



Testing Mobile Apps and Websites: *Conquering the Multitude with the help of Automation*

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Few words about the presenter

- » Michael Yudanin,
Certified Software Quality Engineer (by the American Society for Quality)
- » In software quality assurance and testing since 1990s
- » Was involved in testing, process improvement, and management roles that included implementation of quality standards; development of policies and procedures; test planning, design, and execution; management of testing teams and business units; test automation for web, Windows, Unix, databases, mobile, etc.
- » Worked with large global corporations and federal government: CDC, UPS, Beazer Homes, the Home Depot, the Weather Channel, Bank of America, Spirit Airlines, etc., as well as with small start-up companies
- » Established **Conflair**, a QA and testing company, in 2006
- » Since 2008 active in mobile test automation. Developed **RealMobile™**
- » For more details see
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Contents

The mobile challenge



The automation challenge



Evaluation criteria



Available solutions



Challenges

- » The multiplicity of **platforms**
 - > Operating systems: iOS, Android, BlackBerry, Windows Mobile, ...
 - > Hardware: Apple iPhone and iPad, HTC, Motorola, BlackBerry, ...
- » Limited **resources**
 - > Weaker CPU
 - > Limited memory
- » **Connectivity** modes
 - > Network: G3, G4, CDMA, GPRS, ..., and Wi-Fi
 - > Carrier: <a whole lot>
- » Embeddedness in the **business process**
 - > End-to-end business processes involving mobile front-end and different back-end (web, Windows, mainframe, DB, ...)
- » **Unique functionality**
 - > Location
 - > Orientation
 - > Barcode scanning
- » **App stores**
 - > Vendor-approved
 - > Alternative
- » **Data Entry**
 - > One has only so many thumbs...
- » ...and more...



Challenges : Platforms

- » Multiple hardware platforms
 - > CPU
 - > Memory
 - > Display size / resolution
 - > Keyboard (soft / hard / external)
 - > Touch functionality
- » Multiple operating systems
 - > iOS versions
 - > Android versions
 - > Windows Mobile vs. Window Phone
 - > BlackBerry
- » Jailbroken / Rooted



Interlude : Jailbreaking and Rooting

- » Relevant to iOS and Android platforms
- » Bringing Unix back to its original state: removing restrictions and enabling root access
- » Allows to install apps that are not in the Apple / Google store
- » Legal yet can violate warranty
- » As of September 2013,
 - > necessary for controlling iOS devices remotely
 - > NOT necessary for controlling Android devices remotely



Challenges : Technologies :

Native Apps vs. Mobile Websites

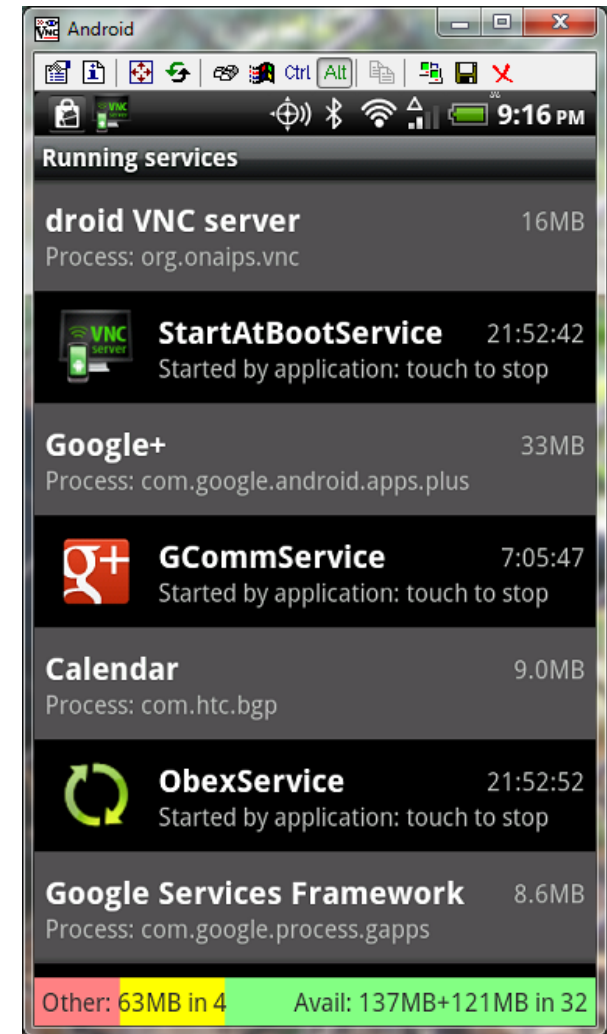
	Native App	Mobile Website
Platform	Platform-specific <ul style="list-style-type: none">- OS- Hardware type (smartphone/tablet)	Platform-agnostic (usually)
Code base	Separate for each platform >>> <i>mind code generators</i>	One for all platforms (usually)
Coding languages	Different languages for different platforms (usually)	One set of languages for all platforms
Dependency	None (almost always)	Mobile browser
Installation	Relevant	Irrelevant
Re-directing	Irrelevant	Relevant

