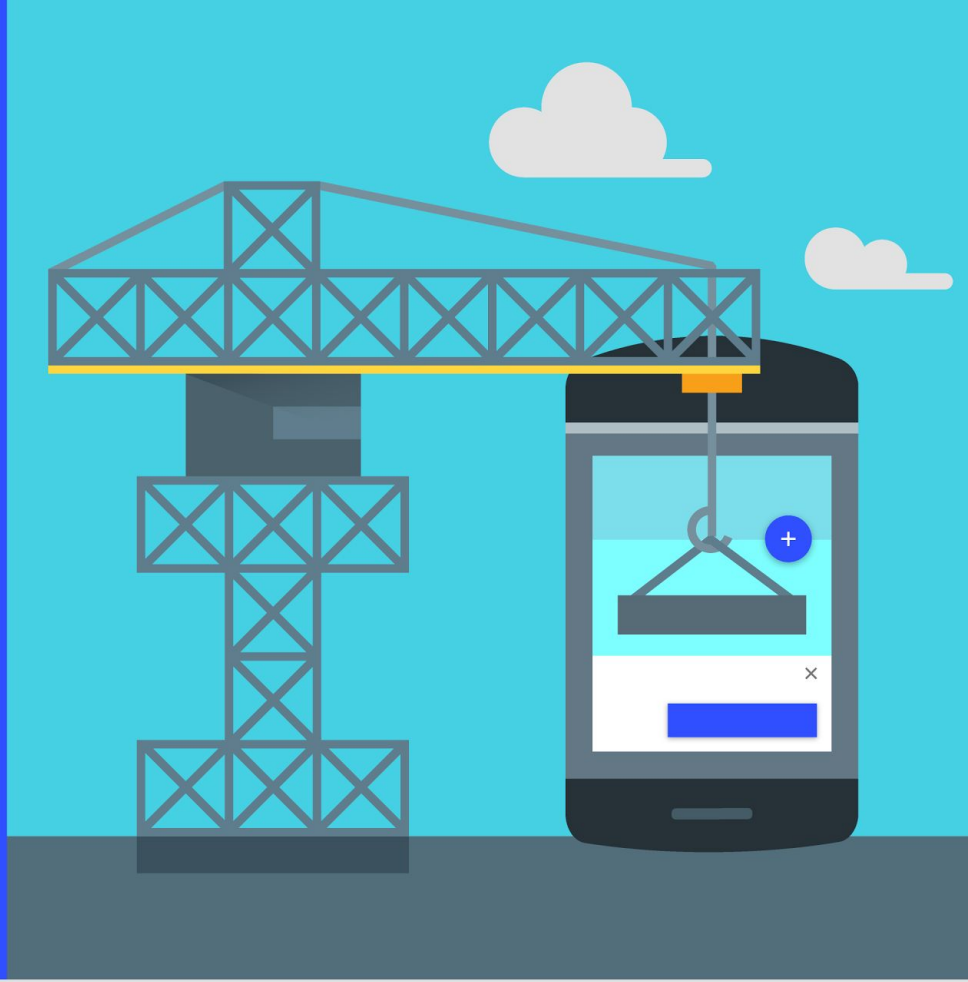
Progressive Web Apps

Introduction to PWA Architectures



What you'll learn

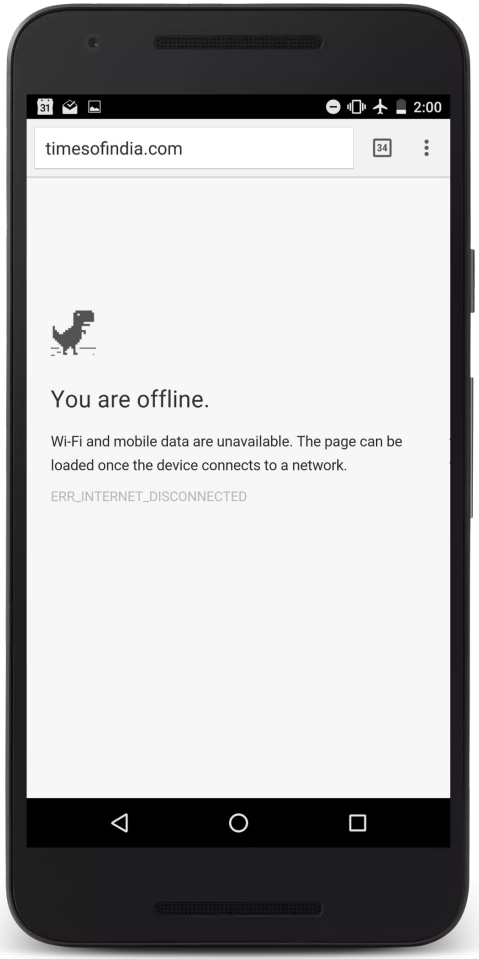
- Instant loading with service worker and app shell
- Architectural patterns
  - Caching strategies
  - sw-toolbox and sw-precache
- How to create an app shell
  - General recommendations
  - Migrate an existing site
- What happens with push notifications?
- Real-world examples

