IN4MATX 133: User Interface Software

Lecture:
Hybrid and Native Architectures

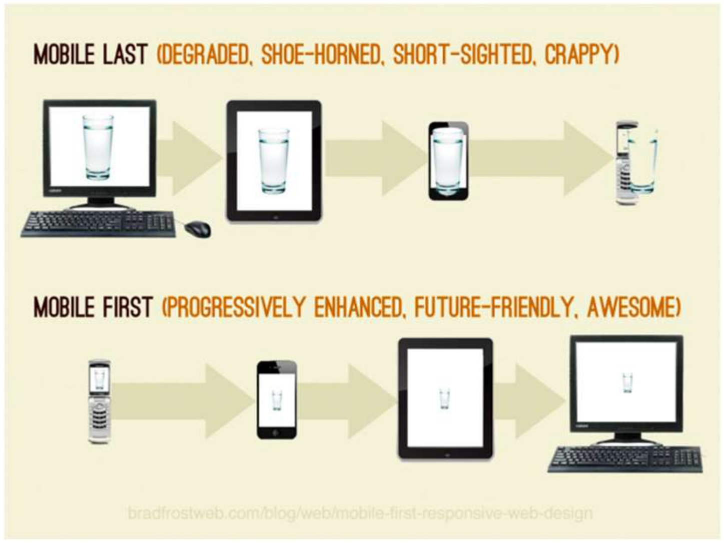
Today’s goals

By the end of today, you should be able to…

- Differentiate approaches to developing mobile interfaces
- Describe advantages and disadvantages of developing native, hybrid, and web applications
- Explain which approach Ionic takes to app development

Mobile-first design

- Plan your design for mobile
- Then make your app *better* with more real estate
    - Add more features
    - Make existing features easier to navigate
- A lot of businesses make mobile-friendly websites before making dedicated apps


MOBILE LAST (DEGRADED, SHOE-HORNED, SHORT-SIGHTED, CRAPPY)
MOBILE FIRST (PROGRESSIVELY ENHANCED, FUTURE-FRIENDLY, AWESOME)
bradfrostweb.com/blog/web/mobile-first-responsive-web-design

Question: why might a business want a mobile app over a mobile website?

There are a variety of ways to build mobile apps

Mobile development methods

- Native
- WebView
- Hybrid
- Responsive
- Progressive Web App (PWA)
  - https://kevinbasset.medium.com/why-havent-pwas-killed-native-apps-yet-29beca4425fa

Native apps

- An app designed to work on a specific piece of hardware
- Usually built with tools created by the hardware or platform manufacturer
  - Android Studio for Android, in Java
  - Xcode for iOS, in Swift or Objective-C

Native apps

- As we think of them today,
  native apps started
  with the first iPhone

- Released a development platform
  alongside the hardware

Native apps

- iOS development languages:
  - Objective-C
  - Cocoa Touch
  - Swift
- These languages were either developed by or pretty much only used by Apple
  - Developer lock-in is a… Disadvantage? Advantage? Both?

Native apps

- iOS development tools:
  - Xcode
  - iOS Source Development Kit (SDK)
  - SDK provides access to phone’s storage, camera, sensors, etc.

Native apps

- Android development languages:
  - Primarily Java
  - C and C++ via Android Native Development Kit (NDK)
- Align more closely with languages used in other contexts
  - Is this an advantage? A disadvantage?

Native apps

- Android development tools:
  - Android Studio
  - Android Source Development Kit (SDK)
  - Various IDEs like Eclipse or NetBeans

Native apps

- Platform-specific codebases
  - Android is in Java,
    iOS is in Objective-C or Swift
  - Both use different libraries
    to communicate with the hardware
- Usually require starting to code
  from scratch

What if we already made a website for our app? Or have some other existing codebase?

What if we want to share code across phone platforms?

