



Mobile Application Testing – Challenges & Best Practices

SSQA – Silicon Valley; Sept 11, 2012



Agenda

- **Key Challenges in Mobile Application Testing**
- **Best Practices**
- **Test Automation**
- **Test Sourcing**
- **Q & A**

Mobile is here to stay...

Gartner

"Not too long ago, PCs were a "fashion accessory" in mature markets with vendors linking themselves to fashion designers and even creating PCs specifically for women. The current 'cool' device is the smartphone, and now PCs will soon have to do battle with media tablets when they are launched in large numbers in the second quarter of 2011," - Gartner

FORRESTER

"The mobile market is no longer just communication: It's Internet, music, video, Web, social networks, navigation, and everything else... The mobile ecosystem now embraces anything a consumer wishes to do either on the move or on a handheld device at home." - Forrester

Mobility is everywhere; across all verticals



Key Challenges

- OS & Device fragmentation
- Soaring user expectation
 - Data usage, Installation, Usability
- Environment
 - Network, Carrier technology, Intelligence, Localization
- Performance
 - < 3second load / launch threshold
- Mobile web / Native apps / Hybrid apps
- Security
- Development Methodology
 - Different development process for multiple device Oss, Reduce release cycle time
- Test Sourcing

Best Practices

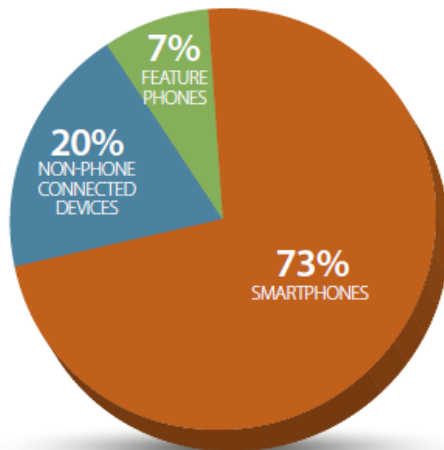
- **Functional Testing**
 - Start testing early. Use emulators / simulators
 - Test the app as a “black box” and try to break it
 - Choose a test automation tool that fits into the company strategy and infrastructure
- **Non-functional Testing**
 - Don't just restrict non-functional test to performance. Carry-out usability test, Installation testing
 - Use the app on different carriers and network connections like 3G, WiFi, or LTE
- Address device fragmentation. Build a “Mobile Test Priority Matrix”
- **Combine tools**
 - Combine testing tools and integrate them into a continuous integration system
- Use internal beta testing for early feedback
- Know the customer base
- Ensure to include respective “app store” standards review as part of the test strategy
- Be active in communities

Test Coverage – What to test (Representative List)

Installation	GUI & Usability	Functional & L10N	Compatibility	Non-functional
<ul style="list-style-type: none"> Install App via App Store <ul style="list-style-type: none"> Over Wi-Fi Over data network Install Ad Hoc build after tailoring it for device App behavior with preinstalled apps First time launch behavior Un-installation and device cleanup 	<ul style="list-style-type: none"> Portrait and Landscape Interface Pop-ups Copy bleed Overlay Layout and alignment Header & Footer Interactions Multi-touch TILT Real world usage Environment Conventions Sitting/standing Single handed 	<ul style="list-style-type: none"> Emulators and Devices Data validation for forms Localization Testing Native language first Layout Text alignment Image & text captions Text-on-buttons Text Encoding Interrupt Testing Phone calls SMS Calendar alerts Volume Ringer Screenshot Sleep Headphones Low battery 	<ul style="list-style-type: none"> Devices and networks Firmware versions Backward compatibility Beta firmware Device screens Resolution Size and dpi Scaling of images/text Device features Flip, Slider or Holster Camera Accelerometer Battery Usage LBS Default or 3rd party browser Link navigation Open/close pop-ups 	<ul style="list-style-type: none"> Performance Testing Emulators Devices Device Cloud Security Testing Code Review Forensics Static Analysis Dynamic Analysis Penetration Testing Device Behavior Battery drain Memory Usage Network carrier testing

