

# Everything you wanted to know about NFC testing... but were afraid to ask

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“ THE IDEA BEHIND THE MOBILE WALLET APPLICATION IS TO MANAGE DIFFERENT (NFC) SERVICES WITH JUST ONE APPLICATION AND IN THIS WAY REPLACE OUR LEATHER VERSION STUFFED WITH PAPER COUPONS AND CARDS. IT COULD BE THE CATALYST FOR THE CONVERGENCE OF MARKET SECTORS. AS DIFFERENT MOBILE WALLETS WILL CO-EXIST, EACH WALLET MAY REQUIRE A SLIGHTLY DIFFERENT TEST APPROACH. ”

Near Field Communication (NFC) is everywhere. It's on the internet, the media and on everyone's lips. But it's not in our phones, at least not in many phones. It has the huge potential to create endless opportunities with manifold use cases connecting several vertical markets. But the fact is that we are all still talking about it, not using it in commercial implementations that go beyond pilots or trails. Clearly, with so many elements involved, different markets, hardware compatibility issues, conflicting models, converging markets, the lack of coordination between stake holders ...things are complicated.

We're all convinced that NFC could be the tonic to refresh the way consumers will purchase retail goods, access and exchange information, use loyalty coupons or enjoy discounts. Whilst many anticipate that the consumer will simply change its behavior and pull out his phone instead of cash or a payment card, just like that...It's not going to be that simple; we need to persuade them and gain their unconditional belief in the technology.

Besides developing an infrastructure and user-friendly, intuitive applications we need to make sure that testing and approval processes are put in place to ensure conformance to the ruling specifications. Security and interoperability are vital elements for global commercial success.

## ON THE TEST BENCH

Testing complex systems, such as an NFC-based environment, requires intensive testing from different parties at different stages in the production cycle. Testing can not and should not be done by one entity and therefore the different stakeholders need to be able to rely on the tests done by other parties.

To demonstrate this in this article, we will tackle two very distinct areas of testing. From a technology perspective, NFC is the big horizontal running through different vertical markets. We will explain how this can be facilitated by the testing for conformance against the ruling international standards. By going up into the verticals, we discuss a bit more in detail the testing on application level.

## INTEROPERABILITY TESTING AT TECHNOLOGY LEVEL

The revolutionary thing about NFC technology is that it opens up a giant spectrum of applications to be brought on one device. These applications serve markets like payment, retail, transport, credentials, automotive, consumer electronics, access control, health care and probably even more.

If we look at today's situation, each of these verticals has its own carriers of which some are already recognized applications using contactless technologies: your credit card is a piece of plastic conform to the EMV level 1 specifications, your train ticket may be on a paper ticket talking plain ISO 14443 or Mifare and your electronic passport has the booklet format defined by the international ICAO standards. Other applications haven't made the technological step to contactless yet: you may still have a bunch of coupons and a deck of loyalty cards in your wallet.

We could say that previously, each vertical could independently select its options and impose parameter values from the contactless technologies available. When soon, the different worlds meet in one NFC device, there will be a strong need for a common NFC protocol stack that fits (and aligns) all verticals. Preferably this should be compliant with the choices already made for the applications already rolled out within the different markets. Logically, people will not carry around several handsets for different purposes for use in different markets.

Since 2004, the NFC Forum has been working on a common set of open NFC standards. In 2010, the NFC Forum launched its own Certification Program: an initiative allowing providers to verify their NFC solutions by authorized laboratories where they are tested for conformance against the published specifications. Devices that pass this certification process receive a Certification Mark as proof of compliance.

Even though up to now this article focused on the NFC contactless interface, there are obviously other interfaces that are crucial in a successful development of NFC applications. Since for a lot of applications a secure environment is needed to provide the required level of security, the work done by organizations like Global Platform, ETSI and GCF/PTCRB (to name a few) in standardization and certification is also vital. The bottom-line is that before starting thinking about end-user applications, testing the technology components in a well-controlled certification environment is key. Only then, one can think about realizing applications taking advantage

of the interoperability and interchangeability of components. The benefits of global certification programs...

When we now have a closer look at the vertical markets such as payment, transport ticketing and retail, by endorsing the certification programs, application level standardisation organisations can rely on hardware with the required stamps of approval to build their system. These certified hardware components can then be integrated in end-user applications, which of course need testing for interoperability on their own. Clearly, cross-industry collaboration and coordination is crucial. Organisations representing groups of different stakeholders are teaming up and work on common solutions to tackle existing technical and ecosystem problems. For instance EMVCo collaborates with the GSM Association (GSMA), the NFC Forum and Global Platform aiming to create a uniform, secure mobile payments standard.

From a testing point of view we, at Clear2Pay, being a provider of test tools for both the payment and mobile technology players, see that companies who are traditional mobile players now require both mobile and EMV test tools. It is thus expected that in the future there will be a consolidation of certification programs.

## THE MOBILE WALLET CASE: APPLICATION TESTING

When looking into application level, the testing approach and scope change. To demonstrate, we focus on the Mobile Wallet case.

