



Leverage Cloud-based Framework for Mobile Application Testing

Guarantee User Experience Across Devices and Platforms

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Executive Summary

The mobile ecosystem is growing at an incredible rate. The rapid adoption of smart devices is changing the way we interact and conduct business today. According to Gartner, 50% of users will access the internet using mobile devices by 2018¹. The growing popularity of mobile apps has triggered this change. According to a report by Nielsen, mobile apps account for 89% of media time on mobile devices.² While businesses are trying to capitalize on this trend, they find it challenging to keep pace with rapid technological changes and the growing number of devices.

User experience is critical to engagement and mobile app testing plays a critical role in ensuring enhanced user experience and adoption. Mobile app developers, however, face difficulties such as rapid device proliferation, increasing competition and market demand. In addition, diverse mobile platforms and changing versions of operating systems present unique challenges in testing mobile apps effectively.

Testing mobile apps require a multi-pronged approach to testing performance, usability, reliability and security across multiple platforms and form factors. In this paper, we discuss various challenges in mobile app testing and the limitations of standalone testing methodologies, and recommend ideal testing strategies and best practices.

1 <http://www.gartner.com/newsroom/id/2939217>

2 <http://www.nielsen.com/content/dam/corporate/uk/en/documents/Mobile-Consumer-Report-2013.pdf>

The Growing Popularity of Mobile Apps

The proliferation of smart phones and devices has completely changed the way people live and organizations do business. While there has been a dramatic improvement in the form factor, it is the software that plays a key role in uncovering the potential of a device. In fact, the incredible success of smartphones can be attributed to the growing mobile application market. According to a Flurry Analytics report, the overall usage of mobile apps grew by 76% in 2014. Another report by Nielsen shows that the average smartphone user downloads 41 different apps and spends about 39 minutes per day on apps.³

The growth of mobile apps present a phenomenal opportunity to connect with consumers. However, it must be remembered that the success of a mobile app depends to a large extent on the user experience it offers. With today's consumers demanding personalized and contextual experiences, shortcomings can impair user adoption, cause significant damage to the brand image and result in loss of revenue.

Fulfilling these performance expectations requires immense effort across every stage of the design and development lifecycle, including mobile testing which is critical to ensuring engaging user experiences. However, testing mobile applications present unique and significant challenges. Mobile applications need to be tested across various form factors, operating systems and software platforms under diverse network connectivity. These factors make mobile testing a complex and arduous task. Add to this the fact that frequent software upgrades require incremental testing to ensure compatibility.

It is therefore imperative to have a comprehensive mobile testing solution with the right level of automation that can help address these challenges and streamline mobile testing and application development.

Mobile apps usage grew by **76%** in 2014.

Dodging the Testing Barriers

Diverse form factors, device fragmentation, complex back-end integration, various connectivity and browser compatibility **issues** present unique testing challenges.

Businesses are under immense pressure to develop apps efficiently and quickly for a diverse range of devices. However, testing mobile applications is far more complex and time consuming than testing conventional web applications. Providing a consistent user experience across devices is the biggest challenge, due to mobile app and device compatibility issues. In addition to this, mobile apps present unique testing challenges owing to several factors that need to be taken into account while devising a testing strategy:

■ Various form factors

The biggest challenge in testing mobile applications effectively is the availability of a huge variety of mobile devices. The sheer number and variety of devices make it infeasible to conduct physical device testing. However, not testing on a physical device may lead to a poor quality application or complete failure of the device, in turn, hampering user adoption and revenues.

³ <http://www.cnet.com/news/nielsen-1-in-2-own-a-smartphone-average-41-apps/>

- **Operating systems and device fragmentation**

Device fragmentation is possibly the most complex challenge. With devices operating on various versions of an operating system, it becomes quite challenging for testers to test compatibility across hardware matrices and ensure consistent user experience.

- **Complex back-end integration**

Almost every enterprise mobile app is integrated with various systems including payment gateways, CRM, ERP, enterprise database, etc. Back end integration compounds the architectural complexity making it even more difficult to test the performance of the app effectively. Ensuring data exchange and compatibility between apps and the systems pose significant challenges.

- **Browser compatibility**

Another technical roadblock is making web applications available on mobile, which means ensuring compatibility across diverse devices and browser combinations. With rapidly evolving technology, it becomes even more challenging for the organization to determine and invest in the right testing strategy.

