



Bringing Mobile Web Back to Life

Agenda

The Story
The Implementation
The Results



Emily Banks ✓
@emjbanks

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Pinterest is the portal to the worst of mobile web UX



sessy
@sessyren

Follow



Pinterest on mobile web is so fuckin' annoying.

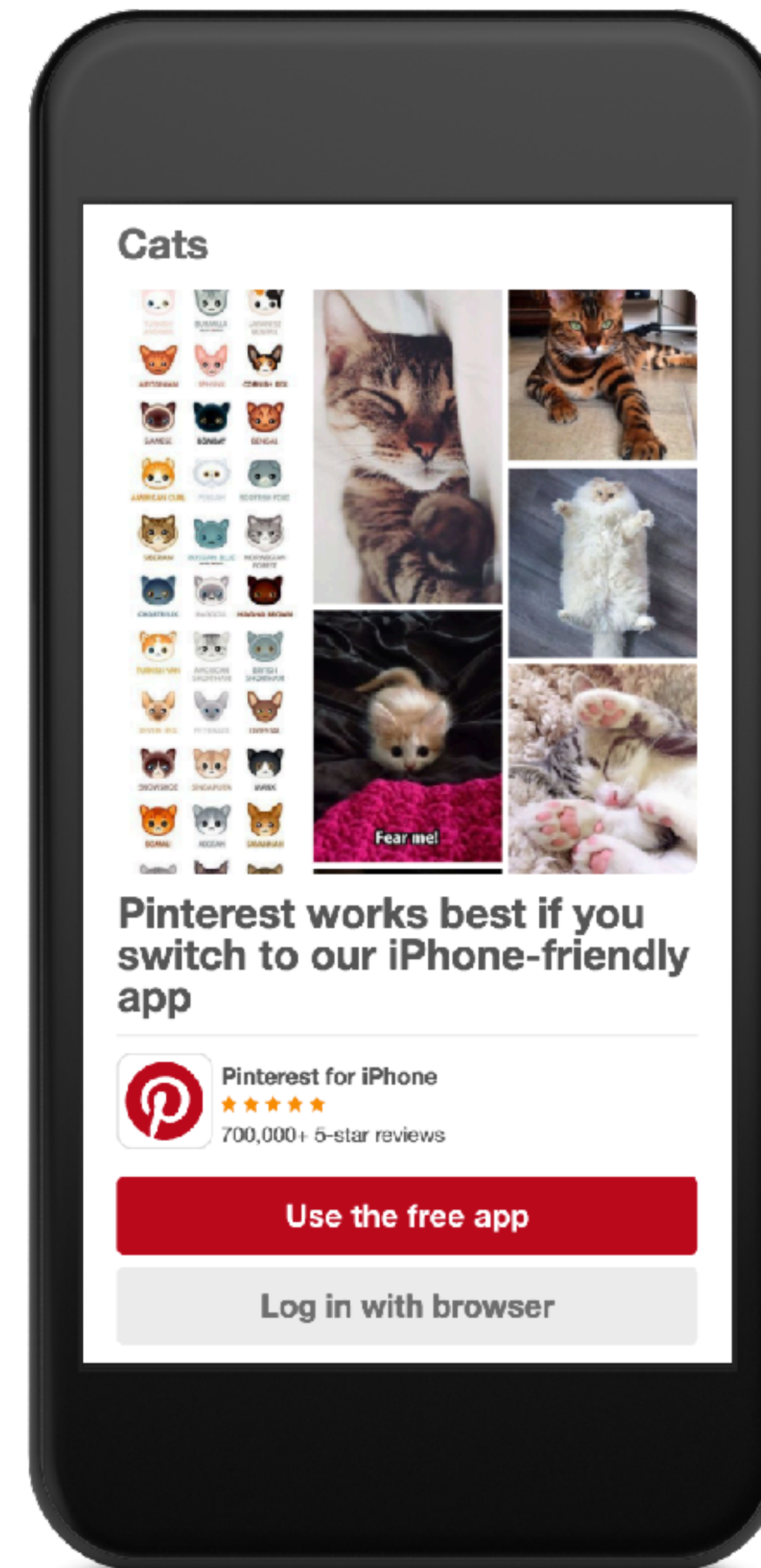


DJ LATER AID :))
@lllvibras

Follow

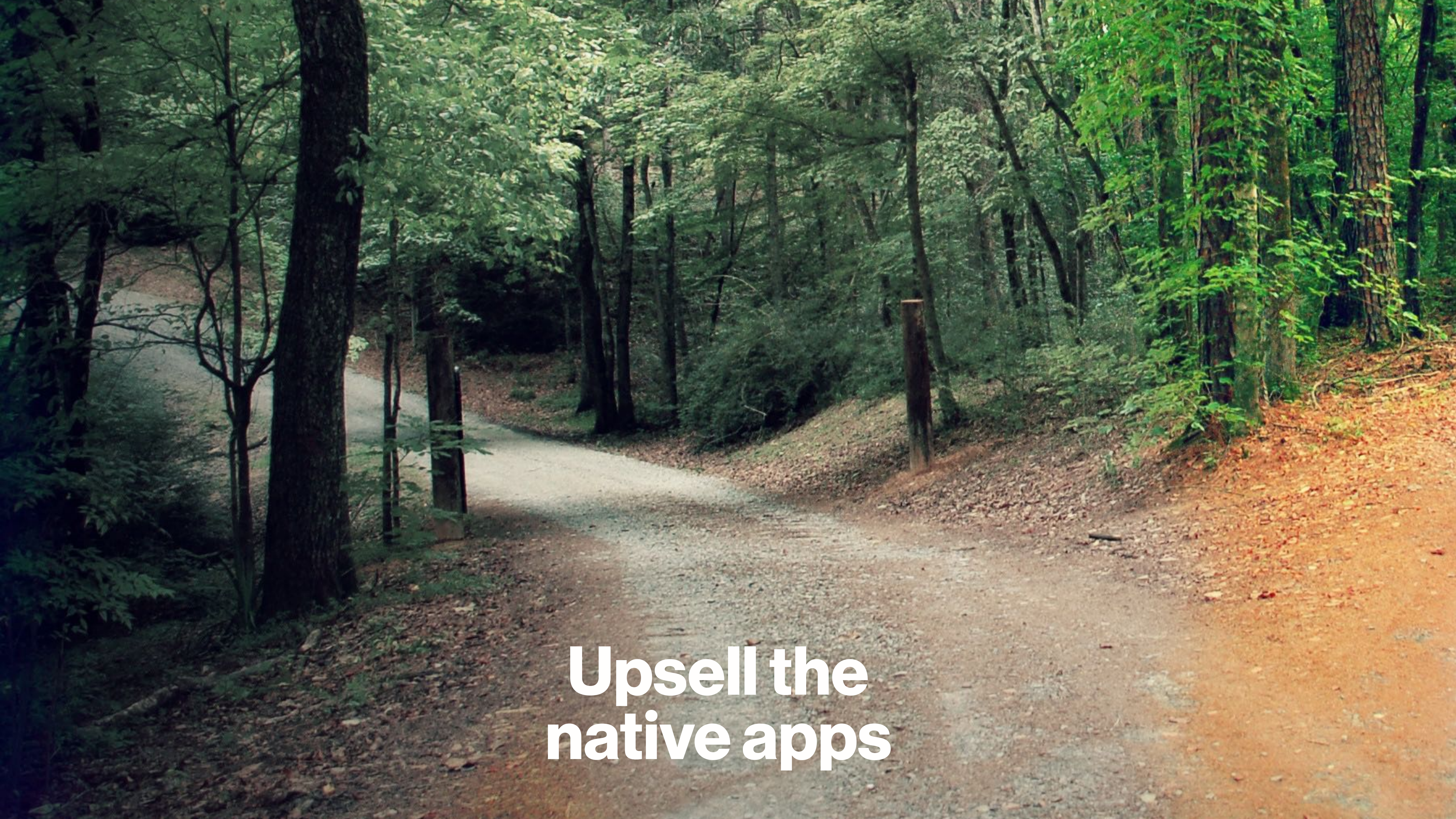


Pinterest's mobile web experience is a nightmare

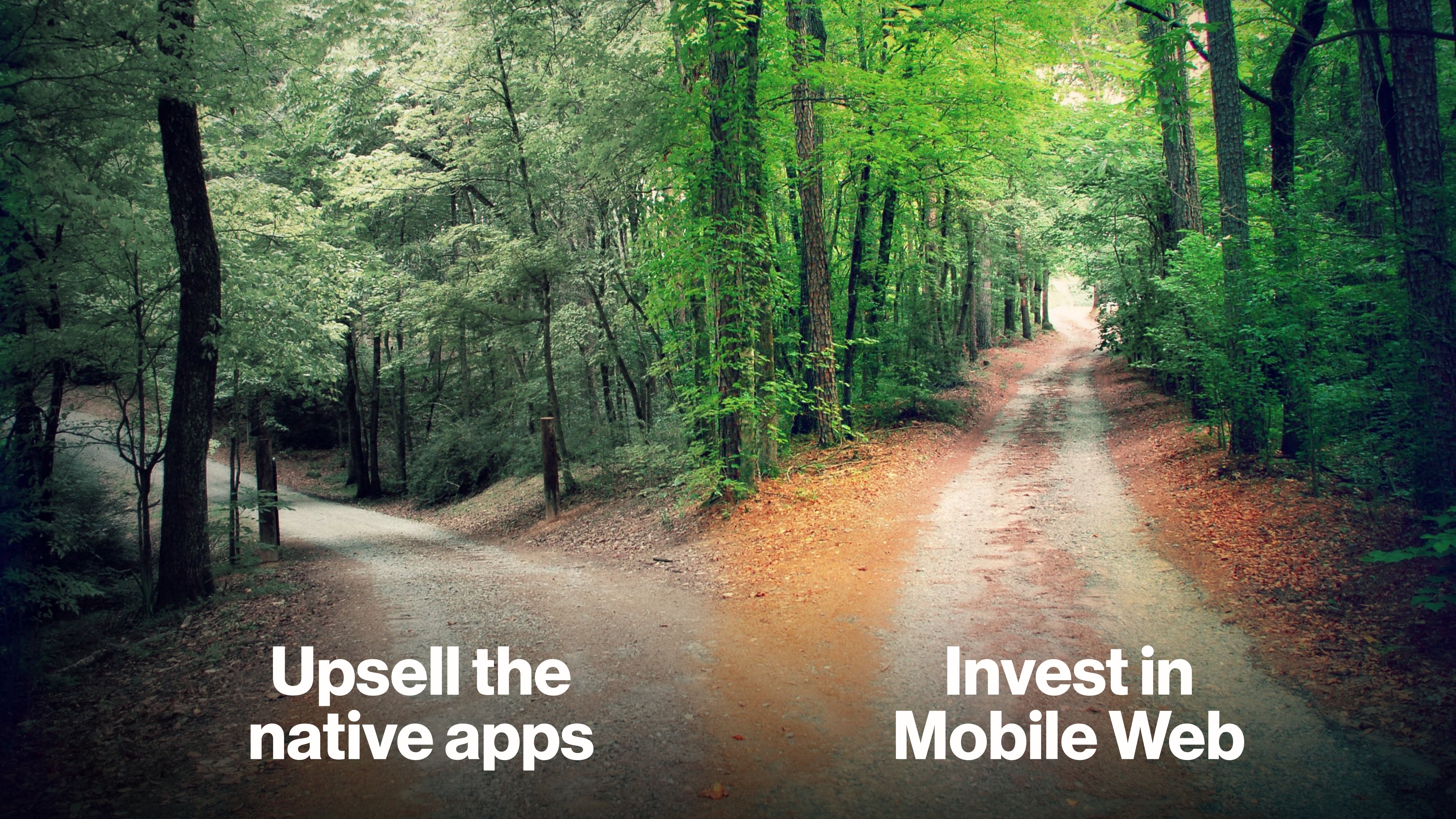


Important lessons

**“Metrics do not measure
sentiment”**

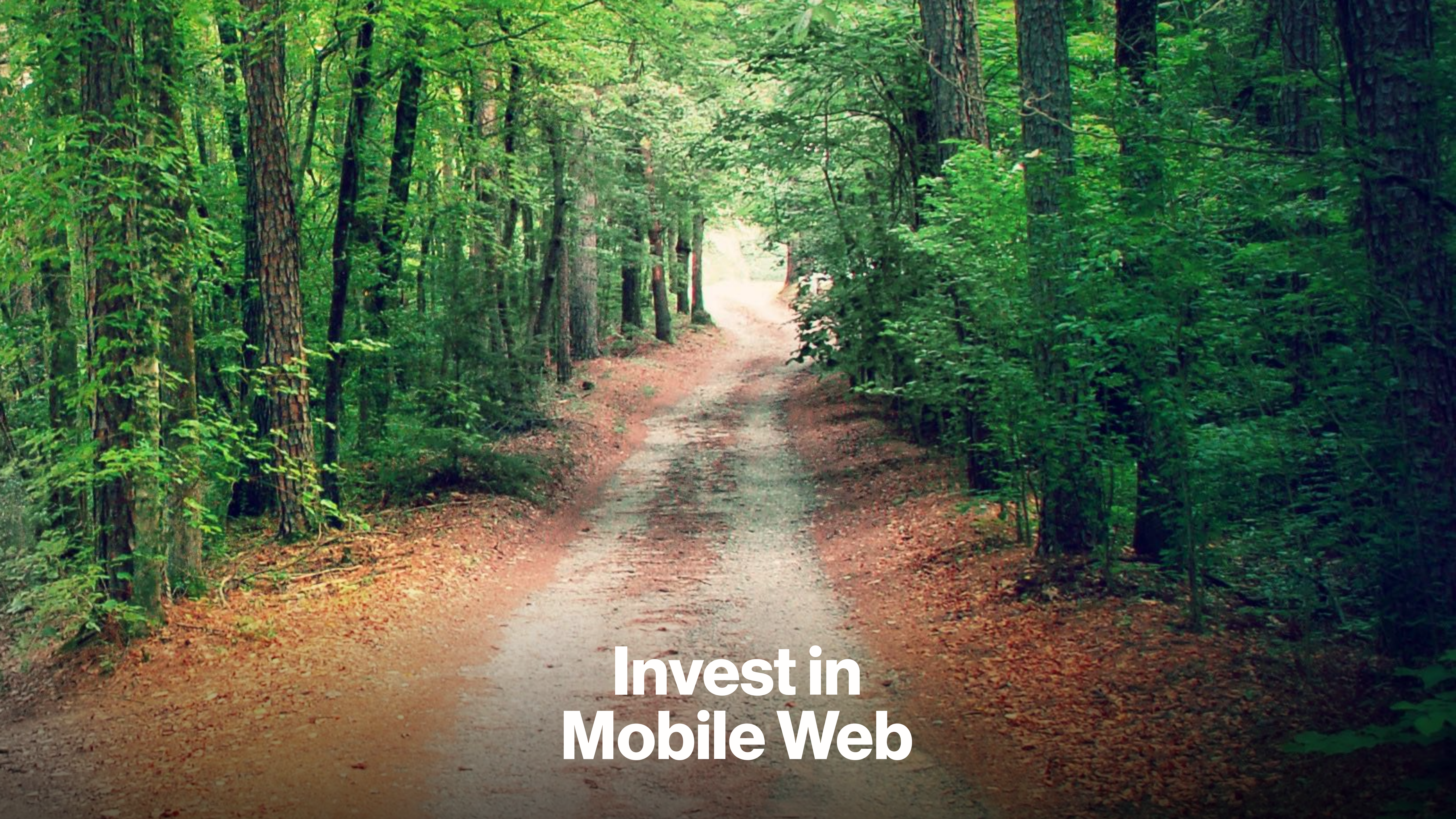
A photograph of a dirt path in a forest. The path starts from the bottom center and splits into two directions: one leading left towards a shaded area and another leading right towards a sunlit area. A wooden signpost stands at the fork. The trees are mostly green, but the ground is covered with fallen brown leaves.

**Upsell the
native apps**

A photograph of a dirt path in a forest. The path starts from the bottom center and splits into two directions: one leading towards the left and slightly upwards, and another leading towards the right and further into the distance. The trees are tall and thin, with green leaves. The ground is covered with brown leaves and dirt. The lighting is soft, suggesting a sunny day with some shade.

**Upsell the
native apps**

**Invest in
Mobile Web**

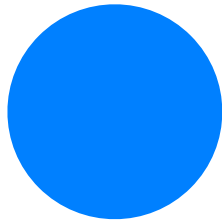
A photograph of a dirt path winding through a forest. The path is covered in fallen brown leaves and leads towards a bright opening in the distance. Tall trees with green foliage line both sides of the path. The text "Invest in Mobile Web" is overlaid in white at the bottom center.

**Invest in
Mobile Web**

But why? Other than sentiment.

- **Light-weight alternative to native app**
- **Capture low-engaged users**
- **Better SEO landing experience**

Should I make my site responsive? Or should I make a separate mobile web site?