Solution: hybrid apps

Hybrid apps

- “Use a common code base to deploy native-like apps on a wide range of platforms”
- Two primary approaches:
  - WebView app
  - Compiled hybrid app

WebView app

- Run a webpage written in HTML/CSS/JavaScript, on the phone’s internal browser
- Load that browser in a lightweight native app
- Ideally, expose some native APIs to the browser

WebView app

- Essentially, the app is just a website
- Allows the same or similar code to be used across an app and a website

WebView app frameworks

- Ionic
- jQuery mobile
- NativeScript
- These frameworks use web technologies (HTML, CSS, TypeScript, JavaScript) rather than platform-specific technologies

WebView app frameworks

- WebView apps are just websites
- What do these frameworks provide?
  - Common mobile interface elements like sliders and buttons (more on that next week)
  - The native app for running the website
  - Some APIs for communicating with platform SDKs

Compiled hybrid apps

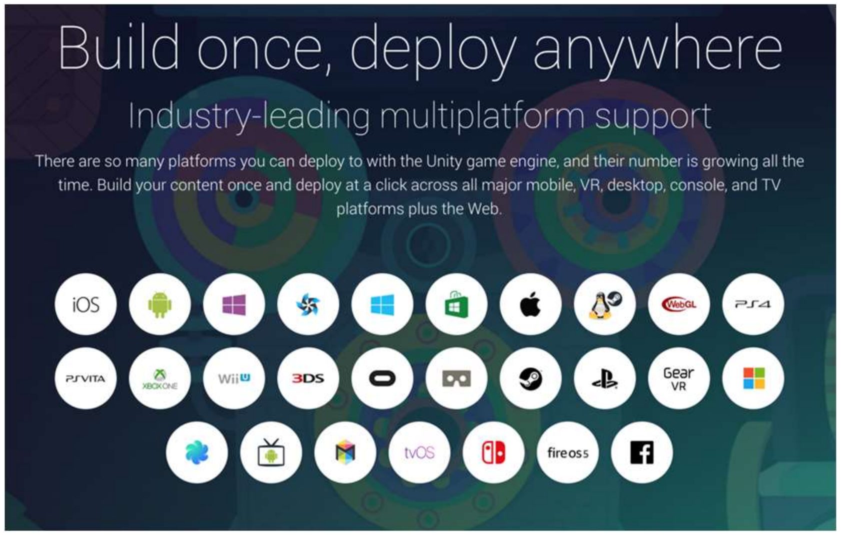
- “Write code in one language, such as C# or JavaScript, and compile it to native code supported by each platform”
- Result: a native app for each platform
- Challenge: less freedom in development

Compiled hybrid app frameworks

- Xamarin
  - C#
- Unity
  - C# of JavaScript
- React Native
  - JavaScript

Unity

- Leading game development platform
  - Supports consoles, web, and mobile
  - Will need to import
    or use platform-specific SDKs



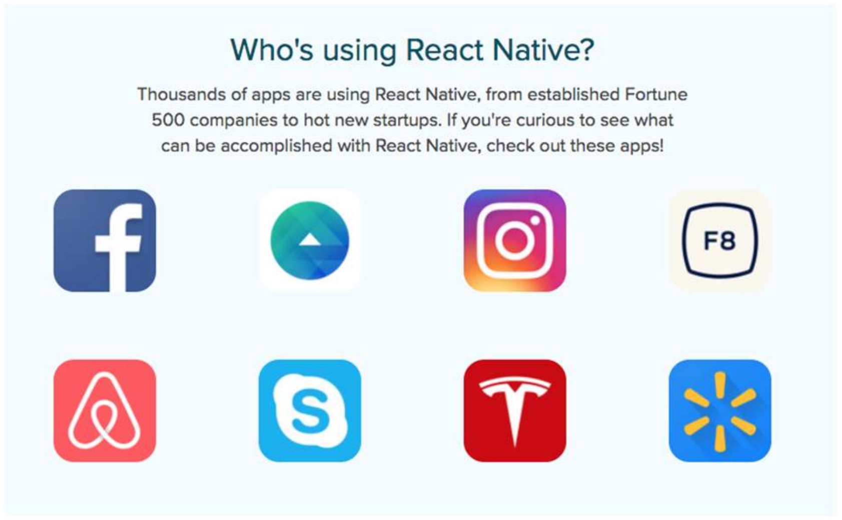
Build once, deploy anywhere

Industry-leading multiplatform support

There are so many platforms you can deploy to with the Unity game engine, and their number is growing all the time. Build your content once and deploy at a click across all major mobile, VR, desktop, console, and TV platforms plus the Web.

React Native

- Uses React, a web framework similar to Angular
- Compiles a webpage to a native app


Who's using React Native?

Thousands of apps are using React Native, from established Fortune 500 companies to hot new startups. If you're curious to see what can be accomplished with React Native, check out these apps!

Performance is just one factor.
How do we choose a development approach?

