Challenges in Mobile App Development

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Quick Note

The views expressed in this presentation are solely our own and do not in any way represent those of our employers.

Agenda

- UI Challenges
- Technical Challenges
- QA Challenges

UI Challenges

Screen Resolutions

- Apps have to run on multiple different device types and resolutions
- Android devices for example ranges in size, resolution, dpi
- Some devices have keyboards with much smaller screens (e.g: BlackBerry Q10)
- Tablets larger screens that the developer would like to take advantage of
- An app can look quite different, and in many cases not work
- Impossible to test app on all variation of devices

Screen Resolutions

- Recommendation is to layout your UI dynamically
- Don’t rely on pixel values for layout, instead use constructs like “Center, Fill, Use Full Width” etc. where possible/available
- Keep a conscious split between your UI layout and your logic (e.g.: MVC)
  - This would allow easier porting to devices like tablets
- Replace specific layouts only where needed
  - To take advantage of keyboard for example

BB10 Cascades/QML Example

```
Container {
    layout: AbsoluteLayout {}

    Button {
        text: "Button"
        layoutProperties: AbsoluteLayoutProperties {
            positionX: 1820
            positionY: 500
        }
    }
}
```

```
Container {
    layout: DockLayout {}

    Button {
        text: "Button"
        horizontalAlignment: HorizontalAlignment.Center
        verticalAlignment: VerticalAlignment.Bottom
    }
}
```

BB10 Cascades/QML Example

```
Container {
    layout: AbsoluteLayout {}

    Button {
        text: "Button"
        layoutProperties: AbsoluteLayoutProperties {
            positionX: CONSTANTS.Button_X
            positionY: CONSTANTS.Button_Y
        }
    }
}
```

Screen Real-estate

- Very limited space on a Mobile Display, yet lots of information to show
- Discoverability is a challenge, how do you inform the user of all the features
- Menus can get cluttered with options, many that users don’t even find
- Gestures are great, but how does a user learn them?

Screen Real-estate

- Difficult problem to solve
- Try to not clutter the UI, but keep it simple, and introduce a flow to your UI that a user can follow
- Make main actions accessible and easily discoverable
- Use analytics to figure out what users use and don’t use, and bubble up those actions
- Visual hints are a good way to educate the user, however, can be intrusive if not done right

Simulators

- Of course you need to try running your code
- Multiple devices, versions, screens, it’s impossible to try them all
- Simulator is definitely a great option to develop and test your application
- Simulators don’t give the full picture however

Simulators

- Performance is not clearly visible on a simulator
- The feel of the application in the hand is different than on a monitor
- Can't represent hardware features like sensors well (e.g.: rotation, gyroscope)
- Pick a couple of candidates from the platforms you are targeting and run your application on the real devices
- For all the platforms you are targeting, use the lowest common denominator
  - If it runs well there, it will only be better on the higher end

Technical Challenges

Performance

- Performance is a huge concern on a Mobile platform
- Very limited resources, memory/CPU/GPU
- Users don’t sit in front of their smart phone for hours, they want quick access to information

Performance

- Start-up time, data loading time, UI Lag are some KPIs that are important
- You want the app to start up as quick as possible, and the app to respond (in some way) to a user action in times under 150ms
- Data loading should be quick
  - Spinners can mask the data loading, but can also make your app seem slow
- Load only what's absolutely necessary to start, and lazy-load the rest in the background

Performance

- There is always a tradeoff between memory and performance
- A key difference of mobile is an app takes up the entire screen
- Memory can be better leveraged by the running application
- Sometimes a better choice is to leverage memory to increase performance
  - Caching data if possible as an example

Battery Life

- Battery life is extremely important to users
- Every operation that is coded drains the battery
- You need to be mindful of battery consumption when you write your code
- Don’t run animations that aren’t necessary
- If you have to poll, be wise about when and how often you poll
- Network connections are high battery consumers, use only when you have to, try to batch your requests if you can