- **Types of connections**

Testing application rendering as per the bandwidth usage is critical to the success of a mobile app. However, multiple mobile data connections such as 3G, 4G, Edge, and varying connectivity and bandwidth issues add to the complexity of testing mobile applications.

Traditional Testing Approaches and their Limitations

Standalone approaches to testing mobile applications are often time consuming and resource-intensive, and increasingly result in significant operational and cost impact. Given the factors discussed above, organizations need a comprehensive testing strategy to guarantee consistent user experience across devices and ensure app quality. This should include an optimal mix of testing methodologies, a wide selection of devices, and the right automation tools to ensure successful mobile app testing.

An optimal mix of testing methodologies, wide selection of devices and the right automation tools are necessary to guarantee consistent user experience across devices.

- **Simulation-based testing**

This is a cost-effective method which allows developers to test the apps simultaneously without leaving the development environment. However, depending solely on simulators can be a deterrent as they do not provide an accurate representation of the apps performance. The scope of testing under this method is extremely limited as it allows the tester to only validate system functionality, making it difficult to verify device specific features and functions. To address this challenge, many testers use emulators that mimic the real device and help validate device features and behavior. However, even this workaround offers limited scalability which is critical in the face of the unprecedented growth of devices.

■ **Manual testing**

Manual testing usually lacks regression testing and the focus is limited to a handful of devices and features. Even rigorous efforts can fall short in ensuring complete device coverage due to the sheer range of devices available today. Manual testing also poses inherent challenges such as slower turnaround times and apps being tested in an uncontrolled environment, resulting in security vulnerabilities. Moreover, manual testing requires significant investment in terms of cost, time and resources which add to the overhead but fail to deliver expected returns.

■ **Device-based testing**

This approach helps validate device-based behavior and functions accurately. With the right selection of testing environment and reconfigurations, this approach can help verify the mobile network as well. However, it is necessary to set up a testing laboratory and invest in physical devices, which significantly adds to the cost of testing. Moreover, with rapid changes in devices and platforms, this approach ceases to be feasible and limits the scope of testing to fewer devices.

Devising a Successful Testing Approach

Organizations need agile methodologies to deliver higher business value faster. Developers need to ensure that apps are engaging, irrespective of the device and platform. There is a plethora of tools and techniques available for mobile testing and the trick is to choose the right combination to help meet quality requirements effectively. With the rapid proliferation of devices and changing operating systems, a cross-platform

mobile app testing strategy is critical to the success of mobile applications. Here is an effective approach that can help narrow down the selection options:

■ **Leverage real device cloud**

A multi-pronged approach is highly effective, and it is recommended that businesses leverage cloud tools and automated tests along with manual testing. In fact, partnering with a vendor can help access remote real devices easily at any time.

■ **Deploy a device emulator**

Deploy a device emulator that uses a live network, bypasses the network, and has quality scripting language. Look for instrumentation and several network options in an emulator to ensure it provides the flexibility needed. It should also comprise diagnostic tools to debug and should have a range of network stacks to enable the testing of apps across various networks. In addition, an emulator should allow the tester to replay test cases and modify device profiles quickly and effectively.