-  **If you have more than 20 web engineers, make a dedicated mobile web progressive web app.**

Reasons to fork for mobile

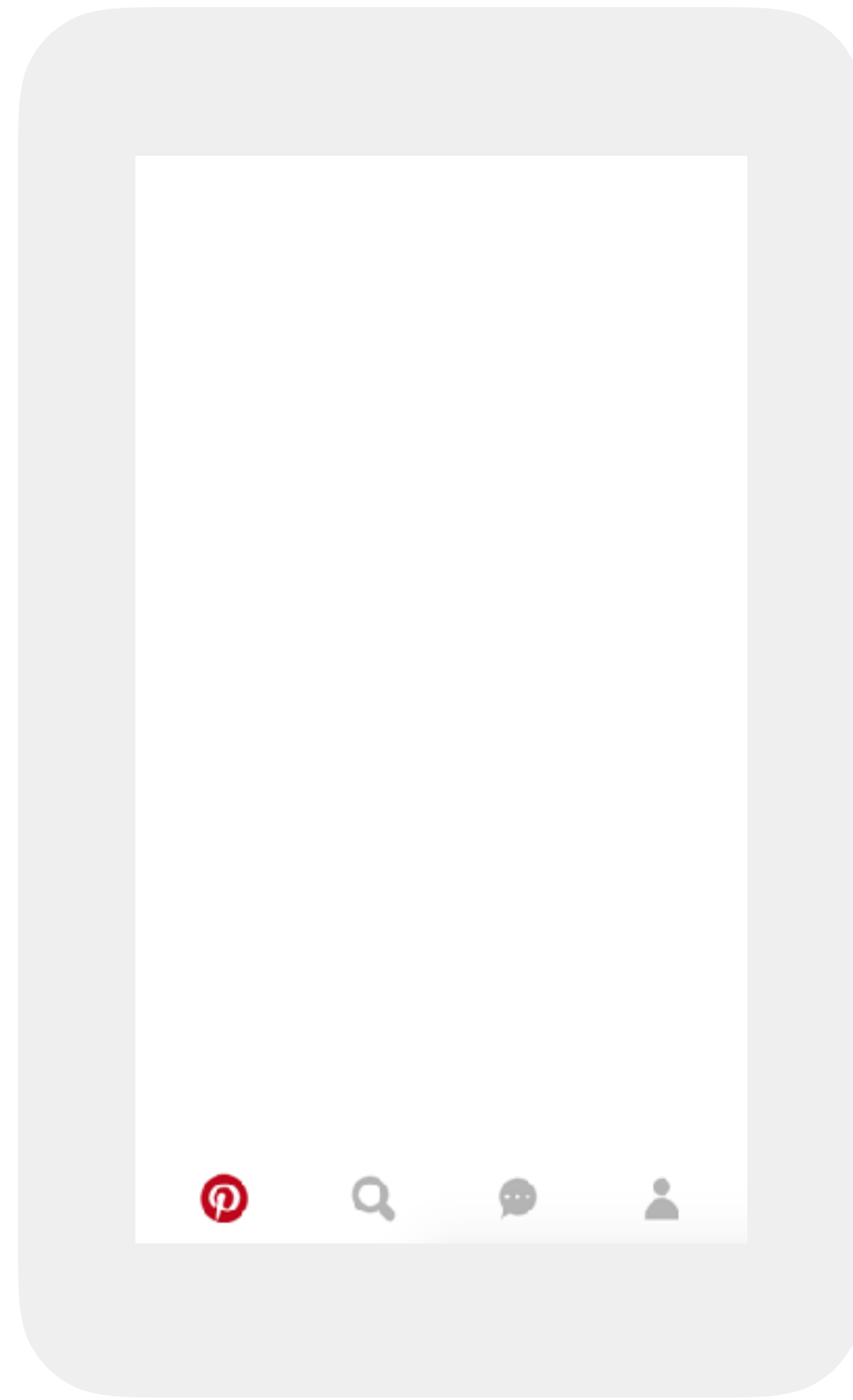
- **Features on desktop don't break mobile**
- **Less logical complexity**
- **Additional surface for experimentation**
- **Optimize for touch surfaces (phone/tablet)**

**Rebuild from
scratch?**

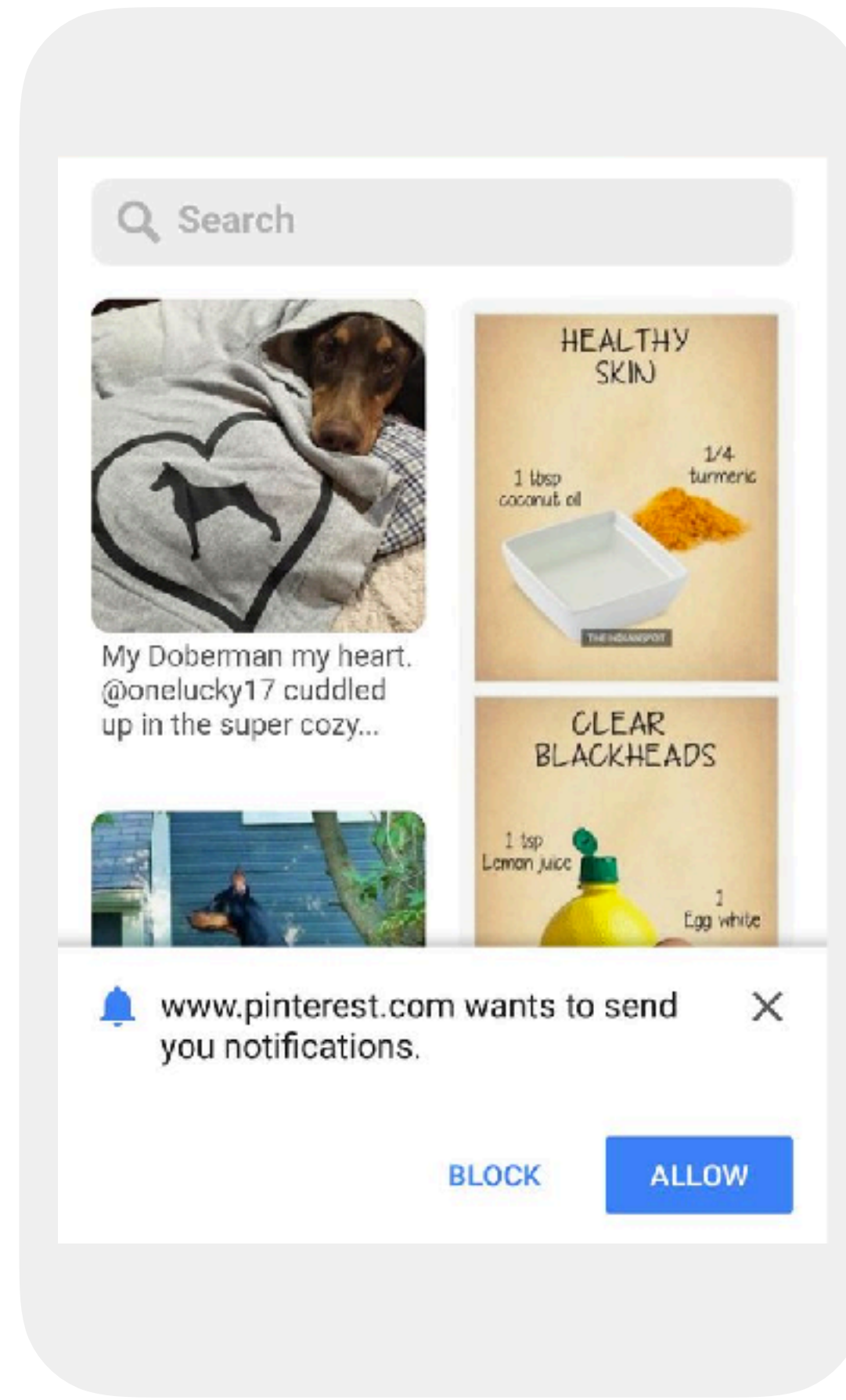


PWA features

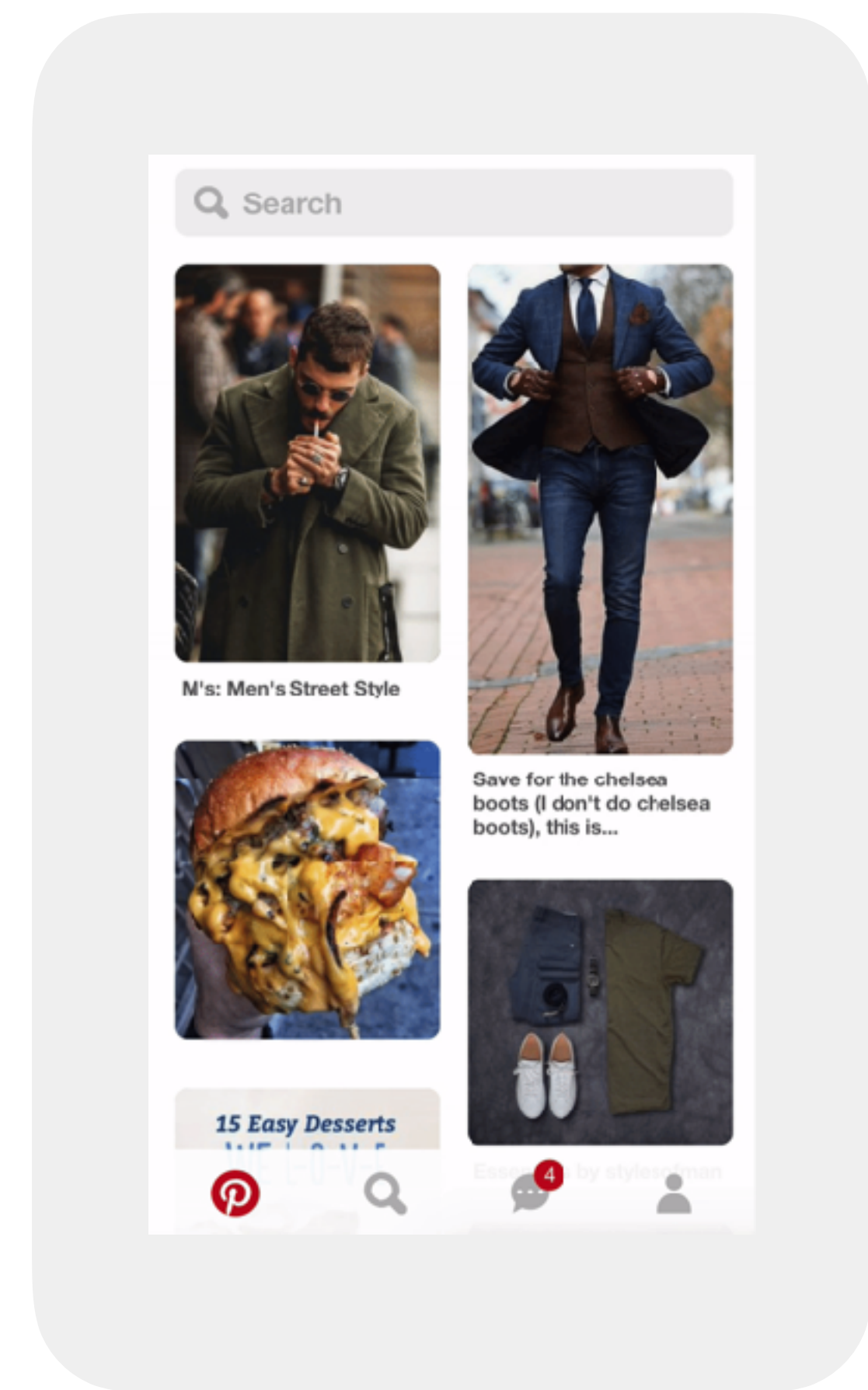
App Shell



Notifications



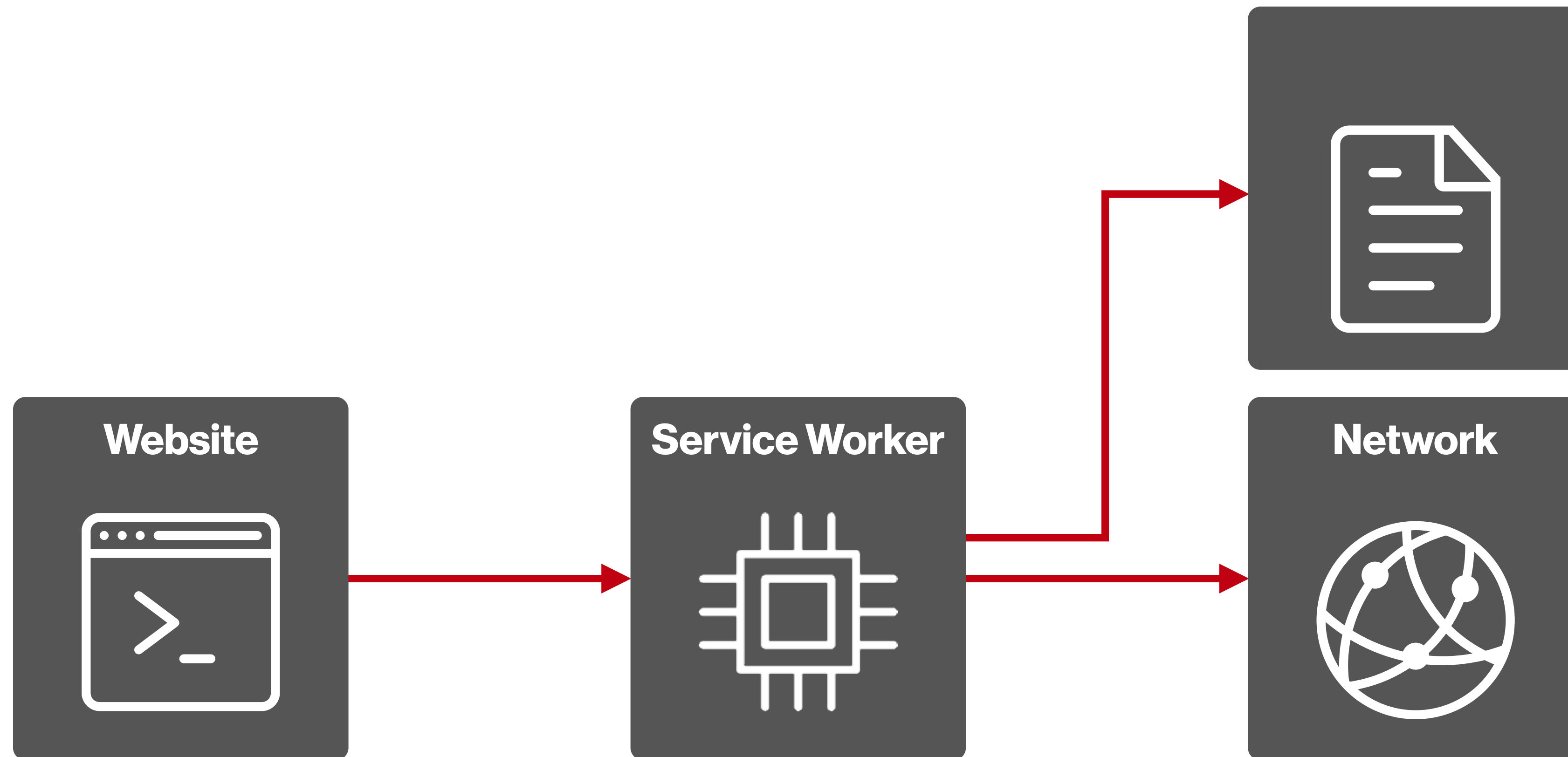
Offline



PWA features

- 1 Background Sync**
- 2 Credential Management API**
- 3 Web Share API**
- 4 Image Capture API**
- 5 Device Memory API**

Service Workers



Service Worker Intro

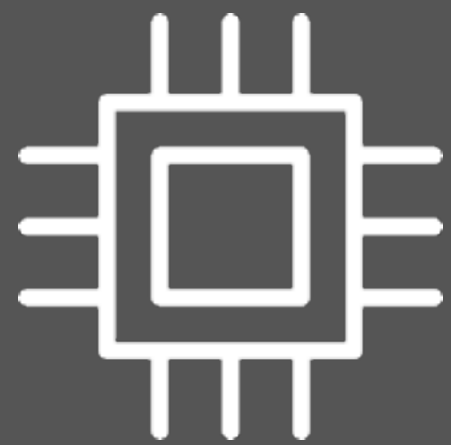
Register service worker

Browser



```
if ('serviceWorker' in navigator) {  
  window.addEventListener('load', function() {  
    navigator.serviceWorker.register('/sw.js').then(function(registration) {  
      // Registration was successful  
      console.log('ServiceWorker registration successful with scope: ', registration.scope);  
    }, function(err) {  
      // registration failed :(  
      console.log('ServiceWorker registration failed: ', err);  
    });  
  });  
}
```

SW



Service Worker Intro

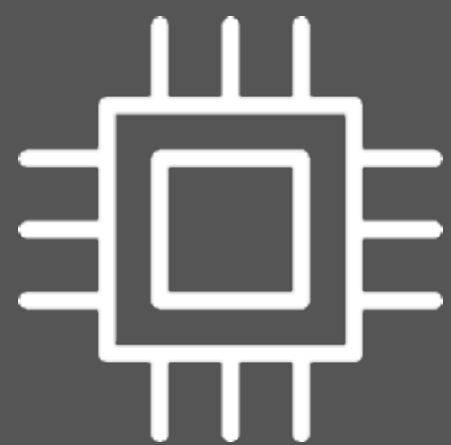
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      // registration failed :(
      console.log('ServiceWorker registration failed: ', err);
    });
  });
}
```

SW



```
var CACHE_NAME = 'my-site-cache-v1';
var urlsToCache = [
  '/',
  '/styles/main.css',
  '/script/main.js'
];

self.addEventListener('install', function(event) {
  // Perform install steps
  event.waitUntil(
    caches.open(CACHE_NAME)
      .then(function(cache) {
        console.log('Opened cache');
        return cache.addAll(urlsToCache);
      })
  );
});
```


Service Worker Intro

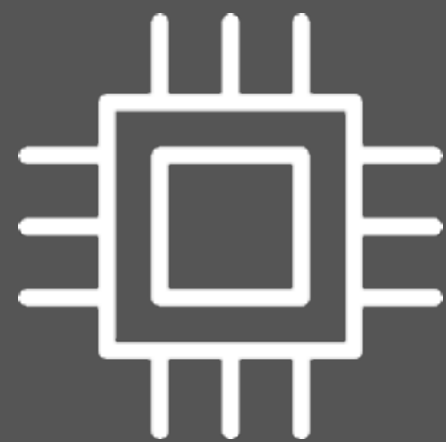
Activate service worker

Browser



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SW



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      .then(function(cache) {
        console.log('Opened cache');
        return cache.addAll(urlsToCache);
      })
  );
});
```

```
self.addEventListener('activate', function(event) {
  var cacheWhitelist = ['pages-cache-v1', 'blog-posts-cache-v1'];

  event.waitUntil(
    caches.keys().then(function(cacheNames) {
      return Promise.all(
        cacheNames.map(function(cacheName) {
          if (cacheWhitelist.indexOf(cacheName) === -1) {
            return caches.delete(cacheName);
          }
        })
      );
    })
  );
});
```


Service Worker Intro

Listen to messages from Browser JS

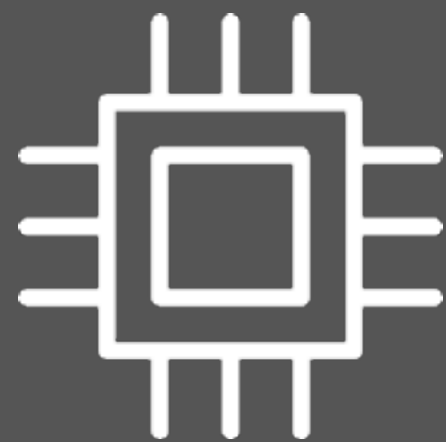
Browser



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      console.log('ServiceWorker registration successful with scope: ', registration.scope);
    }, function(err) {
      // registration failed :(
      console.log('ServiceWorker registration failed: ', err);
    });
  });
}
```

```
navigator.serviceWorker.addEventListener('message', event => {
  console.log(event.data.msg, event.data.url);
});
```

SW



```
var CACHE_NAME = 'my-site-cache-v1';
var urlsToCache = [
  '/',
  '/styles/main.css',
  '/script/main.js'
];

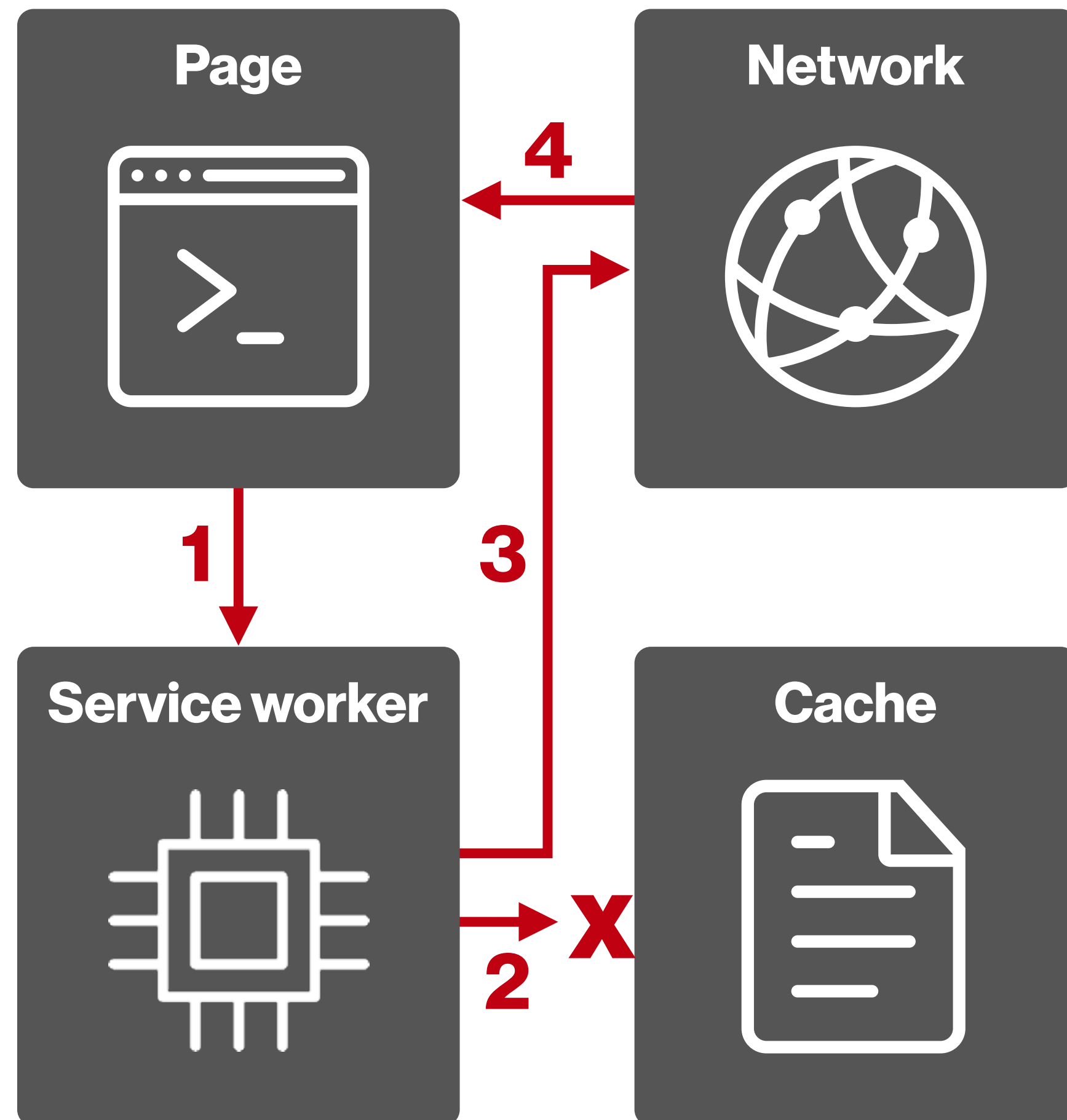
self.addEventListener('install', function(event) {
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```

