",  
      "type": "image/png"  
    }]
```

```
{  
    "src": "/assets/images/icon-152x152.png",  
    "sizes": "152x152",  
},  
MANIFEST.JSON  
,  
{  
    "src": "/assets/images/icon-192x192.png",  
    "sizes": "192x192",  
    "type": "image/png"  
},  
{  
    "src": "/assets/images/icon-384x384.png",  
    "sizes": "384x384",  
    "type": "image/png"  
},  
{  
    "src": "/assets/images/icon-512x512.png",  
    "sizes": "512x512",  
    "type": "image/png"  
}  
]  
}
```

SERVICE WORKER



SERVICE WORKER

JavaScript

Web worker

Runs in the background

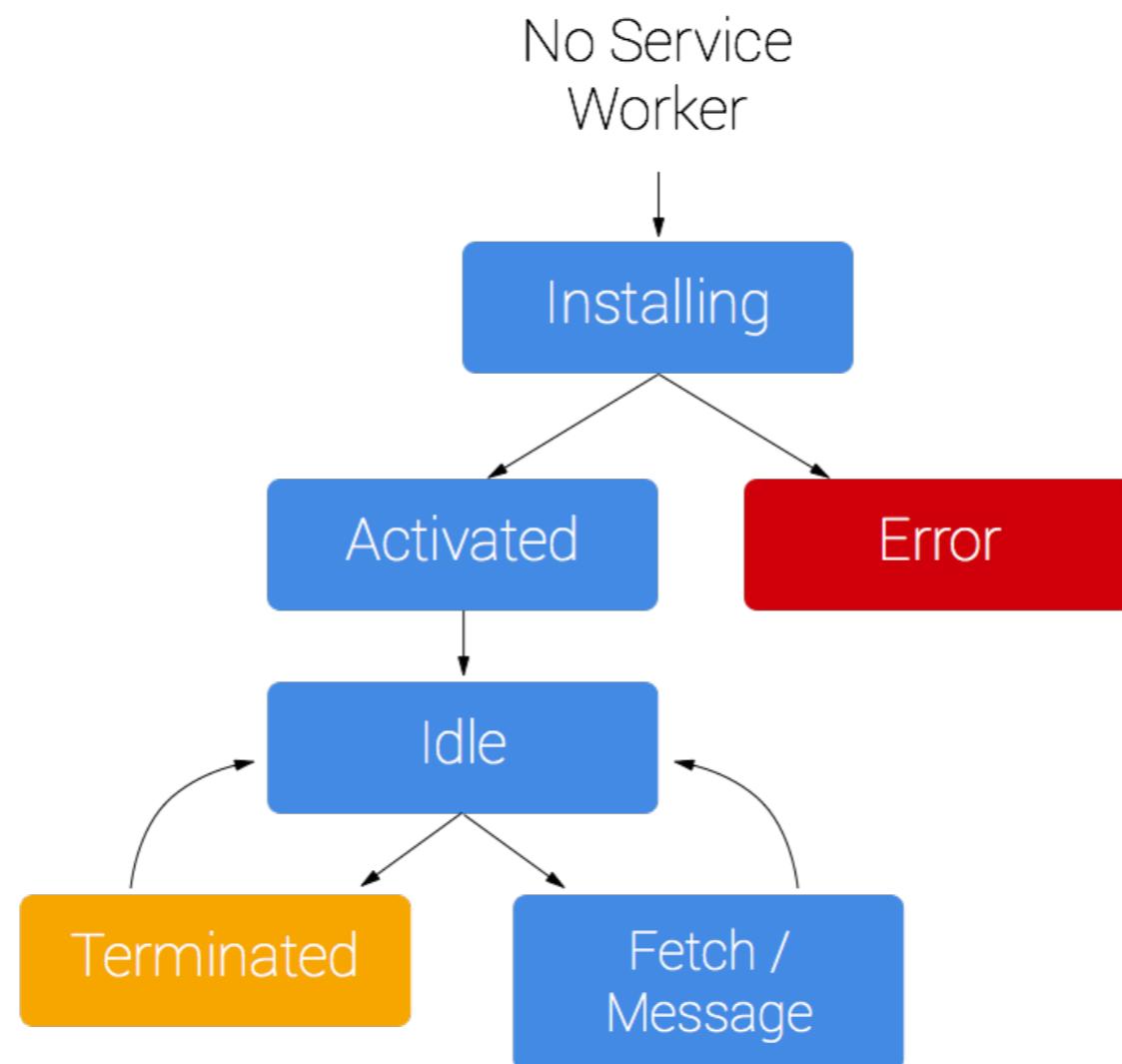
Separate thread

Promises

No access to DOM

No global state

SERVICE WORKER



developers.google.com/web/fundamentals/primers/service-workers

REGISTER SW

```
if ('serviceWorker' in navigator) {  
  window.addEventListener('load', function() {  
    navigator.serviceWorker.register('/service-worker.js')  
      .then(function(registration) {  
        return registration.update();  
      })  
  }) ;  
}
```

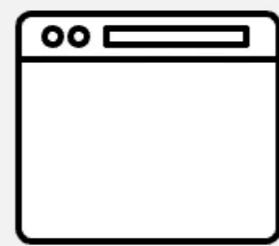
SERVICE WORKER WORKS?