Challenges : Platforms : Resources

- » Not your PC
 - > Weaker CPU
 - > Little memory



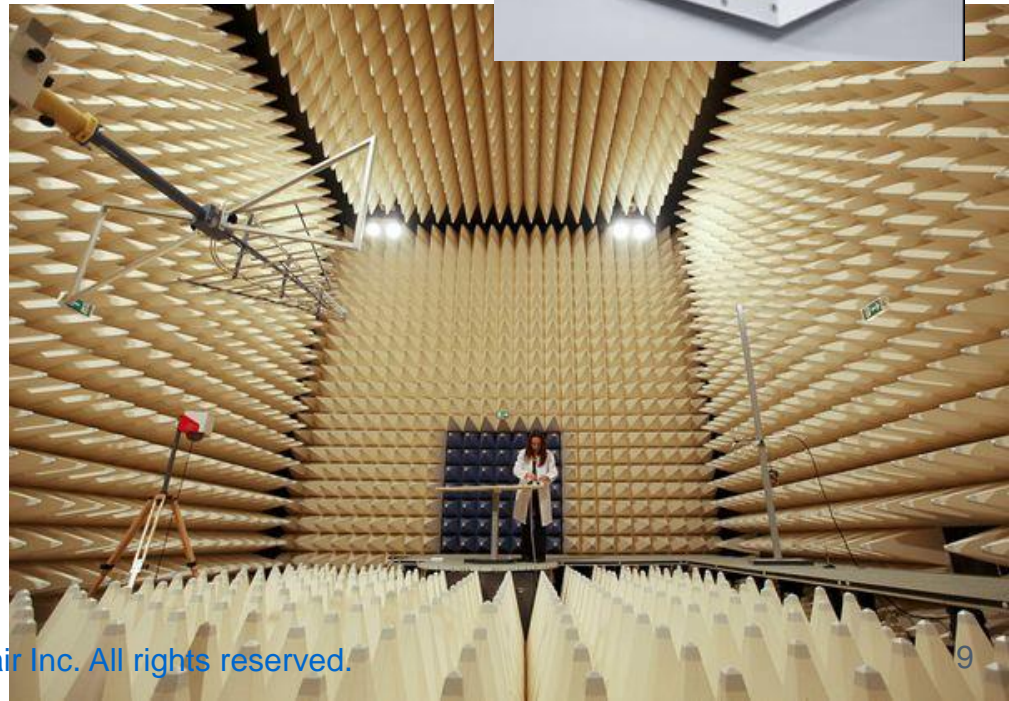
- » Prone to fail due to memory leaks
 - > Endurance/Reliability tests
- » Cannot install a full-featured test automation tool on a mobile device



Challenges : Connectivity modes

- » Different network types
 - > G3, G4, CDMA, GPRS, ..., and Wi-Fi
 - > Combination of network and Wi-Fi
- » Different carriers
 - > US & Canada
 - > Europe Western and Eastern
 - > Japan
 - > India and China
- » Reception
 - > How do you simulate varying reception conditions?

Faraday cage



Challenges : Business Process

- » Information
- » Social media
- » Games
- » Retail
- » Banking
- » Telephony
- » Professional
 - > Financial
 - > Medical
 - > Engineering