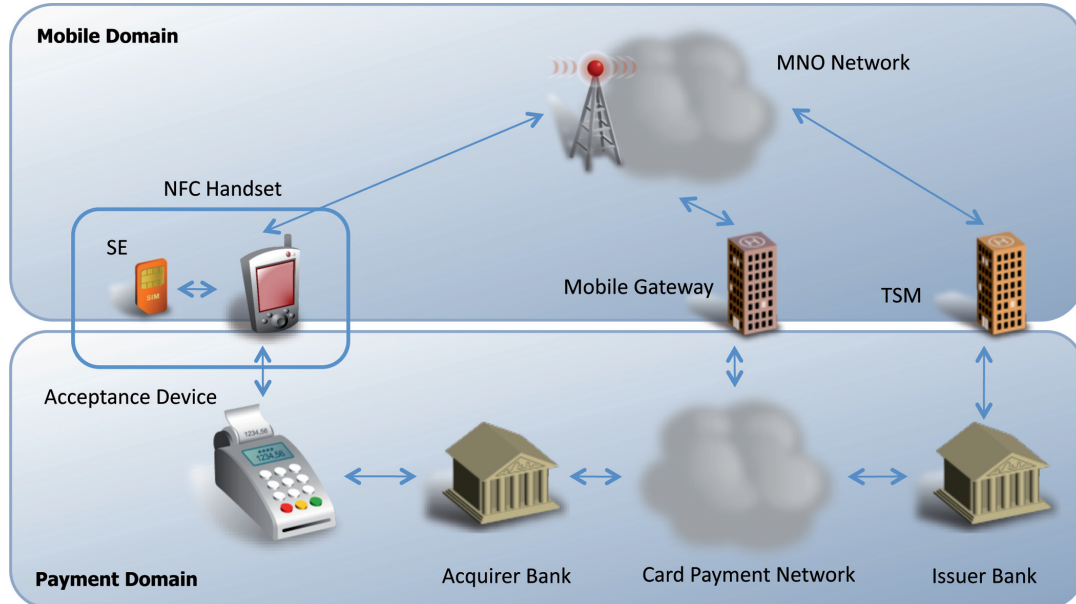
The idea behind the Mobile Wallet application is to manage different (NFC) services with just one application and in this way replace our leather version stuffed with paper coupons and cards. It could be the catalyst for the convergence of market sectors. As different mobile wallets will co-exist, each wallet may require a slightly different test approach. Application level testing typically requires control over multiple interfaces at the same moment.

But let's first sketch the context, and take the example of a mobile NFC payment, EMV style (see picture). It kicks off with a tap of the handset on the terminal. The terminal will forward the data over the card payment network to the Issuer bank that will authorize the transaction. Via the handset's Over-the-Air interface, the mobile payment application will also interact with the payment domain. Depending on the solution, messages (for instance for updating counters, resetting PIN or requesting balance inquiry information) are directed towards the mobile gateways or Trusted Service Managers (TSM) connected to payment network or to the issuer banks directly.

The testing task, including conformance and interoperability, looks virtually unworkable because of the large number of entities in the environment. The best approach is to make an abstraction of the different components and concentrate functionalities around the interfaces of the unit under test,

the mobile wallet application. Let's apply this approach to the mobile Wallet application on the NFC handset together with the one or more mobile card applications on the secure element:

level higher, by automating the pressing of keys on the handset and the validation of the messages displayed. As such, the human error factor is practically completely eliminated, for even more accuracy and time gain.



As described earlier, the entity under test has 2 interfaces: the Over-the-Air interface, and the contactless NFC interface. We can now make abstraction of the processing going through the different interfaces and replace each one with a simulation of the respective environment:

- A test simulator replacing the mobile gateway or TSM on the over-the-air interface and
- A test solution simulating the "classic" payment chain, including the contactless terminal

With these two simulators, we have already a nice test environment for the mobile payment application, where both can be used as a sparring partner: the mobile payment device can be isolated from the rest of the real environment and the behavior can be tested in different situations –both valid and invalid- by configuring both test simulators.

Obviously, simulating interfaces alone does not allow for comprehensive testing. A more robust test environment is installed by adding automated Test Suites which include pre-defined, customizable Test Scripts that avoid manual manipulation of the simulators and the consequent human error factor. Moreover, test scripts can be run over and over again...this repeatability is vital. A detailed output test file or log provides the test data in a structured analysis report.

All this still involves some manual intervention such as, for example, introducing PINs or requesting updates from menus on the handset. We can take the testing experience even a

A way of doing this is by implementing a dedicated application interface (API) on the handset. This implementation, is actually an extension of the wallet application dedicated to testing, and is able to communicate with the test tool over a standard communication protocol (like tcp/ip over wifi). When in a test scenario a button needs to be pressed,

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the test tool will send an Automation Command Message to the Mobile Wallet application, where it hooks into the processing. In a similar way, the mobile wallet application will send a Display Command Message each time a new screen is displayed.

### SAFEGUARDING THE FUTURE

With many major brands announcing their mobile involvement, we truly must be on the verge of a real NFC quantum leap. But let's not forget that, in the end, it's the end-user who has the power to take it or break it. In this article, we described the two areas of how testing can achieve the needed consumer confidence in NFC technology. Preferably across the vertical markets, at least, if we want to get rid of our leather wallet one sunny day and send our cards to the cloud.

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