



Service Virtualization for Mobile Application Testing

Executive Summary

With mobile applications increasingly serving as the primary interface to the business, delivering a compelling user experience has become imperative. In fact, recent studies report that even a delay shorter than the blink of an eye causes many users to start abandoning your application, and 63% of users would be less likely to do business with your company after experiencing an issue with your mobile app.¹

Since there's essentially zero room for error, you might expect that thoroughly validating and optimizing mobile applications prior to deployment would be common practice. However, testing is often compromised and curtailed due to the complexities involved:

- Mobile application transactions are highly dependent upon system components that are commonly beyond the team's control. Testing and development typically requires access to third-party services, mainframes, databases, etc. that are difficult to access, as well as APIs that are evolving in parallel with the mobile app.
- Telco network factors such as bandwidth, latency, and jitter significantly impact application performance, and these conditions tend to vary dramatically for different user populations. Without realistic network conditions in the test environment, it's difficult to trust that performance test results accurately predict real-world performance.

With this in mind, how do you ensure a positive user experience? One innovative strategy is to leverage simulated test environments that bring the behavior of system dependencies and network conditions under your direct control. These simulated test environments draw upon two key technologies to deliver anytime, anywhere access to a complete and realistic test environment:

- *Service Virtualization* enables organizations to emulate the behavior of myriad dependencies involved in end-to-end mobile application transactions.
- *Mobile Network Virtualization* adds the ability to accurately emulate the performance of telecommunications networks (e.g., bandwidth, latency, and jitter) for different user populations.

By testing mobile applications against these simulated test environments, enterprises can ensure that those applications are validated extensively and accurately, then effectively optimized *before* deployment. Ultimately, this helps the business reduce costs, improve customer satisfaction, and increase profits.

¹ <http://portal.sliderocket.com/AHJMM/Tealeaf-Mobile-Transactions-Survey>

Mobile Apps Are Fast-Becoming the Primary Interface to the Business

Software has undeniably become a primary driver of innovation and success in today's business world, and it now serves as the primary interface to most businesses. With mobile activity skyrocketing, organizations committed to increasing business and improving customer satisfaction are turning to mobile apps that connect people to that primary interface anytime and anywhere.



Figure 1: Mobile activity is skyrocketing²

As we transition to mobile, it's critical to rethink how we're developing software—not just in terms of the way we're engaging with the device (e.g., smaller interface, touch screen), but also the way we're engaging with the customer/user. This requires an understanding of what transactions are most critical for our clients as well as a concerted strategy for optimizing those transactions to ensure a satisfactory user experience.

Mobile App Quality Directly Impacts the Business

In today's marketplace, switching costs are at all-time low while the number and range of alternatives for any given application are at all-time high. With a delay of just 400 milliseconds, your user is already beginning to think about switching:

² <http://blog.moovweb.com/2013/02/the-post-pc-revolution-is-here-dont-panic/>

In the time it takes to blink an eye—**400 milliseconds**—
online AND mobile users will have begun to abandon your application



Figure 2: Performance glitches impact the brand and drive customers away³

At the same time, as software applications increasingly serve as the primary interface to the business, the liabilities and damages associated with application failure grow exponentially.

The bottom line is that quality matters. Faulty mobile apps are costly from a number of different perspectives. Failure to meet user expectations in terms of usability, functionality, and performance will inevitably result in lost business. Beyond that, any reliability, privacy, or security issues discovered in your application can cause brand erosion as well as open the door to legal liabilities.

The State of Application Performance

With mobile, performance comes to the forefront as users expect instant access—and if you can't deliver it, it's extremely easy for them to find another provider who can. Yet, performance in general has been a longstanding challenge throughout the software industry. A 2012 study published by Computerworld UK found that performance issues were common, critical, and increasing:

- 74% experienced performance issues with critical business applications
- 82% reported speed and responsiveness problems in the past year
- 50% believed performance issues were occurring at a greater frequency

Further complicating the performance challenge, mobile brings a totally new—and more complex—paradigm for the way we're presenting an application. The endpoints or the end devices are more ubiquitous, there are numerous operating systems, and even the variations within a single OS such as