Challenges : Business process

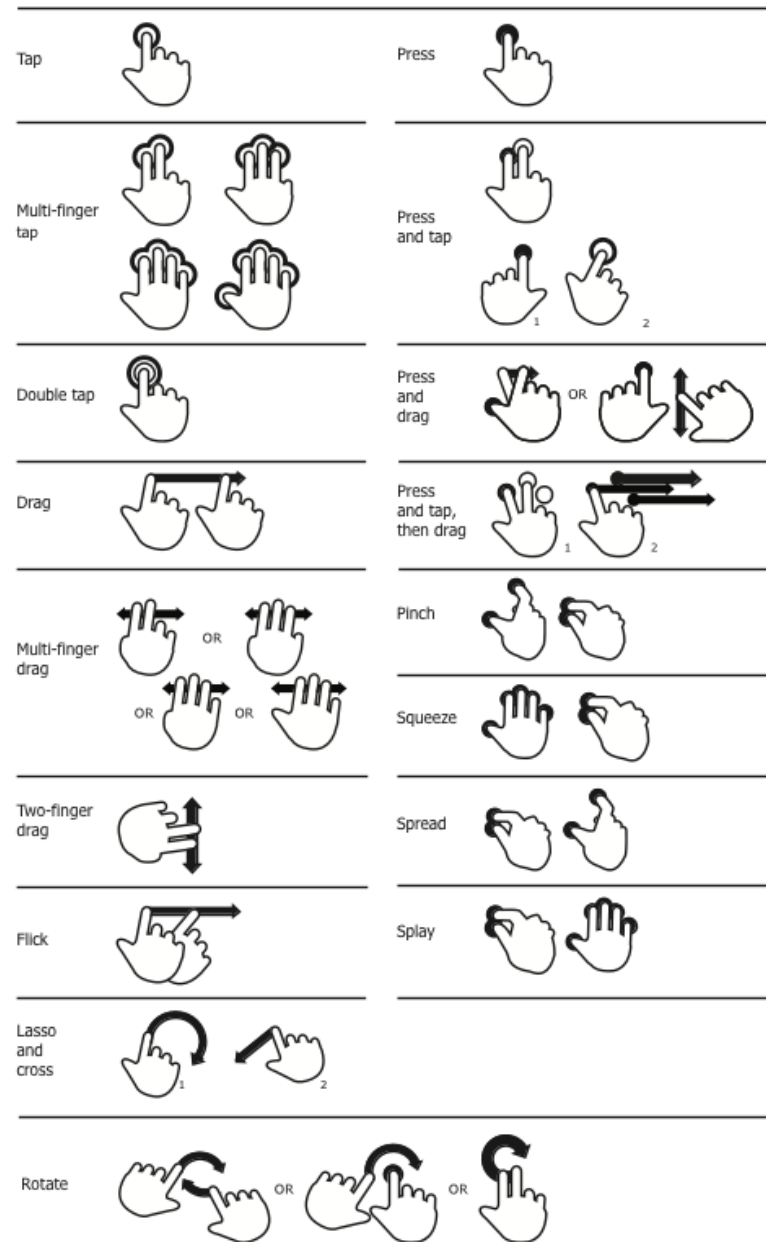
Many mobile apps are merely a front-end for complex business functionality that involves:

- » Mainframe computers
- » Database servers
- » Application servers
- » Parallel front ends
 - > Web
 - > Windows
 - > Web services
 - > Other mobile devices



