Selecting the Right Mobile Test Automation Strategy: Challenges and Principles

Understanding the various options and choosing the tools and automation processes best suited to testing both mobile Web and native mobile apps can reduce complexity and speed time to value.

Executive Summary

The mobile phone has transitioned from its traditional role as a mere communication medium to that of a multipurpose personal gadget. Technological advancements and the proliferation of devices across operating systems (Apple iOS, Android and Windows Mobile) and platforms have made it more challenging for hardware manufacturers and application developers to develop and roll out new products.

For vendor peace of mind, mobile applications must be tested to ensure they run on key platforms and across a multitude of networks. Despite the pressures of short mobile development cycles, quality testing of applications across operating systems, device platforms and networks is a necessary but daunting task to ensure long-term success in what is a highly fragmented and competitive global market. Moreover, non-functional testing – including usability, security and adaptability – is as critical as functional testing. Effective testing can help device makers and application developers collect appropriate metrics that improve product quality.

This white paper explores industry best practices on mobile testing and demonstrates effective ways of managing mobile application quality through test automation. As with conventional applications, there is an increased need to automate mobile applications testing to improve scale and efficiency. A well-orchestrated automation strategy enables hardware manufacturers and software developers to reduce effort and accelerate time to market.

Mobile Technology’s Growth Promise

The growth of mobile devices is evidenced by the following:

- Globally, the user base of location-based services has grown from 96 million in 2009 to more than 526 million in 2012, according to Gartner Research.1
- Worldwide mobile advertising and content revenue is forecast to reach $67 billion this year.2
- IDC predicts that smartphone shipments will reach 978 million in 2014.3
- By 2016, smartphones and tablets will put power in the hands of a billion global consumers, according to Forrester Research, Inc.4
- Mobile device makers are providing customized platforms to increase their share of the customer’s wallet.
Two Key Challenges in Mobile Application Test Automation

Mobile Platforms and Technology Coverage

The primary factor that determines an automation tool’s success is its ability to work across platforms and technology stacks. The following challenges influence automation success:

- **Device Diversity:**
  - Multiple platforms and browsers.
  - Rendering differences.
  - Mobile devices with varied application run times.

- **Network Challenges:**
  - Multiple network types (e.g., GSM/GPRS/ Wi-Fi/Wi-Max).
  - Different speeds of connectivity across geographies.
  - Multiple network operators with customized network features.

- **Hardware Challenges:**
  - Limitations in processing speed.
  - Limitations of mobile memory size.
  - Differences in device communication protocols (e.g., WAP/HTTP).

Test Execution Challenge

Test execution across different devices and browsers is a huge, challenging effort. For example, consider a test case that is created and needs to be executed on three different platforms — iOS, Android and Blackberry. In this example, the test case is expected to be executed on 13 different devices and in 10 different combinations, which leads to 130 rounds of testing. Designing a test execution matrix of this scope is both difficult and time-consuming (see Figures 1 and 2).

Mobile Testing Industry Opportunities

In the growing mobile market, the need for specialized mobile testing is growing. The following three opportunities contribute almost 80% of total market demand.

- **Mobile Automation Testing**
  - There are only a handful of tools available to successfully automate testing. The ROI promised by automation testing highlights the need for more options.

- **Functional Testing**
  - Mobile functional testing always involves a non-heuristic component that cannot be automated.

- **Mobile Performance Testing**
  - Compared with a desktop/notebook environment, mobile device system resources (e.g., processing power, memory, etc.) are limited. Hence, performance testing of mobile applications is crucial. Therefore, this domain is growing and has great potential.

Real-time Scenario for a Smartphone-based App: Sample Test Execution

![Real-time Scenario for a Smartphone-based App: Sample Test Execution](image)

Figure 1
Mobile Automation: What and Why?

Mobile applications are becoming increasingly sophisticated, significantly increasing the requirement for functional testing (see Figures 3 and 4). To tackle this, test organizations are increasingly exploring alternatives to traditional manual testing. Automated testing is a highly effective approach to mobile app QA that can provide significant business returns, provided it is implemented by using the right tools and architecture, factoring in cross-platform challenges.

The following specific types of testing also need to be automated:

- **Cross-platform compatibility testing**: This is necessitated by the growing number of handsets and platforms.
- **User experience testing**: Most testing organizations have limited experience with design and execution of usability tests.
- **Field or network testing**: Testing must be performed in a geographically distributed environment to account for a variety of network types.
- **Structural challenges**: Integrating mobile testing toolsets into existing IT systems is a crucial hurdle.

Test Automation Mechanisms for Mobile Apps

A mobile Web site can be automated in one of the following three manners:

- **User agent-based automation**: This approach leverages user agent add-ons that come with popular browsers such as Mozilla Firefox and Google Chrome. The user agents help render the specific Web content that would be displayed on the device onto a regular desktop browser. The functionality can be automated by using popular tools such as QTP, Selenium or RFT — each of which supports all desktop browsers.
- **Cloud-based automation**: Cloud-based test automation vendors support Web-based QA across platforms. Cloud-based automated solutions are highly effective as they are offered as a unified package.
- **Lab-based automation (devices/simulators)**: This method involves setting up tools in a test environment and leveraging simulators or physical devices to automate testing using popular open-source tools such as Selenium. Web driver–supported device browsers and simulators are best suited here.

Approaches for Native and Hybrid Mobile Applications

**Cloud-based Approach**

Cloud-based test automation is one popular means for achieving native and hybrid types of test automation. The method is useful when long-term automation is required across a set of predefined devices. Commercial tool add-on mechanisms such as HP QTP and IBM RFT are also available for test engineers who are familiar with
industry-wide products. The ability to automate from anywhere is a great advantage: All that is needed is connectivity to the cloud lab. The "automation-from-anywhere" feature is a distinct advantage when using tools such as Perfecto Mobile and Device Anywhere.