Business considerations

- Development time
- Development cost
- Maintenance concerns
- Available infrastructure

UX and design considerations

- Consistency with platform
- Device capabilities
- Interaction models supported
- Performance and usability

Technical considerations

- Programming languages
- Integration with device
- Performance
- Upkeep and maintenance
- Flexibility
- Compatibility

Pros and cons of each option

Strengths of hybrid apps

- Can share a codebase between web and mobile
- Can save time and effort (sometimes)
- Easily design for various form factors
- Access to some device capabilities

Weaknesses of hybrid apps

- Performance issues
- Inconsistency with platform
- Limited access to device capabilities

Strengths of native apps

- Consistent experience with platform
- Leverages full device capabilities
- Uses native UI elements

Weaknesses of native apps

- Need to support separate development for each platform
- Cost of app development and maintenance
- Need to learn/manage multiple programming languages
- Need to manage multiple sets of tools

Hybrid apps vs. native apps

- Hybrid apps are great when time or money is a concern and you need to deploy on multiple platforms

- Native apps are great when performance and consistency with the platform are major concerns

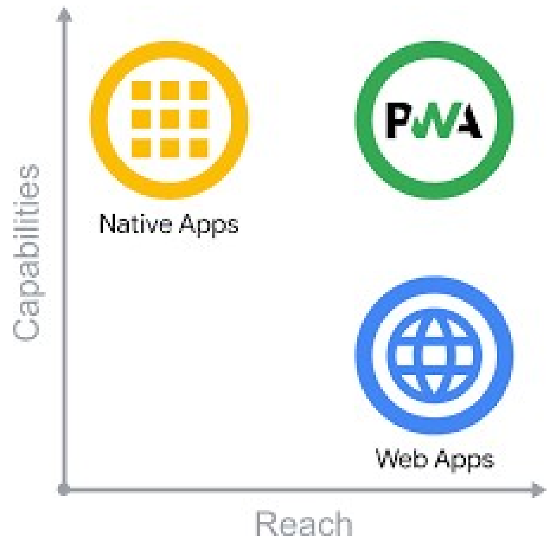
Hybrid apps vs. native apps

- Hybrid apps
  - News sites
  - Informational apps
  - Product showcase
  - Seasonal/one-off

- Native apps
  - Games
  - Content-heavy apps
  - Uses a lot of device resources
  - Needs specific OS capabilities

Progressive Web Apps (PWAs)

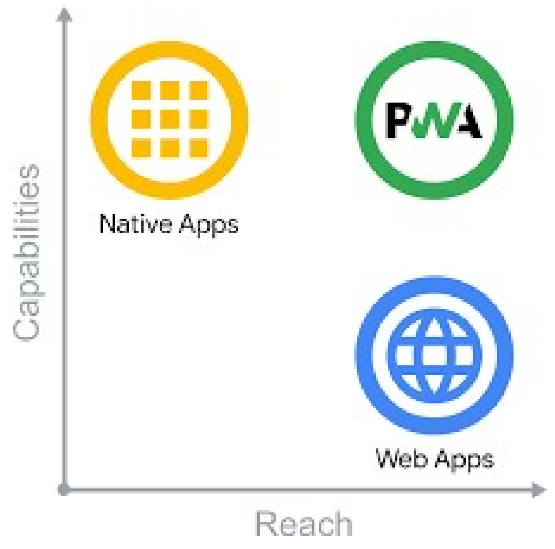
- Intended to “fill the gap” between native apps and web apps
- Really just a website that you can “install” on a phone
- Supported by major browsers & phones
- No associated framework, just a few files to add



https://en.wikipedia.org/wiki/Progressive_web_application

Progressive Web Apps (PWAs)

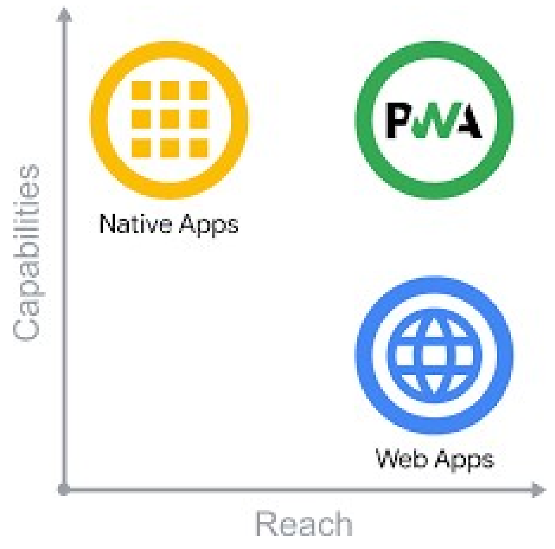
- Add some information to an app manifest (manifest.json)
  - Desired device orientation, URL to open, links to icons
- Relies on everything your browser relies on for other features
  - Web Storage for saving values
  - https://en.wikipedia.org/wiki/Web_storage



https://en.wikipedia.org/wiki/Progressive_web_application

Progressive Web Apps (PWAs)