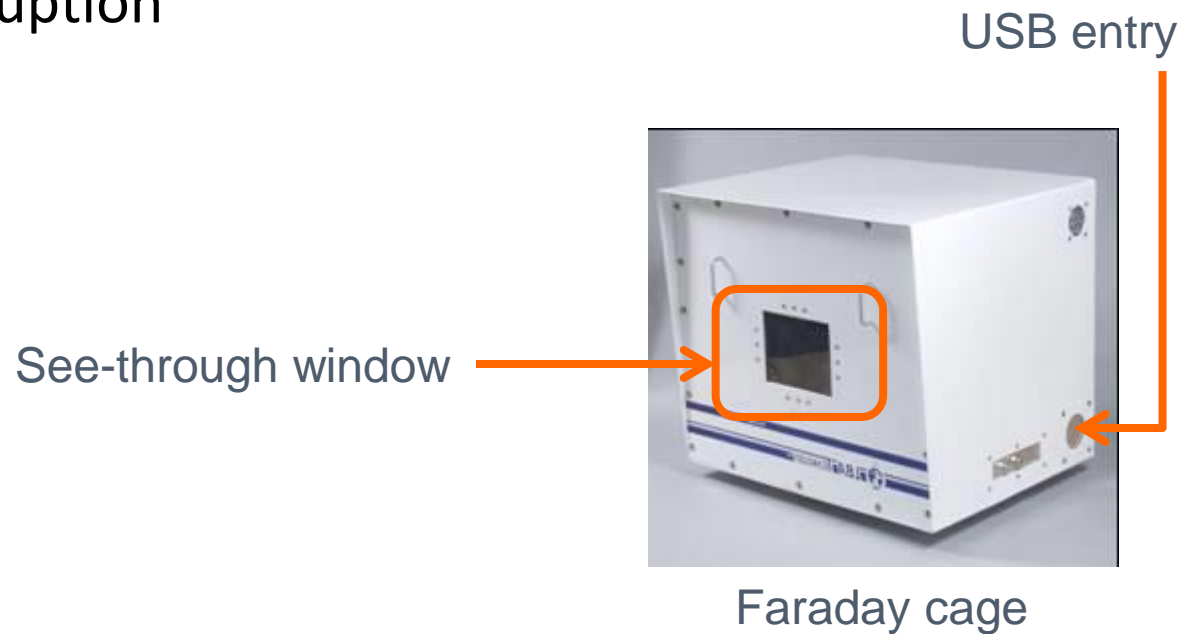
Challenges : Unique functionality

- » Gestures & shake-up
 - > HW and SW-dependent
 - > Conventions?
- » Location awareness
 - > GPS + DB(s)
- » Orientation
 - > Portrait / Landscape
 - > Default
- » App install
 - > Store
 - > Side-load
- » Automatic opening of the mobile website version



Challenges : Survivability and recovery

- » Battery
- » Low reception and loss of reception
- » Loss of GPS signal
- » Data transfer interruption



Challenges : Unique functionality : Location

GPS Simulators

- » Emit signals that mimic live GPS signals
- » Allow full control over the signal
- » Can simulate GPS alternatives, e.g.:
GLONASS, BeiDou, Galileo



Challenges : Functionality : Barcode

» Factors to consider:

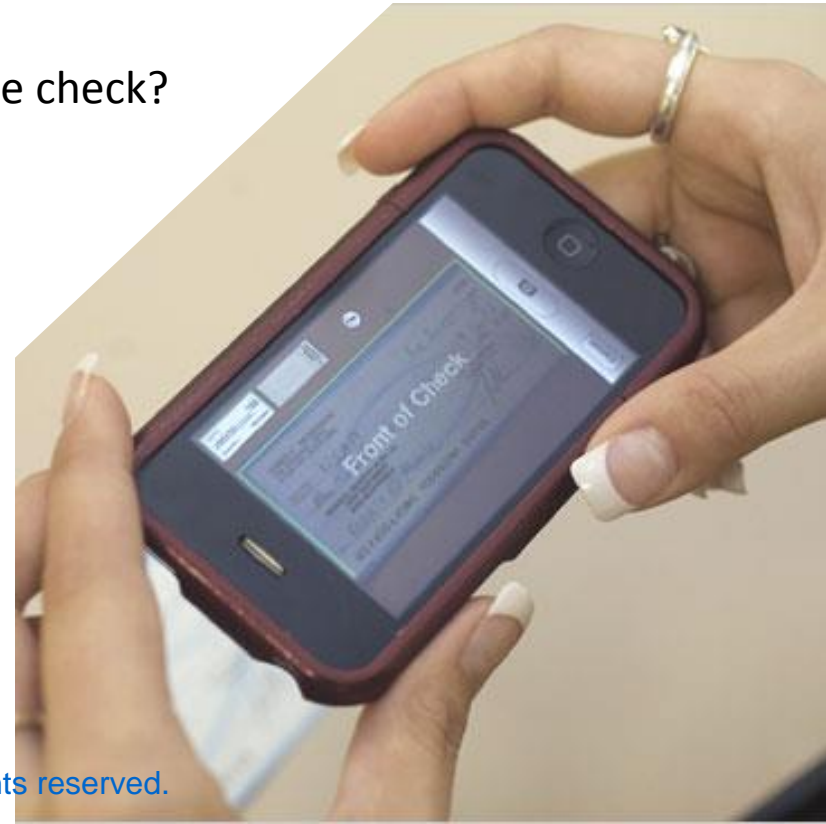
- > Types of barcode
- > Fonts
- > Paper
- > Lighting
 - + Research what are the expected lighting conditions
 - + Can be more than one
- > Distance
 - + What is the expected distance from the barcode?
 - + Are there any physical limitations?



