

NFC–Capable Mobile Devices for Mobile Payment Services

Stamatis Karnouskos

SAP AG, Germany

INTRODUCTION

An old saying coming from the telecom world states that nothing can be really considered as a service unless you are able to charge for it. As we move towards a service-oriented society, the necessity to pay in real time for a variety of services via different channels anywhere, anytime, in any currency increases. According to Gartner (www.gartner.com), worldwide mobile phone sales totaled 816.6 million units in 2005, a 21% increase from 2004. Due to the high penetration rates of the mobile devices, they pose an interesting candidate for the real-time payment scenarios. Several efforts have already been done (Karnouskos, 2004), but as new technology comes aboard, new capabilities are also brought along. Near Field Communication (NFC) is such a technology, which due to the industry support and its low cost (in comparison with similar ones) may become dominant in short-range communication among a variety of devices, including mobile phones. NFC is well equipped in order to facilitate mobile payments with little interference from the user side.

Mobile Payment

People today use their mobile devices to pay for a variety of mostly intangible goods such as ring tones, games, digital content, and so forth. However existing solutions are confined usually within one service provider and usually consist of local island solutions. The promising trend is to mainly use mobile devices at physical points of sale (POS) and additionally expand the payment capabilities in virtual ones. We consider as mobile payment, any payment where a mobile device is used in order to initiate, activate, and/or confirm this payment (Karnouskos, 2004). A global study by Arthur D. Little Consulting (Taga & Karlsson, 2004) estimates that m-payment transaction revenues will increase from \$3.2 billion in 2003 to \$37.1 billion in 2008 worldwide. There is evidence of the need for real-time, open, and trusted payment services that can support in a more efficient way the processes evolved in existing electronic and mobile commerce scenarios. Although in the last few years we have witnessed several standardization efforts, the rise and fall of some mobile payment services, promising technologies, ongoing trials, predictions for the future,

investments on startup companies, and so forth, there is still no solution that is open, widely accepted, and acknowledged as a clear market leader.

Several reasons exist as to why the mobile payment has not become mainstream such as user friendliness, security, cost, high learning curve for users, lack of the right business models, lack of advanced technology in devices and mobile networks, non-existent cooperation among the key players, and so on. Implementation of mobile payment services is more complex than originally thought and to provide a viable solution has been proven challenging both at the technology and business level. NFC could be one of the enablers that can lead us into effectively tackling some of the issues that have hindered other mobile payment approaches; therefore it is interesting to look at its capabilities and the context of its usage in mobile payment scenarios.

Near Field Communication

NFC is an interface technology for exchanging data between electronic devices. It represents the second generation of the proximity contactless technology, which supports peer-to-peer communication and enables access to services, anytime, anywhere, with any type of NFC-enabled stationary or mobile device. As NFC-compliant devices are brought close together, they detect each other and begin to communicate. This is done at small distances of about 10 cm (4 inches). NFC is based on RF technology at 13.56 MHz, is standardized ISO 18092, and is backwards compatible with ISO 14443. The data exchange rate can be up to 424 Kbit/sec (while 1 Mbit/sec is planned). NFC was designed with the goal to be easy and intuitive to use, in order to be successful also among the technology illiterate users.

NFC devices operate in two different modes:

1. **Reader Mode:** This mode allows the communication with other tags which effectively transforms any device to a fully capable tag reader.
2. **Card Emulation Mode:** This enables the device to behave like a tag itself which can be read by other devices in reader mode.

Standardization of NFC is done within the NFC Forum (www.nfc-forum.org), which was launched in 2004 and in

the meanwhile has more than 70 members, many of which are key players in their domains and drive the consortium to success. The Nokia 3220 mobile phone (Nokia, 2004) was the first NFC-enabled device that was brought to the market and delivered all the services envisioned by the NFC forum including service discovery, ticketing, and payment. Today other mobile phones also exist such as the Samsung SGH-X700. NFC is compatible with Sony's FeliCa card (<http://www.sony.net/Products/felica/>) and the broadly established contactless smart card infrastructure based on ISO 14443A, which is used in Philips' MIFARE technology (<http://www.semiconductors.philips.com/products/identification/mifare/>). This backwards compatibility with the existing infrastructure will ease the introduction of NFC-related services, as not everything has to be done from scratch.