```
self.addEventListener('install', event => {  
    // do I even exist?  
});
```

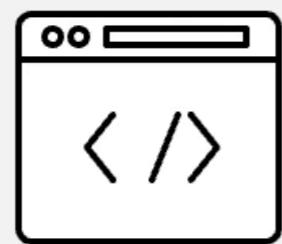
```
self.addEventListener('activate', event => {  
    // am I even active?  
});
```

```
self.addEventListener('fetch', event => {  
    // can I even do cool stuff?  
});
```

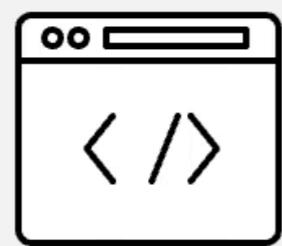
INITIAL PAGE LOAD



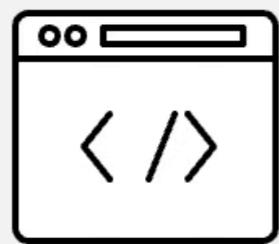
REGISTER SERVICE WORKER



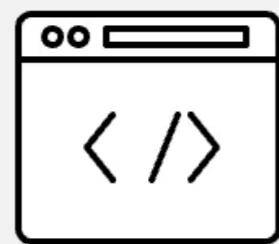
SERVICE WORKER AS PROXY



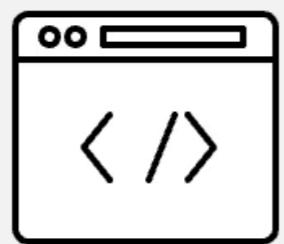
HIJACK FETCH



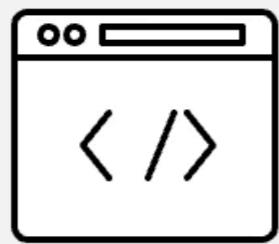
CACHE ON INSTALL



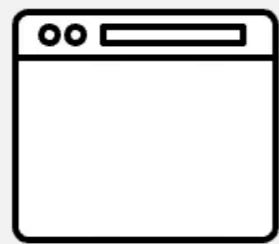
CACHE ON FETCH



SERVE FROM CACHE



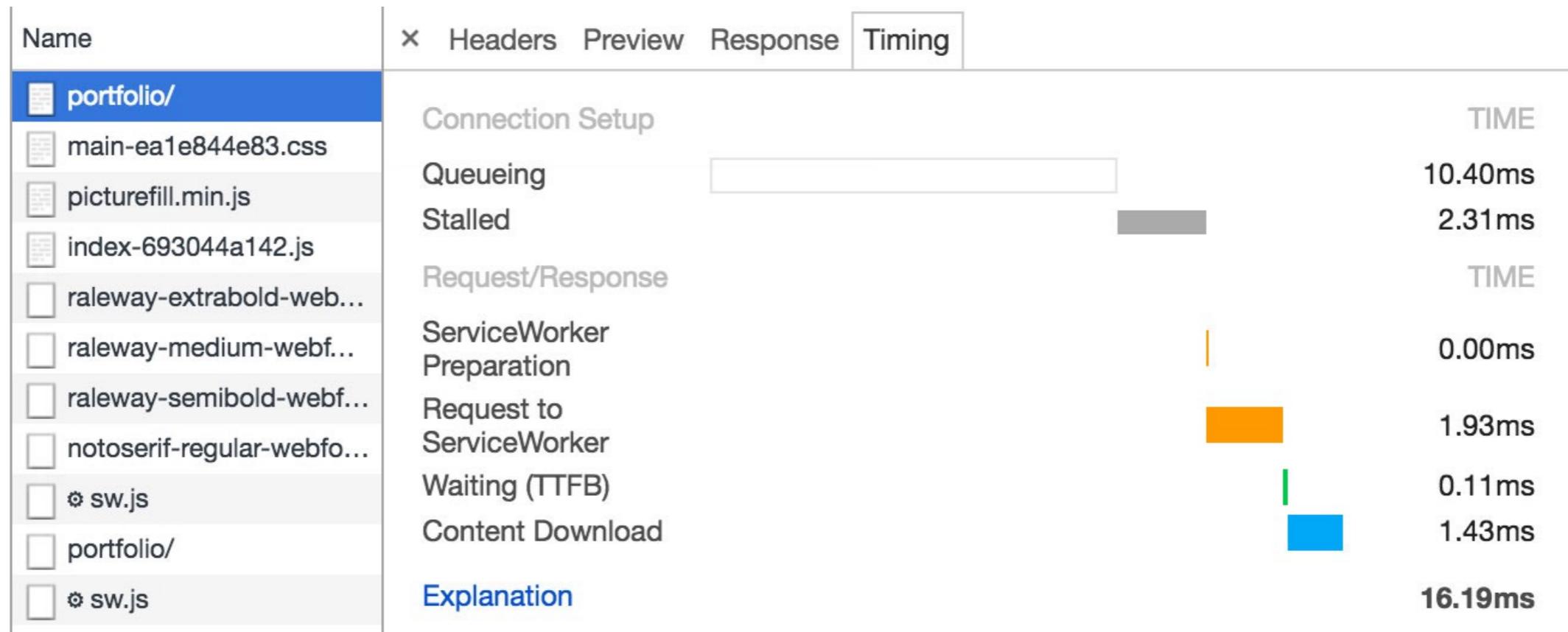
UPDATE SERVICE WORKER



FROM



TO



CACHING THINGS



Precaching

PRECACHING

```
const CORE_CACHE_NAME = 'core-cache';
const CORE_ASSETS = [ /* css, bundle.js, offline page */ ];

self.addEventListener('install', event => {
  event.waitUntil(
    caches.open(CORE_CACHE_NAME)