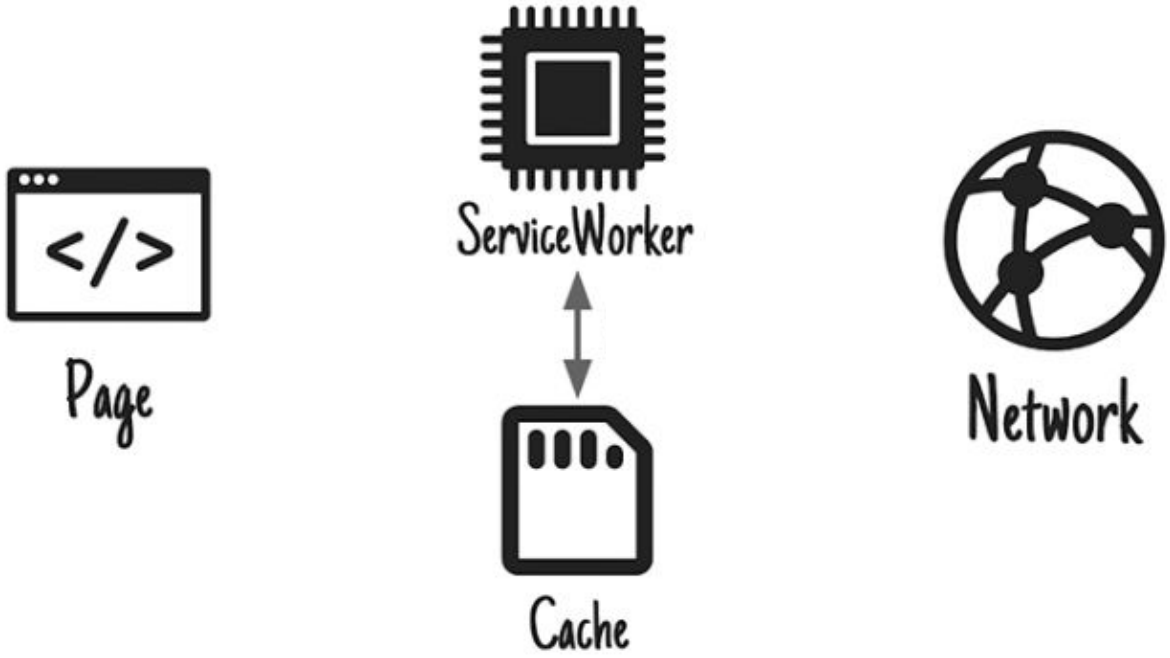
Instant loading with service worker and app shell

PWA should always be reliable.

But, sometimes there’s no connection.

PWAs deliver a good experience even when offline or on an unreliable network.