Challenges : Functionality : Checks

» Factors to consider:

- > Color
- > Texture
- > Paper
- > Lighting
- > Distance
 - + What is the expected distance from the check?
 - + Are there any physical limitations?
- > Ink
 - + Color
 - + Thickness
 - + Texture
- > Handwriting / typing



Challenges : App stores

» Apple

- > App Store
- > Cydia

» Android

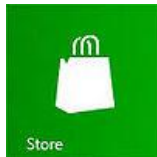
- > Google Play (former Android Market)
- > Side-load

» Microsoft

- > Windows Store
(former Windows Phone Marketplace)

» Side load

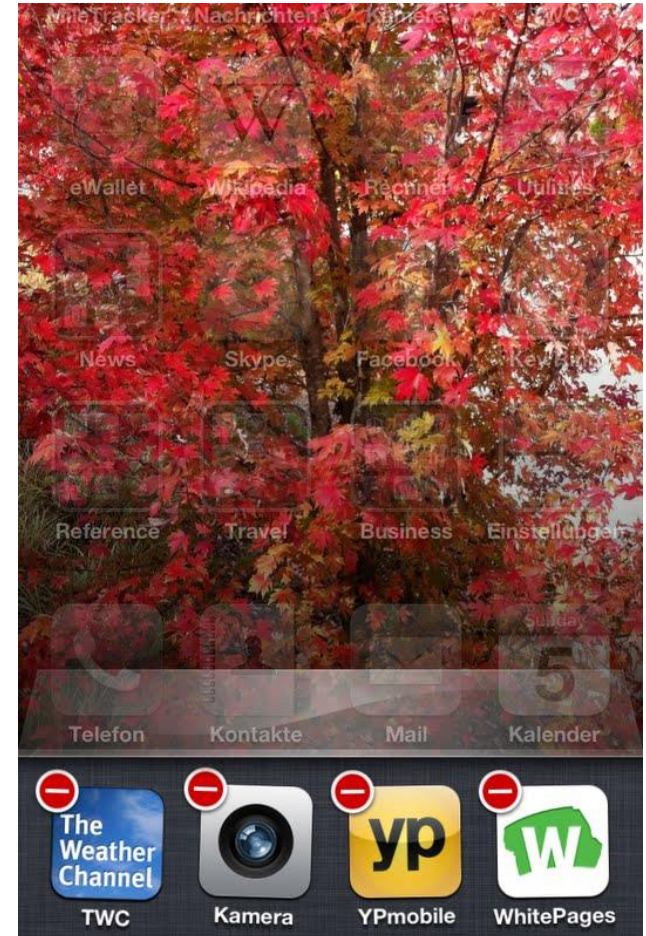
- > Installing native apps from other sources



Challenges : Performance

- » App opening time
 - > When not in memory
 - > When pre-loaded

Automation that can unload apps
from memory



Challenges : Orientation

» Reliability tests

- > Important to discover memory leaks
- > Outcome frequently depends on the device HW and OS flavor



Automation that can access a device that is being physically manipulated

Challenges : Data Entry

- » Typing on a smartphone keyboard, hard or soft, takes 2-5 times longer than on a computer keyboard.
- » No copy-paste from test data files is available.

Challenges : Compatibility

- » Hardware compatibility
 - > Apple: iPhone versions & iPad versions
 - > Android: device and tablet versions
- » OS compatibility
 - > Apple: iOS versions
 - > Android: OS versions *and* flavors
- » Carrier compatibility
- » Mobile Website
 - > Does it open automatically on all target platforms?

Automation that can handle multiple hardware and software platforms

Challenges : Interoperability

- » Data Exchange
 - > Exchanging data with the app server, DB server, ...
 - > Data upload after off-line
- » Invoking functionality
 - > Notifications: tray, pop-up, update
 - > Real-time messaging
 - > Video streaming
- » App updates

Automation at the level of mobile OS,
not merely at the level of the mobile app



Challenges : Production monitoring

» Is your system in production working properly everywhere it is supposed to work?