³ <http://portal.sliderocket.com/AHJJM/Tealeaf-Mobile-Transactions-Survey>

Android can be staggering. Not surprisingly, a 2012 World Quality Report found that organizations worldwide are struggling with even basic attempts at ensuring mobile application quality and performance:

- 69% do not formally test mobile applications
- 66% do not have the right tools
- 59% characterize QA teams ability to effectively test as merely “average”
- 35% lack appropriate testing methodologies

Performance Issues are Costly

When a performance issue occurs in the field, the cost of pinpointing and resolving the root cause can run up to \$45,000 an hour. This might seem high at first glance, but consider how many people in the organization are typically involved in (or impacted by) each issue:

- **Customer service** learns about the issue and reports it.
- **QA** tries to bring up an environment to reproduce the issues.
- **Ops** then attempts to understand if it’s repeatable in their environment.
- **Development** receives the issue, then has to access an environment to reproduce the issue, isolate the root cause, and resolve the root cause (without breaking something else).
- **Multiple teams from Development to Ops and beyond** need to develop and execute a plan for releasing the updated application to the field.

It's also important to consider costs to the business over the long term. If the application cannot perform its designated business function, then revenue, productivity, and brand will invariably suffer.

Mobile Testing Must Embrace an Extended Infrastructure

Ensuring optimal performance for mobile apps is complicated by the complexity of mobile networks. Performance testing not only has to consider the traditional operation environment in which service calls are working through your internal networks; it also has to address a whole new infrastructure that the mobile device is connected through. This can include:

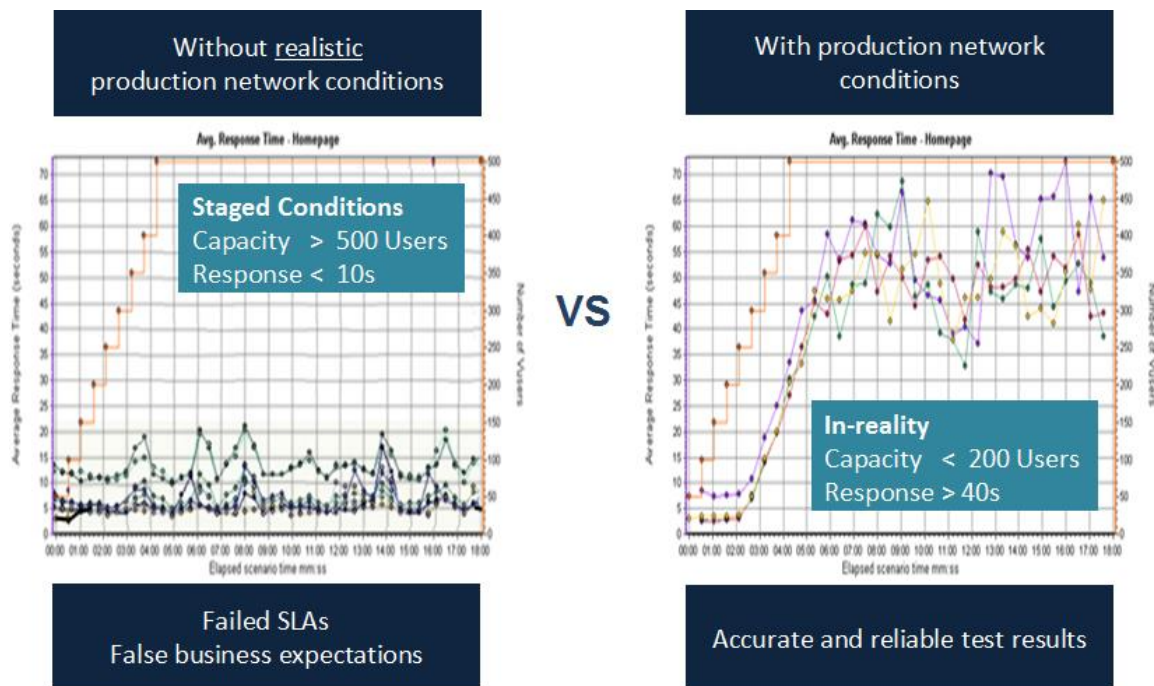
- Telco networks
- Wi-Fi/hotspots
- 3rd party cloud services
- Content networks
- ISPs

Before mobile, we could concentrate on our current operational infrastructure without worrying about the broader Telco network. Now, it’s a primary concern—and we find that it’s beyond our control. Simulation technology lets us bring it under our control, providing access to a complete test environment as early and often as the team desires.