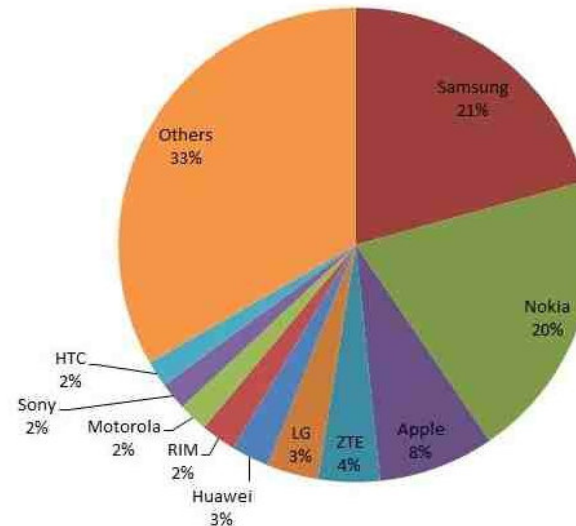
Mobile Test Priority Matrix

Device Mix



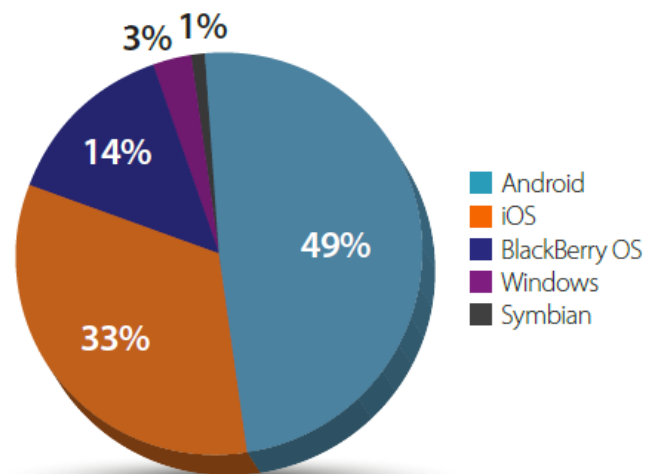
Source: Millennial Media, Q1 2012.

Device manufacturer market share



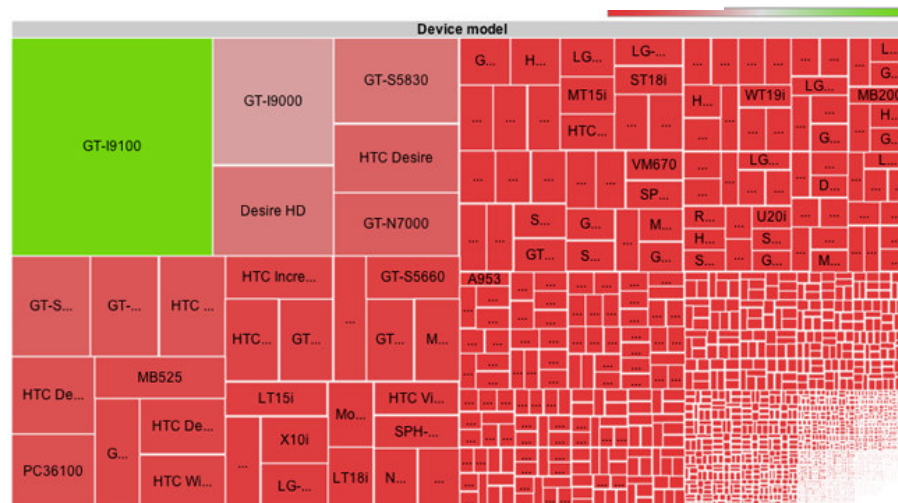
Source: trak.in

OS Mix



Source: Millennial Media, Q1 2012.

Android device fragmentation



Source: BGR

Mobile Test Priority Matrix – Contd...