- > Opening time
- > Main functionality
- > Transaction time



Production Monitoring Dashboard

Android		iPhone	
Test set executed on: 12/10/2012 3:27PM ▼		Test set executed on: 12/10/2012 3:28PM ▼	
Location: Atlanta, GA		Location: Atlanta, GA	
FAIL		PASS	
Opened in: 4.245s Avg screen load time: 2.31s (1.2s) Missed ads: 4%		Opened in: 5.245s Avg screen load time: 1.31s (0.4s) Missed ads: 7%	
Script	Result	Script	Result
1. Open app	PASS	1. Open app	PASS
2. Validate sale transaction	PASS	2. Validate sale transaction	PASS
3. Validate reports	PASS	3. Validate reports	PASS
4. Install app	FAIL	4. Install app	PASS

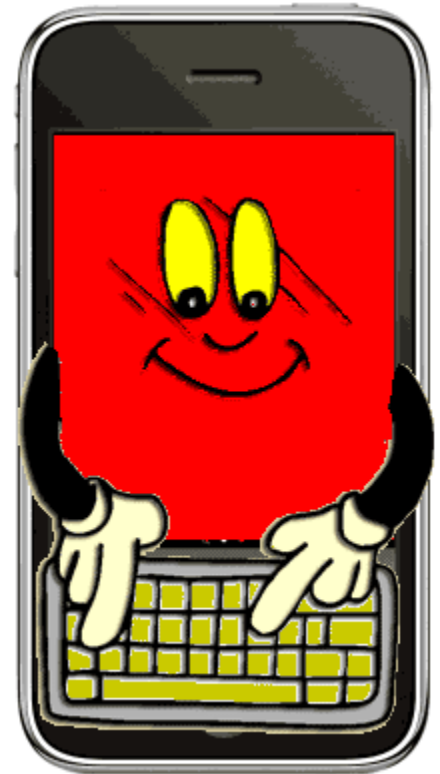
*Report results
to the Production Monitoring Dashboard*



*Run apps at different locations
every X minutes*

Automating mobile tests : Why automate?

- » All the regular reasons
plus
- » Data entry
 - > Significant time gap between devices and PC
- » Time-to-market
 - > Increased need for regression testing
- » Exposure
 - > Production monitoring
- » Memory leaks
 - > Mobile devices are quicker to fail – little memory
 - > Reliability tests



THE ULTIMATE CHALLENGE OF MOBILE TEST AUTOMATION

Automating
mobile apps and websites
as we automate
PC applications and websites:

1

All the functionality

- Clicking buttons
- Entering data
- Validating images
- Verifying text
- Scanning barcodes
- Imitating low reception
- ...

2

on real devices
while keeping them intact

3

in one script

From Challenges to Criteria

1. Technology

- i. Platform support
 - + Mobile
 - + Other
- ii. Device operations
 - + Jailbreaking / rooting
 - + Hardware modification
 - + Instrumentation

> Connectivity

2. Vendor

- i. Size
- ii. History
- iii. Location (legal)

3. Cost of ownership

- i. Licensing
- ii. Other software to purchase / rent
 - + Automation tools
 - + Remote control
 - + ...
- iii. Hardware to purchase / rent
- iv. Script development effort
- v. Skill acquisition
 - + Training
 - + Hiring

What do we have? Approaches

- » Emulators
- » Hardware modification
- Instrumentation vs. rooting/jailbreaking
- » Special tools
- » Common tools

Automation : Approaches : Emulators

- » A piece of software installed on the PC that emulates the device.



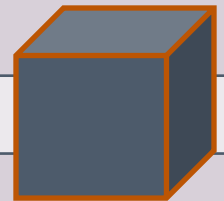
PRO	CONTRA
1. Easy to install and manipulate	1. Not realistic
	2. Not always up to date on the latest patches of the OS

Automation : Approaches : HW modification

» Hard-wiring the device to allow remote control.



PRO	CONTRA
1. Device hardware utilized	1. Not realistic
2. Tools usually maintained by at least midsize companies	2. Might take significant time to add newly released devices to the lab
	3. Highly complex hardware and software



Automation : Approaches : Remote & Instr

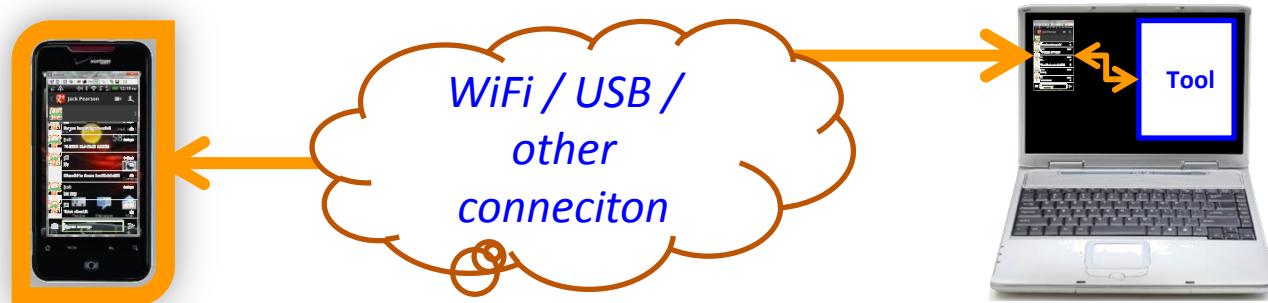
- » Instrumentation: adding special hookups to the application under test to control it by signals from a computer