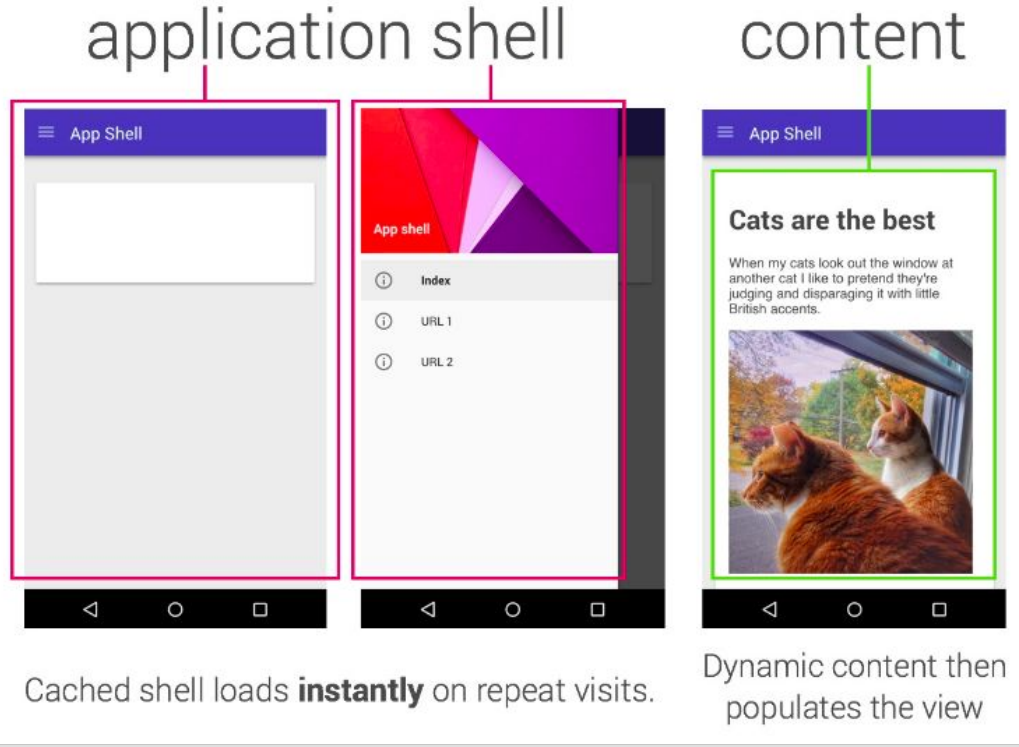
Service Worker and Cache Storage API

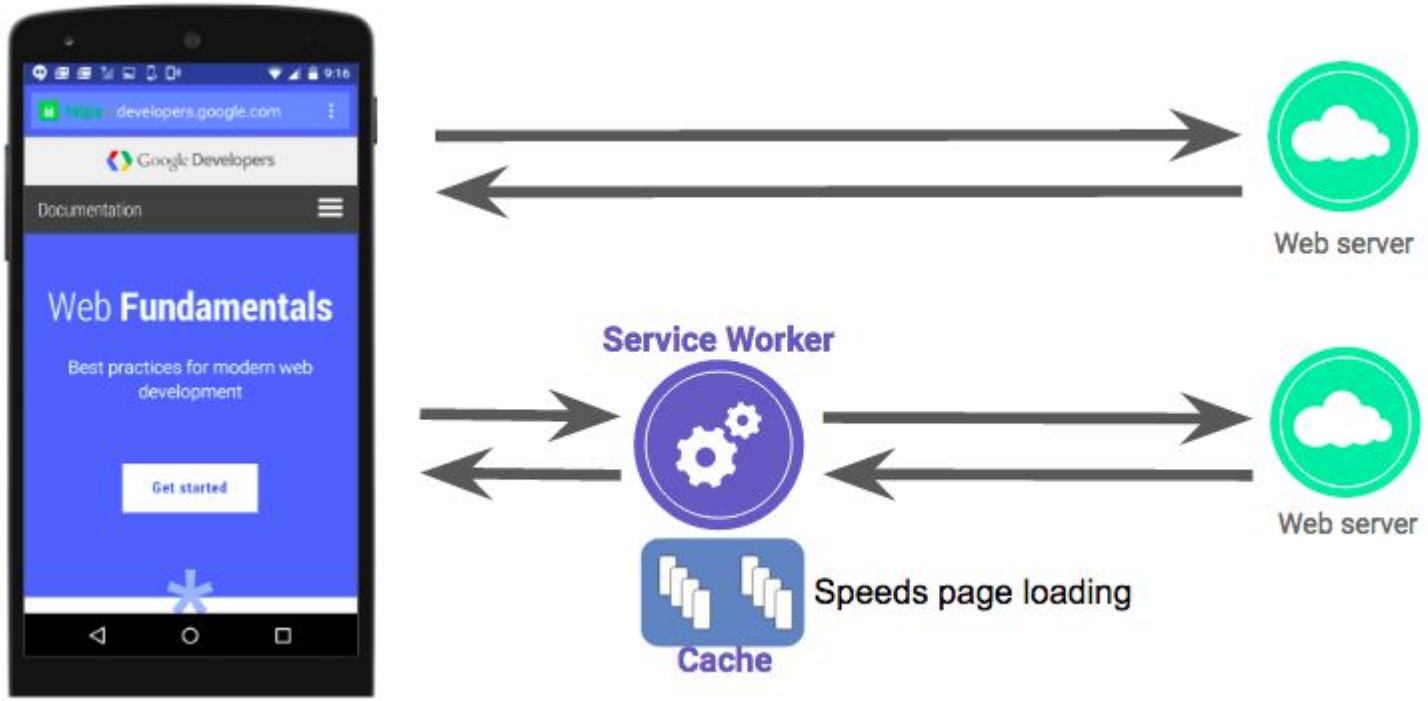
Service Worker

+

App Shell

What is an application shell?