Multiple approaches to build a “Mobile Test Matrix”

- Group devices based on the hardware and / or software specification and prioritize them
- User base – Build a test matrix based on the device and software version the user uses
- Use statistics from vendor market place (especially useful for native apps like games, utilities, etc.)
- Risk based and functionality based matrix

Example:

Group 1, priority C: Small devices with a small CPU, RAM and low resolution. Older software versions and older browsers.

Group 2, priority B: Mid-range devices with an avg. CPU, RAM (<512 MB), good screen size and resolution. The software is not the latest.

Group 3, priority A: High-end devices with a dual/quad-core CPU, RAM (>512 MB) and a high screen resolution. Latest software versions.

SNO	Device	Android OS	Network Provider	Screen Size	Network
1	HTC Aria	2.1	AT&T	3.2	3G
2	HTC Incredible	2.2	Verizon	3.7	3G
3	HTC My Touch	2.1	T-Mobile	3.2	3G
4	Motorola Droid	2.0-2.2	Verizon	3.7	3G
5	Motorola Droid 2 Global	2.2	Verizon	3.7	3G
6	Motorola Droid X	2.1-2.2	Verizon	4.3	3G
7	Nexus One	2.1-2.2	T-Mobile	3.7	3G
8	Samsung Captivate	2.1	AT&T	4	3G
9	Samsung Vibrant	2.1	Sprint	4	3G
10	Samsung Intercept	2.2.1	T-Mobile	3.2	3G
11	Samsung Epic 4G	2.1	Sprint	4	4G
12	HTC EVO	2.2	Sprint	4.3	4G
13	Motorola Atrix	2.1	Sprint	4	4G

Affiliate Code	Affiliate Name	Login Page Status	Sign Up	Create Profile	Welcome Email	Set PCs	Update Profile	PC Settings Page Copy	Update PCs	Sub account Sign in	Welcome Overlay Copy	Sign In Overlay Copy
ATT	AT&T U-verse TV	✓	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
BHN	Bright House Networks	N/A	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
CHARTER	Charter	✓	✓	✓	✓	N/A	✓	✓	✓	✓	✓	✓
COX	Cox	✓	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
DIRECTV	DIRECTV	✓	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
DISH	DISH Network (Beta)	✓	✓	✓	✓	✓	✓	✓	✓	N/A	✓	✓
SUDDENLINK	SUDDENLINK	✓	✓	✓	✓	N/A	✓	✓	✓	✓	✓	✓
TWC	TWC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	✓	✓
VERIZON	VERIZON	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
WOW	WOW	✓	✓	✓	✓	N/A	✓	✓	✓	✓	✓	✓
COMCAST	Xfinity	✓	✓	✓	✓	N/A	✓	✓	✓	✓	✓	✓
OTHER	Other	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CABLEVISION	IO TV	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N/A	Comcast	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Mobile Web / Native Apps / Hybrid Apps

Feature	Native app	Hybrid app	Web app
Development language	Native only	Native and web or web only	Web only
Code portability and optimization	None	High	High
Access device-specific features	High	Medium	Low
Leverage existing knowledge	Low	High	High
Advanced graphics	High	Medium	Medium
Upgrade flexibility	Low (Always by way of app stores)	Medium (Usually by way of app stores)	High
Installation experience	High (From app store)	High (From app store)	Medium (By way of mobile browser)

Source: IBM

Testing considerations

Native App	Web app
Installation & Upgrade	Load / Performance
Device ID access, Notification	Site rendering
Functionality and Usability testing on multiple Devices and OS	Functionality and Usability testing on multiple Browsers
APIs access and connectivity	

Test Automation – Overview

Types of Test	Manual Testing		Test Automation
	Using Devices	Using Emulators	
Unit	No	Yes	No
Integration	No	Yes	No
System	Yes	No	No
Regression	Yes	No	Yes
Compatibility	Yes	No	Yes
Usability	Yes	No	No
Performance	Yes	No	Yes
Security	Yes	No	Yes
Sync	Yes	No	No

