Mobile Payments: Three Steps to NFC Testing Success
A White Paper
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Smartphone shipments are likely to top classic mobile phone shipments for the first time ever this year. More smartphones were shipped in the first three months of 2013 compared to feature phones: a smartphone will soon be just a "phone". Mobile applications are big business, and we can say with certainty that their growth will continue. To get a clearer idea of the size of the market and its potential for further expansion, let's take a look at some facts and figures:

- About 75% of the world’s inhabitants now have access to a mobile phone.
- By 2016, global mobile cellular connections are expected to exceed 8 billion, meaning that soon there will be more mobile phones than people on the planet.
- Smartphone adoption already exceeds 50% of the population in Australia, U.K., Sweden, Norway, Saudi Arabia and UAE, and it’s over 40% in the U.S., New Zealand, Denmark, Ireland, Netherlands, Spain and Switzerland.
- By 2016 an estimated 300 billion mobile applications will be downloaded.
- Worldwide mobile transaction volume and value is expected to average 42 percent annual growth between 2011 and 2016.
- By 2016, the market is forecast to be worth $617 billion with 448 million users.

As the traditional mobile phone is being replaced by the smartphone, the latter is also rapidly replacing the PC as the 'device of choice' for purchasing goods, sharing files, browsing the web and e-mailing. And now Near Field Communication (NFC) technology means we can even convert the phone into a wave & pay device, and applications such as mobile wallets are about to change the way we do business and fuel the economy. With NFC technology, the smartphone is indeed poised to replace the leather wallet:

- By 2018, 38% of mobile phones will be NFC-enabled (with a corresponding increase in the use of NFC solutions).
- The value of mobile payments using NFC technology is projected to reach 42.3% in 2015 and 49.6% in 2018.

The accelerated evolution of mobile devices has now reached a point where their base function, making live phone calls, has become a minor capability. The last two decades have seen personal mobile devices grow from handy chat and texting devices into an indispensable pocket-sized do-it-all gizmo. But modern mobile devices have more to offer than just computing power on the move; the mobile device is increasingly becoming the payment mechanism of choice.

As with all emerging technologies, mobile payment solutions are implemented in diverse ways. There is no clear universally accepted interoperable mobile payment standard yet. Industry associations such as the NFC Forum, EMVCo and GSMA are working closely together towards this goal, in a market characterized by fragmented service offerings and highly accentuated geographical differences.

Trust in technology

The development of general mobile applications for mobile devices is still a relatively new business model, but it is mature compared to the development of financial or mobile payment apps. This difference in maturity is mirrored in the perceived consumer risk in usage; while people are happy to install an endless stream of trivial and often unstable utilities to pass the time, they show more caution and prudence when dealing with payment related apps. The standard of acceptability is understandably higher where real money is involved.

Consumers have shifted from cash payments to electronic payments (using debit and credit cards) over a few decades and mobile payment involves another change in user behavior. Human nature is notoriously bad at evaluating perceived risk against true risk. To reap the benefits of the new mobile reality, payment apps must be bulletproof. The customer’s mobile phone is their window on the world and their toolkit for navigating their way through a myriad of daily tasks. The mobile payment application downloaded onto a customer’s device has become their primary interface with the financial service provider.

Rigorous testing is the only way to ensure quality of service and engender a culture of trust and security in this "new" payments channel. But despite the success and global mushrooming of mobile payment pilots and initiatives, the key values of quality and interoperability seem to have been overlooked. Products and services need to be reliable and universal: a transatlantic traveler should be able to use a device in New York the same way as they would do in London, for instance.

When it comes to mobile payment applications, ensuring this interoperability and assuring high quality can be a complex, time-consuming and costly task. This is especially true if companies rely on manual testing or traditional tools alone. For the development community, it’s a major challenge to release applications that are stable on multiple portable devices and platforms - applications that are ‘device agnostic’.

Testing mobile payment applications: be bulletproof... or fail

There’s something of a myth surrounding testing, that it’s an expensive and time-consuming luxury. But rather than wondering whether you can afford it, the question should be – especially in the case of mobile payment applications: Can you afford not to?

Mobile users expect high performance and security. With payments, consumers must have a positive experience with every single transaction, right from the start. If you launch an application that does not deliver what is expected, it is unlikely to survive, and may deter users from taking that essential technological ‘leap of faith’. And an imperfect payment solution could significantly damage a brand reputation built up over many years.
The advantages of a well-designed automated testing environment easily outweigh the investment:

- Fully automated testing replaces time-consuming, manual operations and precludes human error
- No need to manually test every single existing smartphone model
- Use testing as a benchmark tool during mobile app development for a faster deployment
- Validate your mobile applications against pre-defined proprietary specifications and international industry regulations (EMVCo, NFC Forum, GlobalPlatform,...)
- Add consistency and uniformity to your applications as well as ensuring quality
- Repeat test scenarios 'on the fly' for a wide coverage with minimal overhead
- Increase the robustness of your apps by testing invalid cases
- Regression testing ensures that system updates or new functionalities do not affect overall functioning of the mobile payment application
- Reusable test scenarios can be applied when deploying future apps and developments

A holistic approach

Until recently, consumers only had a payment card, and this didn't require much interaction except insertion in an ATM or a dip in a POS device. With the rapid adoption of smart phones and uptake of mobile contactless payments, they now have powerful devices in their hands, with a significant impact on testing.