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        cacheNames.map(function(cacheName) {
          if (cacheWhitelist.indexOf(cacheName) === -1) {
            return caches.delete(cacheName);
          }
        })
      );
    })
  );
});
```


Service Worker Intro

Fetch handlers



```
self.addEventListener('fetch', function (event) {
  event.respondWith(
    caches.match(event.request).then(function(res) {
      if(res){
        return res;
      }
      requestBackend(event);
    })
  );
});

function requestBackend(event) {
  var url = event.request.clone();
  return fetch(url).then(function(res) {
    //if not a valid response send the error
    if(!res || res.status !== 200 || res.type !== 'basic'){
      return res;
    }

    var response = res.clone();

    caches.open(CACHE_VERSION).then(function(cache) {
      cache.put(event.request, response);
    });

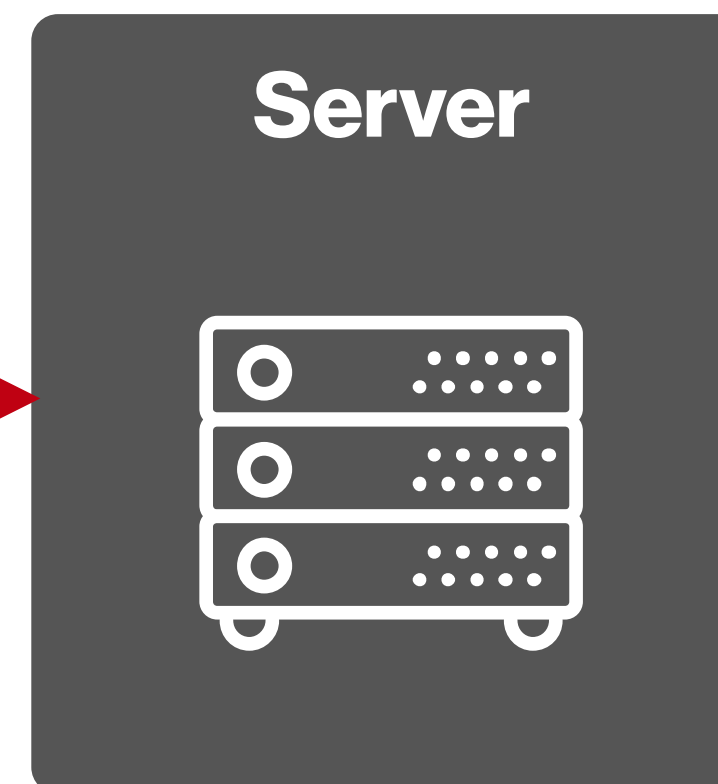
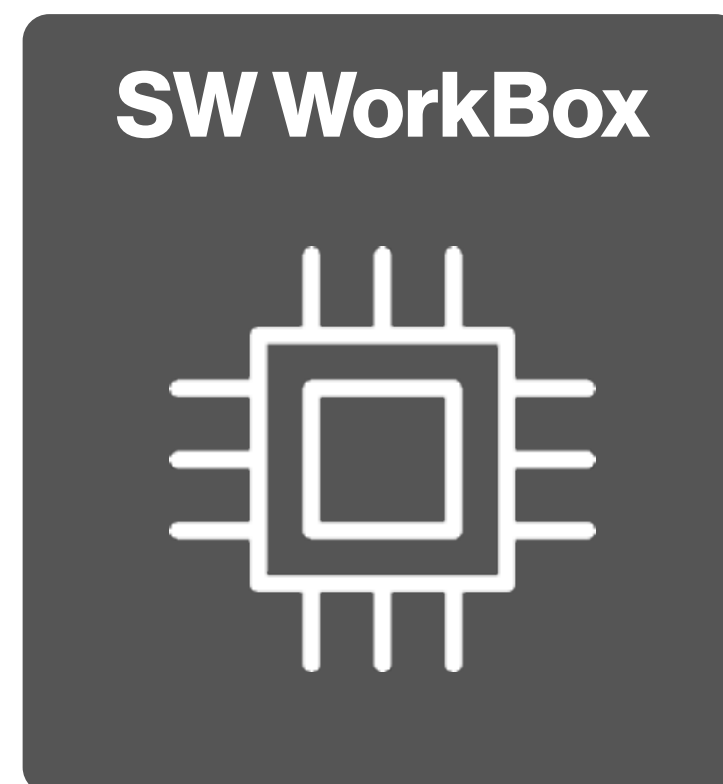
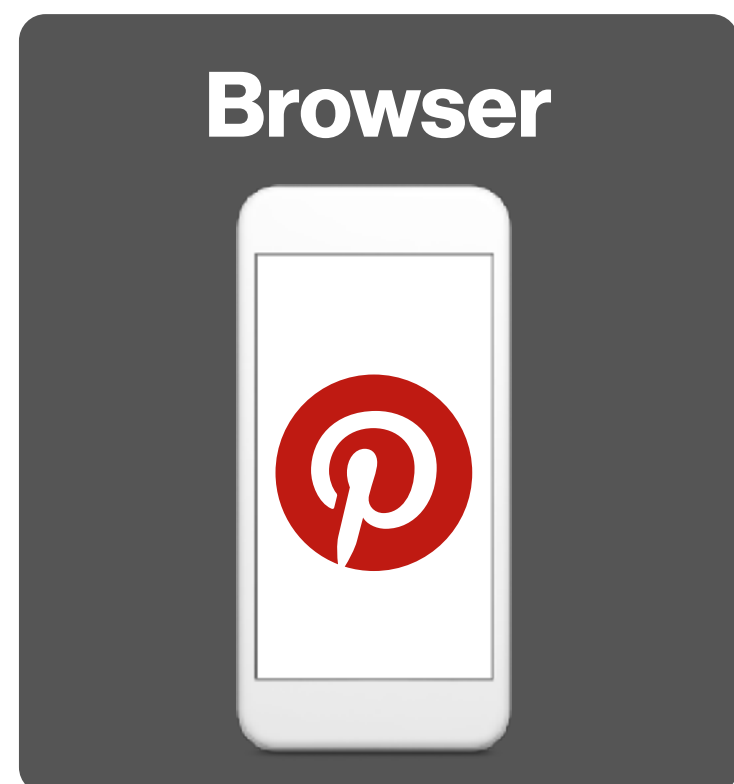
    return res;
  })
}
```


First Page Loads

First Page Load

```
4  const workbox = new WorkboxSW({ handleFetch: true, skipWaiting: true, clientsClaim: true });
5  $Cache.precache.unshift({
6    url: 'sw-shell.html',
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9  workbox.precache($Cache.precache);
10
11  // Runtime cache all js/css
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23    ],
24  });
```

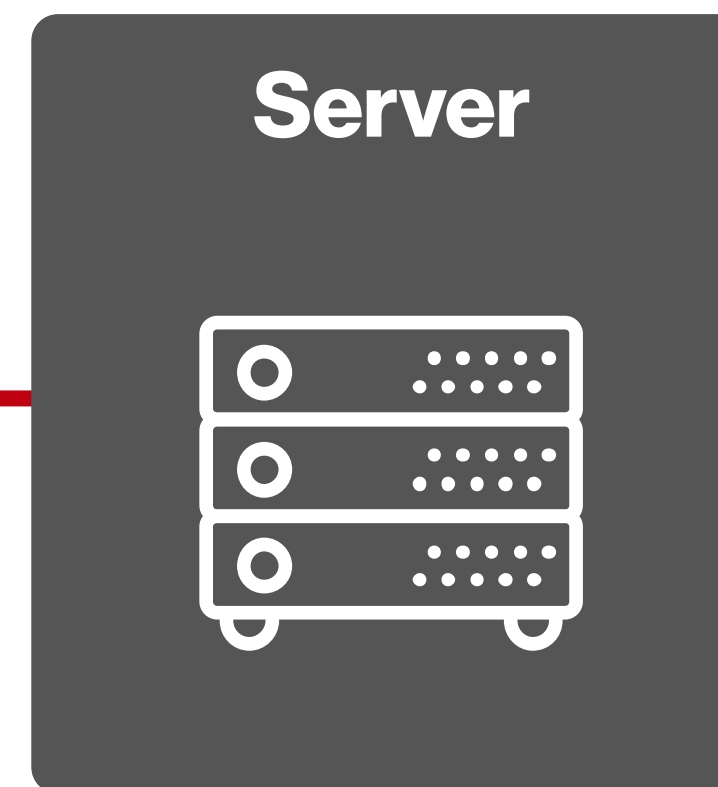
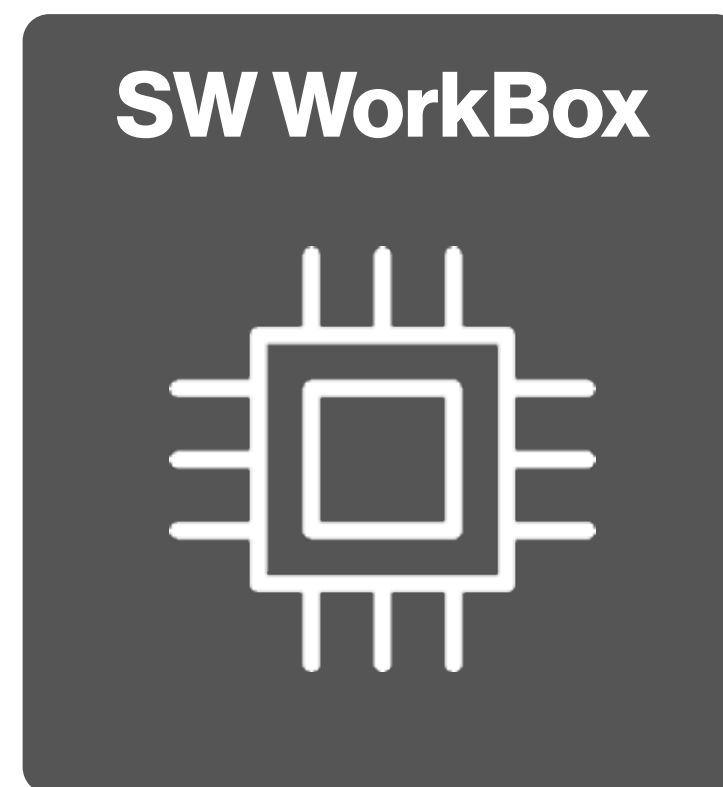
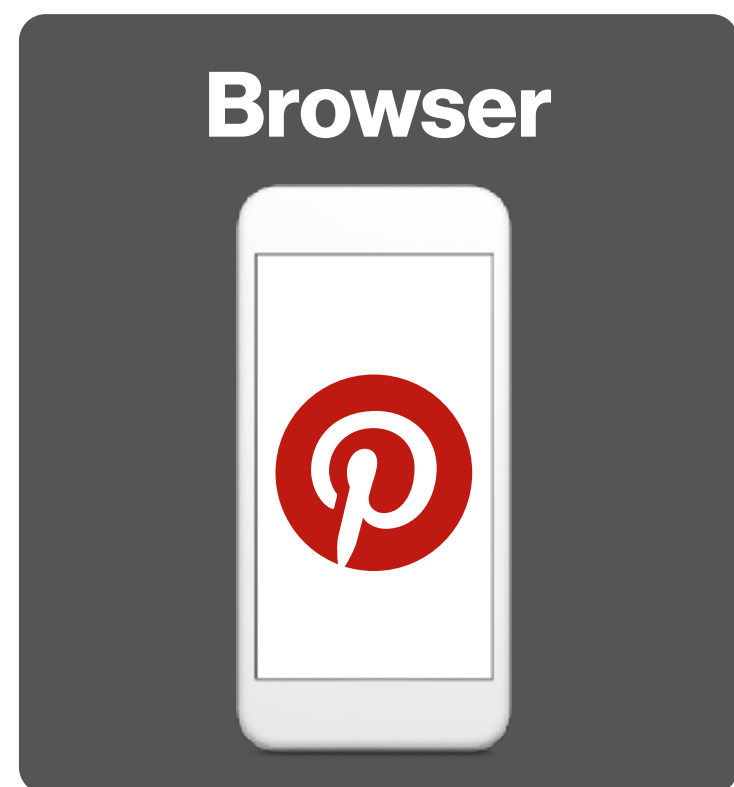
Sends a request to pinterest.com



First Page Load

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```

Receives HTML response



First Page Load

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```

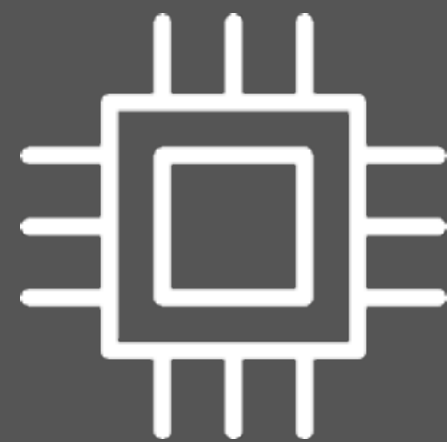
Browser



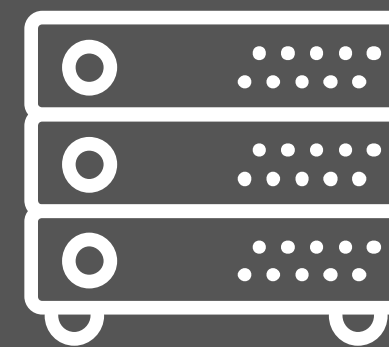
Parse HTML, extract
initial state and
register SW onLoad



SW WorkBox



Server



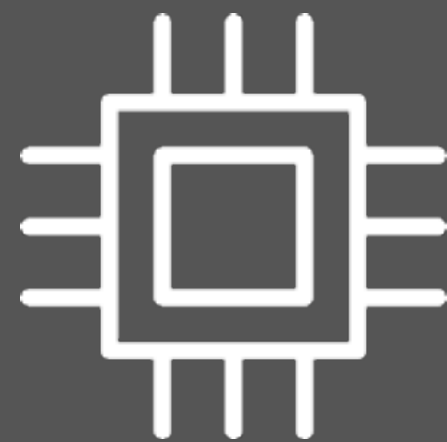
First Page Load

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```

Browser

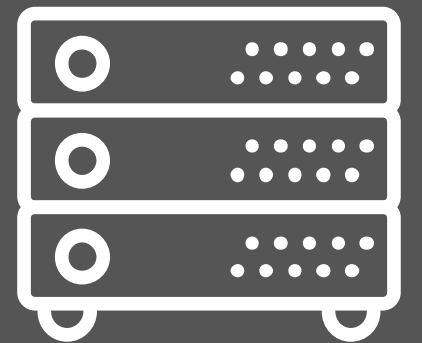


SW WorkBox



- Precache page chunks JS bundles, e.g. locale, lib, vendor
- Send a request for sw-shell.html and precache it before we even need it
- Setup cache first strategy for the rest of JS and CSS. We will store it in cache after we will request it for the first time
- Capture requests inside of self.addEventListener('fetch') handler

Server



First Page Load

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24  });
```

Notice, this request is captured by SW

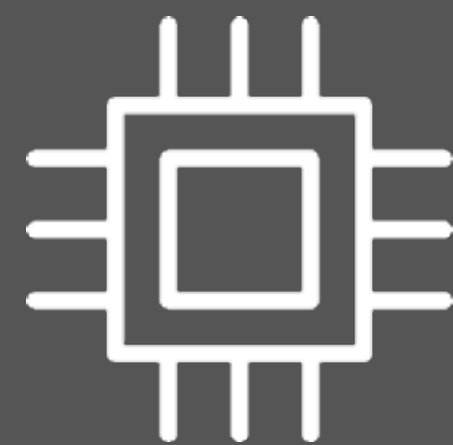
Browser



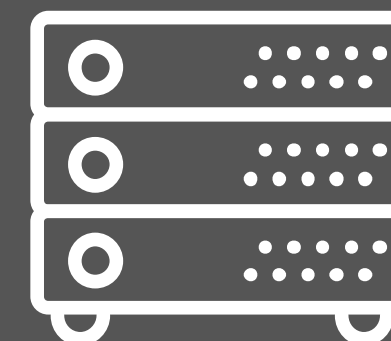
Fetches additional JS from pinterest.com



SW WorkBox

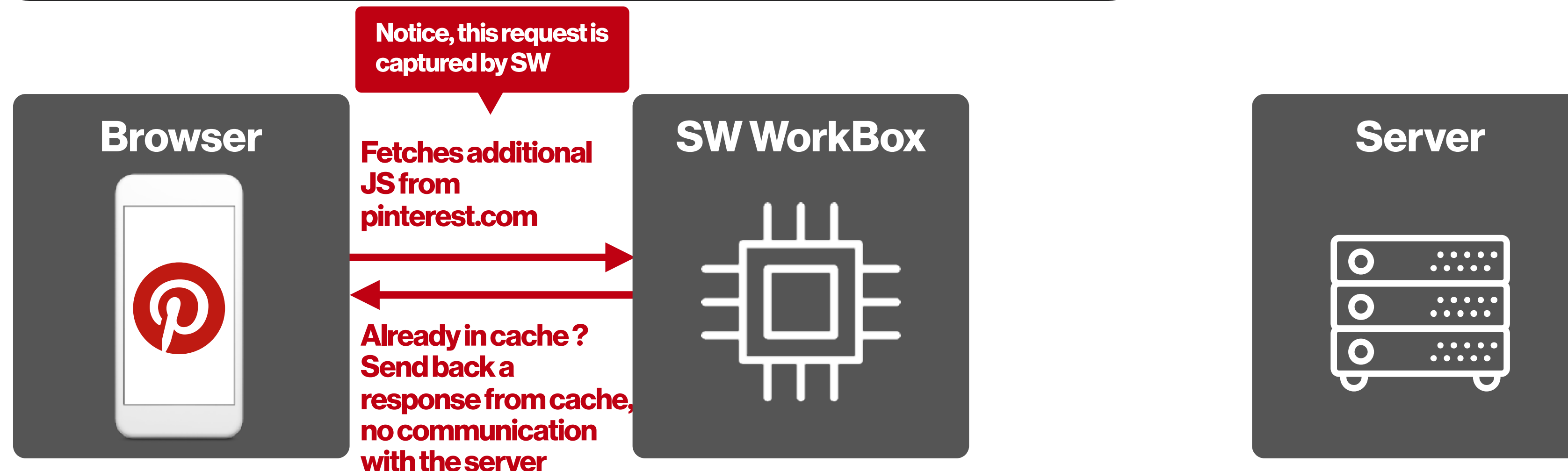


Server



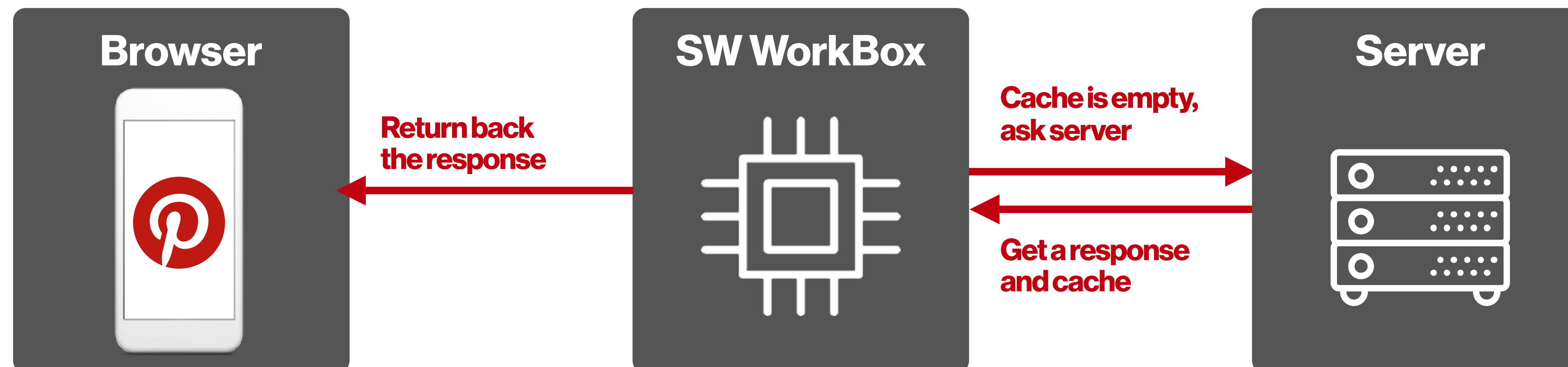
First Page Load

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First Page Load

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```



App Shell

The image shows a mobile application interface on the left and its network performance analysis in Chrome DevTools on the right. The app interface features a search bar at the top and a bottom navigation bar with five icons: Home, Following, Explore, Notifications, and Saved. The network panel on the right is set to 'JS' and shows a list of resources loaded from a ServiceWorker and the disk cache.

