Introduction

- Mobile computing and mobile phones have changed and merged since the 1960s
- Mobile apps have changed how we use computers
- PC use continues to grow, but people spend relatively more time on mobile apps
- Mobile apps are different than PC apps in important ways
- Testing changes in response to these differences, but not everything is different
- What changes, and what doesn’t change, when you move into the mobile world?
- Let’s take a look…
Testing Mobile: What’s the Same?

- Test techniques and considerations
  - Black-box, white-box, etc.
  - Test automation, especially regression testing
  - Test data management and test environment management
- Bugs are everywhere
  - No evidence that mobile apps are less buggy than other software
  - Simple doesn’t mean “won’t fail”
- It’s not just about functionality
  - Usability, performance, and reliability are critical
  - Testing must address these issues
- Safety-critical and mission-critical apps need special attention
  - Don’t test such apps less just because they are mobile
  - If anything, such apps might be used in more critical settings
- Skills growth a constant consideration
  - Technology changes rapidly
  - Test tools are evolving

Testing Mobile: What’s Different?

- So, does everything stay the same? No, some things are different:
  - Sensors affect behavior
  - Connectivity changes
  - Radios are weird
  - Extreme interoperability
  - Battery and power management
  - CPU, memory, and storage limits
  - Updates, updates, all the time
  - Interaction with the real world
  - Interaction with the user
  - Rate of technological change
- Let’s take a closer look at each of these areas and how they affect testing…
Sensors Affect App Behavior

- Some mobile apps can use sensors directly (e.g., heartrate, accelerometer, GPS)
- Some apps affected indirectly by sensors (e.g., device orientation)
- Peripherals such as keyboards, screens, etc. may also be used
- For testing
  - Identify sensors and peripherals used directly and indirectly
  - Apply equivalence partitioning and boundary value analysis to keep test configurations reasonable
  - Apply risk analysis to further trim configurations if needed

Connectivity Changes

- Some apps rely on connectivity to work, and some change their behaviors based on connectivity state
- The type of connectivity can affect behavior (e.g., WiFi vs. mobile)
  - Mobile connectivity can vary in terms of generation, speed, data restrictions
  - WiFi connectivity can also vary
- Connectivity can change mid-transaction
- Decision tables, use cases, state-based testing, and even pairwise testing can be used to detect connectivity/app issues
- Apps meant to be used in motion should be tested in motion for connectivity change issues, if relevant
Radios Are Weird

- Radios in mobile devices include the cellular network, WiFi, Bluetooth, NFC (RFID), and possibly others
- Radios and radio signals exhibit behaviors that can be perplexing to people used to dealing with PC apps
  - Signal strength variation
  - Faraday cages (e.g., elevators, metal roofs)
  - Line-of-sight
  - Rayleigh and Rician fading (e.g., cell signal in “street canyon”)
  - Signal travel limitations
- When testing apps that use radios for input or output, understand the underlying technology
- If app use cases include in-motion use (e.g., navigation), test across multiple in-motion scenarios with various user personas

Little Conversations Inside Outside Always

- PC apps are often either standalone or interact in limited ways
  - Word processor (copy-paste)
  - E-mail app (SMTP/POP)
- Mobile apps often have extreme interoperability
  - With multiple other apps on device
  - With OS and device capabilities (e.g., sensors and cameras)
  - With services and protocols on Internet
  - With other devices via radios or other transmitter/receiver (e.g., infrared)
- Use equivalence partitioning to identify all interfaces and all ways your app interoperates (send/receive, passive/active, request/respond)
- Use fuzzing on app’s incoming interfaces
- Use equivalence partitioning and boundary value analysis on communication interruptions, signal attenuation, throughput changes, etc.
How Lithium Affects Everyone’s Mood Now

- Thirty years ago, if you knew about lithium, it was usually the pill form.
- Now, lithium rules the (battery) world, and people get depressed when their lithium discharges.
- Battery, heat, and power management issues are significant.
- Test apps under various power and power management conditions.
- For outdoor-use apps, consider temperature conditions.
- If changing conditions can enable/disable features in your app, test for changes between and during operations.
- Decision tables, use cases, and state-based tests can be useful.

What a Cute Little Processor You Have

- CPU, memory, and storage are limited relative to PCs.
- A typical Windows PC has 2x CPU power than a mobile phone.
- Moore’s law for mobile devices, especially CPUs, is limited by power and heat issues.
- Power management features tend to throttle CPU performance when engaged.
- Test device-side performance and reliability for native and hybrid apps, especially under conditions of:
  - Multiple active apps
  - Power management and heat stress.
Hit By a Water Cannon of Updates

- Updates, updates, all the time
  - Your apps are probably on a hamster wheel of upgrades, due to competitive pressures
  - Even if your apps aren’t changing all the time, interoperate apps are
- You need automated regression tests
- If you can’t create maintainable regression tests at the GUI, consider command line, API, and even data approaches
  - Tcl/Tk scripting available for Android
  - Remember the perfect is the enemy of the good
- Simulators, outsource test labs, and crowdsourcing also options

Responsive to the Outside World

- Some apps are subject to interaction with and interruptions from the outside world
  - News and weather updates and alerts
  - Social media
  - Messages and phone calls
  - Navigation software
- Use equivalence partitioning, decision tables, state-based, and use case testing
- Can intersect with connectivity and power management, so consider pairwise testing of such conditions with interactions and interruptions
Poke Spread Pinch Swipe Poke

- Not since the invention of the GUI has interaction with the user changed so much
- More like tickling a baby than pounding a typewriter
- Input validation testing must not only consider equivalence partitions and boundary values of inputs, but must also cover equivalence partitions of the different ways inputs can occur
- For inputs that are interruptions, consider the issues on the previous slide
- Usability testing is critical, especially given screen size, soft keyboards, etc.

Even the Second Derivative Is Increasing

- Mobile apps consume a greater percentage of users time
- The total number of hours spent on mobile apps worldwide is following an exponential rate of growth
- The number of apps of similar types is growing
- However, the number of new types of apps is growing, too
- This means that the accelerating rate of technological change will mean new testing challenges for the foreseeable future
Conclusion

- In many ways, testing of mobile apps is still just testing
- Many best practices apply unchanged
- However, mobile-specific considerations are important and change the way apps must be tested
- If anything, mobile apps have more potential dimensions of testing than similar PC apps
- Expect continuous, disruptive change
- Apply and extend testing best practices

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