- A good PWA should:
  - Start fast, stay fast
  - Work in any browser
  - Be responsive to any screen size
  - Provide a custom offline page
  - Be installable



https://web.dev/pwa-checklist/

Progressive Web Apps (PWAs)

- Main advantages
  - They require almost no new code or libraries, making them ideal for having a shared codebase with your website and implementing progressive enhancement
  - Most apps don’t need native features
- Main disadvantage
  - They don’t show up in managed app stores like Apple’s App Store or Google Play, so not discoverable through traditional means
- To learn more visit (great resource for getting started):
  - https://developer.mozilla.org/en-US/docs/Web/Progressive_web_apps

One Hybrid (WebView) framework: Ionic

Ionic

- WebView app framework
- Launched in 2013
- Interface implemented in Angular
  - Recently added support for React and Vue
- Capacitor is the recommended hybrid app runtime for ionic, replacing Cordova
- Apache Cordova is still supported, but not recommended for new projects

https://ionicframework.com/resources/articles/capacitor-vs-cordova-modern-hybrid-app-development

Capacitor

- It provides the native app which opens the WebView
- Supports PWAs
- Also provides plugins for connecting to device resources
- Hundreds of plugins
  - Official
  - Community

https://github.com/capacitor-community/

https://capacitorjs.com/docs/apis

Ionic Native

- Ionic Native is a wrapper to bring plugins to ionic
  - Ionic Native plugins are imported as services
  - Can wrap Cordova plugins as well
- Capacitor has retro-compatibility with most Cordova plugins

https://ionicframework.com/docs/native/

Ionic Native

Some example plugins

- Geolocation
- Bluetooth
- Camera
- Health
- Gyroscope
- Pedometer

https://ionicframework.com/docs/native/

Ionic Native

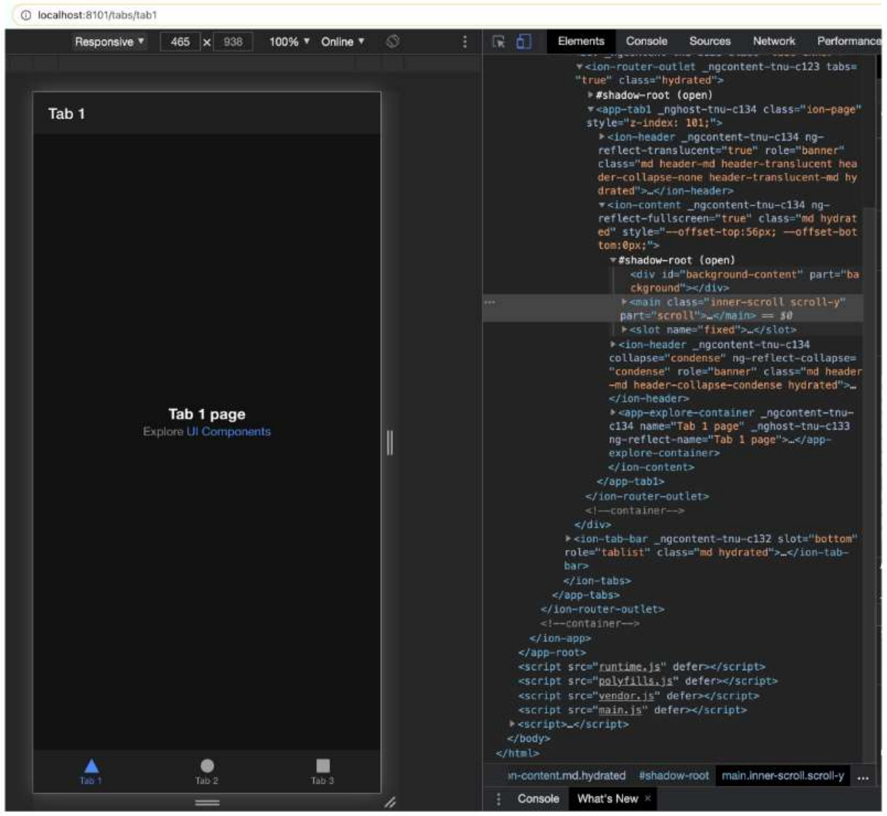
Some example plugins

- Facebook
- LinkedIn
- WeChat
- Apple Pay
- Google Maps
- Youtube

https://ionicframework.com/docs/native/

Ionic Dev

- Provides a WebView to open up Ionic apps
  - Lets you test your Ionic app in abrowser