Name	Status	Size	Time	Waterfall
entryChunk-webpack-796f87...	200	(from ServiceWorker)	0 ms	
vendor-mweb-356b91b07e2...	200	(from ServiceWorker)	0 ms	
entryChunk-mobile-96551f8f...	200	(from ServiceWorker)	0 ms	
pjs-locale-en_US-mobile-4e1...	200	(from ServiceWorker)	0 ms	
pjs-HomePage-8d19cb6f76c...	200	(from ServiceWorker)	72 ms	
pjs-AuthPageWrapper-651d5...	200	(from disk cache)	81 ms	

Page reloads

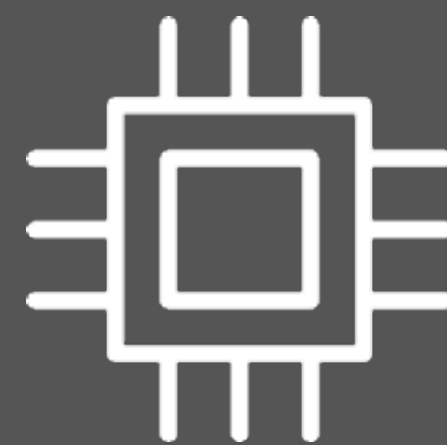
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Browser JS

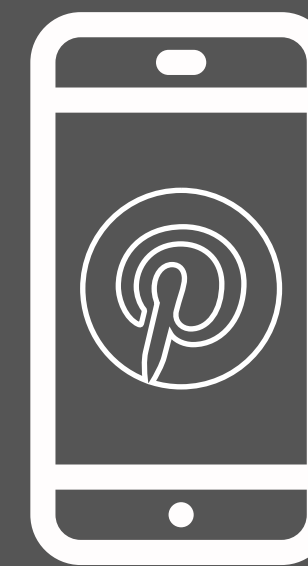


1. A request to
pinterest.com

SW WorkBox

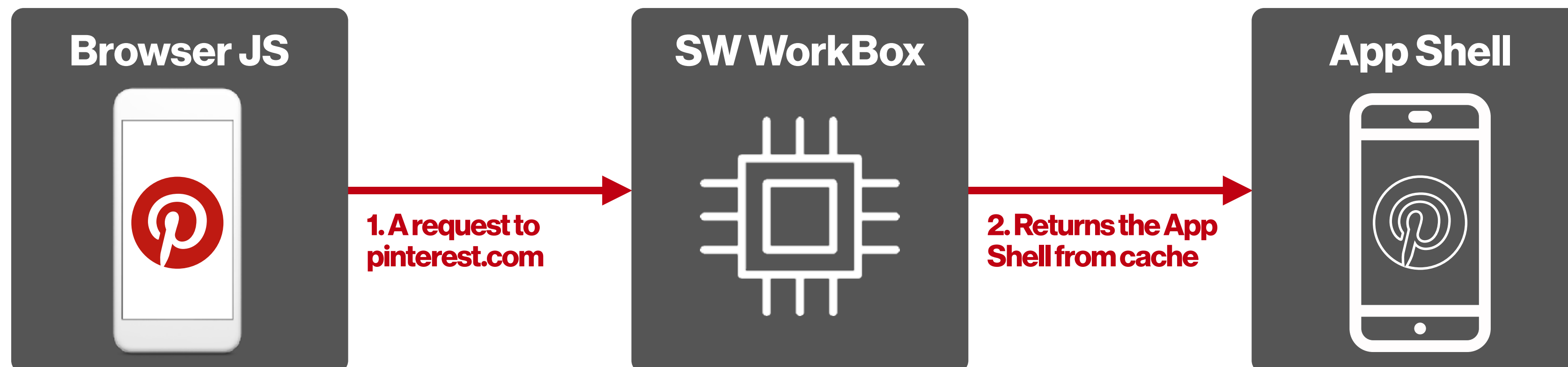


App Shell



Page reloads

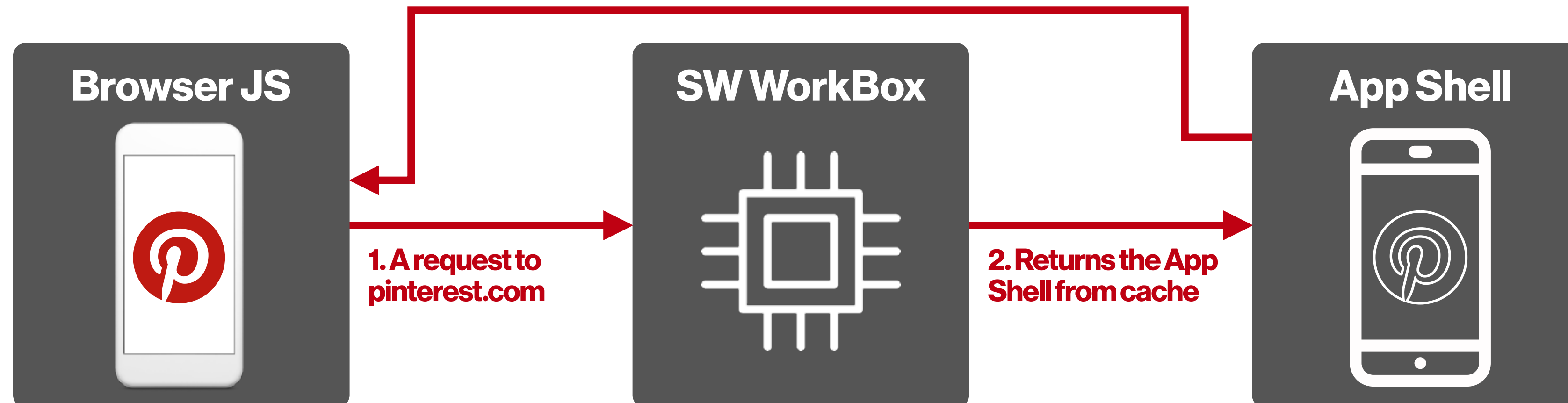
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21      new RegExp('/(about|amp|business|pw|secure|connect|analytics|template|website|download|oauth|iphone)/.*'),
22      new RegExp('/(offsite|invited|login|oauth_error|verify|help|jobs|careers|messages|)/'),
23      new RegExp('/email/(remove|settings|unsubscribe|disassociate|update_settings|feedback)')
24    ],
25  });
```



Page reloads

```
15  workbox.router.registerNavigationRoute('sw-shell.html', {
16    blacklist: [
17      new RegExp('/manifest.json'),
18      new RegExp('/robots.txt'),
19      new RegExp('/sw.(js|html)'),
20      new RegExp('/_/_/'),
21      new RegExp('/(about|amp|business|pw|secure|connect|analytics|template|website|download|oauth|iphone)/.*'),
22      new RegExp('/(offsite|invited|login|oauth_error|verify|help|jobs|careers|messages|)/'),
23      new RegExp('/email/(remove|settings|unsubscribe|disassociate|update_settings|feedback)')
24    ],
25  });
```

3. Works similar to a server-side HTML response. After parsing and executing HTML, it will spawn additional requests for JS assets

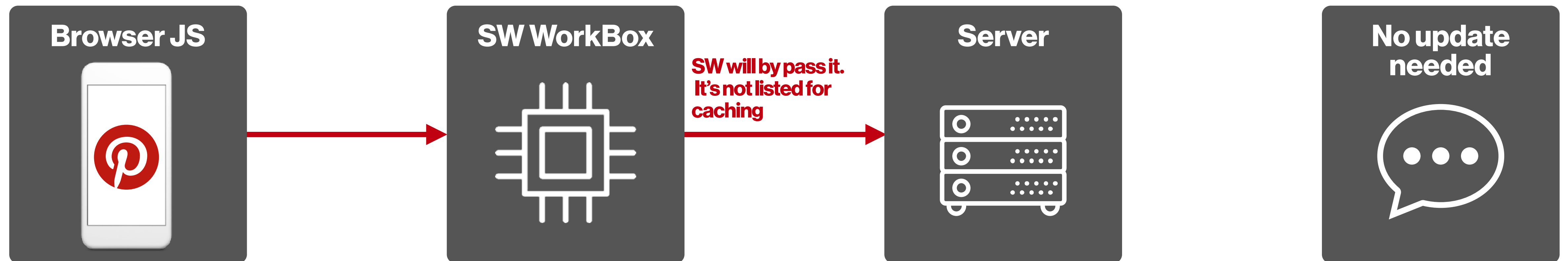


**Updating App
Version**

Update version

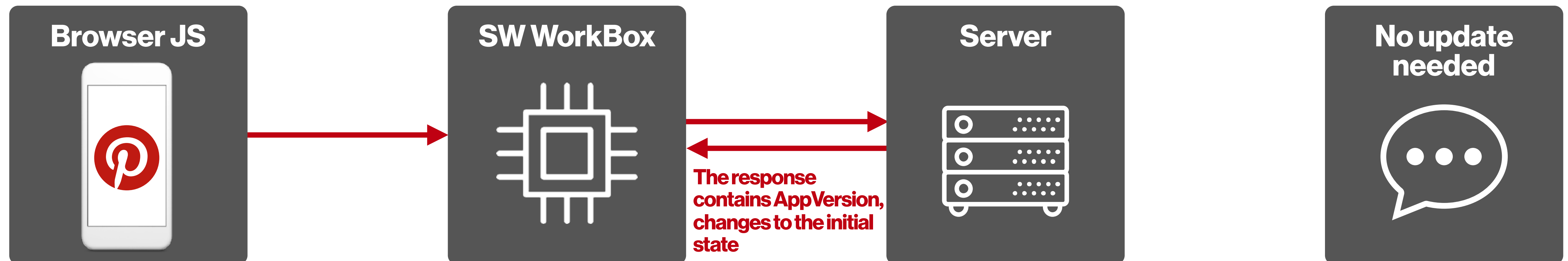


Update version



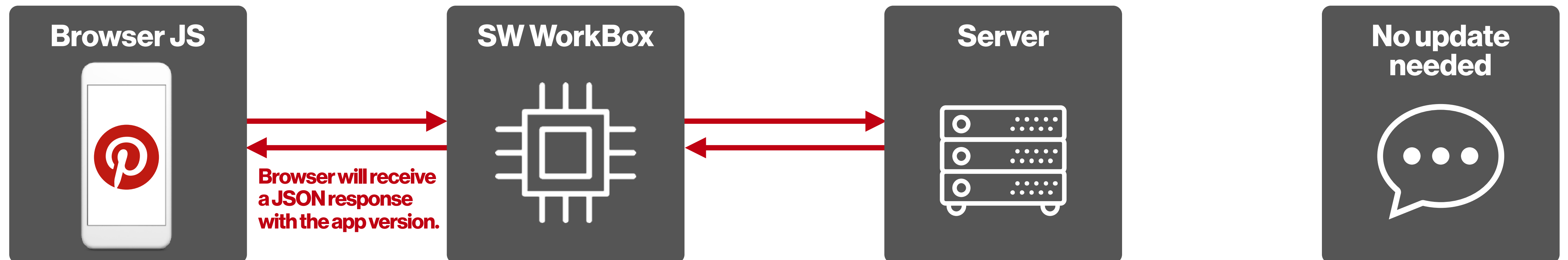
Update version

```
response {  
  status: "success"  
  client_context {  
    app_version: "a82b667"  
    experiments {}  
  }  
  pin {}  
}
```



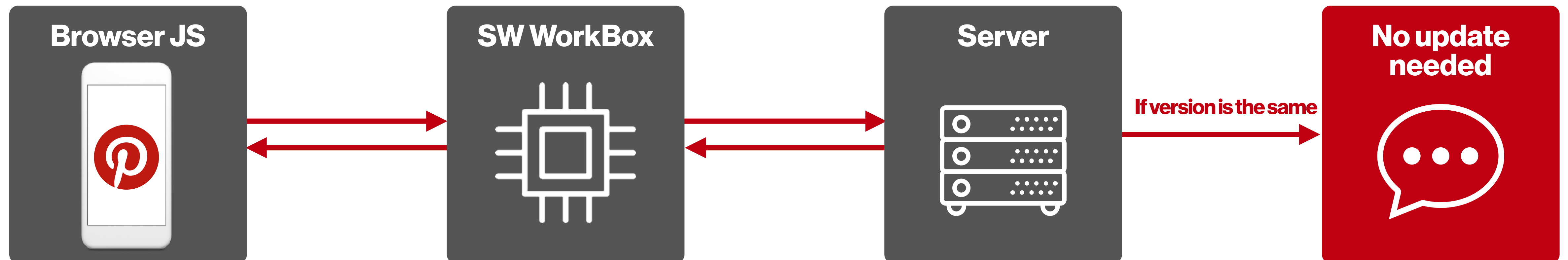
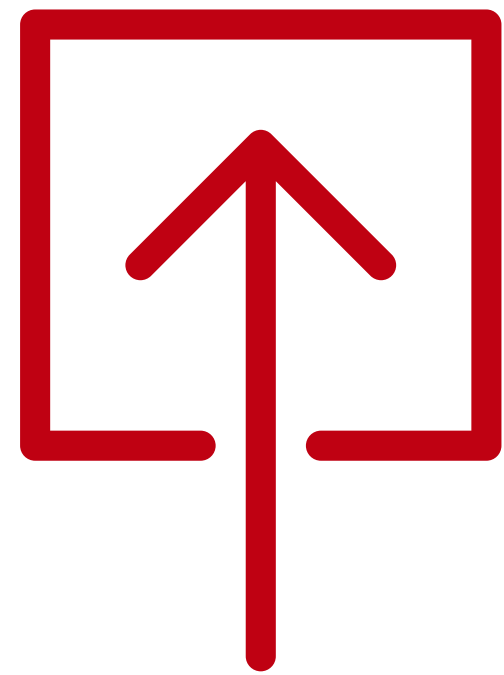
Update version

```
response {  
  status: "success"  
  client_context {  
    app_version: "a82b667"  
    experiments {}  
  }  
  pin {}  
}
```



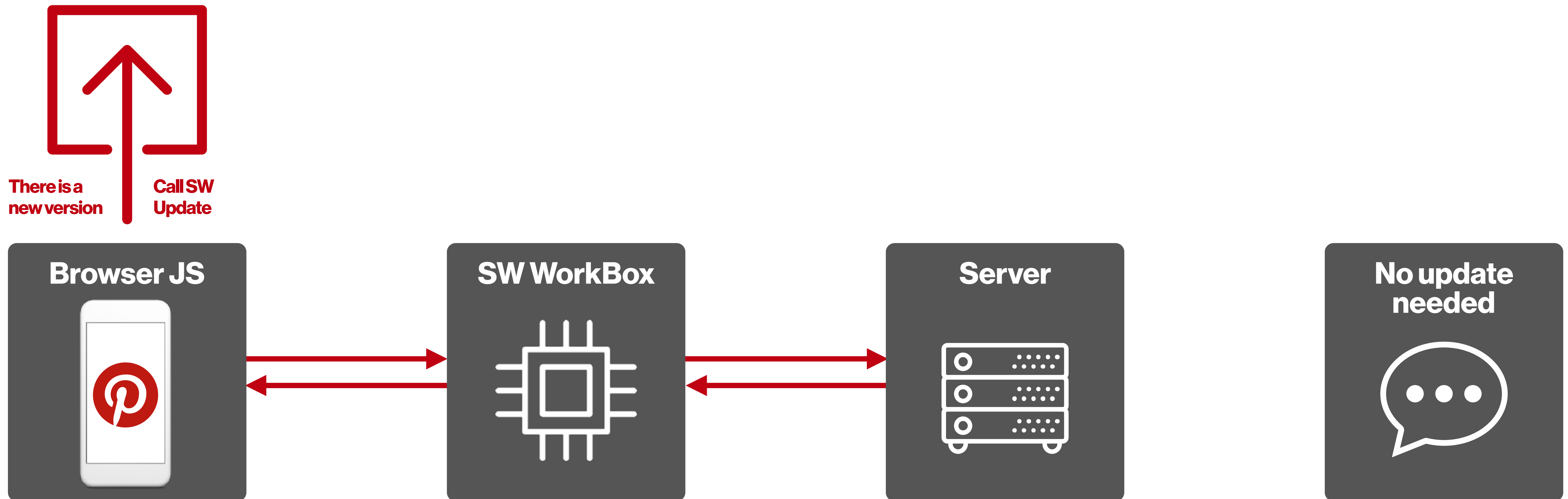
Update version

- Save the updated initial state in the locale storage
- It will override AppShell's initial state on future page reloads



Update version

- Do `window.location.reload(true);` on the next navigation
- `clients.claim()` sets this worker as the active worker for all clients
- `skipWaiting()` forces installation of the waiting ServiceWorker



Generating SW files

