Chapter 17
State of the Art for Near Field Communication:
Security and Privacy Within the Field

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ABSTRACT

This chapter provides an overview of Near Field Communication (NFC) technology. It first introduces the technology and gives a brief history. It examines what the technology is and how it works. It looks at the various operation modes and hardware architectures available for the technology. This is followed by some examples in use of the technology today, in particular NFC in use in mobile payment environment. The chapter then focuses on NFC technology from the perspective of security and privacy of personal information when using the technology. Finally, the chapter looks at the security and privacy challenges that are currently faced by the technology and suggests some possible solutions to these challenges.

INTRODUCTION

For years now pervasive computing researchers have investigated ways of connecting the virtual world of the Internet with the physical world in which we live (Want, 2011). Near field communication (NFC) has been heralded as the standard that might make this vision a reality (Want, 2011). By connecting the physical with the virtual, objects, people and places can be linked with online content. Naturally, there are advantages and disadvantages to this linkage, some of which will be discussed in this chapter. But one of the central advantages is that this linkage can provide useful

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related information that can be amalgamated and displayed in various formats. The most interesting potential of NFC technology is observed when it is used in conjunction with mobile devices. NFC mobile phones or smart phones function as contactless cards which are used to leverage the existing contactless infrastructure used by smart cards (Agrawal & Bhuraria, 2012). On top of this, NFC smart phones leverage the Internet and multimedia capabilities to create many innovative services, which have been demonstrated as having a transformational impact across disciplines like electronic payments and retailing, public transportation and even healthcare (Agrawal & Bhuraria, 2012).

Points for virtual coupons or loyalty cards can be collected with an NFC smart phone from company advertising posters found in magazines or located in any public place. These virtual coupons or points can be redeemed in store to receive discounts or special offers. For example, a coffee store advertising a 10% discount available from their advertising posters can be scanned and used the next time the consumer enters the coffee store.

NFC enabled smart phones can increase technology ease of use for consumers in many ways. An example of this ease of use can be understood by imagining a scene where a person going to the movies has an NFC smart phone and waves it in front of a poster for the desired movie on his way into the cinema. The tickets are automatically bought and loaded onto the smart phone, eliminating the need for cash and the time needed to queue for tickets. Similar scenarios can be envisioned when using public transport or boarding a plane. Mobile check-in for flights using an NFC enabled device can facilitate consumers boarding flights with one simple swipe of their NFC smart phone.

To some, these scenarios may still seem like science fiction but such scenarios could potentially be in operation in the very near future.

In order to better understand this technology and how it has evolved relatively quickly into stuff of science fiction, a brief description and history of the technology is now outlined.

NFC is a Radio Frequency (RF) technology for short-range communication that exchanges data between a reader, such as a phone or sensor, and a target, such as another reader or a microchip embedded in a device. NFC devices can receive and transmit data at the same time. The specification details of NFC can be found in ISO 18092 (Information technology - Telecommunications and information exchange between systems — Near Field Communication — Interface and Protocol (NFCIP-1), 2004). It is a follow-on technology from Radio Frequency Identification (RFID). The history of RFID can be traced back to the Second World War, where the Royal Air force tagged their planes with suitcase-sized devices to establish a friend-foe detection system. The first commercial release of the technology came in the 1960's in the form of a 1 bit RFID for securing goods in shops, which is still widely used. In the 1990's RFID became more common for use in admission control systems and toll road systems (Roberti). NFC devices can indeed function as a passive RFID tag but they can also function as smart contactless cards and a smart medium to exchange data between various devices.

In 2002, NFC was developed by NXP Semiconductors and Sony. In general, because NFC is an evolution of RFID and smartcard technology (Vazquez-Briseno, Hirata, Sanchez-Lopez, Jimenez-Garcia, Navarro-Cota, & Nieto-Hipolito, 2012), it is compatible with most existing RFID and contactless smartcard systems, but its architecture is different in principle. While RFID and contactless smartcards have a reader/tag structure, an NFC device can be both reader and transmitter. An NFC Data Exchange Format (NDEF) was specified to ensure RFID tags and contactless smartcards are compatible with NFC applications. A key characteristic of NFC is that its wireless communication interface usually has a working distance limit of about 10cm.