      .then(cache => cache.addAll(CORE_ASSETS))
      .then(() => self.skipWaiting())
  )
});
```

SERVE FROM CACHE

```
self.addEventListener('fetch', event => {
  const request = event.request;
  if (isInCoreCache(request)) {
    event.respondWith(
      caches.open(CORE_CACHE_NAME)
        .then(cache => cache.match(request.url))
    )
  }
})
```

Hijack Fetch

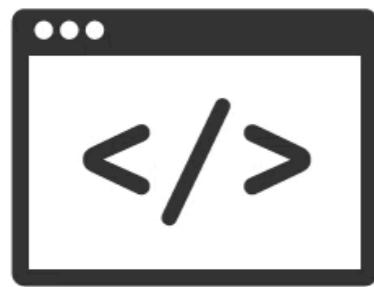
HIJACK FETCH

```
self.addEventListener('fetch', event => {  
  const request = event.request;  
  event.respondWith(  
    '_\(_ツ)_/_'\n  );  
});
```

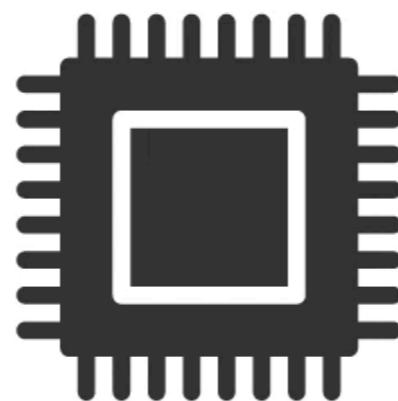
CACHING STRATEGIES



CACHE ONLY



Page



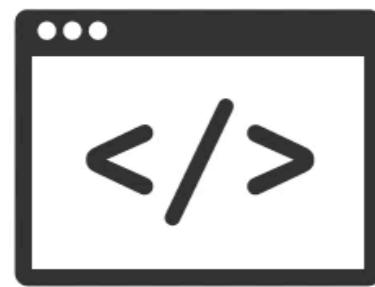
ServiceWorker



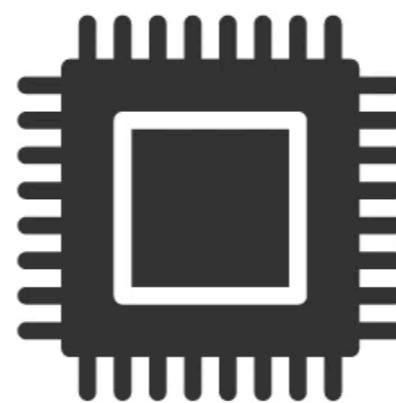
Cache

[Offline cookbook by Jake Archibald](#)

NETWORK ONLY



Page



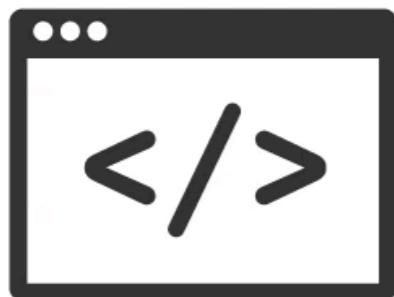
ServiceWorker



Network

[Offline cookbook by Jake Archibald](#)

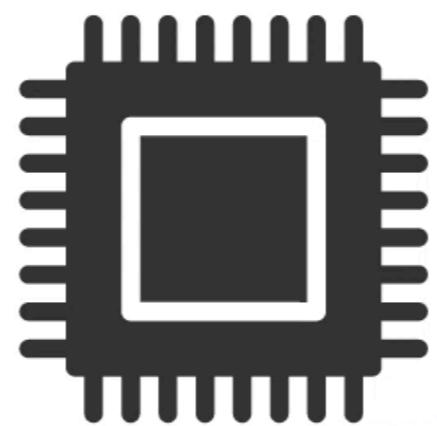
CACHE FIRST



Page



Network