```
42  /* Create a service worker for every locale to precache the locale bundle */
43  const ExperimentConfigs = locales.reduce((configs, locale) => {
44    return Object.assign(configs, {
45      ['mobile-${locale}']: Object.assign({}, BaseConfig, {
46        template: path.join(__dirname, 'swTemplates/mobileBase.js'),
47        cache: {
48          template: path.join(__dirname, 'swTemplates/mobileCache.js'),
49          precache: [
50            'vendor-react-.*\\.js$',
51            'entryChunk-www-.*\\.js$',
52            'vendor-mweb-.*\\.js$',
53            'entryChunk-mobile-.*\\.js$',
54            'entryChunk-webpack-.*\\.js$',
55            `locale-${locale}-mobile.*js$`,
56            'pjs-LoginPage.*\\.js$',
57            'pjs-SignupPage.*\\.js$',
58            'pjs-HomePage.*\\.js$',
59            'pjs-ExplorePage.*\\.js$',
60            'pjs-SearchPage.*\\.js$',
61            'pjs-NotificationsPage.*\\.js$',
62            'pjs-ProfilePage.*\\.js$',
63            'pjs-CloseupPage.*\\.js$',
64          ],
65          strategy: [{
66            type: 'prefer-cache',
67            matches: [
68              'webapp\\js\\.*\\.js$',
69              '.*\\.css'
70            ]
71          }]
72        },
73        notifications: Object.assign({}, BaseConfig.notifications, {
74          template: path.join(__dirname, 'swTemplates/mobileNotifications.js'),
75        }),
76      })
77    });
78  }, {});
```

Mobile Base
Template

Mobile Cache
Template

Webpack
SW Plugin

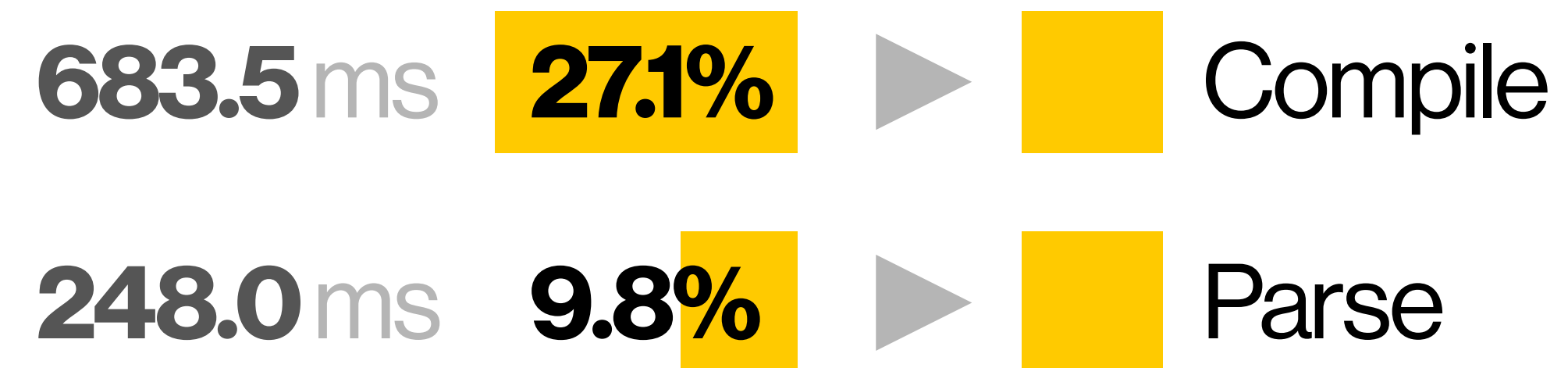
sw-mobile-
en_US.js

sw-mobile-
ru_RU.js

sw-mobile-ja.js

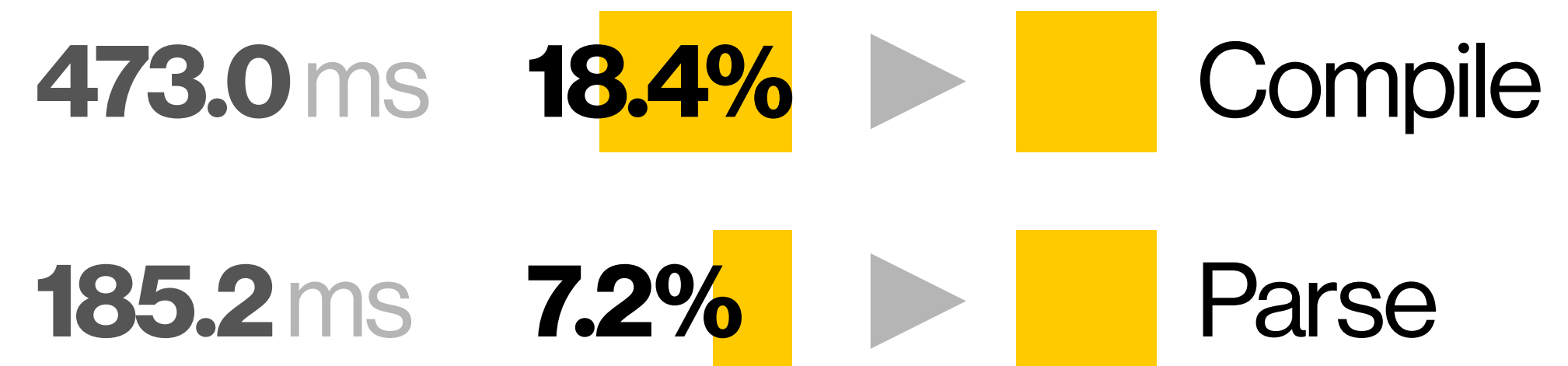
About V8 Code Caching

First Load



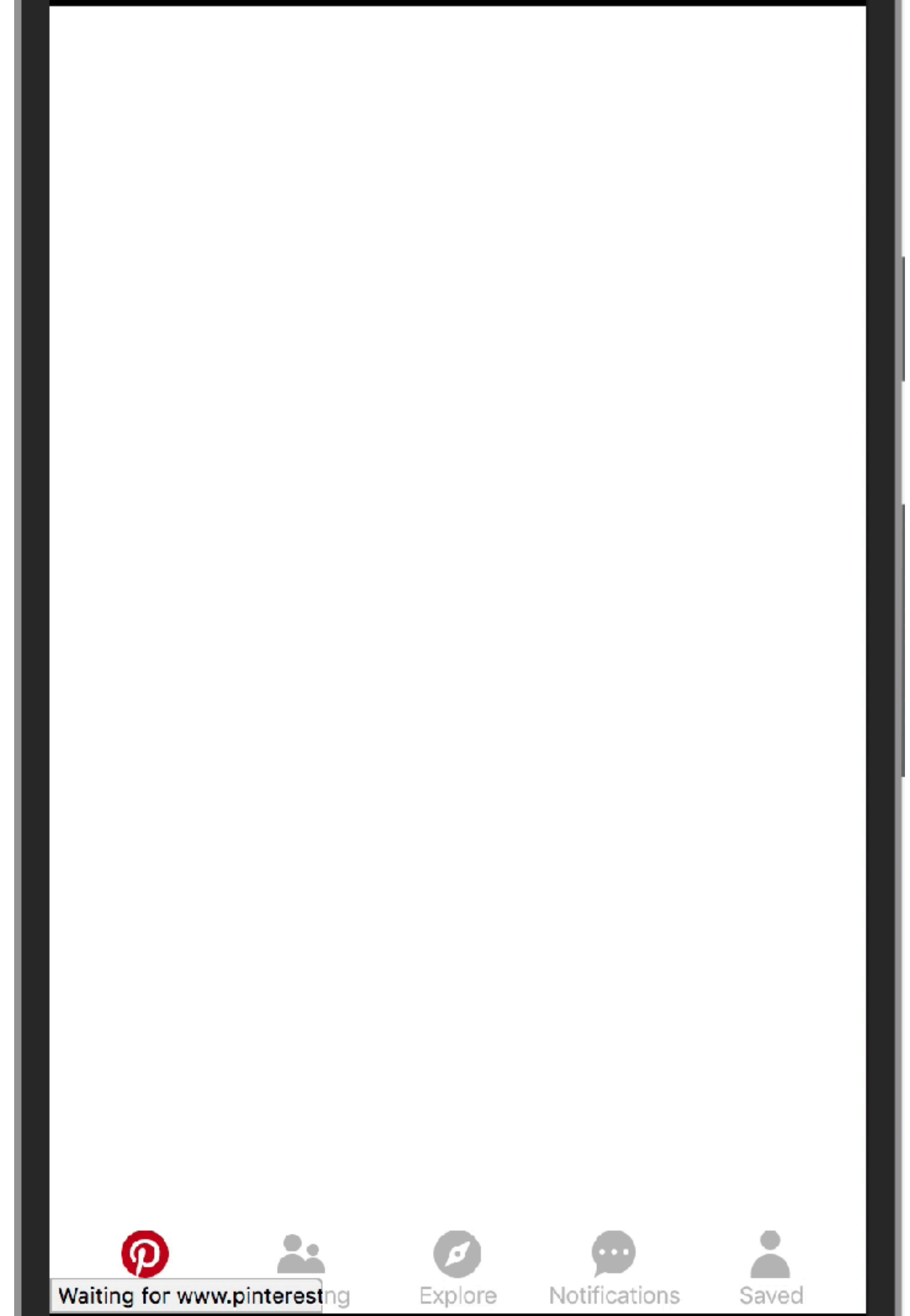
Measurements for main Pinterest bundle

Repeat Load (with code-caching)



30% faster JS Compile
25% faster JS Parse

Offline navigation



JS Bundling

JavaScript chunk types

Vendor

React, Redux, React Router etc (73KB)

Entry

Main shell, Core logic, Redux store (72KB)

Async

Async route chunks (1-2KB)

Route-based Code Splitting

```
// Create a loader

const Closeup = () => import(/* webpackChunkName: "CloseupPage" */ 'app/mobile/routes/CloseupPage');

// Register it to the route

route('/pin/:pinId', routes.Closeup, { name: 'Closeup' }),

// Render a react-router-v4 Route with the route bundle loader
<Route exact key="matched-route" path={path} render={matchProps =>
  <PageRoute
    bundleLoader={loader}
    routeName={name}
    {...matchProps}
    {...props}
  />
/>

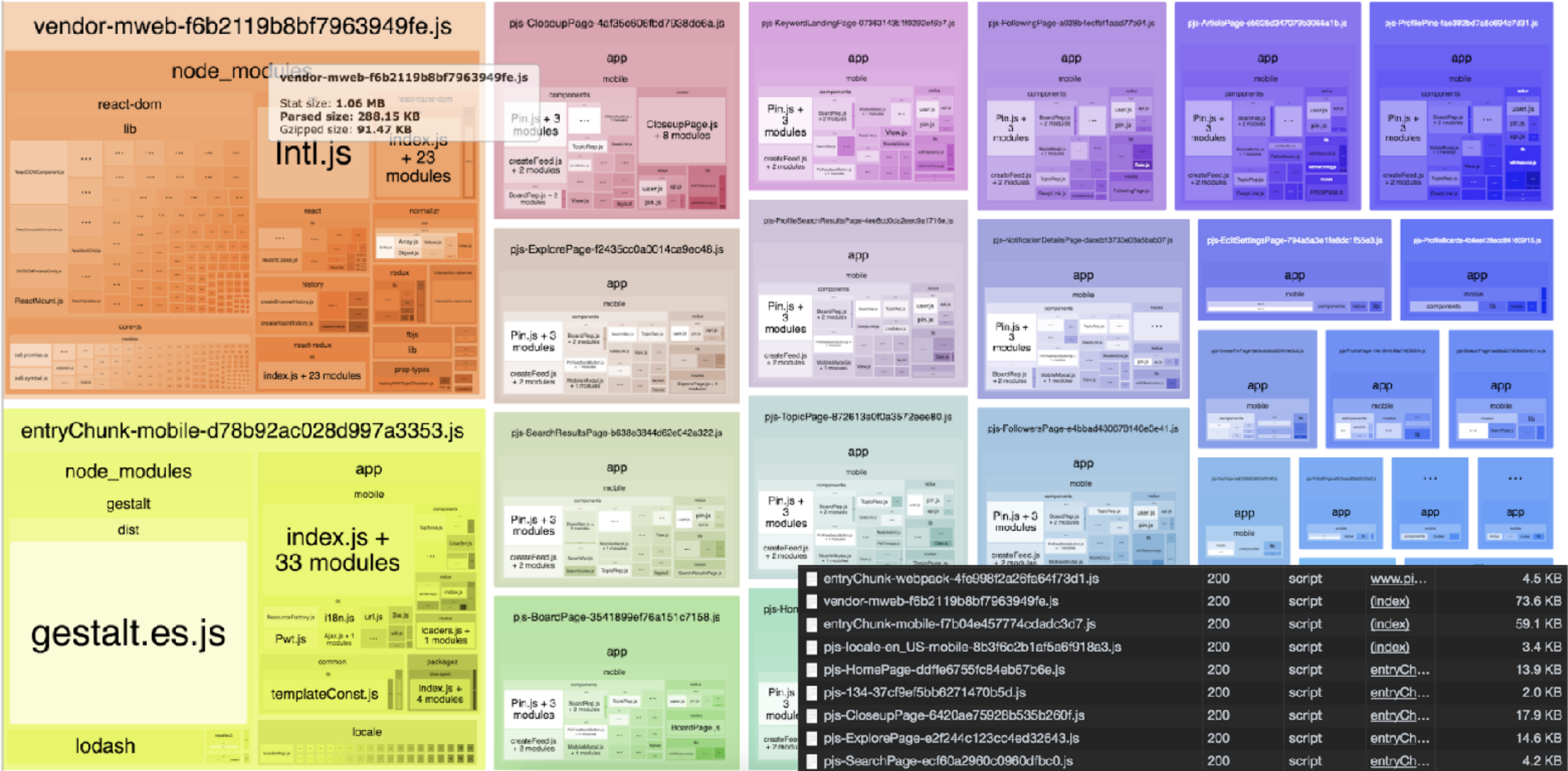
// Async load the route bundle
class PageRoute extends PureComponent {
  render() {
    const { bundleLoader, ...props } = this.props;
    return <Loader loader={bundleLoader} {...props} />;
  }
}