**Lab-based Approach**

There are multiple tool sets with different capabilities available for organizations interested in a lab-based approach. Tools such as EggPlant, Jamo, See Test, ZAP, SilkTest and Test Quest provide industry tool add-ons. They are useful in enabling automation in a closed environment, for continuous automation or to achieve test regression functionality. They also cover nonfunctional scenarios that handle mechanisms largely relevant to mobile apps.

**Open Source/Platform-specific Tools**

Device platform-specific tools reliability is a high priority. Platform vendors supply tools such as Robotium for Android and iOS instruments for iOS to provide this facility. However, to leverage this effectively, it requires additional programming skills.

**Potential Areas of Automation in End-to-End Mobile Application Testing**

![Graph showing potential areas of automation in end-to-end mobile application testing](image)

*Source: Cognizant; based on 350-plus projects performed across all vertical markets and our analysis of industry trends.*

Figure 4
Cognizant’s Tools
We have our own platform to easily automate testing of mobile native and Web apps automation across platforms.

Our platform ensures single type scripting that works cross-platform and thus guarantees greater reusability of scripts. The platform also offers an easy interface for testers to auto-generate scripts. For instance, scripts can be automated without any programming or scripting language knowledge. It also comes with a facility to automate as applications are created to support the Agile development methodology.

Mobile Application Testing Tools
Selection Criteria
There are many successful techniques that can make testing applications on mobile devices more effective and efficient. It is essential to ensure functional and nonfunctional compliance of mobile applications on devices and mobile automation. It is also key to establish labs for testing mobile applications.

Some basic criteria for mobile application testing include the use of emulators, multiple browsers, different operating systems and the unique types of testing required for GUI, field and interruption testing. There are roughly 10 key principles that need to be considered while selecting the right tool.

10 Key Principles in Selecting the Right Tools for Mobile Testing
It is good practice to start with a proof of concept (PoC) on critical platforms before narrowing down to a tool or tool set. One tool may not achieve cross-platform automation goals. When test automation tools are evaluated, organizations must not overlook how they integrate with test management environments. One starting point is to identify reusable scenarios across platforms and group them accordingly. This facilitates the creation of an appropriate, time-saving framework.

For native apps, choose critical test cases that can be run across releases as automation candidates and ensure that there is a cross-platform reusability and multi-browser compatibility. Always keep in mind different form factors while determining test coverage, especially for the mobile Web. Consider different connectivity aspects for automation execution runs.

In addition, the following recommendations will be helpful in informing your test automation journey:
- Perform tool feasibility tests, because mobile technologies and platforms vary.
- Select tools that support both platform simulators and devices, because you can mix and match devices and simulators to optimize runs on different platforms.
- Aim for automation in nonfunctional areas – interruption and hardware scenarios that include battery state changes.
- Always optimize on platform support: In some cases, there may be a need for one or more tools to perform automation.
- Identify multiple device support and versions support.
- Determine the use of utilities and reusable functions that add value to automation.
- Ensure ROI per each mobile platform and duration of execution as part of the tool consideration process.
- Look for avenues for early automation, because most mobile projects are Agile.
- Integrated execution with the test management tool and application lifecycle management is an important success factor for a tool.
- Look for data-driven automation support: Iterations in the execution will increase coverage and ROI. Good candidates for automation are test cases that have repeated business logic, functional flows or data-driven tests: Smoke test and build acceptance testing, regression testing, synchronization testing, compatibility testing, GUI testing and testing non-dynamic UI components, as well as cross-platform functional testing.

Moving Forward
The principles and success factors of test automation for mobile applications are much different than those traditionally applied to conventional applications. The attributes of devices, environment, tool sets and test coverage add multiple layers of complexity. It requires keen insight and a customized approach for a well-orchestrated automation strategy.

The best practices covered in this paper will guide you toward setting test automation goals and choosing appropriate coverage, the right tool sets and a comprehensive approach. Making automation effective and efficient ultimately yields cost and time reduction in the app development lifecycle.
About Cognizant

Cognizant (NASDAQ: CTSH) is a leading provider of information technology, consulting, and business process outsourcing services, dedicated to helping the world’s leading companies build stronger businesses. Headquartered in Teaneck, New Jersey (U.S.), Cognizant combines a passion for client satisfaction, technology innovation, deep industry and business process expertise, and a global, collaborative workforce that embodies the future of work. With over 50 delivery centers worldwide and approximately 145,200 employees as of June 30, 2012, Cognizant is a member of the NASDAQ-100, the S&P 500, the Forbes Global 2000, and the Fortune 500 and is ranked among the top performing and fastest growing companies in the world. Visit us online at www.cognizant.com or follow us on Twitter: Cognizant.

About Cognizant’s Mobile Testing CoE

Cognizant’s Mobile Testing Center of Excellence (CoE) provides state-of-the-art solutions for mobile testing requirements with best-of-the-breed testing practices and processes. It specializes in offerings such as unit testing, functional testing, multi-language compatibility testing, security testing, automation testing, performance testing, device testing and application testing. Our Mobile Testing CoE features a strong pool of certified mobile testing experts, built through long-term competency development programs. In addition, it houses smart products and frameworks powered by a focused R&D team, which takes mobile application testing to a whole new dimension.

About the Authors

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Footnotes

1 http://www.gartner.com/it/page.jsp?id=1230413
2 http://www.mediapost.com/publications/search-marketing-daily/edition/2012/07/13/?print
3 IDC Worldwide Smartphone 2012-2016 Forecast Update, June 2012.