COUPLING NFC WITH MOBILE PAYMENT SERVICES

NFC can be used as a communication protocol for mobile payment applications. In a typical scenario, the user would simply bring in-contact his mobile device with the payment point of sale (POS), and the payment transaction would occur. NFC-enabled devices (e.g., mobile phones) provide an additional security layer since they can transmit encrypted payment information to a POS in a way similar to that used with RFID-enabled credit cards. Furthermore, beyond the existence of an NFC-compliant tag capable of storing a unique ID and transmitting encrypted data at 13.56 MHz using the ISO-18092 air interface protocol, NFC devices also feature a smart card microcontroller. The last can be used as a secure storage for applications and credentials that can be used in payment applications. This allows NFC devices

to store data on multiple payment options which provides a flexible base for several business scenarios. Apart from that, the ISO-18092 standard used is also compatible with the ISO-14443A standard, which is currently used by RFID-enabled POS currently installed in several merchants.

NFC devices can technically operate in two different modes which allows NFC-enabled phones the capability to:

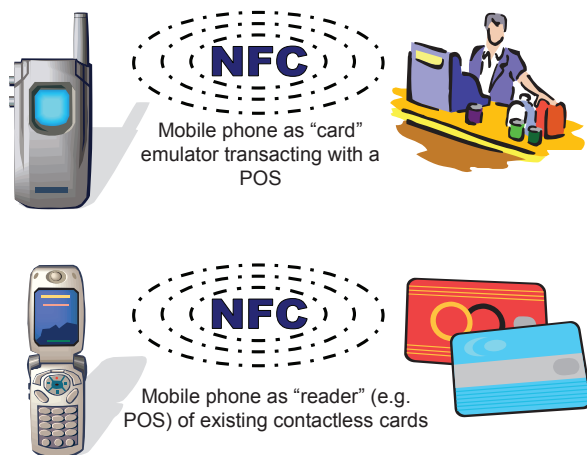
- Fully replace the existing contactless smartcards (when functioning in "card emulation mode"), business and technology wise. All existing business cases that use such cards can now include NFC-enabled mobile phones, which can act as authentication tokens for any transaction.
- Act as a "reader," therefore any reader/POS in the merchant side can be replaced with a mobile phone. Furthermore, the mobility advantage will make it possible to extend existing business cases.
- Make possible new business cases, due to the ability of an NFC-capable device to slip into both modes. For instance in "reader" mode, information can be obtained from a smart advertisement about a concert and the video could be downloaded online from the Internet address specified by the smart tag. The user can pay online and receive the ticket on the mobile phone. Later in "card emulation mode" the user can enter the concert hall by simply waving his mobile (which now has the authentication token stored) from the respective reader.

There are numerous scenarios where NFC-enabled mobile payments can be applied such as gaming, ticketing, purchase of goods, real-time money transfer, and so forth. NFC mobile phones can fully substitute all form of cards as we know them today (credit, debit, prepaid, etc.) and flexibly enable more flexible business models and services to be built.

A number of trials using an NFC mobile phone in order to realize applications that can be hosted under the mobile payment umbrella started within 2005/2006. Most notably:

- In the city of Caen in Normandy, France, trials began in October 2005 (and initially for six months) on NFC-based mobile payments (Caen, 2005). The 200 volunteers in the trial are able to pay with their mobile phone in selected stores (retail), for parking, in tourist sights, and so on. This is the world's first large-scale trial of this emerging technology, and valuable feedback will be obtained from mobile operators, retailers, and consumers. The solution used in this trial incorporates secure, over-the-air (OTA) download of applications on a GSM network and automatically recognizes the appropriate application to launch when an NFC connection is made. The Samsung D500 mobile phone that

Figure 1. The double mode of NFC-enabled devices in payment scenarios



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