// Load it and render
class Loader extends PureComponent {
  componentWillMount() {
    this.props.loader().then(module => {
      this.setState({ LoadedComponent: module.default });
    });
  }
}
```

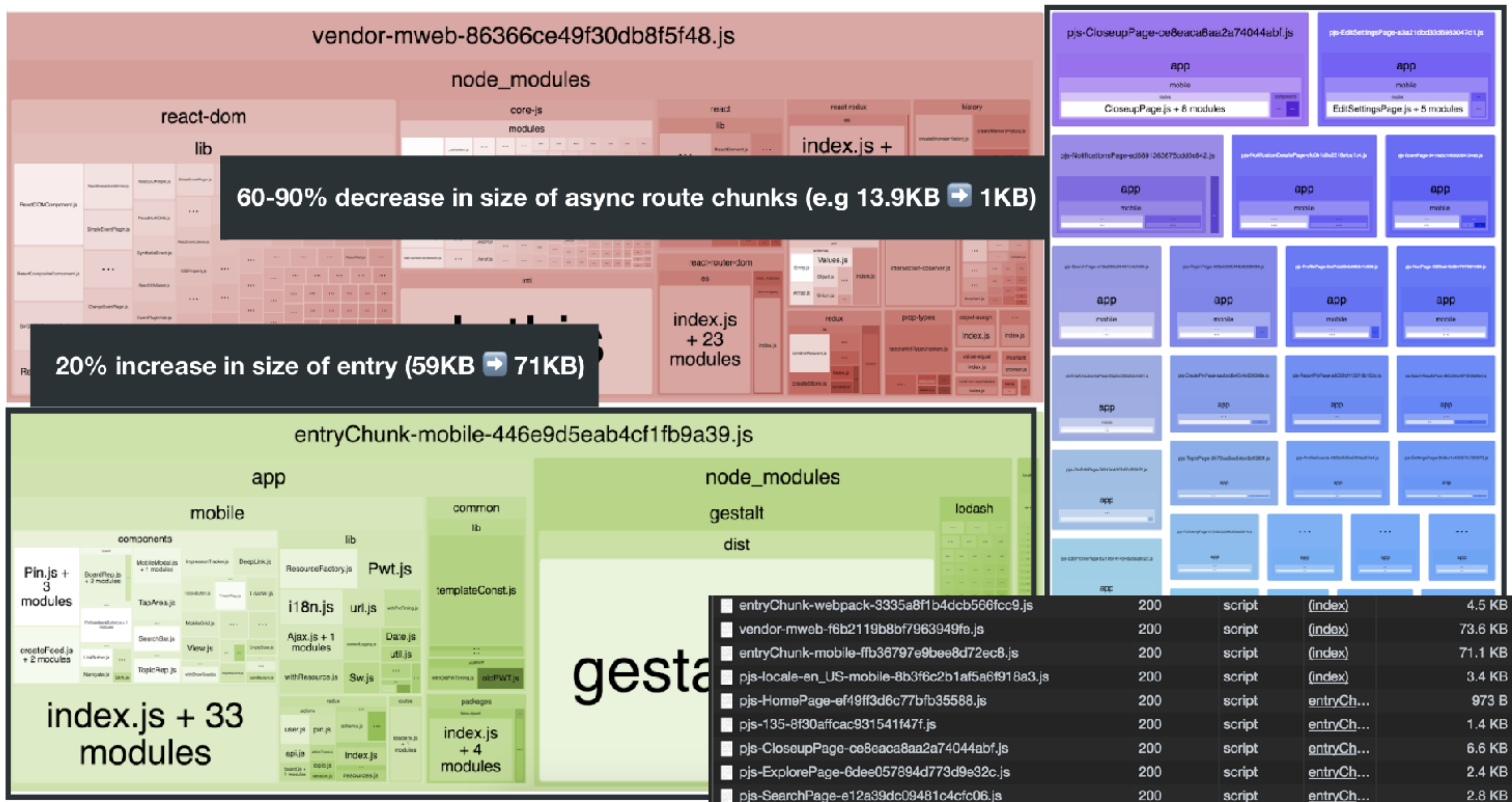

■ entryChunk-webpack-b037e06305ec66166bd8.js	...	s...	(...	4.6 KB	675 ms
■ vendor-mweb-6a726997d4ec0fa7b530.js	...	s...	(...	73.5 KB	1.29 s
■ entryChunk-mobile-3f8a2e3521a051e0ae69.js	...	s...	(...	72.5 KB	1.29 s
■ pjs-locale-en_US-mobile-8b3f6c2b1af5a6f918a3.js	...	s...	(...	3.4 KB	636 ms
■ pjs-HomePage-ebf70a2546c949004685.js	...	s...	...	1006 B	571 ms
■ pjs-138-8d081ec0c0cce375e5a2.js	...	s...	...	1.3 KB	574 ms
■ pjs-CloseupPage-1140162ad7d842d99997.js	...	s...	...	9.4 KB	636 ms
■ pjs-ExplorePage-a6785e10b69ca0158f97.js	...	s...	...	2.4 KB	593 ms
■ pjs-SearchPage-4cc439e68e217d627d11.js	...	s...	...	2.9 KB	904 ms

Webpack Bundle Analyzer

Before splitting out common async route code



After moving out common code from async chunks into entryChunk



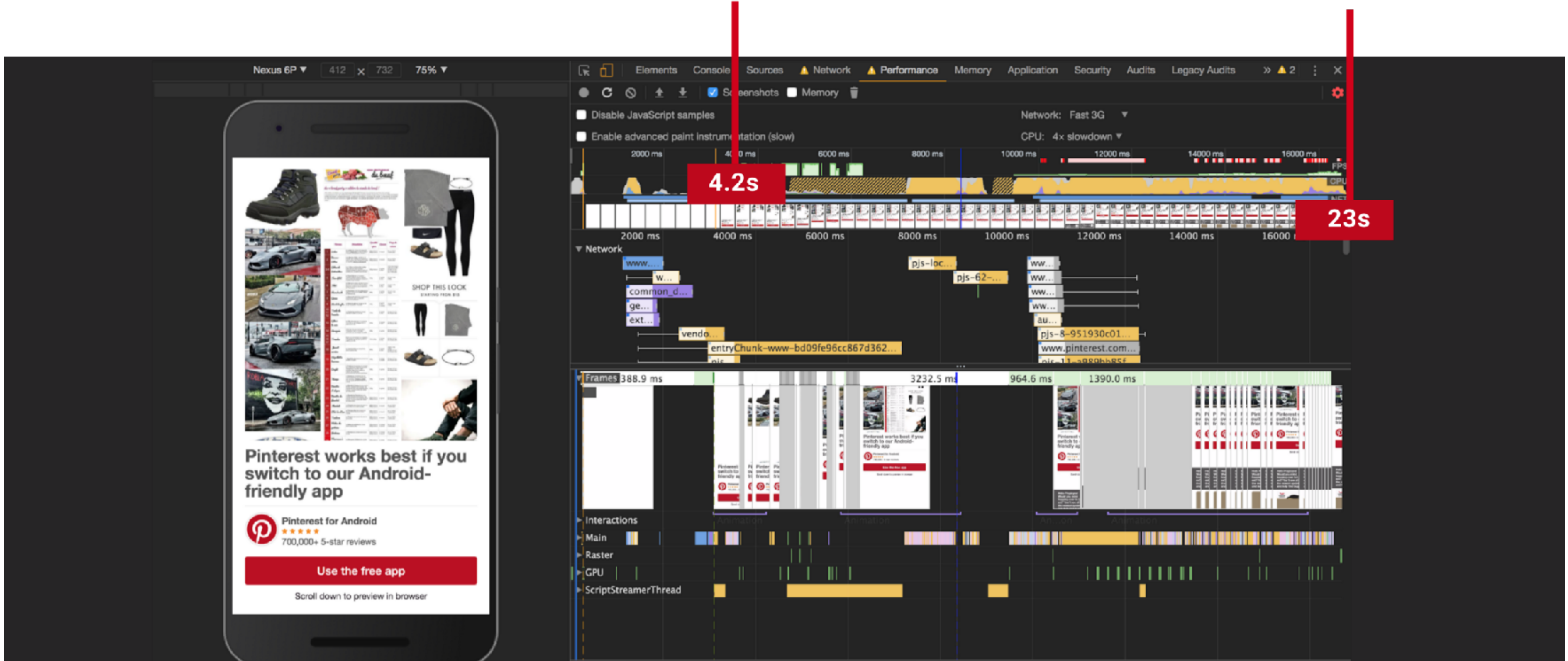
Loading Time

Pinterest's old mobile site

3G Network

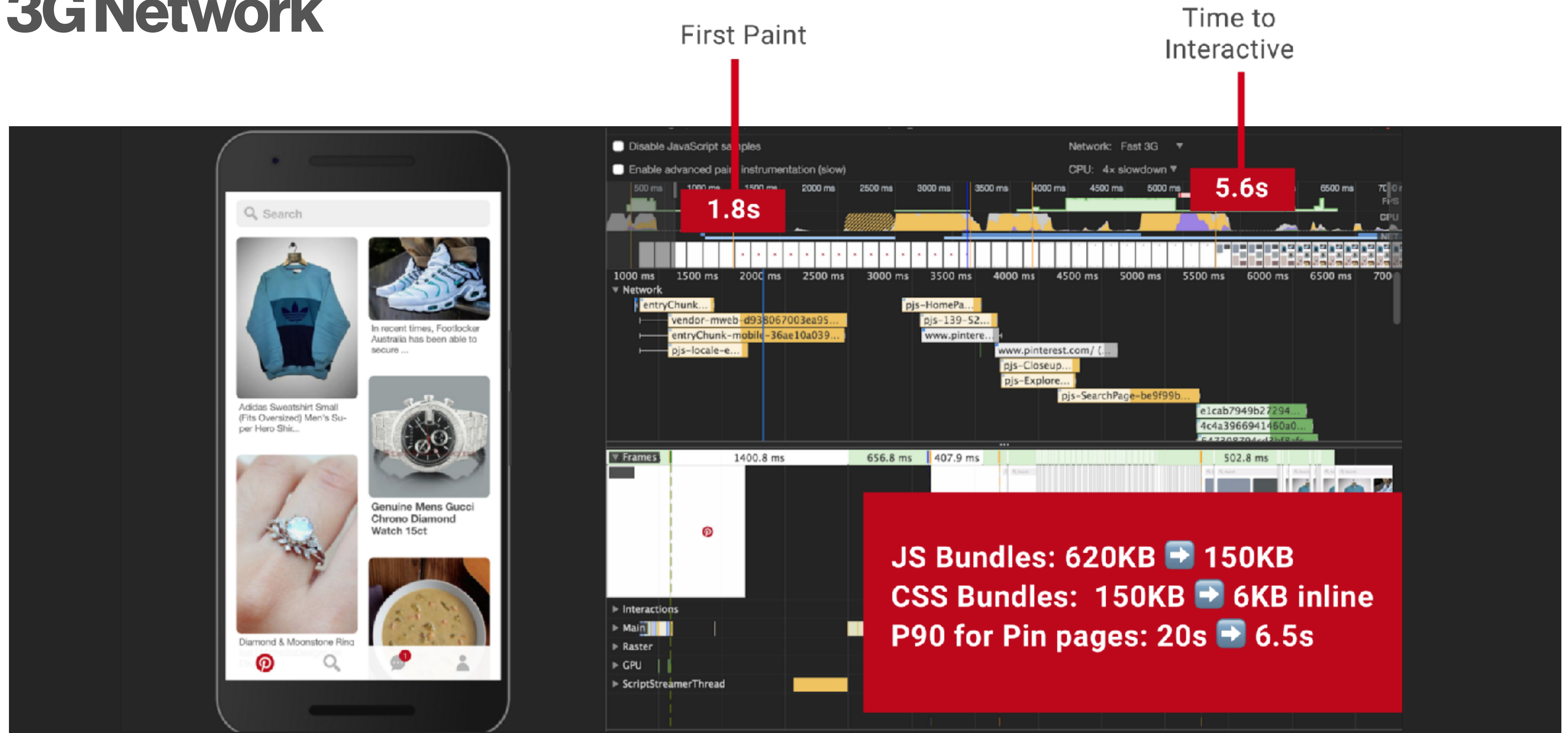
First Paint

Time to Interactive



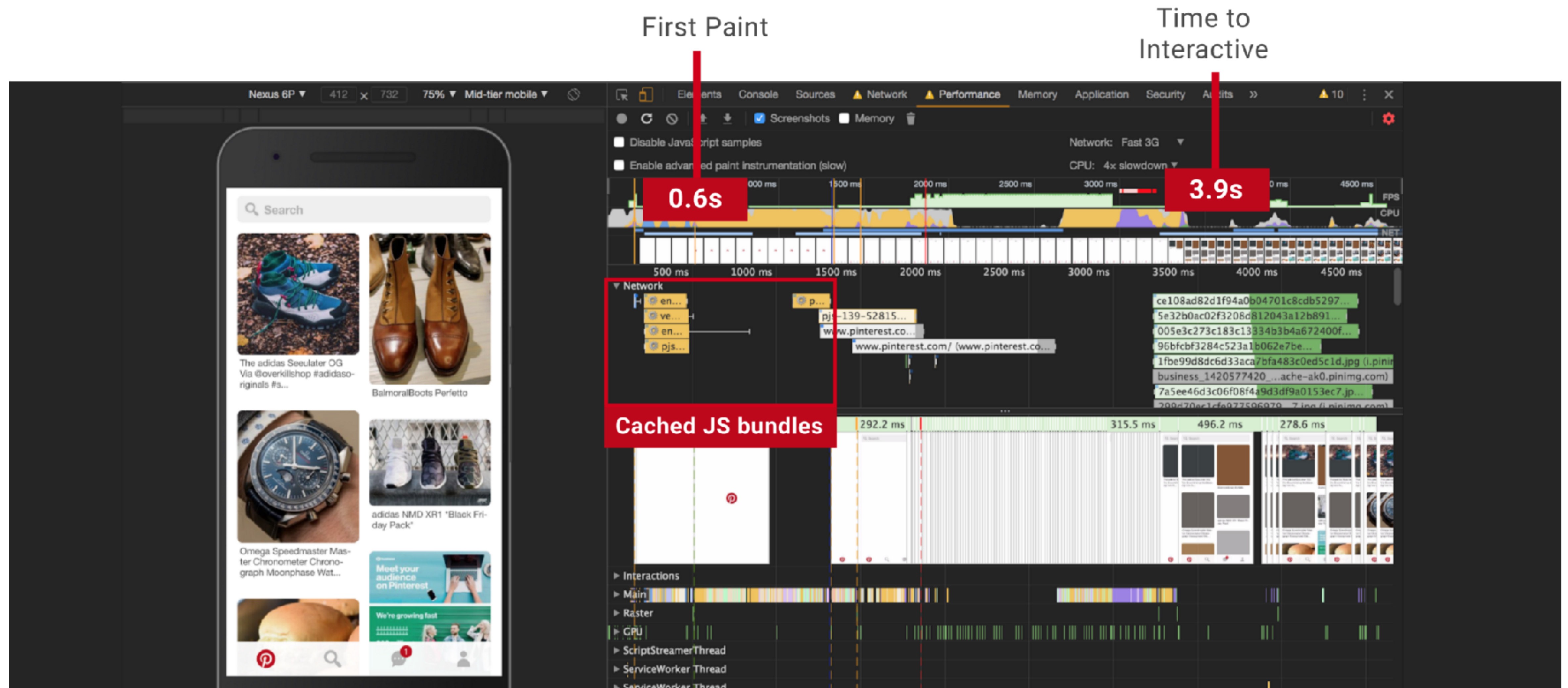
Pinterest's new mobile site

3G Network



Pinterest's new mobile site

Repeat Loads over 3G Network



**Background
Sync**

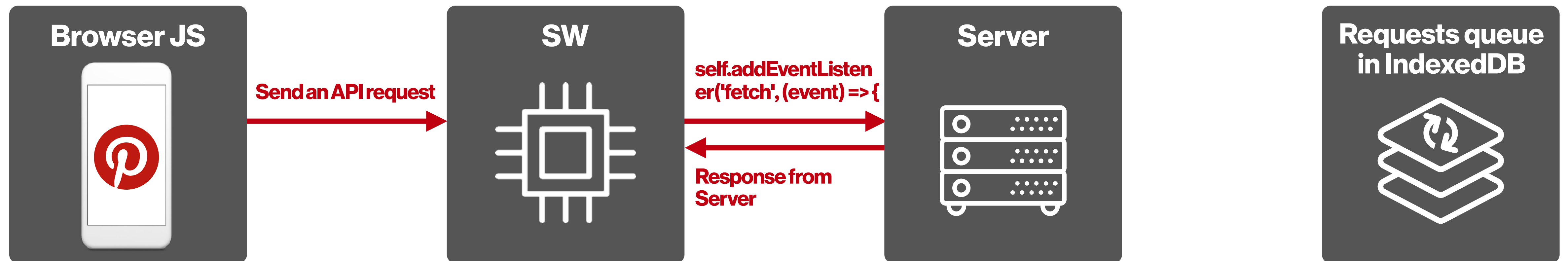
Background Sync



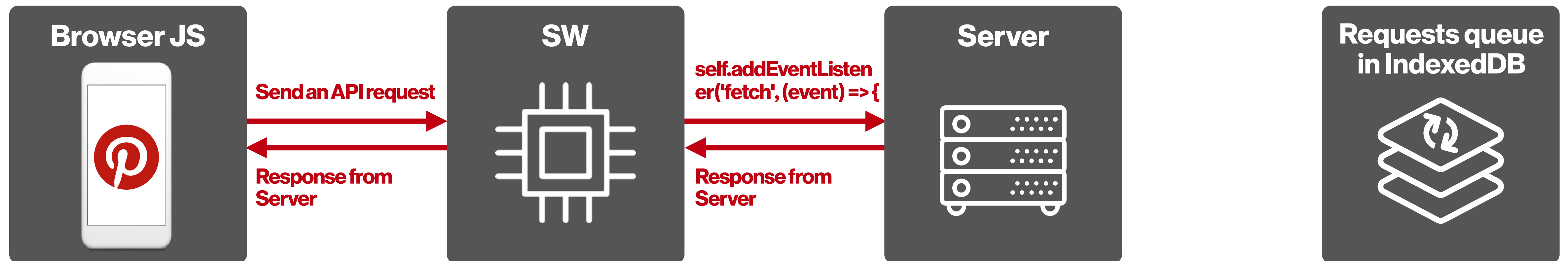
Background Sync



Background Sync



Background Sync



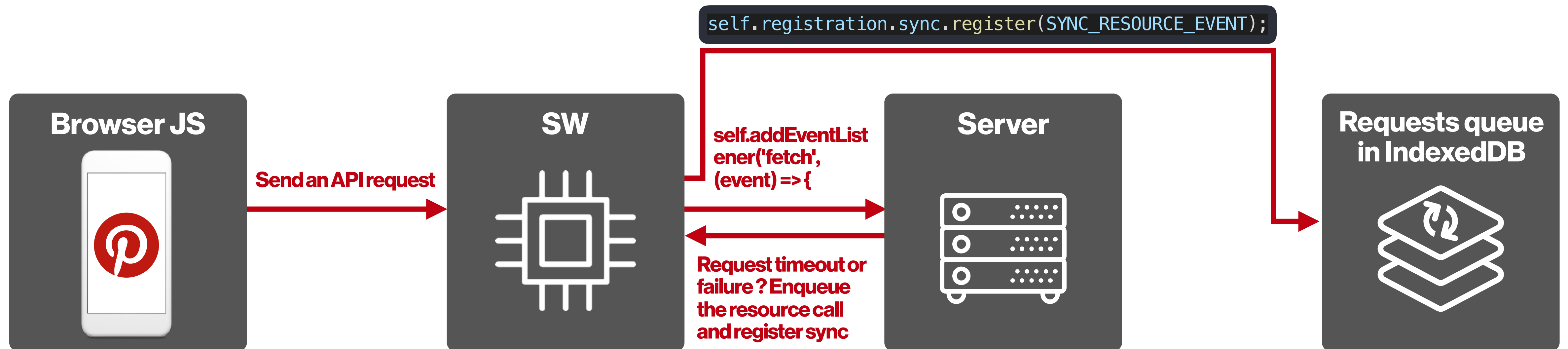
Background Sync



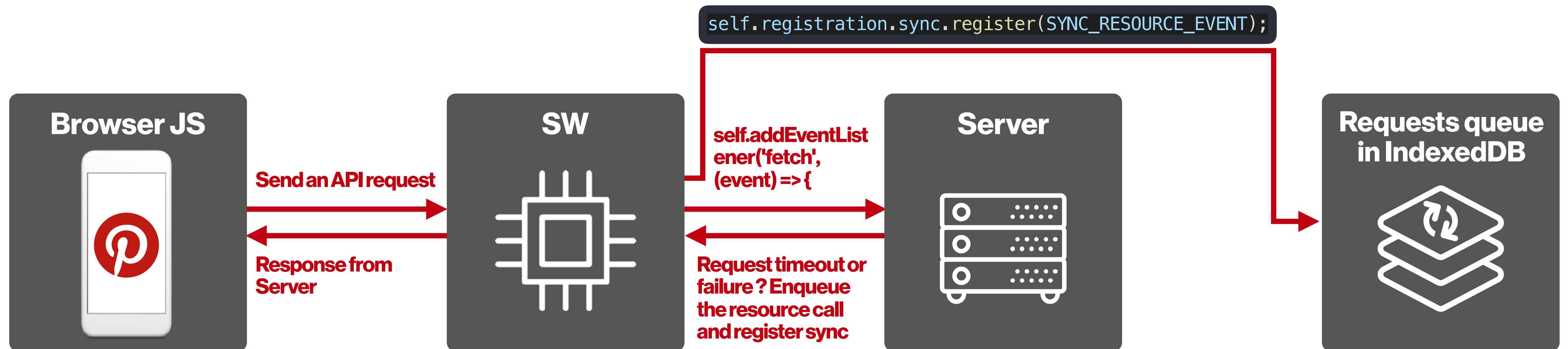
Background Sync



Background Sync



Background Sync



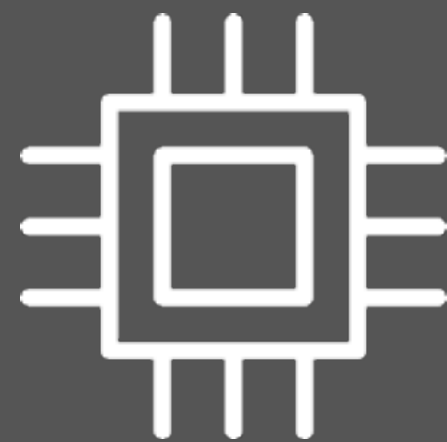
Background Sync

```
self.addEventListener('sync', (event) => {  
  if (event.tag === SYNC_RESOURCE_EVENT) {  
    event.waitUntil(replayFromResourceSyncQueue());  
  }  
});
```

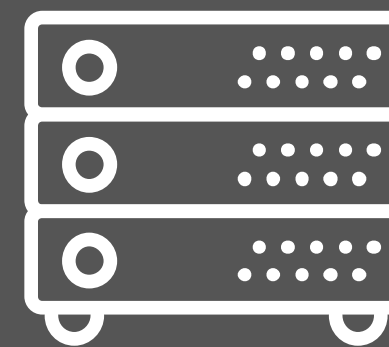
Browser JS



SW



Server



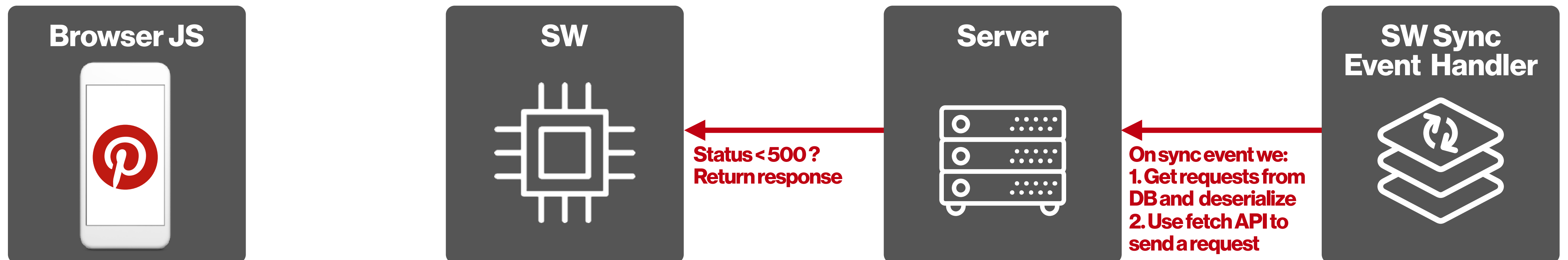
SW Sync
Event Handler



On sync event we:
1. Get requests from
DB and deserialize
2. Use fetch API to
send a request

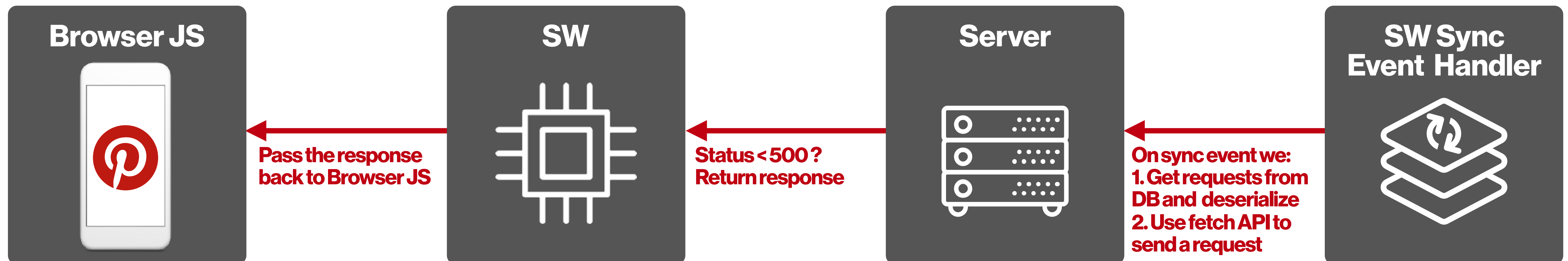
Background Sync