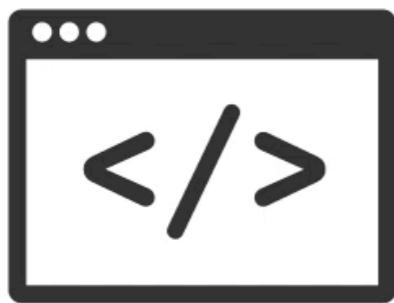
ServiceWorker



Cache

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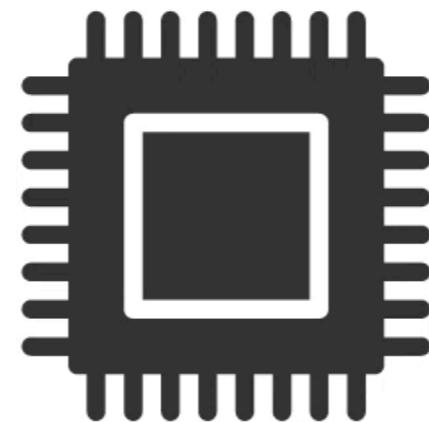
NETWORK FIRST



Page



Cache



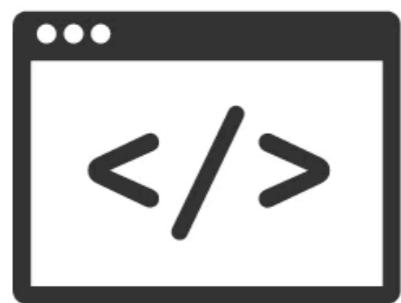
ServiceWorker



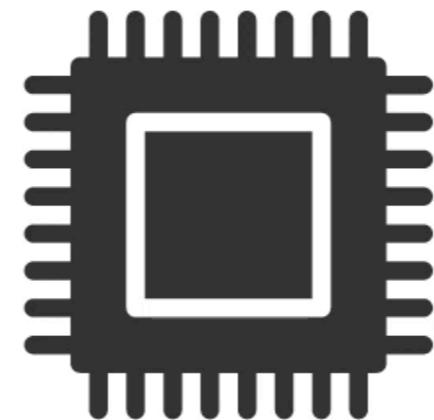
Network

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CACHE & NETWORK RACE



Page



ServiceWorker



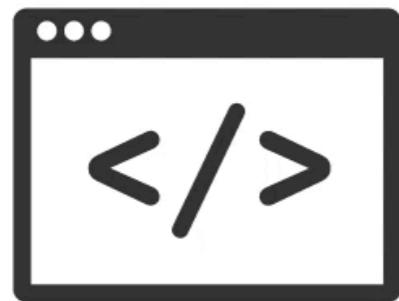
Cache



Network

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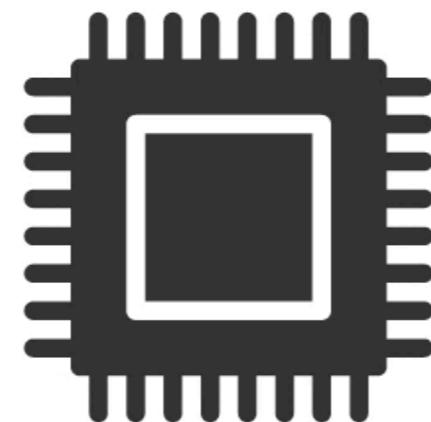
STALE WHILE REVALIDATE



Page



Cache



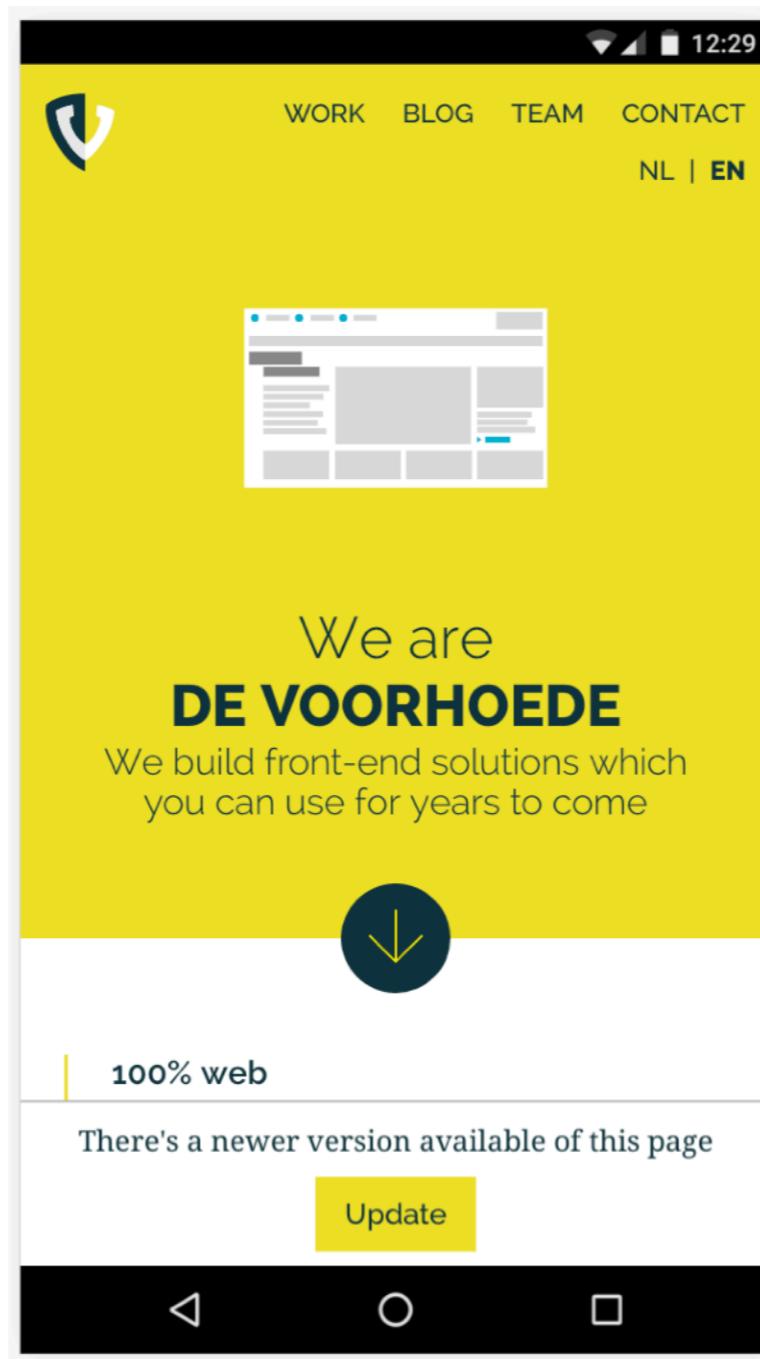
ServiceWorker



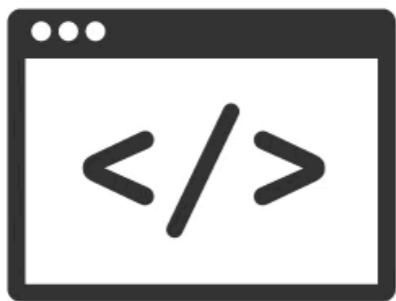
Network

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STALE WHILE REVALIDATE



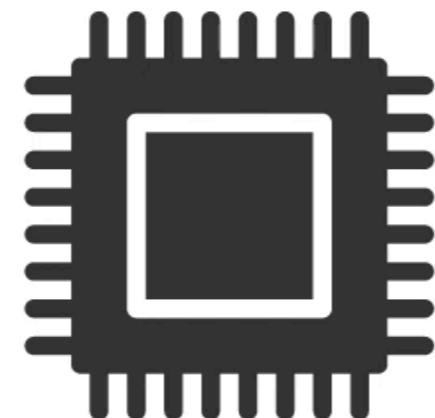
GENERIC Fallback



Page



Cache



ServiceWorker



Network

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RUNTIME CACHING

```
self.addEventListener('fetch', event => {