Realistic Network Conditions Are Critical for Predictable Results

Getting access to the appropriate infrastructure components is one challenge; configuring them to represent realistic behavior is another. Configuring realistic performance conditions can be time-consuming, tedious, and challenging. The most common approach today is to look at the internal production network, assess its capacity, and use that as a model for dev/test environments. However, if this environment doesn't accurately represent real-world conditions, performance testing will result in false assurances.

For example, when one organization ran the following tests against a staged environment, test results indicated that that their application supported a capacity of over 500 concurrent users and response times of less than 10 seconds. However, that staged test environment did not represent realistic network conditions. When the same tests were later run against production network conditions, the capacity was actually less than 200 concurrent users and the response time was greater than 40 seconds.



Since they optimized performance and validated SLAs against this unrealistic staged test environment, they set a business expectation that was unachievable in the field.

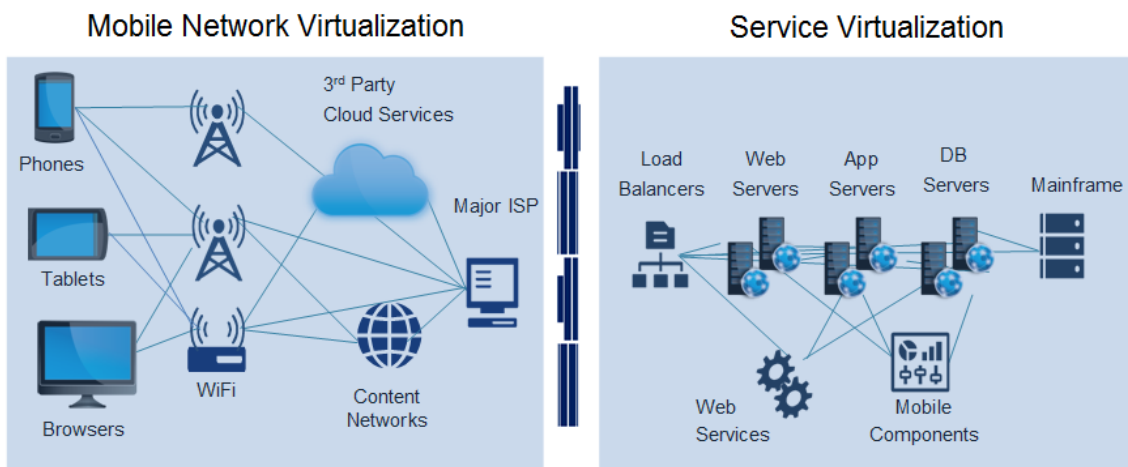
The more accurate and realistic the test environment, the more effectively you'll be able to anticipate and optimize real-world application performance and behavior.

How Environment Simulation Helps

Simulation technologies help organizations gain an accurate assessment of how mobile applications will perform under realistic network conditions *before production*, then cost-effectively make the adjustments needed to deliver a positive user experience from the start.

Service virtualization addresses the test environment access constraints that commonly delay mobile testing efforts and/or downsize their scope/frequency. Mobile application transactions are highly dependent upon system components that are commonly beyond the team’s control. Testing and development of mobile apps typically requires access to third-party services, mainframes, databases, etc. which are difficult to access as well as APIs that are evolving in parallel with the mobile app. Using service virtualization, teams can rapidly create simulated test environments that provide flexible access to the necessary system behavior. These simulated test environments can be accessed anytime, anywhere in order to test an application from a functional perspective. They can also be used in order to complete some interesting performance simulation from the internal network perspective.