```
self.addEventListener('sync', (event) => {  
  if (event.tag === SYNC_RESOURCE_EVENT) {  
    event.waitUntil(replayFromResourceSyncQueue());  
  }  
});
```



Background Sync

```
self.addEventListener('sync', (event) => {  
  if (event.tag === SYNC_RESOURCE_EVENT) {  
    event.waitUntil(replayFromResourceSyncQueue());  
  }  
});
```



Redux Normalization

Redux Normalization



Redux Normalization

```
pin {  
  id  
  image  
  board {  
    id  
    name  
    owner {  
      id  
      name  
    }  
  }  
  original_pinner {  
    id  
    name  
  }  
}
```

Redux Normalization

```
pin {  
  id  
  image  
  board {  
    id  
    name  
    owner {  
      id  
      name  
    }  
  }  
  original_pinner {  
    id  
    name  
  }  
}
```


Redux Normalization

pins | “1234567” { id, image, description, **board**, **original_pinner** }

boards | “9021000” { id, name, **owner** }

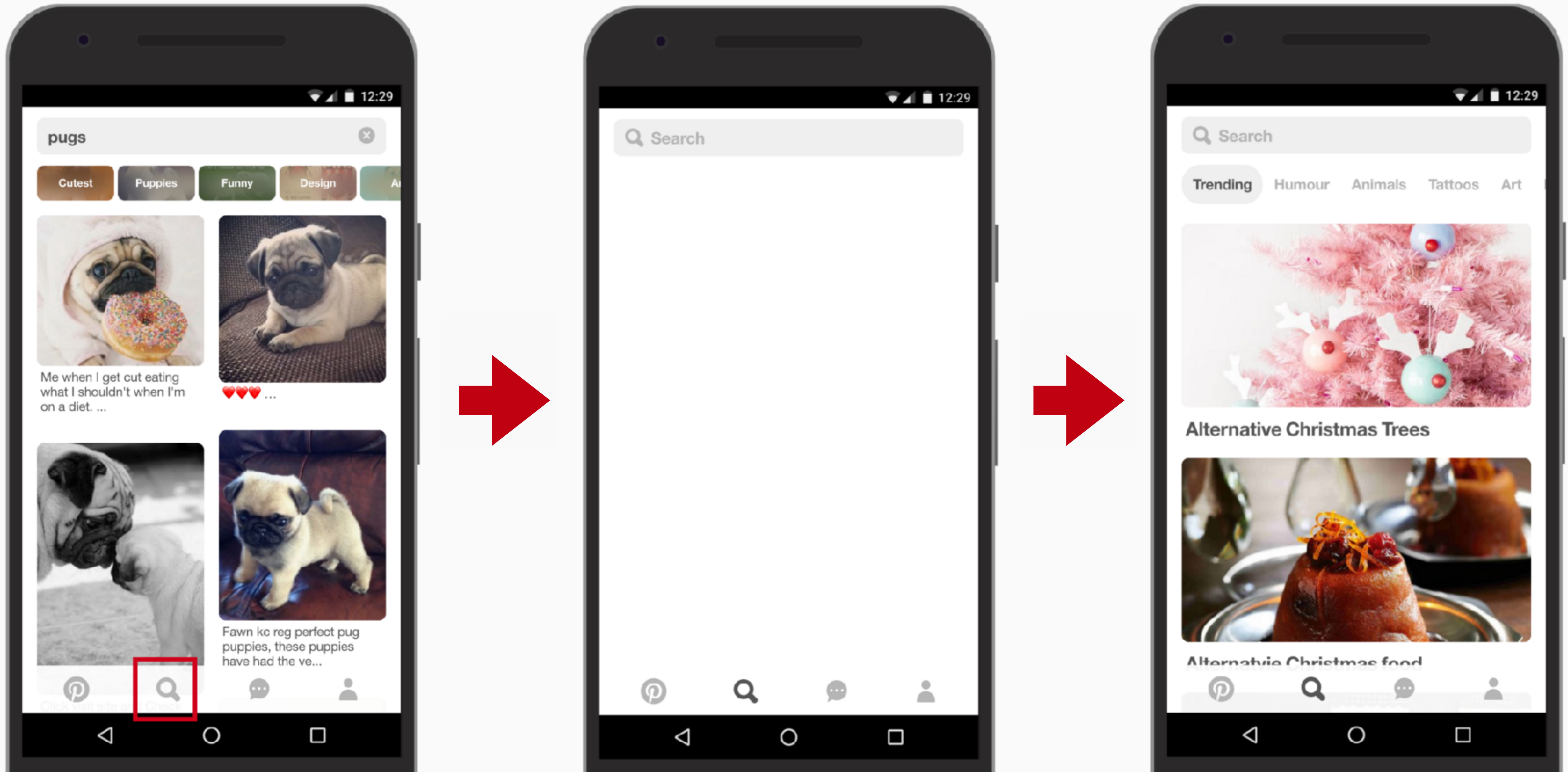
users | “48151623” { id, name }
 | “8675309” { id, name }

Redux Normalization