Test Automation Tools – Representative List

Emulators	Automation tools	Real device experience
<ul style="list-style-type: none"> ▪ iPhoneY ▪ Adobe Device Central ▪ DotMobi ▪ Google Mobilizer 	<ul style="list-style-type: none"> ▪ Selenium ▪ Gomez ▪ MoneyTalk ▪ SeeTest ▪ Robotium ▪ Jamo 	<ul style="list-style-type: none"> ▪ DeviceAnywhere ▪ PerfectoMobile

Testing on Device Cloud



Networks and Locations

- | | |
|-------------|-----------|
| ▪ AT&T | ▪ USA |
| ▪ Verizon, | ▪ Canada, |
| ▪ Sprint, | ▪ Europe |
| ▪ Vodafone, | ▪ Asia |
| ▪ Bell | |
| ▪ Idea, | |
| ▪ Orange | |
| ▪ O2 | |
| ▪ T-mobile | |
| ▪ Virgin | |



- Access to over 2500+ device models across all platforms – iOS, Android, BlackBerry, Windows and legacy platforms
- Dedicated network access to device clouds across geographies including USA, Canada, Europe and Asia
- Leverage cloud services to offer a wide network test coverage across 30 major carriers like AT&T, Verizon, Sprint, Vodafone, Bell, Idea, Orange, O2, T-mobile and Virgin

Test Automation – Tool Comparison

Criteria		Countdown	Device Anywhere	PerfectoMobile	Robotium	Jamo Solution	Zap-fix
Hardware Integration		Data port	Electrical Integration (PCB Level)	Data port + Camera +Mic	Data Port	Data port	Data Port
Testing Interface		Web based client	Java Swing Client download for Win, Max and Linux	Web based interface	Only through API's based on Android Framework and JUnit3, test can be executed directly on Device or on Emulator.	Web based client	
Client Operating Systems		Web client	Windows, Mac and PC	Any Flash capable browser	Windows+ Eclipse+Java+ Android SDK + ADT for eclipse	Windows CE	Windows, Mac OS, and Unix
Test management		Test case management	Comprehensive test management - Storing test plans, tracking test progress and auto-generated test report	Test Management,	Simulate User Interaction	Simulate User Interaction	Test Case management
Third Party Tool Integration		No	HP, IBM, Custom Test Harness	QTP	Integrates with Maeven and Ant , In future they have plans to integrate with Cucumber.	Eclipse, QTP, Visula Studio	QTP
Platform Support		Android, Blackberry, Windows Mobile/PPC, Symbian S60 / UIQ, BREW, J2ME	iPhone, Android, Blackberry, Windows Mobile/PPC, Symbian S60 / UIQ, BREW, J2ME	iPhone, Android, BlackBerry, Symbian	Only Android	Android, Blackberry, iPhone/iPad, Windows Mobile, Windows CE	iPhone, Android
Device Connectivity	USB	Yes	No	No	Yes, we can test even on Simulator	Yes	Yes
	Serial	Yes	No	No	No	No	
	Bluetooth	Yes	No	No	No	No	
	Other com ports	Yes	No	No	No	No	
	Remote location connectivity	Yes	Yes	Yes	No	Yes	Yes
Test Reporting	Report generation	Yes	Yes	Yes	Yes, will be shown in Eclipse IDE. Need to do some customization to get report in HTML.	Yes	Yes
	Execution Recording	No	Yes	Yes	No	Yes	Yes
Device Interaction	Power Cycle	Yes	Yes	Yes	Executed on device /Emulator only (Supports Activities, Dialogs, Menus, Context Menus, Toasts)	Yes	Yes
	Phone Flip	Yes	Yes	Yes	Doesn't support Web and Flash apps.		
	Keypad	Yes	Yes	Yes	Not Available	Not Available	Yes
	Calling	Yes	Yes	Yes	Only through API's based on Android Framework and JUnit3, test can be executed directly on Device or on Emulator.	Yes	
	Voice/Audio support	Yes	Yes	Yes	Windows+ Eclipse+Java+ Android SDK + ADT for eclipse	Windows+ Eclipse+Java+ Android SDK + ADT for eclipse	
	Battery Removal	No	Yes		Simulate User Interaction	Not Available	