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Architectural patterns and caching strategies

SSR .vs. CSR architecture

Server-side rendering (SSR)

- Initial request loads HTML, CSS, JavaScript, and all content
- Server does rendering and quickly returns a complete page
- Page updates reload the entire DOM

Client-side rendering (CSR)

- Initial request loads HTML, CSS, JavaScript (possibly partial content)
- JavaScript runs in browser and makes 2nd request to get content
- Page updates reload only the dynamic content

SSR

Pros

- It’s simple!
- Quick first load returns complete page w/dynamic data prerendered
- Mature technique & tooling
- Works reliably across a range of browsers
- Good for sites where you mostly navigate and view static content

Cons

- Reloads entire DOM every time new data is received or after user interaction
- Delay during “next” load means app loses perception of being fast
- Frustrated users abandon app

CSR

Pros

- Page updates instantly when new data is received from the server or after user interaction
- Good for animated or highly interactive pages (a draggable slider, a sortable table, a dropdown menu)

Cons

- Requires separate HTTP requests to load static and then dynamic content
- Developers lose control because site runs on clients
- Parsing JavaScript is slow … especially on mobile devices

Recommended patterns for PWAs

In recommended order:

1. Application shell (SSR both shell + content for entry page). Use JavaScript to fetch content for any further routes and do a "take over"
2. Application shell (SSR) + use JavaScript to fetch content once the app shell is loaded
3. Server-side rendering full page (full page caching)
4. Client-side rendering full page (full page caching, potential for JSON payload bootstrapping via server)

Caching strategies

Strategy	Best strategy for ...	sw-toolbox
Cache first, Network fallback	When remote resources are unlikely to change, such as static images.	toolbox.cacheFirst
Network first, Cache fallback	When data must be as fresh as possible but you still want to display something as a fallback when network is unavailable.	toolbox.networkFirst
Cache-network race	When content is updated frequently or on devices with slow disk access.	toolbox.fastest
Network only	When only fresh data can be displayed on your site. If the fetch fails, then the request fails.	toolbox.networkOnly
Cache only	When you must guarantee that no network request will be made. For example, to save battery on mobile. “Cache only” either resolves the request from the cache or fails.	toolbox.cacheOnly

Using libraries to code service workers

sw-toolbox library

- Loaded by SW at run time
- Applies caching strategies to URL patterns
- Installs via Bower, npm, GitHub

```
importScripts('js/sw-toolbox/sw-toolbox.js');
```

sw-precache library

- Integrates with build process
- Generates SW code for caching
- Maintains resources in app shell
- Hooks into build process (Gulp, Grunt)

How to create an app shell

Migrating an existing site

Think of migration as a series of milestones that you deploy separately to progressively roll out a better PWA.

- Move to HTTPS
- Implement an app shell architecture
- Static content only: cache all assets (HTML, CSS, JavaScript, static images)
- Static + dynamic content: cache app shell, populate dynamically with fetch()

Use a web app manifest file

```
{
  "short_name": "App shell",
  "name": "App shell",
  "start_url": "/index.html",
  "icons": [{
        "src": "images/icon-128x128.png",
        "sizes": "128x128",
        "type": "image/png"
      }, {
        "src": "images/apple-touch-icon.png",
        "sizes": "152x152",
        "type": "image/png"
      }, ],
  "display": "standalone",
  "orientation": "portrait",
  "background_color": "#3E4EB8",
  "theme_color": "#2E3AA1"
}
```

Point to the manifest from index.html

```
<!-- Add to your index.html -->


<!-- Web Application Manifest -->
<link rel=”manifest” href=”manifest.json”>
```

Register a service worker

```
if ('serviceWorker' in navigator) {
    navigator.serviceWorker
             .register('./service-worker.js')
             .then(function() { console.log('Service Worker Registered'); });
  }
```

Cache the app shell manually

```
var cacheName = 'shell-content';
var filesToCache = [
  '/css/bootstrap.css',
  '/css/main.css',
  '/js/bootstrap.min.js',
  '/js/jquery.min.js',
  '/offline.html’,
  '/’,
];

self.addEventListener('install', function(e) {
  console.log('[ServiceWorker] Install');
  e.waitUntil(
    caches.open(cacheName).then(function(cache) {
      console.log('[ServiceWorker] Caching app shell');
      return cache.addAll(filesToCache);
    })
  );
});
```