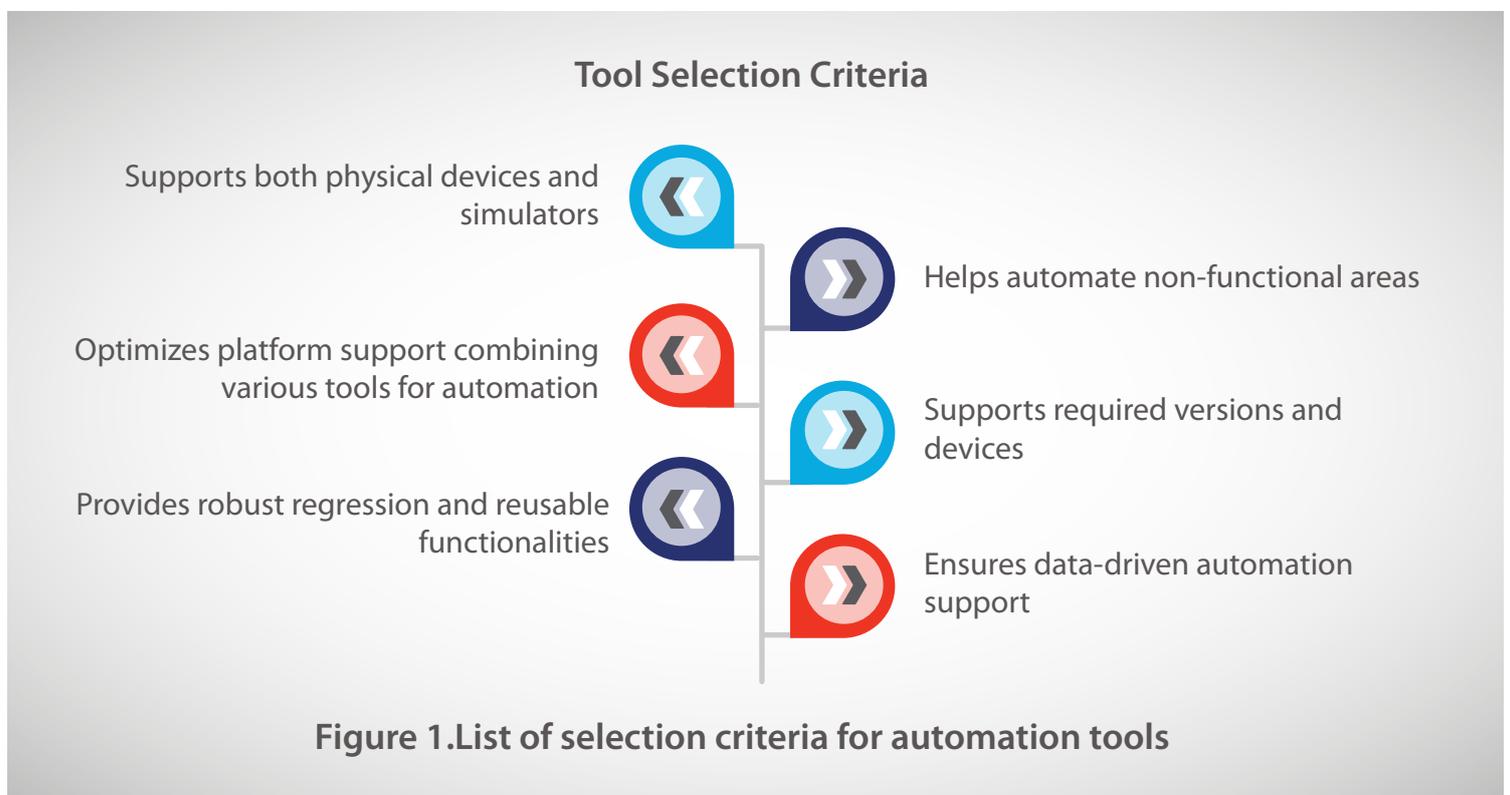
■ **Automate as much as possible**

Lastly, an ideal approach is to combine emulators and real devices. While emulators help automate script and playback functionalities and debug applications, testing on a physical device helps optimize app behaviour, response and user experience.

With the rapid proliferation of devices and changing operating systems, a cross-platform mobile app testing strategy is critical to the success of mobile applications.

iOS and Android offer the broadest support and organizations should look for solutions ranging from platform-specific to crossplatform. Ensuring that testers have the right experience and skill sets further strengthens the testing setup. Automation tools need to be selected based on the type of testing, such as stability testing and compatibility or functional and regression automation. There are several automation tools that enable test regression functionality or continuous automation such as EggPlant, SkillTest, Quest and Jamo.

Tools and techniques need to be selected based on the type of application being developed whether it is a native, mobile browser, hybrid or enterprise app with a high level of interactivity. Since various tools and techniques offer varied features and functionality in terms of platform coverage, it is important for the tester to combine multiple approaches and tools to reduce defects and mobile apps risk significantly. Testers need to go beyond conventional functional testing and account for usability, security and device localization. Figure 1 provides a list of criteria to look for while selecting the automation tools for testing.



Mobile App Testing Best Practices

In addition to adopting the right approach, selecting the right tool and devising the right strategy to ensure increased efficiency and testing productivity, organizations need to follow certain best practices. These are fundamental to mobile app testing. They bring uniformity in testing and ensure cross-platform coverage.

▪ Back-end interaction testing

Any interactivity between mobile apps and data and services require scheduled testing. In order to ensure a stable platform, the components responsible for such interactions should be

packaged separately and tested. Network usage should be handled asynchronously so that the app can be tested across multiple networks for usability and interactions.

