NFC – the intuitive contactless technology becomes reality

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Near Field Communication (NFC) is opening-up completely new perspectives for the mobile communication industry. It enables contactless peer-to-peer communication, reading/writing of contactless cards and, when combined with a smart card IC, emulation of a contactless card. NFC has taken major steps towards market acceptance: ISO standards are in place for the interface and communication protocols, many leading companies in the field are promoting it within the NFC Forum, and numerous field trials are being deployed around the world. Different architectures are being considered for NFC and security mobile phone architectures. The first Philips cellular system solution integrating NFC hardware and software illustrates a successful implementation of one of these architectures.

Keywords: Near Field Communication; contactless; wireless; contactless systems; data exchange; smart cards; mobile telephone systems; NFC Forum

1. Introduction to NFC

Jointly developed by Philips and Sony, Near Field Communication (NFC) is a combination of contactless identification and interconnection technologies that enables contactless short-range communication between mobile devices, consumer electronics, PCs and smart objects.

1.1 The NFC experience

Enabling rapid and easy communication, NFC is the perfect solution for exchanging data in our increasingly complex and connected world. Secure mobile payments and transactions, easy peer-to-peer communication and simple access to information on the move become possible with NFC. Its intuitive touch-based operation makes it particularly easy for consumers to use.

NFC related applications could be split into four basic categories:

- Touch and go: applications such as access control or transport/event ticketing, where the user only needs to bring the device storing the ticket or access code close to the reader.
- Touch and confirm: applications such as mobile payment, where the user has to confirm the interaction by entering a password or just accepting the transaction.
- Touch and connect: linking two NFC-enabled devices to enable peer-to-peer transfer of data such as music, pictures or synchronizing address books.
- Touch and explore: NFC devices may offer more than one possible function. The consumer will be able to explore a device’s capabilities to find out which functions and services are offered.
As illustrated in Fig. 1, NFC devices enable these numerous applications because they can read and write contact-less cards, communicate with peer devices and, when combined with a smart card device, emulate contact-less card behaviour. NFC is backward compatible with the proximity contact-less interface standard ISO 14443 and can thus leverage the contact-less infrastructure being currently rollout by major players in the field (e.g., point of sales in banks, restaurants, gas stations, stadiums, public transport, etc.).

1.2 The NFC interface and communication protocol standards
The NFC interface and communication protocols have been standardized in ECMA and ISO/IEC.

ISO 18092 (derived from ECMA 340) defines communication modes for Near Field Communication (NFCIP-1). This international standard specifies modulation schemes, coding, transfer speeds, and frame format of the RF interface, as well as initialization schemes and conditions required for data collision control during initialization. Furthermore, it defines a transport protocol including protocol activation and data exchange methods.

The standard outlines an active and a passive communication mode. Figure 2 and 3 outline these different communication modes. In passive communication mode the Initiator generates the RF field, starts the communication and the target is answering using load modulation for the data transfer. The active communication mode shares the power between both initiator and target (allowing thus lower power consumption). The device that is sending data is also the device that is generating the RF field.

Passive and active modes should support three different communication speeds: 106, 212 and 424 kbit/s. The RF communication at 106 kbit/s and the initialization (single device detection) is compliant to the ISO/IEC 14443A / Philips' MIFARE® communication. The RF communication and initialization at 212 kbit/s is compliant to Sony's FeliCa™ communication scheme. Furthermore, ISO 21481 (NFCIP-2, derived from ECMA 356) specifies the communication mode selection mechanism, designed not to disturb any ongoing communication at 13.56 MHz for devices implementing ISO/IEC 18092 (see above), 14443 ('proximity' contact-less interface) and 15693 ('vicinity' contact-less interface).

1.3 The NFC Forum
The NFC Forum (www.nfc-forum.org) is a non-profit industry association launched in 2004 by Philips, Nokia and Sony. More than 50 organizations from around the world representing all relevant industry domains have joined the Forum to promote NFC technology (semiconductor companies, handset manufacturers, mobile phone operators, service providers, software companies, smartcard manufacturers, payment processing companies, etc.). MasterCard International, Matsushita Electronic Industrial Co, Ltd, (Panasonic), Microsoft, Motorola, NEC Corporation, Samsung, Texas Instruments and Visa International are Sponsor Members and sit on the Forum's board of directors. The NFC Forum promotes implementation and standardization of NFC technology to ensure interoperability between devices and services. The vision of the NFC Forum is to enable users to access content and services in an intuitive way by simply touching smart objects and connecting devices just by holding them next