  const request = event.request;
  if (isSomethingParticular(request) && isNotCached(request)) {
    event.respondWith(
      return fetch(request).then(response => {
        return caches.open('mycache')
          .then(cache => {
            cache.put(request, response.clone())
          })
          .then(() => response)
        })
      )
    }
  }
})
```

RUNTIME CACHING

```
// Append to the cache when something happens in the client!
self.addEventListener('message', event => {
  const message = event.data;
  caches.open('api-cache').then(cache => {
    return cache.match('/messages?ajax=true')
      .then(response => {
        // We can break open the response,
        // append something to its contents,
        // create a new response with these contents
        // and overwrite the cached response with it
      })
    })
})
```

DEVTOOLS & TESTING



CHROME DEV TOOLS

The screenshot shows the Chrome DevTools interface with the "Application" tab selected. On the left, the sidebar lists "Manifest", "Service Workers" (which is currently selected), and "Clear storage". Under "Storage", it shows "Local Storage", "Session Storage", "IndexedDB" (with a sub-item "chatDb - http://localhost:7924"), "Web SQL", and "Cookies" (with a sub-item "http://localhost:7924"). Under "Cache", it shows "Cache Storage" (with a sub-item "core-cache - http://localhost:7924") and "Application Cache". Under "Frames", it shows "top".

Service Workers

http://localhost:7924/

Source: [service-worker.js](#)
Received 14/12/2017, 10:49:40

Status: ● #17547 activated and is running [stop](#)

Clients: [http://localhost:7924/ focus](#)
[http://localhost:7924/ focus](#)

[Update](#) [Push](#) [Sync](#) [Unregister](#)

LIGHTHOUSE

The screenshot shows the Lighthouse audit interface with the following scores:

- Progressive Web App: 82
- Performance: 100
- Accessibility: 100
- Best Practices: 92

Progressive Web App
These audits validate the aspects of a Progressive Web App, as specified by the baseline [PWA Checklist](#).