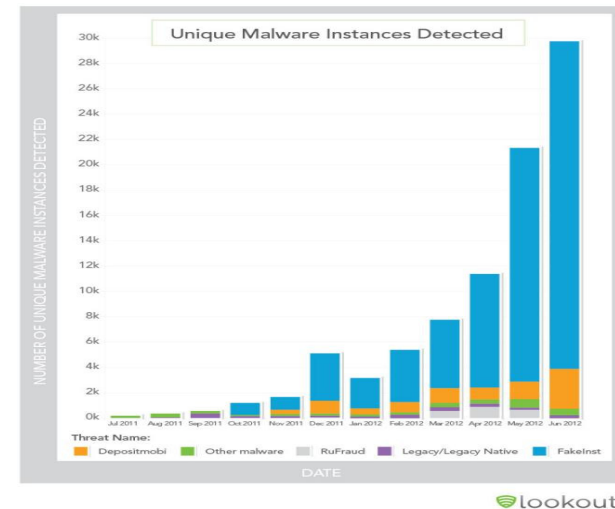
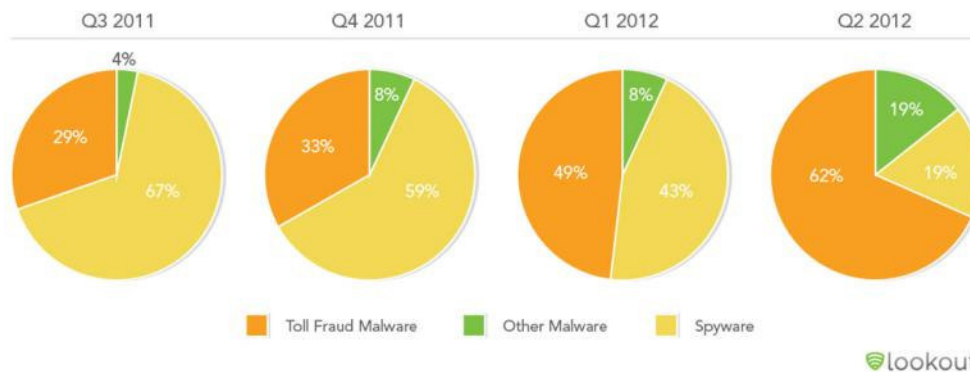
Test Automation Tool Selection – Few factors to consider

- Supported devices
- Emulator support
- Availability of integrated simulators
- Types of connection supported
- Multi-device support (this is important to run same test on multiple devices)
- Compatibility with existing automation tools
- Security - VPN connections, data sharing, etc.
- Functionality supported - swipe, drag and drop, zoom, scrolling, pinching, rotating, etc
- Image / text recognition
- Debugging and test reporting
- Test case management and version control support