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https://ionicframework.com/docs/cli/commands/serve

Deploying Ionic apps

- Involves packaging up an app and “signing” it as a developer
  - For Android, this requires installing Android Studio
  - For iOS, this requires installing Xcode and getting a developer account
- Can then “deploy” the app to the app store
  - The iOS app store includes features for “beta” deployment with a small group of developers
- This process is often a pain

https://ionicframework.com/docs/building/ios or https://ionicframework.com/docs/building/android

Ionic iOS and Android Deployment

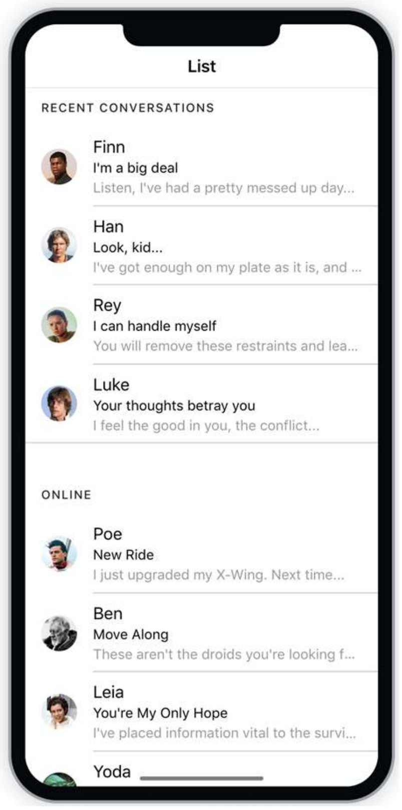
- “The key mantra of Capacitor is that developers should embrace native tools like Android Studio and Xcode”
- Pre-builds projects to be used in Xcode and Android Studio
  - Lets you test your Ionic app on an actual device or emulators
  - Emulators have limited use of plugins

https://ionicframework.com/docs/developing/starting

What does Ionic add over Angular?

Ionic components

- Ionic provides Angular-style components for a lot of interface elements common in mobile interfaces
  - Lists, buttons, sliders, tabs, modal dialogs, search bars, much more
  - These are the focus of next lecture



List

RECENT CONVERSATIONS

Finn
I'm a big deal
Listen, I've had a pretty messed up day...

Han
Look, kid...
I've got enough on my plate as it is, and ...

Rey
I can handle myself
You will remove these restraints and lea...

Luke
Your thoughts betray you
I feel the good in you, the conflict...

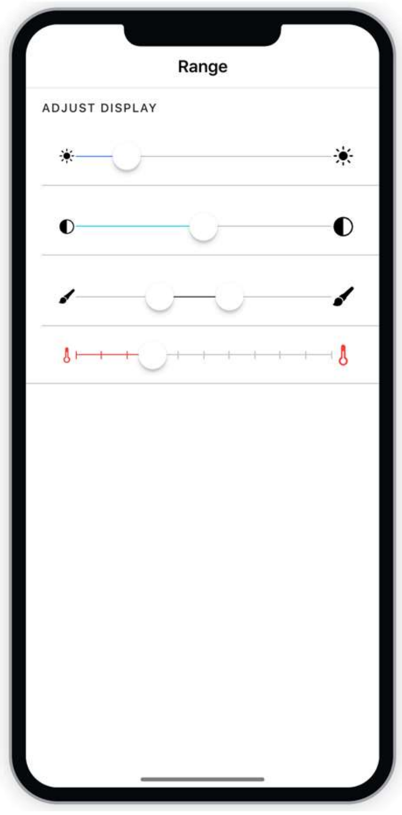
ONLINE

Poe
New Ride
I just upgraded my X-Wing. Next time...

Ben
Move Along
These aren't the droids you're looking f...

Leia
You're My Only Hope
I've placed information vital to the survi...

Yoda



https://ionicframework.com/docs/components/

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