82

2 failed audits

- ▶ Does not redirect HTTP traffic to HTTPS ✗
- ▶ User will not be prompted to Install the Web App
Failures: Manifest start_url is not cached by a Service Worker. ✗

▶ 9 Passed Audits

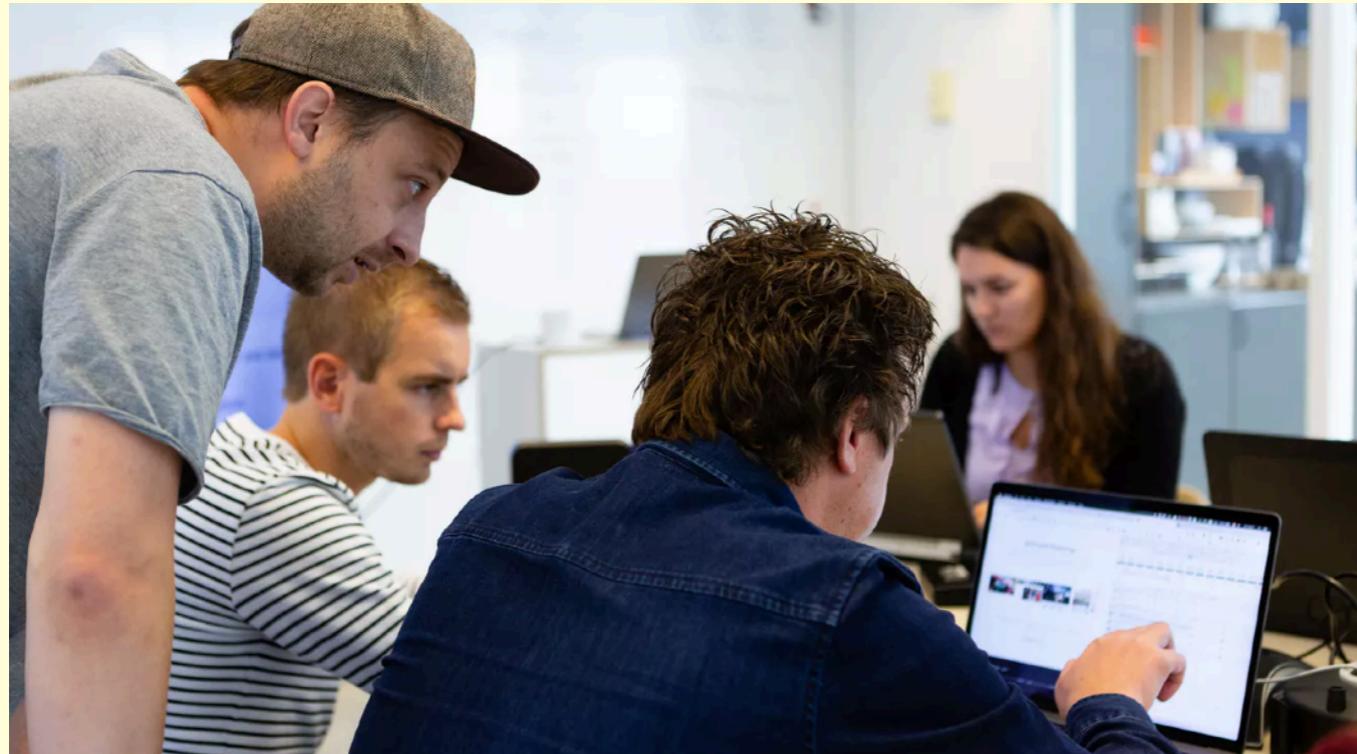
▶ Manual checks to verify

Performance
These encapsulate your app's performance.

100

Metrics
These metrics encapsulate your app's performance across a number of dimensions.

131 ms	263 ms	394 ms	526 ms	657 ms	789 ms	920 ms	1.1 s	1.2 s	1.3 s



thanks

Declan Rek

// @DeclanRek

// voorhoede.nl