However, as we explained above, network conditions beyond internal operations are also critical considerations in the world of mobile apps. Network factors such as bandwidth, latency, jitter, and packet loss significantly impact application performance—and these conditions tend to vary dramatically. *Mobile network virtualization* provides the ability to accurately emulate the performance of telecommunications networks for different user populations. This is done in conjunction with service virtualization efforts that provide access to system components which are difficult to access, test, or configure for dev/test purposes.



Together, these two simulation technologies establish a very complete simulated test environment. We’ve found that organizations using simulation technology in this manner can reduce performance incidents by 70% on average within the first 6 months of implementation.

How Service Virtualization Works

Service virtualization helps development and QA teams access the complete, realistic test environments needed to develop or test an application as follows:

1. **Capture or Model Behavior:** Real system behavior is captured—using monitors to record live transaction details on the system under test, by analyzing transaction logs, or by modeling behavior from a simple interface.
2. **Configure:** The resulting “virtual asset” can be extended with specific response parameters for performance, test data, and response logic. Parasoft makes it simple to mimic conditions for more complete testing, including “what-if”, security, concurrency, fail-over and error scenarios.
3. **Test:** From an intuitive graphical interface, users can rapidly access the exact test environment needed. The simulated test environments are available 24/7 for automated or manual testing with any testing framework.

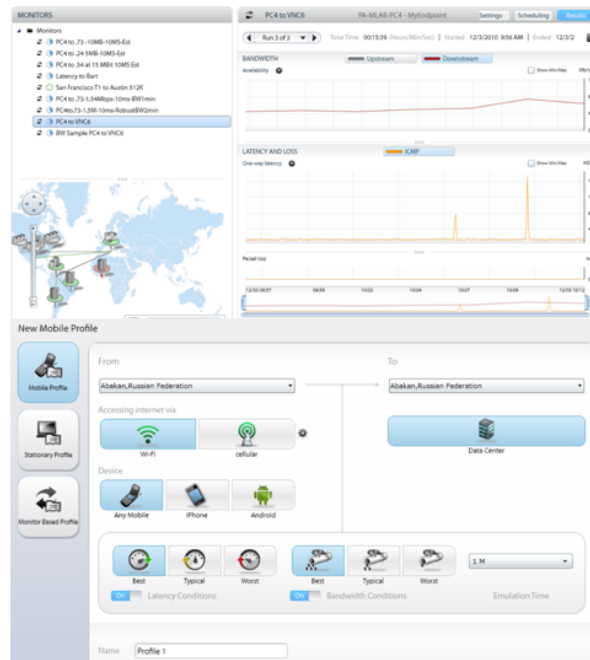


How Mobile Network Virtualization Works

Once you start building mobile network virtualization into your test environment, you can effectively set expectations of how that application will perform and—better yet—optimize that application in order to better meet the expectations of your end users.

This is accomplished by:

1. Discovering true network conditions by capturing conditions from production environments or by tapping libraries of network profiles for a broad array of mobile and broadband conditions.
2. Simulating the realistic network conditions in a test environment.
3. Analyzing and optimizing your mobile application in terms of how it’s going to perform for your target user populations.



Conclusion

Limitless access to accurate and realistic test environments is imperative for ensuring that test results reliably predict how applications will perform once deployed. Testing, validating, and optimizing apps *before* application deployment or infrastructure change occurs is critical to promoting a positive end-user experience. However, the complexity of mobile applications (and the networks and infrastructure that support them) makes reliable testing challenging, putting profits, productivity and brand at risk.

Using service virtualization in concert with mobile network virtualization not only leads to a better user experience for a broader user base, but also helps the business reduce costs and increase profits.



About Parasoft

Parasoft researches and develops software solutions that help organizations deliver defect-free software efficiently. By integrating Development Testing, API Testing, and Service Virtualization, we reduce the time, effort, and cost of delivering secure, reliable, and compliant software. Parasoft's enterprise and embedded development solutions are the industry's most comprehensive— including static analysis, unit testing, coverage analysis, requirements traceability, functional & load testing, dev/test environment management, and more. The majority of Fortune 500 companies rely on Parasoft in order to produce top-quality software consistently and efficiently.

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