Using sw-precache from Gulp

```
var gulp = require('gulp');
var path = require('path');
var swPrecache = require('sw-precache');
var paths = {
  src: 'app/'
};

// Gulp task
```

```
// Gulp task
gulp.task('generate-service-worker', function(callback) {
  swPrecache.write(path.join(paths.src,
'service-worker.js'), {
    // 1
    // 2
    // 3
  }, callback);
});
```

```
//1
staticFileGlobs: [
  paths.src + 'index.html',
  paths.src + 'js/main.js',
  paths.src + 'css/main.css',
  paths.src + 'img/**/*.{svg,png,jpg,gif}'
],
```

```
//2
importScripts: [
  paths.src + '/js/sw-toolbox.js',
  paths.src + '/js/toolbox-scripts.js'
],
```

```
// 3
stripPrefix: paths.src
```

Push Notifications

“Push” behavior when app is inactive

Q: *What happens when push notifications are enabled when using an app shell but the the app is not active?*

A: The Push API allows the server to push messages even while the app is not active.

1. App shell gets a **token** for registering push notifications.
2. Server sends a message that wakes up the service worker. This triggers the push event.
3. User **taps** to ignore the notification until later, dismiss it, or take action.

Real world examples

Real world examples of app shells

Offline Wikipedia app, a demo by Jake Archibald

Flipkart Lite's, an e-commerce company

Voice Memos, a sample web app that records voice memos

AliExpress, one of the world's largest e-commerce sites

BaBe, an Indonesian news aggregator service

United eXtra, a leading retailer in Saudi Arabia

The Washington Post, America's most widely circulated newspaper published in Washington, D.C.


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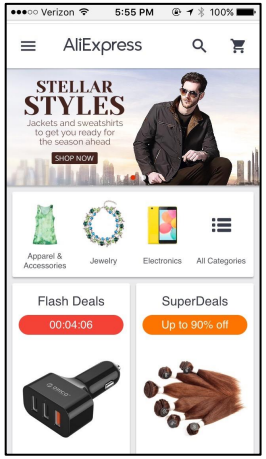
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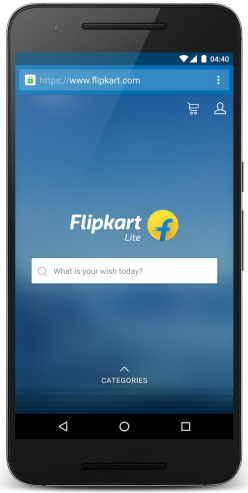
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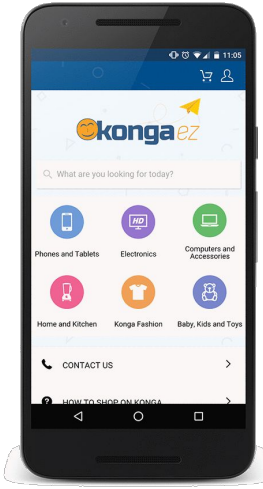
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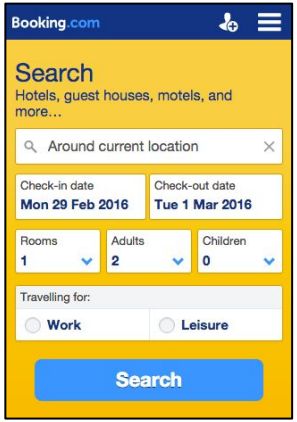
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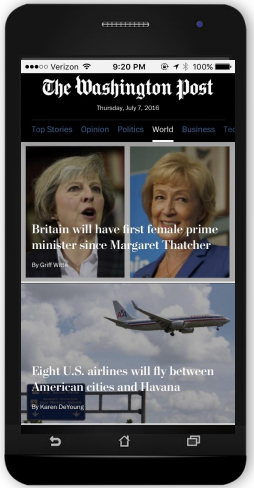
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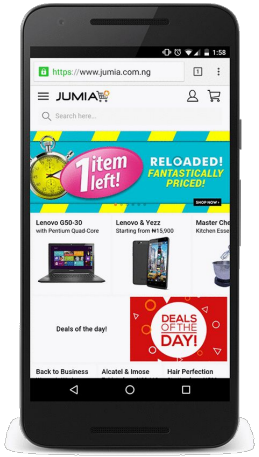
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- web app manifest