Mobile application testing can differ dramatically from conformance and interoperability testing applied to cards and devices at a technology level. Where 'traditional' testing applied to one interface, such as NFC or even to one layer of the protocol (analog, digital), mobile application testing typically requires control over multiple interfaces at the same moment:

Take the case of mobile phone (or mobile wallet), running a contactless payment application. This may simultaneously:

- Communicate over its NFC contactless interface, exchanging data with a contactless device
- Use its over-the-air interface for exchanging information with a Trusted Service Manager (TSM) and Mobile Payment Gateway
- Interact with other NFC handsets in a Peer-2-Peer mode, potentially holding different applications for payment, transit ticketing, loyalty, and so on.

All these apps have their own graphical user interface (GUI). In the past, such GUIs were running in a controlled environment such as ATMs or POS devices, but they are now 'growing in the wild' on handsets of different brands, with different features and with different operating systems. And applications are dynamic, with new functions and features added over time, multiplying the testing effort.

A good testing strategy is essential, and great care must be taken when setting up a performing test environment.

The environment described below can be successfully applied to fully automate the testing of mobile payment applications.

The essential 'Three-piece Test Harness'

1. Simulations

Within the test environment, PC-based simulators replace the various components of both the classic payment chain and the mobile ecosystem that interact with the mobile device (which is the unit under the test).

All components within the payment chain can be isolated and simulated including:

- POS devices
- Network Systems (host systems)
- The Universal Integrated Circuit Card (UICC), which is the smart card used in mobile terminals in GSM and UMTS networks containing the Subscriber Identity Module (SIM) application and, potentially, the mobile card payment application

Simulating the behaviour of each of these components provides the developer and tester with a fully controlled environment consisting of sparring partners that communicate with the device under test. This means that, even if the components are not yet available in the live environment, development can move ahead unhindered. Another advantage of using simulators is that they allow for testing invalid and unexpected reactions. Testing the behaviour of a device under test in such cases increases robustness of the system. As the different simulators can be tweaked manually, together they create the perfect foundation for an automated testing environment.
Three steps to success

Mobile applications, such as mobile payments, are changing the way we behave in our daily lives, but they are also influencing the testing strategies of mobile application providers and mobile application issuers. Social media have empowered citizens in ways never seen before, increasing the influence that customers can bring to bear on important issues. Financial transactions and services are also subject to this unforgiving scrutiny; so getting it right is vital.

Testing mobile payment applications is complex, involving a sophisticated ecosystem with several interfaces, each with its own intricacies. Providers also have to take into account different device models, screen sizes and resolutions, responsiveness of the application and multiple operating systems…which are always subject to updates. A properly deployed testing suite removes the need to manually test each and every potential mobile phone model, and ensures consistent support as new models appear on the market.

Using the three-piece test harness presented here:

- Provides a single, fully-automated test environment, controlling all the interface elements
- Maximizes the benefits of testing
- Brings robust mobile payment applications to the consumer.

At the same time, providers and issuers enjoy reduced costs, bring products faster to the market and can be assured that their applications have the power to perform.

Adopting the three-step solution, making testing part of your development chain, even in the early stages, ensures the reliability of your applications while bringing them securely and speedily to market. You can have confidence in your mobile payment apps, but — even more importantly — so will your customers.

2. Test Scenario Scripting with Graphical User Interface (GUI) automation

Building on top of these simulations, a robust test environment should cater for automated testing. The tests are implemented in test scripts that are either predefined or customizable, and extendable by test engineers. The scripts facilitate comprehensive and complete test coverage by allowing the behavior of mobile applications to be tested in different situations, typically testing both valid and invalid use cases.

Such a test environment allows different simulators to be integrated into one test solution, thus controlling and testing the interfaces of the device or application under test. The scripted test cases reduce manual manipulation of the simulators’ behavior, precluding any human error factor that would result from this. Test scripts can, of course, be run over and over again: repeatability is vital.

3. Test Scenario Scripting with Graphical User Interface (GUI) automation

The third part of the mobile application testing harness enables testers to validate the implementation of the mobile phone's business logic, states and screens.

Mobile payments differ from traditional payment cards in that most of the use cases are triggered from the graphical user interface, requiring data input and button clicks. By automating this input on mobile device keypads and validating the displayed messages, manual interaction is virtually eliminated, leading to even greater accuracy - improving performance and saving time and money.

The importance of the GUI in the application should not be under-estimated - all test manipulations on the GUI can be driven electronically from the test tool, taking automated testing to a higher level.

Using intelligent image recognition technology that is independent of the mobile OS, interfaces can be tested across all mobile platforms, providing a user-friendly and flexible solution for functional testing. Using pre-defined or custom-written test scenarios, the solution can be used in integrated environments for regression and load testing.

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