PRO	CONTRA
1. Real devices utilized	1. AUT changed
2. Little load on device's memory and CPU	2. Security / configuration management risks
3. Communication-agnostic >>> <i>depends on the tool used</i>	3. Cannot open AUT automatically
	4. Cannot work with other applications, e.g., Settings

Automation : Approaches : Remote Control

- » Control the device remotely; jailbreak if needed
- » Decoupling automation tools, remote control, and the AUT

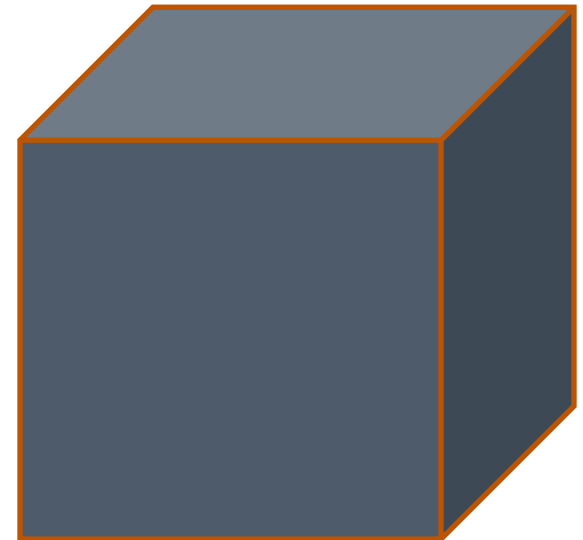


PRO	CONTRA
1. Real devices utilized	1. Jailbreaking required for iOS
2. Little load on device's memory and CPU	2. Remote control software required – usually platform-specific
3. Communication-agnostic >>> <i>depends on the tool used</i>	3. Usually cannot simulate gestures
4. Can use common automation tools	

Automation : Approaches : Special tools

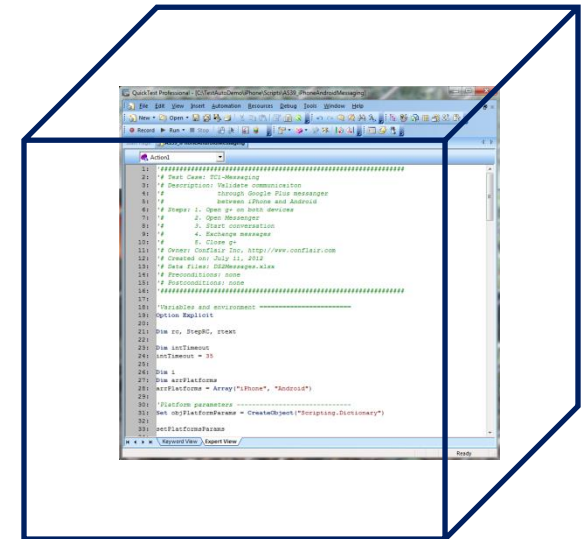
- » Tools dedicated to automating tests for mobile platforms
 - > Different approaches:
HW modification, instrumentation, remote control
 - > Some have unique scripting languages
 - > Some are add-ons to common tools
 - > Usually support 1-2 platforms
 - > Accommodating new platforms requires changing to the tool
 - > All are supported by small or midsize vendors

**An add-on to a common tool
is akin to a
stand-alone tool with added dependency.**



Automation : Approaches : Common tools

- » Mobile test automation as a method:
utilizing common tools in a way that allows
automating mobile interfaces
- » Usually use jailbroken iOS devices
- » Use common remote control applications
- » Platform-agnostic
 - > Utilizes multiple remote control apps
- » Communication-agnostic
- » Can support all non-mobile platforms
that the utilized tool supports



Demo



You will find videos that record demos
of using common tools to automate tests for mobile devices at:

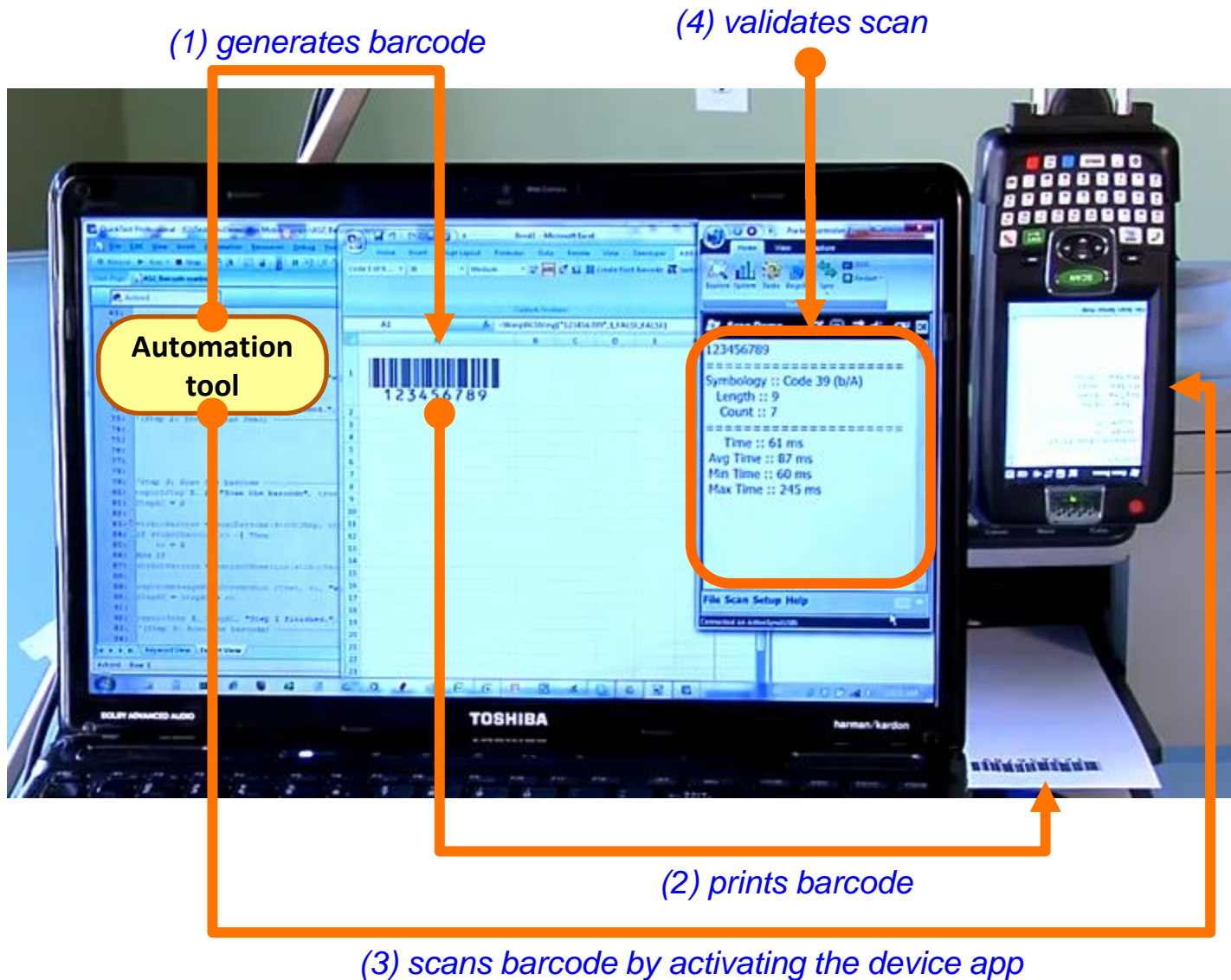
<https://www.youtube.com/watch?v=vkpBUZpKz68>

https://www.youtube.com/watch?v=HwRB_WbE5x4

Automation : Special cases

- » Multi-platform process automation
- » Barcode / Check scanning
- » Voice recognition
- » Multi-finger gestures

Automation : Barcode Scanning



Summary

- » The task of mobile test automation is to address the challenges
 - > Multiple platforms
 - > Limited resources
 - > Variety of connectivity modes
 - > Unique functionality
 - > ...while working with real, intact devices
- » None of the currently available methods can do that 100%
- » Each enterprise should compile a set of criteria in order to select the best method for its needs

Thank you!

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