■ **Cross-device testing**

The core functionality of an app needs to be tested across a wide range of devices and manufacturers. Using device cloud services can not only provide cost advantages but also the flexibility and scalability required to test across device types. Testers should devise units of core functionalities and run them on emulators using extensive integration tests. They should also run final tests for release across the widest possible range of devices. Ideally, these tests should flag off battery usage to highlight potential bugs.

■ **Integrating cross-platform testing**

Typically, Android and iOS projects are handled separately. However, coordinated testing for certain shared functionalities such as interaction of network with back-end data and systems is recommended.

Delivering Efficiencies at Every Level

Cloud-based test automation is gaining significant traction as it supports native, hybrid and web applications. It also supports all the features including orientation, swiping, taping and loading UI. This is an effective solution where long-term automation is needed across various devices. Test automation allows developers to perform cross-platform tests using real devices connected to live networks. It offers the ability to automate anytime from

anywhere providing an added advantage to the developers. A cloud-based platform also provides the scale and flexibility to test a wide range of features across a plethora of devices. Parallel testing makes it possible to capture bugs during the development process and troubleshoot quickly, thereby reducing cycle times and ensuring a superior user experience. Above all, these tools are easy to use and do not require any coding. Developers can simply drag and drop events and actions and automate tests on their own.

Cloud-based frameworks such as:

- **Xamarin and Calabash** offer powerful user interface (UI) testing automation functionality. Tests are written as per user behavior that performs swiping, taping, rotating and loading UI features.
- **Perfecto Mobile** is another cloud-based automation tool that provides the flexibility to configure devices over the cloud to suit user requirements. It is a comprehensive platform that allows developers to test their apps using solutions such as UFT, Selenium or TFS
- **Rational Test Workbench (RTW)** is a tool from IBM which is compatible with Rational Quality Manager (RQM). It helps manage manual test artifacts and supports continuous integration. Integration testing helps significantly reduce test cycle times.

Cloud-based frameworks offer the flexibility to modify scripts on-the-go to align with UI design changes. These platforms offer comprehensive regression testing with extensive device coverage and provide test results within minutes.

Extensive Device Testing

Offers the widest range of device types, allowing testers to select a range based on operating system, market popularity and manufacturer.



Accelerated Debugging

Generates test results instantly enabling developers to compare performance simultaneously, identify bottlenecks and troubleshoot early in the cycle.



Comprehensive App Support

Cloud-based platforms offer full-stack coverage that not only manage native crashes but exceptions as well. This provides visibility into not only native crashes, but into crashes across platforms.



Continuous Integration Support

Cloud-based platforms such as Xamarin are designed to integrate with continuous integration (CI) tools such as Team Foundation Server and Jenkins that fix bugs early in the cycle enabling developers to build high-quality apps.



Advantages of Using a Cloud-based Framework

Conclusion: Leveraging Cloud as a Force Multiplier

Unprecedented innovation in the mobile landscape will only make mobile app testing even more complicated. The right level of automation is the key to addressing these challenges. However, a careful selection of tools coupled with a judicious mix of approach and testing processes require in-depth knowledge and skill sets.

Leveraging cloud-based testing framework can help meet these development pressures. These frameworks offer cross-platform testing capabilities with powerful user interface testing functionalities and help run and analyze app performance across platforms and form factors. They offer extensive scalability and integration with other automation tools to meet unique testing requirements effectively. Hosted platforms help reduce the cost of ownership, while leading automation tools help accelerate development and build high-quality native and hybrid mobile apps.

Author Profile

Mr. Balaji has over 23 years of experience in the IT industry across application Value Management, Infrastructure Management, BPO and Strategic Operations handling, P&L, Delivery, Operations and Customer Relations across Multiple Verticals which include, Information Services, Retail & Hospitality, Manufacturing & Logistics, and Consumer goods.

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About GAVS

GAVS Technologies (GAVS) is a global IT services & solutions provider for customers across multiple industry verticals. GAVS offers services and solutions aligned with strategic technology trends to enable enterprises take advantage of futuristic technologies like Cloud, IoT, Managed Infrastructure Services, and Security services.

GAVS has been recognized as an emerging player in the Healthcare Provider IT outsourcing sector by Everest Group, and as a prominent India-based Remote Infrastructure Management player by Gartner.

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