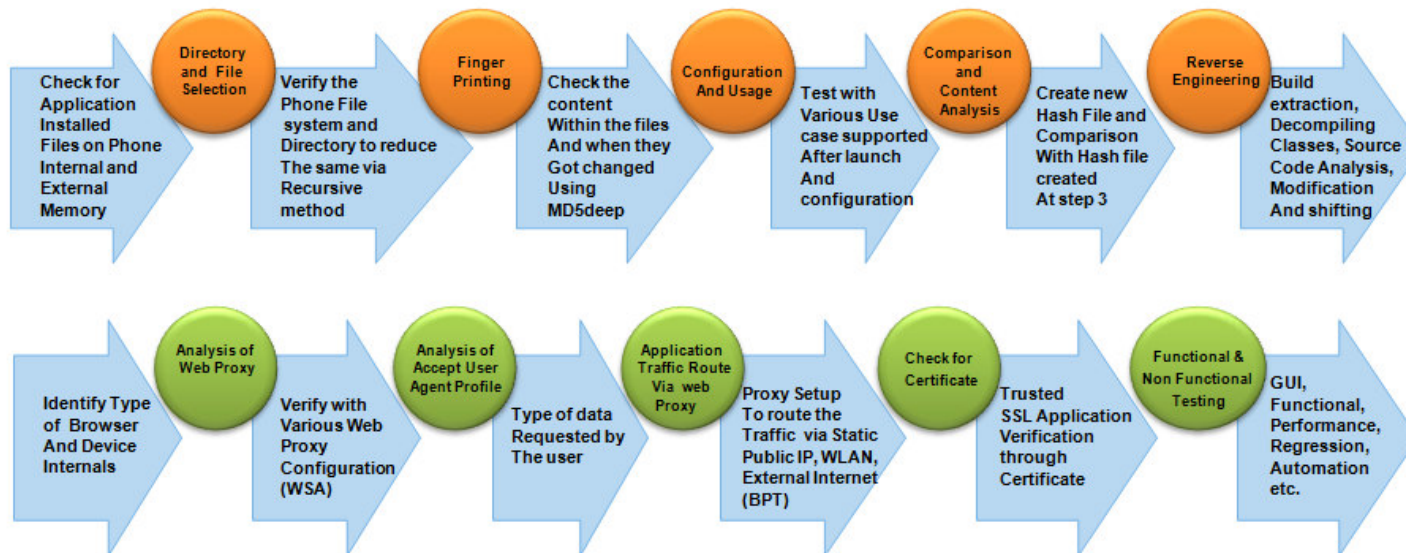
Mobile Application Security

Application-based Threats Breakdown
Detections of Toll Fraud Malware, Other Malware, and Spyware



Test Approach

Installer Based Application



Test Sourcing

	Sourcing Type	Pros	Cons
Lab based testing	In-house	<ul style="list-style-type: none"> ▪ Ease of communication ▪ Professional testers ▪ Integrated with SDLC ▪ Aligned to organization's process and goals 	<ul style="list-style-type: none"> ▪ Not easily scalable ▪ High upfront cost ▪ High maintenance cost ▪ Cannot simulate user demographic ▪ Lab based testing
	Outsourced	<ul style="list-style-type: none"> ▪ Professional testing ▪ Streamlined communication ▪ Access to range of devices and tools ▪ No upfront infrastructure cost 	<ul style="list-style-type: none"> ▪ Lab base testing ▪ Infrastructure and Licensing cost ▪ Limited user demographic simulation ▪ Lab based testing
Real-world testing	Beta testing	<ul style="list-style-type: none"> ▪ No direct cost ▪ Outside of lab environment ▪ Real-world access to mobile devices, OS and carriers 	<ul style="list-style-type: none"> ▪ Not professional testers ▪ Increased effort in diagnostic and fixing ▪ Risk of exposing unfinished product in to user community ▪ Limited resource and geographic coverage ▪ Security & IP Protection
	Crowdsourced	<ul style="list-style-type: none"> ▪ Outside lab environment ▪ Real-world access to mobile devices, OS and carriers ▪ Geographically spread ▪ (Professional Testers) 	<ul style="list-style-type: none"> ▪ Lack of communication ▪ Quality of testers (can be limited thru careful sourcing) ▪ Lack continuity and process integration ▪ Security & IP protection

Speaker Bio

Kaarthick Subramanian currently serves in the Independent Testing Services organization at CSC, where he leads the Banking, Financial Services and Insurance (BFSI) testing practice. Earlier, at Polaris Software Lab Ltd (financial technology company), Kaarthick served as VP and Head of Testing Engagements (Strategic Accounts). Kaarthick's engagement with Fortune 500 companies has involved deploying strategies, techniques and tools around test management, functional testing, and the automation of enterprise applications. Kaarthick has helped organizations like Polaris and Lionbridge (and their clientele) build efficient practices in the QA and Test Management space. You may reach Kaarthick at ksubramani30@csc.com



BUSINESS SOLUTIONS
TECHNOLOGY
OUTSOURCING