

The More Things Change (Location)

Best Practices Evolve and Abide in Mobile Testing



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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



Dr. Mega Volt in a Faraday Cage



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

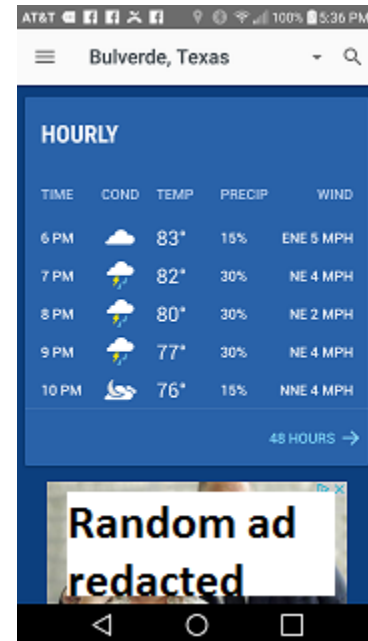
- ❖ Updates, updates, all the time
 - ❖ Your apps are probably on a hamster wheel of upgrades, due to competitive pressures
 - ❖ Even if your apps aren't changing all the time, interoperating apps are
- ❖ You need automated regression tests
- ❖ If you can't create maintainable regression tests at the 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

Time Spent per Adult User per Day with Digital Media, USA, 2008-2015

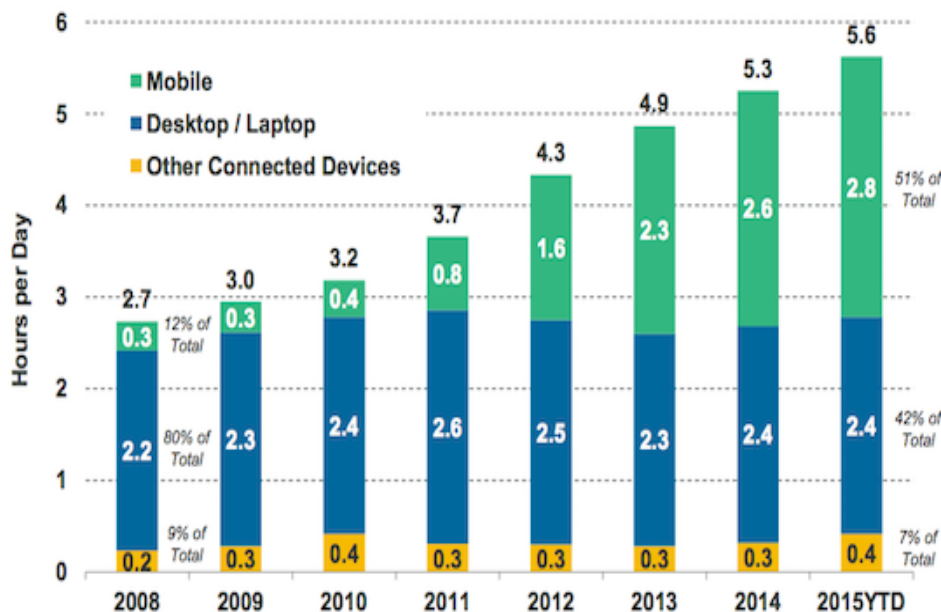


Figure from businessofapps.com



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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