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Factors that hinder the success of SIM-based mobile NFC service deployments

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ABSTRACT

Near Field Communication (NFC) enables bidirectional wireless proximity communication between mobile handsets. From an end user point of view, mobile NFC services are expected to replace plastic cards (for payment, ticketing, transport, etc.) by bringing improved convenience and functionality. SIM cards have been used to secure the data and applications that implement mobile NFC services. A total of 300 commercial and pilot SIM-based mobile NFC service initiatives have been reported in 2015. However, their deployment is so complex that no commercial solution has succeeded in reaching out the mass market with few exceptions in special institutional settings (e.g. Japan). Although particularly urgent to the telecom industry, existing scientific research provides limited explanations to why these initiatives are not succeeding. We present a framework that identifies twenty-six factors that hinder the success of SIM-based mobile NFC service deployments.

1. Introduction

Near Field Communication (NFC) is a standardised technology that enables bidirectional wireless proximity (i.e. a few centimetres) communication between electronic devices. The introduction of NFC interfaces in mobile handsets enabled the emergence of mobile NFC services. From an end user point of view, these are expected to bring improved convenience and functionality and replace plastic cards (for payment, ticketing, transport, etc.). An example of improved convenience is performing payments by tapping a mobile phone in a Point Of Sales (POS) terminal instead of swiping a plastic card. An example of improved functionality is displaying real-time information about mobile NFC services using applications in mobile handsets, which is something that is not possible to do in plastic cards as these do not possess display capabilities.

A central component for mobile NFC services is the Secure Element (SE), "a secure microprocessor (a smart card chip) that includes a cryptographic processor to facilitate transaction authentication and security, and provide secure memory for storing payment applications (e.g., American Express, Discover, MasterCard, Visa and other payment applications). SEs can also support other types of secure transactions, such as transit payment and ticketing, building access, or secure identification" (Smart Card Alliance, 2011). Traditionally, the role of the SE has been served by the Universal Integrated Circuit Card (UICC) (GSMA, 2015), which is popularly referred to as the Subscriber Identity Module (SIM) card.

Due to the use of SIMs as SEs for mobile NFC services, Mobile Network Operators (MNOs) are key actors in the business ecosystems required to deploy mobile NFC services as any Service Provider (SP) (e.g. a bank or a transport company) wishing to securely offer mobile NFC services has to be granted access by the MNOs to space in the SIMs. Multiple types of actors take

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part, directly or indirectly, in SIM-based mobile NFC service deployments (e.g. merchants, SIM providers, and payment schemes (Smart Card Alliance, 2011)). For the purpose of this article, in addition to MNOs and SPs, two roles are particularly important: the Trusted Service Manager (TSM) and the Wallet.

The core function of the TSM is to bridge the infrastructures of SPs and MNOs to allow end users' service credentials to be sent from the SPs to the mobile handsets and the SIMs. Within this core function, the TSM provides flexibility to allow SPs and MNOs to choose the extent to which they want to be abstracted from technical complexities imposed by their counterparts (e.g. SPs may prefer to be abstracted from Over-The-Air (OTA) communications) and from specificities required to deploy mobile NFC services (e.g. Wallet installations). The TSM may also take the role of a trusted party to the SPs to guarantee that end users' credentials are securely transferred all the way from the SPs to the SIMs.

The Wallet is a mobile application which is expected to (GSMA (2015), Mobey Forum (2015), GSMA (2012a) and Smart Card Alliance (2011)): (1) act as a digital container and access point to end users for payment cards, tickets, loyalty cards, and other items that can be found in a conventional wallet; (2) be open and ubiquitous, accepted at most merchant locations, and across a multiplicity of different terminals; (3) provide a consistent experience for end users regarding design, branding, and functionality regardless of the mobile handset it is running on; and (4) take a central role in the communication with the SIM and in the management of certain shared services (e.g. the Proximity Payment System Environment (PPSE) for payments).

There are many potential benefits of mobile NFC services for MNOs and SPs. For example, collect fees from renting out space in the SIMs, reduce plastic handling and related costs, perform proximity marketing, reduce fraud, increase customer retention, increase speed and convenience leading to higher transaction volumes, differentiate from competitors, and enter new product markets (GSMA, 2011; SIM Alliance, 2007; Mobey Forum, 2011). In 2015, the Groupe Speciale Mobile Association (GSMA) reported a total of 300 commercial and pilot mobile NFC service initiatives (GSMA, 2015).

Despite the large number of attempts, deployments of SIM-based mobile NFC services are so complex that no commercial solution has succeeded in reaching out the mass market with the exception of a few cases in special institutional settings (e.g. in Japan) (Dahlberg et al., 2015). The reality is further paled by the failure of flagship initiatives for the industry (e.g. Isis/Softcard in the United States (US)) and the emergence of alternative non-SIM based solutions (e.g. Apple Pay and Host Card Emulation (HCE)). Although urgent for the telecom industry and scientifically challenging, research on the identification of the limiting factors for the success of SIM-based mobile NFC service deployments is still limited (Dahlberg et al., 2015).

We present a framework that identifies twenty-six factors that hinder the success of SIM-based mobile NFC service deployments. We follow a qualitative analysis approach due to the complexity of the topic, relatively low maturity of prior research (Dahlberg et al., 2015), and limited sources of data, particularly quantitative. Generally speaking, previous studies used a qualitative approach (e.g. Guo and Bouwman, 2016; Gannamaneni et al., 2015; de Reuver et al., 2015; Ozcan and Santos, 2015). Using observations collected mostly from specialized practitioners' literature (e.g. NFC Times and NFC World), we provide some basic validation of the relevance of the factors in the framework (using Karl Popper's famous example, we observe a few *white swans*). These observations also provide details of the causal processes that underlie the framework's factors, which help a reader to understand how the factors manifest themselves in practice, which may help to generate new hypotheses.

In terms of contribution to theory, this study improves the rigor and relevance of theory on mobile NFC services, and captures different dimensions of the topic and thus limits the risk for partial understandings. In terms of contribution to practice, this study offers valuable insights for executives from MNOs, SPs, technical vendors, and other parties interested in mobile NFC services. Our framework can be instrumental for practitioners to recognise, identify, and avoid the most common and important mistakes. In addition, it helps practitioners to focus on important factors, and disregard relatively less important factors.

This article is organised as follows. In the next section, we describe previous work related with the topic of this article. Section 3 describes the framework. Section 4 provides a validation of the framework. Section 5 provides the main conclusions and limitations of our work, and suggestions for future work.

2. Related work

Research so far focused on mobile payments, with little research dedicated to other types of services (Dahlberg et al., 2015). Due to the criticality of offering multiple types of service to the success of SIM-based mobile NFC services (de Reuver et al., 2015), and the fact that similar challenges apply independently of the type of service, this article applies generically to any type of NFC service. However, as the literature on mobile payments is, to a very large extent, representative of previous work related with this article, most of our references are from research on mobile payments.

Previous research focused extensively on adoption factors of mobile payments, with less research focusing on the failure factors (Gannamaneni et al., 2015). To address this weakness, Gannamaneni et al. (2015) proposed a framework to unveil and analyse the factors that contribute to failure of mobile payments. Relatively to Gannamaneni et al. (2015), we are more thorough in terms of literature research, theoretical background, analysis, and case study validation, which results in a framework which is more grounded and informative. Guo and Bouwman (2016) studied the slow adoption of NFC by Chinese merchants. Qasim and Abu-Shanab (2015) studied network externalities in mobile payments. From a resource dependence theory point of view, Ozcan and Santos (2015) investigated mobile payments' market failure to emerge. de Reuver et al.