QA Challenges

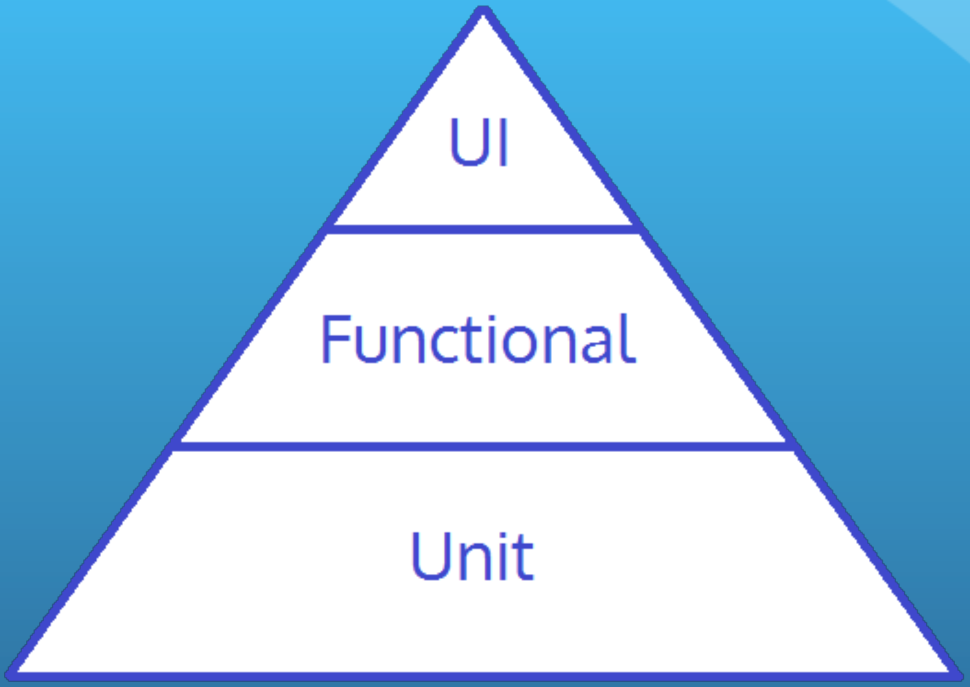
How to Test?

- Mobile platforms are immature
- Missing common testing tools
- Don’t run on common hardware
- Testing on real hardware can be expensive or difficult
- Simulators aren’t perfect

Options

- Skip Testing Altogether… (*gasp*)
- Raise an Army…
- Automation!
  - But How? First things first…

Back Up a Step



- Most tests are Unit tests
- Inverse time to run

Unit Tests

- Test Only One (Small) Thing!
- xUnit Frameworks
- Compile-Time or Run-Time?
- Really Off-Device or On-Device?

- Many teams choose to run Unit Tests On-Device…

Unit Tests

- On-Device has significant long-term costs:
  - Often become (very) slow over time
  - Require custom setups/hardware to run
  - Difficult to integrate into CI systems
  - Developers do not run them
- Off-Device at Compile-Time has none of these drawbacks
- So why choose On-Device?
  - The **Native/Library Problem…**

The Native/Library Problem

```
...
native void nativeCall();
...
import platformLibrary;
...
public class Foo {
    void doSomething() {
        platformLibrary.platformCall();
        // ...
        nativeCall();
    }
}
```

Solving The Native/Library Problem

- Introduce a little abstraction:

```
public class NativeWrapper {
    native void nativeCall();
}

public class Foo {
    void doSomething() {
        new NativeWrapper().nativeCall();
    }
}
```

Solving The Native/Library Problem

- Introduce some Dependency Injection:

```
public class Foo {
    Foo(NativeWrapper nativeWrapper) {
        this.nativeWrapper = nativeWrapper;
    }

    void doSomething() {
        nativeWrapper.nativeCall();
    }
}
```

Solving The Native/Library Problem

- Provides a way to mock-out platform specifics
- Convert run-time Unit Tests to compile-time
- Get around any platform limitation
- Can also use to remove:
  - Databases
  - Network
  - File I/O

Unit Tests

- Always prefer Off-Device tests executed at compile-time:
  - Faster
  - Easier to Run
  - Easier to Integrate into build/CI
  - Use existing xUnit/Mocking frameworks
  - Can be run from within IDE

Functional Tests

- Tests Several Parts Together
- Often ‘On-Device’:
  - Allowed to use ‘real’ Databases, File I/O, system services, etc.
  - Don’t have to be On-Device…

Easiest approach:

- Build app libraries/classes into a test app

UI Tests

- Test an App End-2-End as a User Would
- Must be ‘On-Device’
- *Very* Fragile
  - Highly dependent on UI design - names, layouts, screen ordering, etc.
  - High false-positive rate - many things even outside of app can go wrong
- … yet still worth doing!

UI Tests

- Good for ensuring basic functionality
- Most platform SDK's have this built-in:
  - uiautomator, Espresso for Android
  - KIF, Automation Instrument API for iOS
  - Truphone Labs for BlackBerry 10
- Will never fully replace manual testing
  - UI Testing tests static use cases, users are not static

UI Tests

Recommendations:

- Use for limited set of static use-cases
- Use when app is at or near completion
  - Great regression/stability testing of released versions undergoing maintenance
- Use in other cases where app (esp. UI) is not changing often/ significantly

Thank you for listening to us