```
articles (pin): { }
▼ boards (pin)
  ► 141019100771271060 (pin): { layout: "default", privacy: "public", url: "/kaylacolq...", ... }
  boardsections (pin): { }
  settings (pin): { }
  categories (pin): { }
  ► experiences (pin): { 40000: {...} }
  ► experiments (pin): { active: {}, triggerable: {...} }
  explore (pin): { }
  feeds (pin): { }
  invites (pin): { }
  notifications (pin): { }
▼ pins (pin)
  ► 141019032066181731 (pin): { origin_pinner: {...}, domain: "delish.com", videos: {...}, ... }
  ► resources (pin): { PinResource: {...} }
  ► search (pin): { queries: {}, recentSearches: [], recentPersonalSearches: [], ... }
  ► session (pin): { origin: "https://ww...", unauthId: "4d691b2eb7...", browserVersion: "9.0", ... }
  stories (pin): { }
  topics (pin): { }
  triedits (pin): { }
▼ users (pin)
  ► 356417895418338297 (pin): { is_employee: true, connected_to_yahoo: false, phone_number_end: "", ... }
  ► 141019169490521396 (pin): { id: "1410191694...", username: "kaylacolqu...", first_name: "kayla", ... }
  ► 267260696545200498 (pin): { username: "Delish", first_name: "Delish.com...", domain_url: "www.delish...", ... }
```

UI Optimizations

Navigation transitions are not blocked on the network



Touch Optimizations

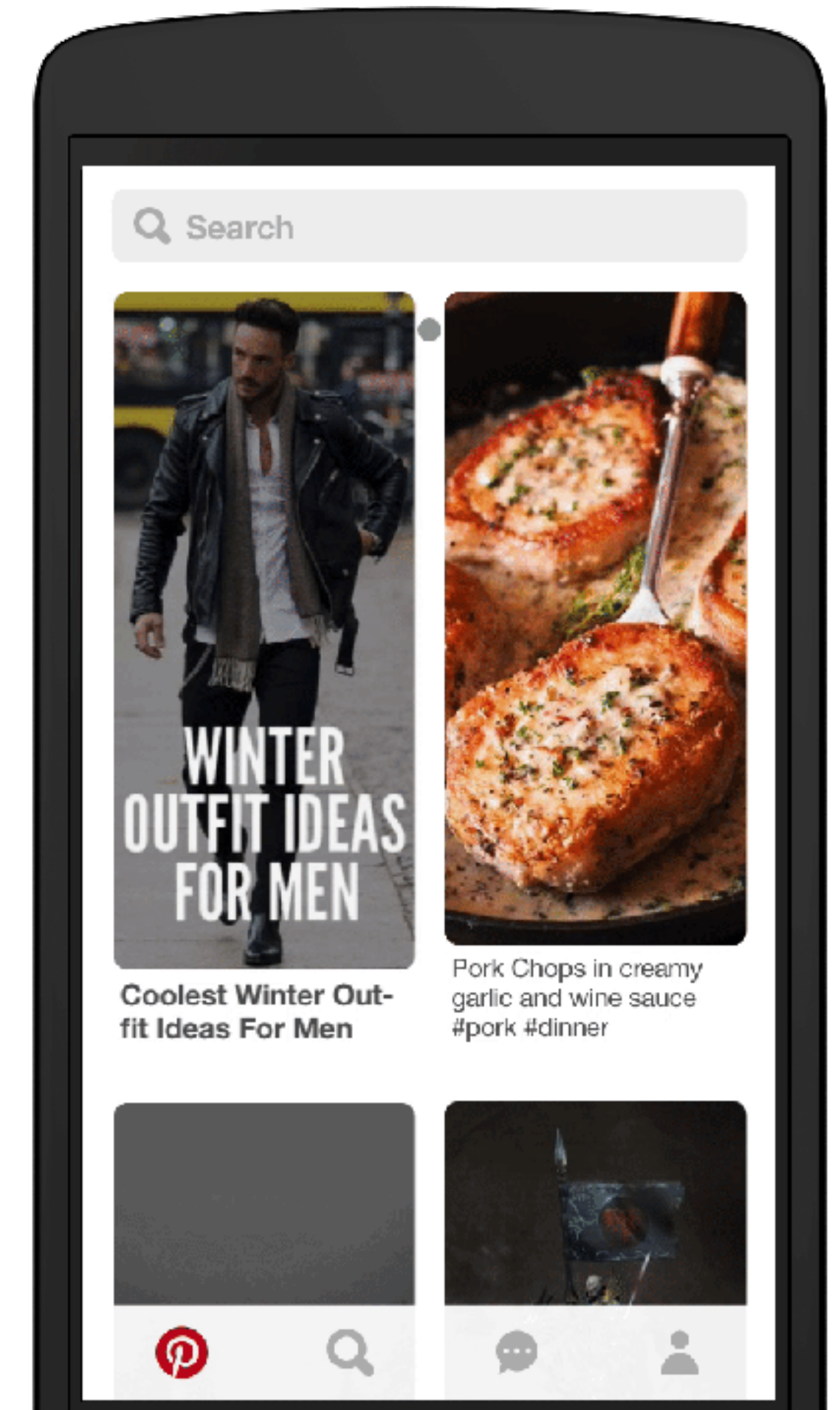
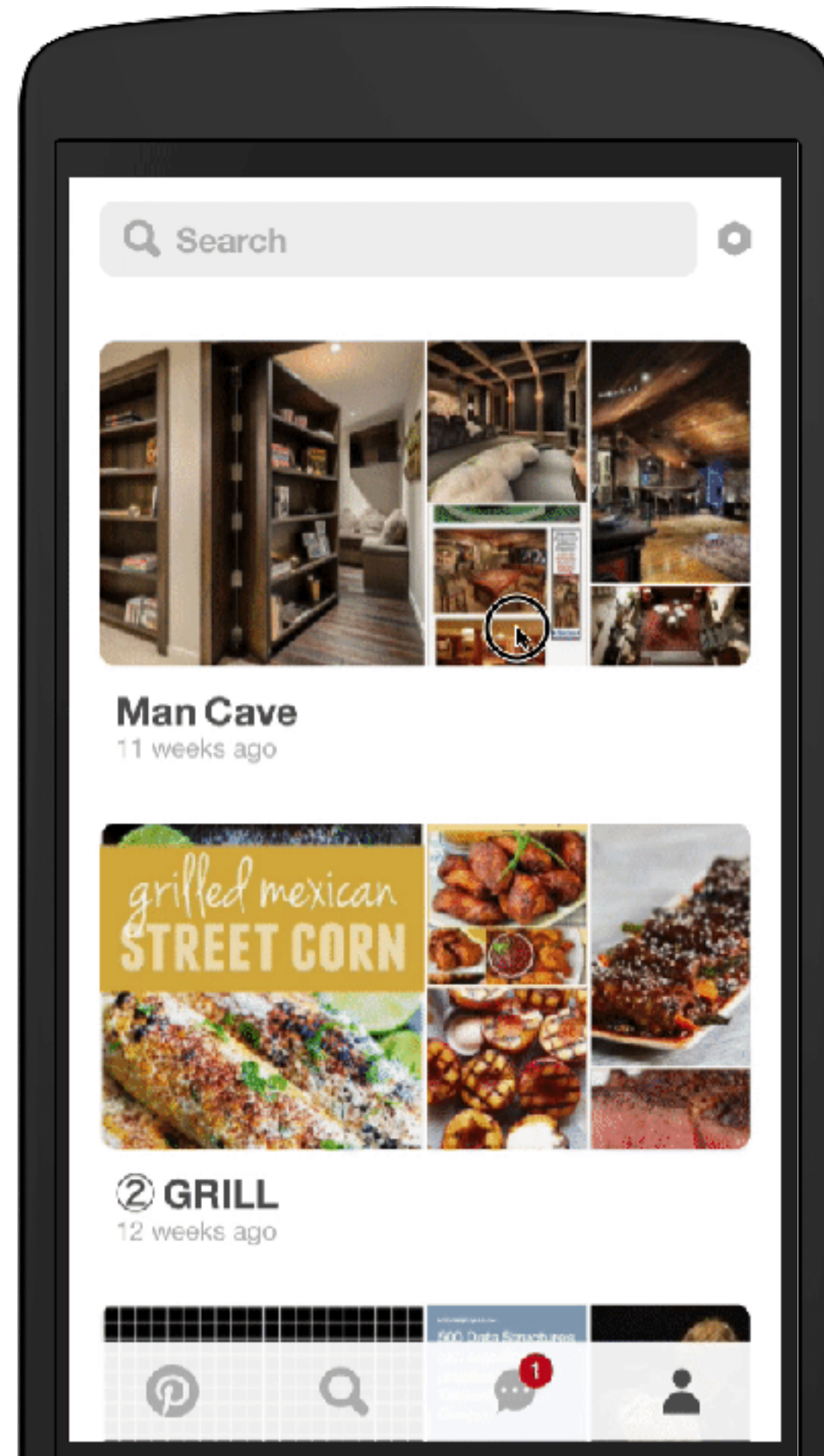
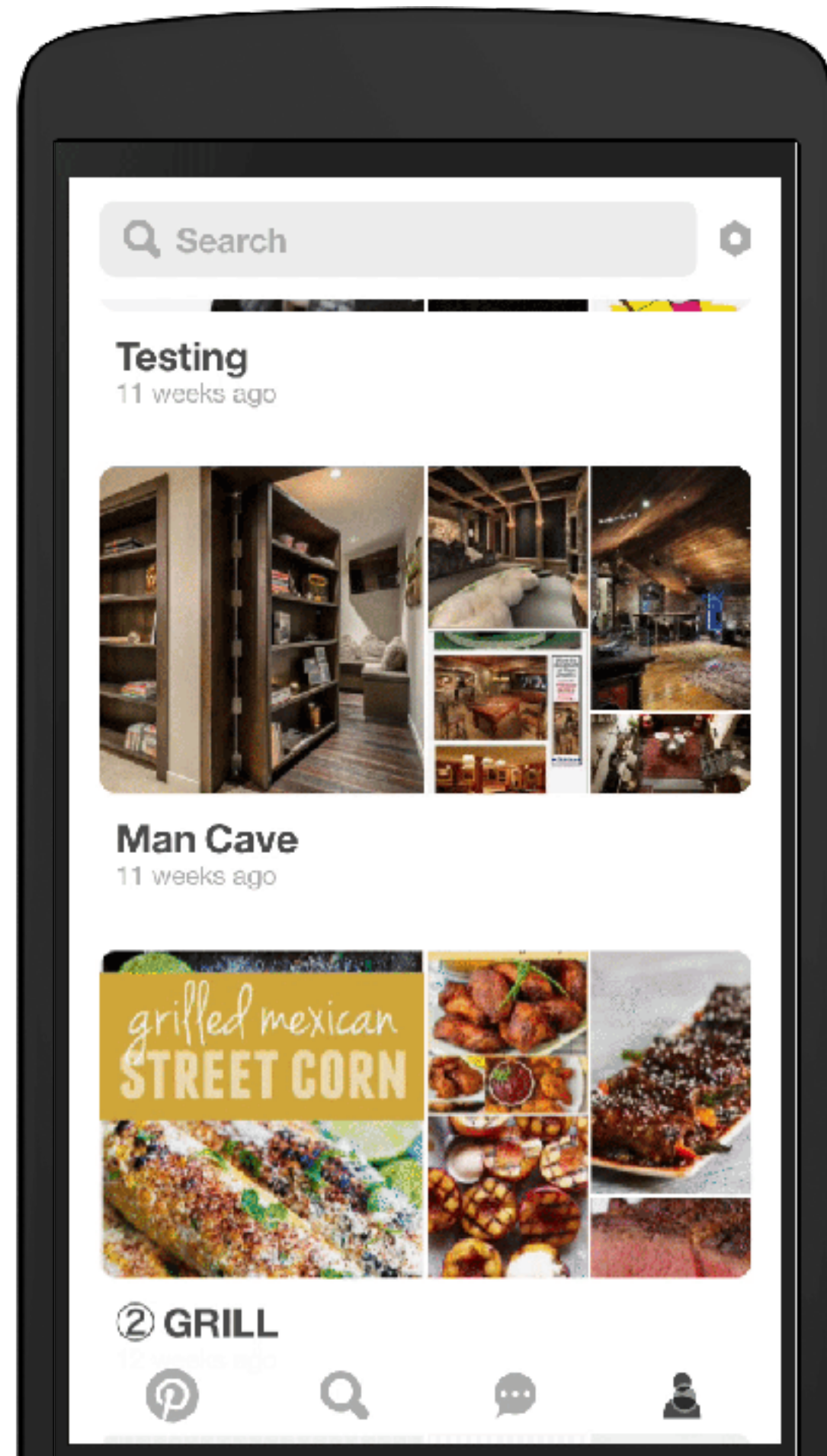
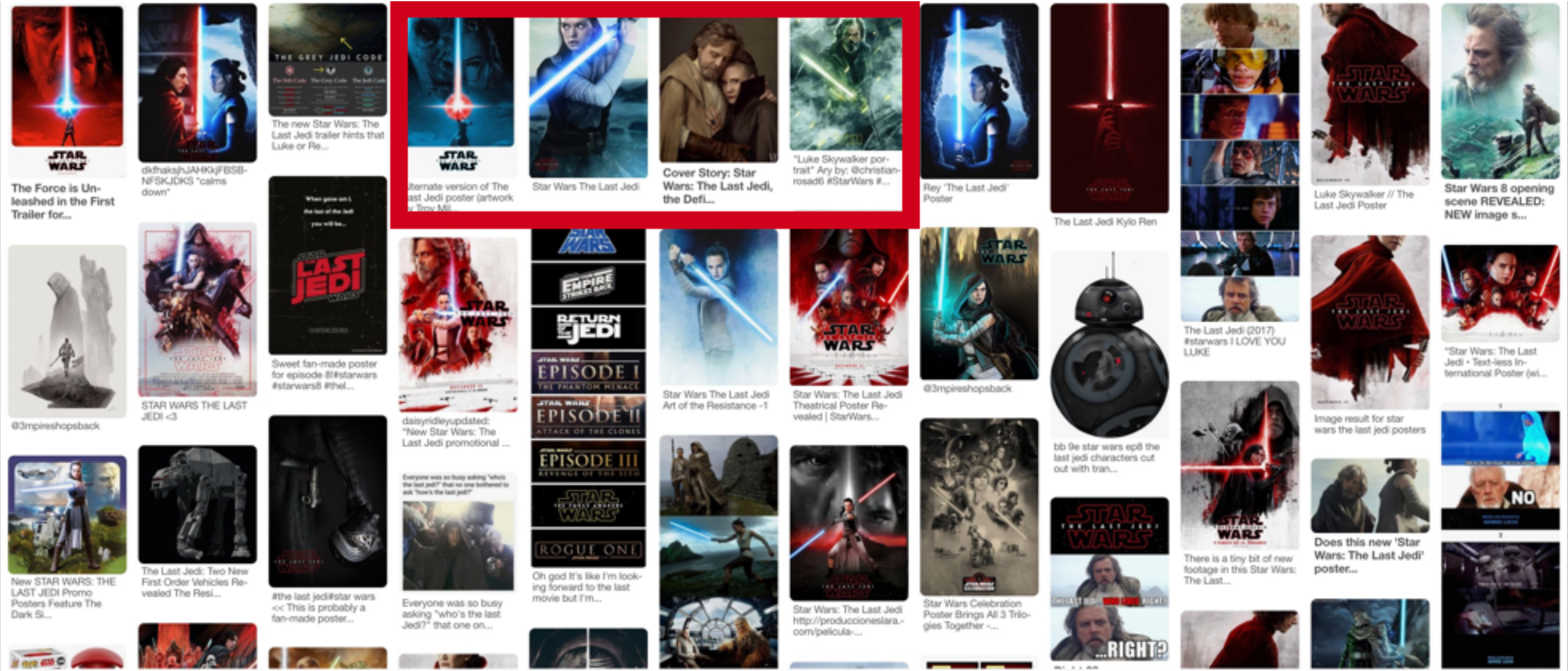
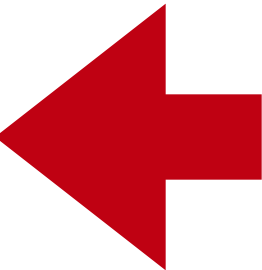
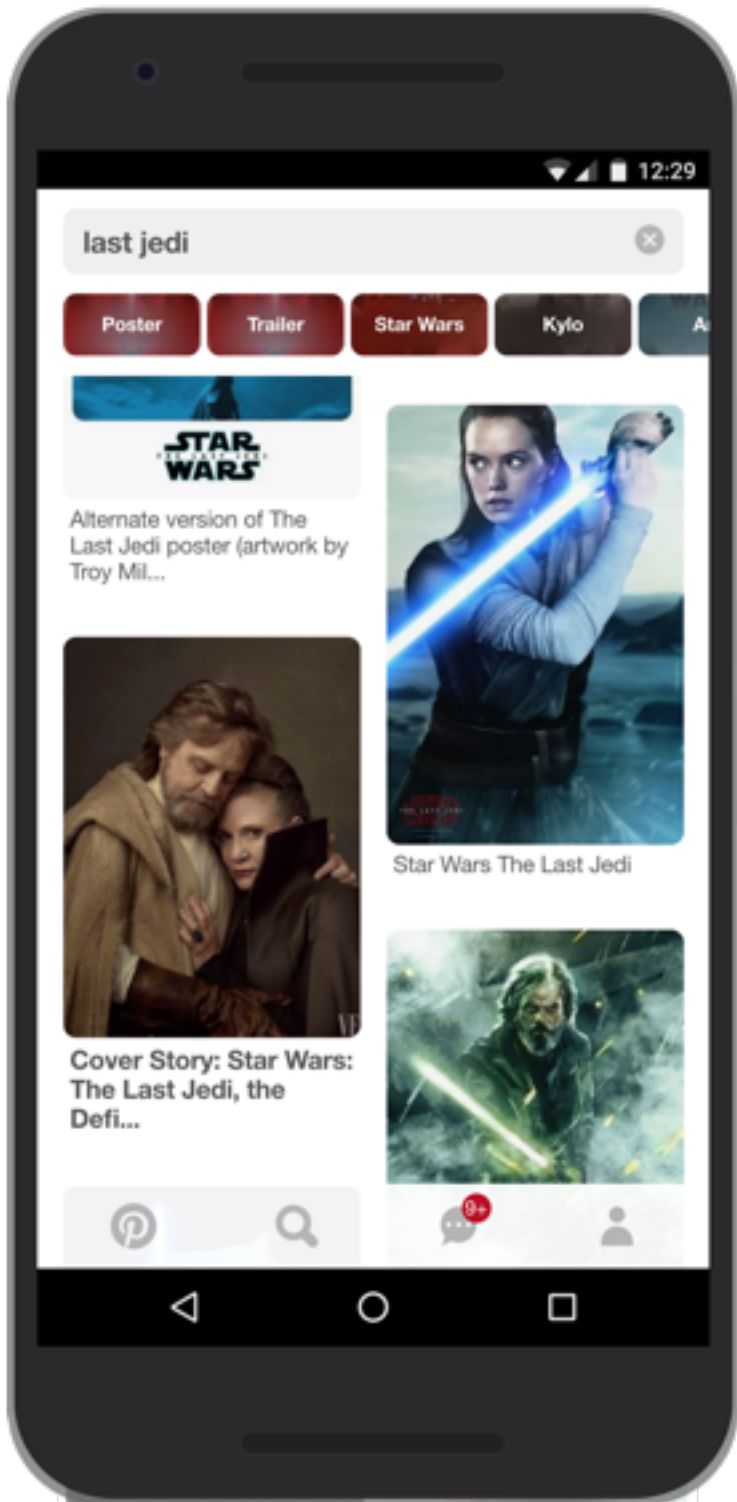


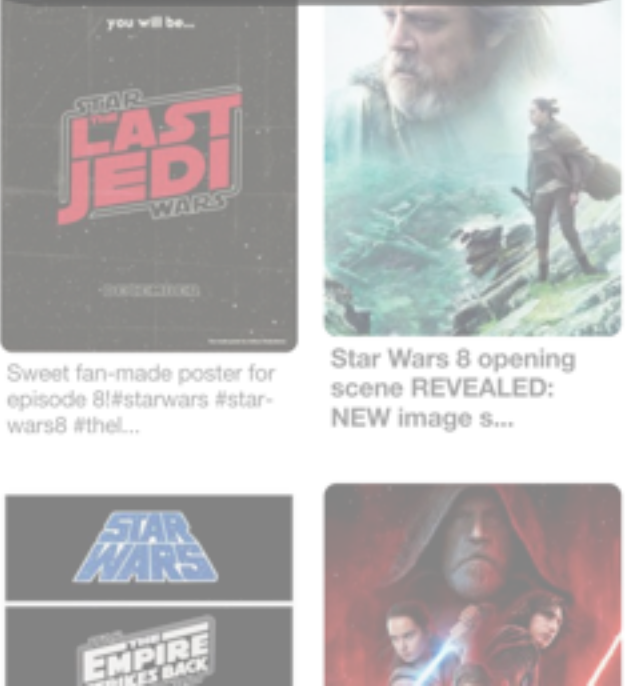
Image Optimization

Masonry grid

In-viewport
(mounted)



Outside-viewport
(not mounted)



Lazy-loaded
images

Dominant Color



Use a dominant color
placeholder

Search



Waiting for imad.pinteng



Explore

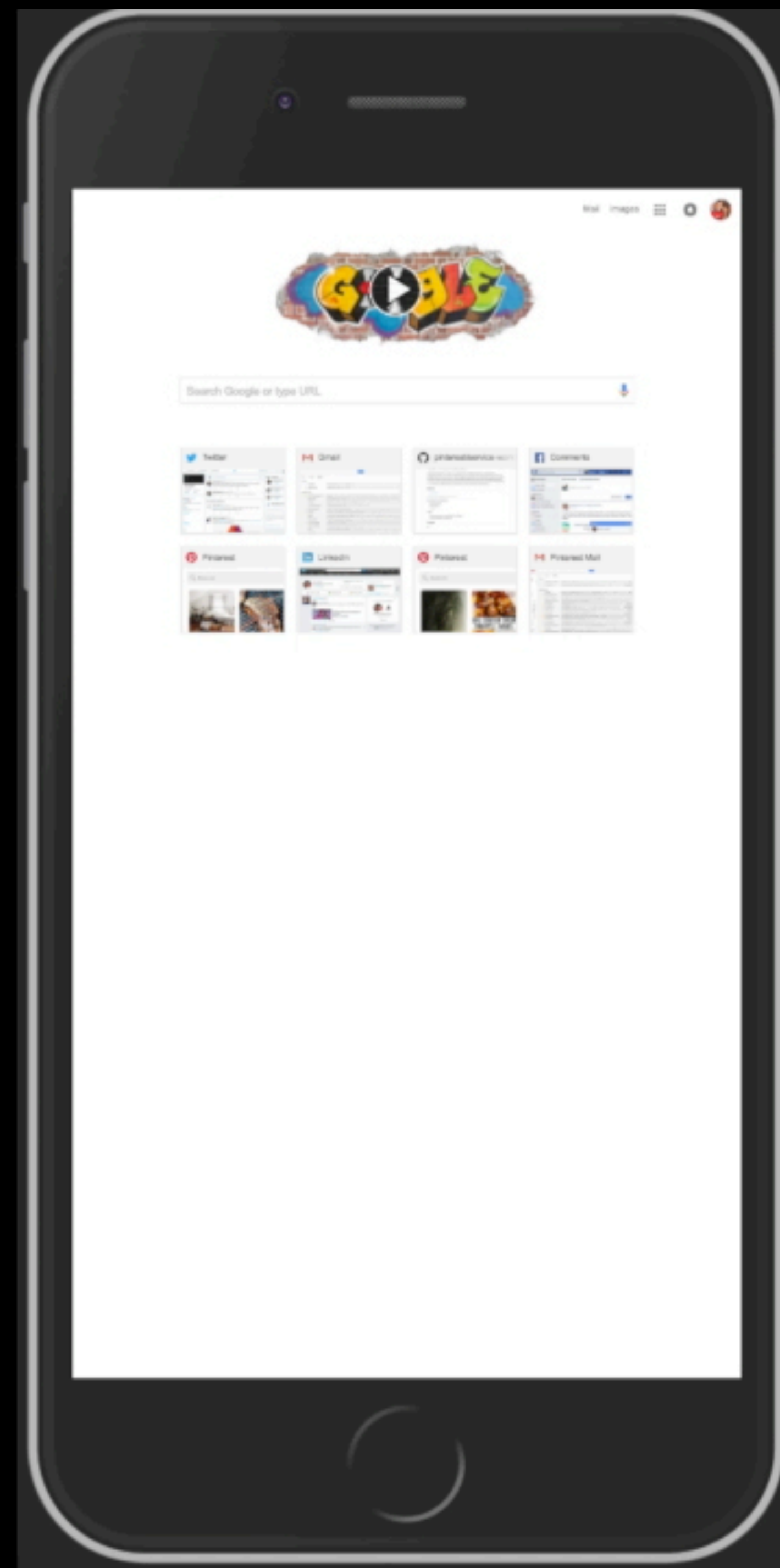
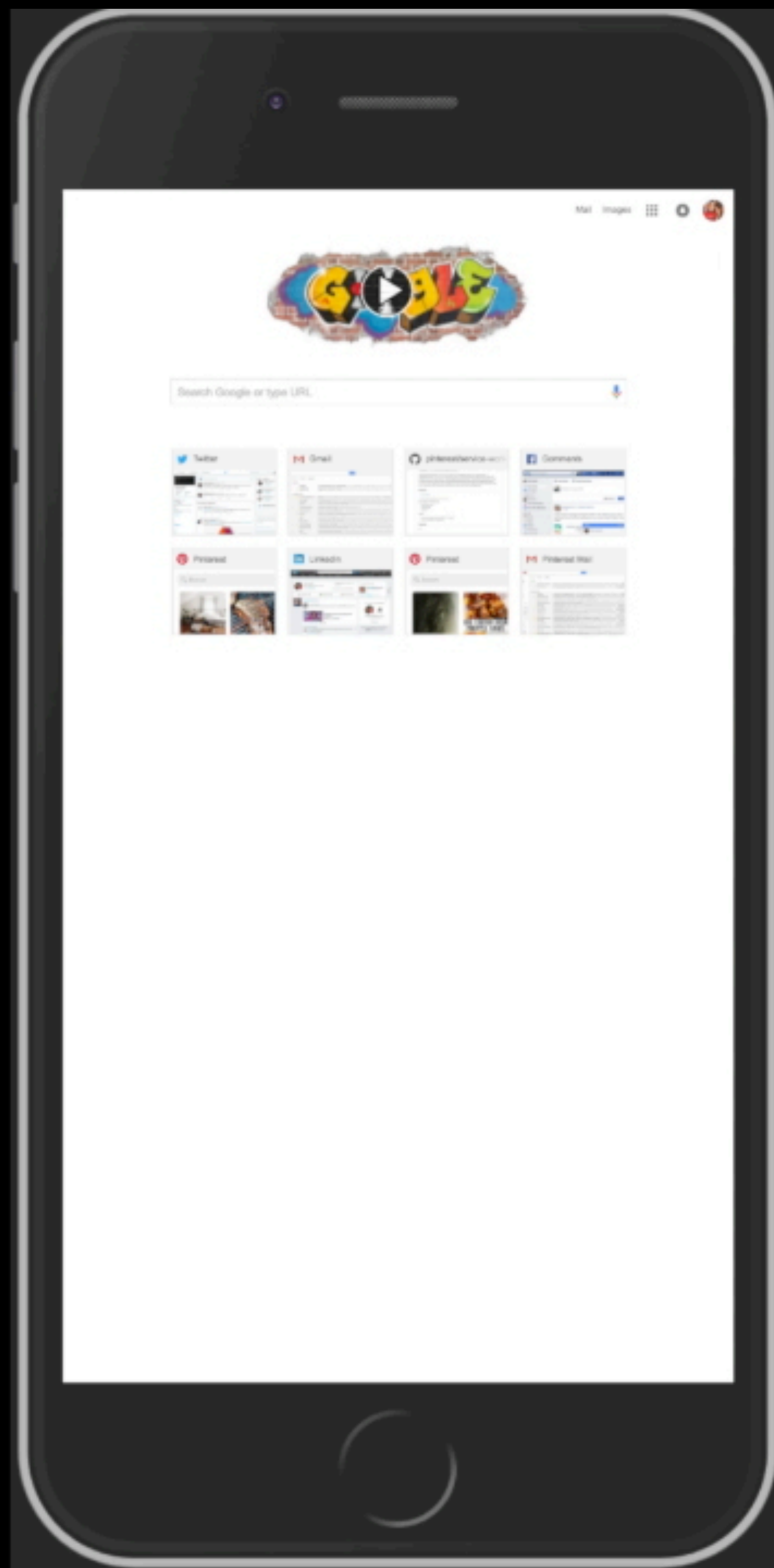


Notifications



Saved

The Results



Comparison

Old mobile web to new mobile web

Time Spent > 5 minutes

User-generated Ad \$

Ad Clickthroughs

Core Engagements

+40%

+44%

+50%

+60%

Across web/native

Time Spent > 5 minutes

User-generated Ad \$

Ad Clickthroughs

Core Engagements

+5%

+2%

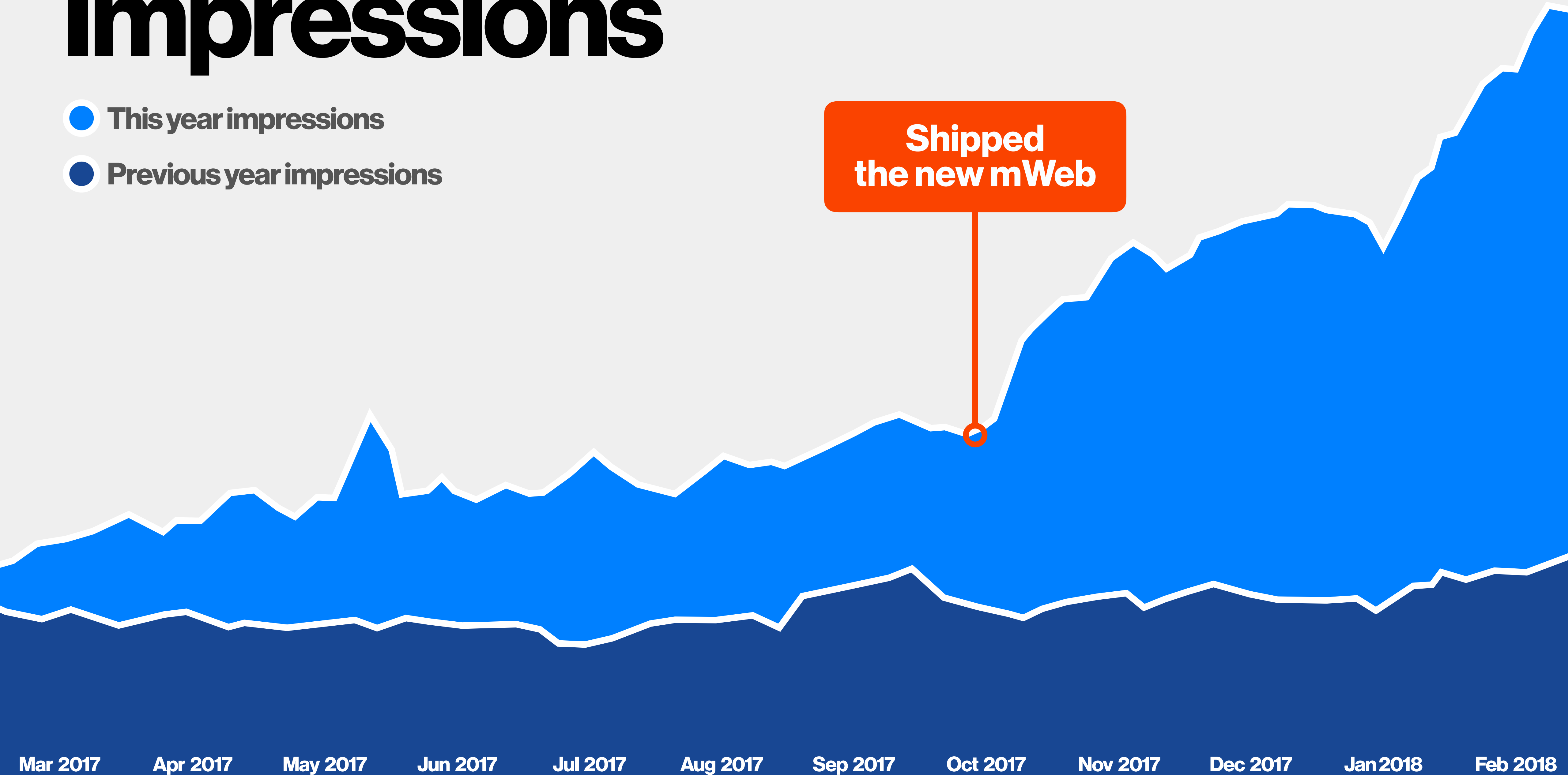
+0%

+2-3%

Impressions

- This year impressions
- Previous year impressions

Shipped
the new mWeb



Performance Metrics

Old Mobile Web

TTFP (Time to first paint)

4.2_s

TTI (Time to interactive)

23_s

JS Bundle Size

620_{KB}

CSS Bundle Size

150_{KB}

New Mobile Web

TTFP (Time to first paint)

1.8_s

TTI (Time to interactive)

5.6_s

JS Bundle Size

150_{KB}

CSS Bundle Size

6_{KB} inlined

Mobile Web Metrics

Pin Impressions

+250%
Y/Y

Ad Impressions

+400%
Y/Y

Signups

+380%
Y/Y

Logins

+150%
Y/Y

Repins

+200%
Y/Y

Time Spent

+160%
Y/Y

Important lessons

**“Beware legacy
assumptions.”**

imad@pinterest.com

github.com/eelyafi

Questions?

