

Near Field Communication: Innovative Payment Technology

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ABSTRACT

Near future contactless payment systems will rely on Near Field Communication (NFC) technology that enables mobile handset to use short-range high-frequency wireless communication between compatible devices. Although only in an early stage of development, NFC electronic payment technology is forecasted to be used to settle more than \$75 billion dollars in international transactions by 2013. Despite this bold prognostication, few transaction processing agencies or retailers appear to be preparing for the expected growth in this form of electronic settlement. This innovative payment platform involves NFC chip placement in a portable device (PDA or cellular phone) with connectivity to a source of funds. While the advent of the electronic purse (e-wallet) has been discussed for many years, NFC is expected to bring it to fruition and support its functionality. Part of the challenge for this innovative settlement option will be to convince retailers and customers of its merits, especially compared to cash, credit card, debit card, prepaid card, and transponder payments formats, as well as assure the financial community it can be configured as a reliable and secure reconciliation network. In the past few years there have been numerous successful NFC operational trials conducted globally. In fact, it is anticipated that North America, the Far East and China, and Western Europe will eventually represent ninety percent of the global NFC market.

Keywords: *electronic payment technology, near field communication, m-commerce, contactless transaction processing technology, proximity payment technology.*

INTRODUCTION

Near Field Communication (NFC) is a standards-based, short-range wireless connectivity technology that enables simple and secure two-way interactions among electronic devices (Schuman, 2008). NFC technology allows consumers to perform contactless purchase transactions, access digital content, and connect devices with a tap or wave of an NFC-compliant component. Although NFC technology is based on radio frequency identification (RFID) but differs from RFID in that NFC is an application initiator, not just a one-way data exchanger (NFC Forum, 2007). NFC functions as an enabling technology that provides a platform for communication protocol and data exchange based on proximity detection to initiate a desired service. Basically what NFC does is facilitate an electronic interchange (i.e. handshake) between two devices in close proximity. NFC removes the need for the user to manually establish linkage and subsequent data exchange either by NFC directly or via another wireless technology. NFC provides global interoperability of contactless identification and interconnection technologies while operating in the 13.56 MHz frequency range, over a maximum distance of a few centimeters (NFC Forum, 2007). Although not yet widely adopted internationally, NFC standards are supported by the world's leading communication device manufacturers, semiconductor producers, network operators, information technology companies, and financial services organizations. NFC is compatible with millions of contactless chip cards (usually embedded in cellular phones) and a majority of device readers already deployed worldwide (Nathanson, 2008).

Contactless Payments

RFID Update Magazine (2008) reported contactless payments grew 15% in 2007 to a global market value of \$200 million. Citing an ABI Research Report, the article further states an expectation of \$820 million by 2013. The advent of contactless, cashless payments grew out of the evolution from personal checks (1950), to credit cards (1970), to debit cards (1990), and into alternate forms of settlement. Contactless payments do not require physical contact between the sending and receiving units as a passive radio frequency transmission platform is used to establish a secure payment

network. In a contactless payment system, an embedded chip and antenna enable the consumer to wave a card or fob over a broadcast reader at the point of sale (POS). This is more convenient than swiping a magnetic stripe on the back of a payment media and contactless connectivity normally can be accomplished in less than half the time. There are several forms of contact payment media, including MasterCard's PayPass, Visa's payWave, JPMorgan Chase's blink, American Express' expressPay, and DiscoverCard's zipContactless (Fest, 2008). American Express was the first payment processor to launch a contactless card with the national release of ExpressPay in June 2005. Both the company's blue and clear AmEx cards and fobs possessed contactless chipsets. With more than 19 million payment holders, MasterCard's PayPass payment cards, fobs, and phones are the most widely accepted contactless payment media worldwide; PayPass is accepted at more than 75 thousand merchant locations. Visa's PayWave follows with 7 million cards and fobs and the company is currently testing a mobile payment platform. Discover's Zip was a late entry to the cashless market, having introduced its first contactless payment solution in December 2006 (Quibria, 2008). According to a 2008 report published by Javelin Strategy and Research, a leading monitor of the multi-channel financial services industry, contactless programs are typically subsidized by card networks and micropayment incentives in an effort to incentivize product adoption.

In addition to speed and convenience, other advantages of contactless payments include a potential increase in product sales and revenues, enhanced customer satisfaction, and reduced loss from fraud in comparison with payment media requiring physical contact. MasterCard reported that a contactless transaction can be conducted up to 40% faster than a traditional credit card and 55% faster than cash for the same transaction settlement (Quibria, 2008). Contactless payment systems also claim to be more secure as account holder information is not exposed (no account holder name nor complete account number is transmitted) since data transfer is encrypted and can only be read in extremely close proximity of the reader unit. Such is not the case with a magnetic stripe transaction that exposes the account holder, account number, security code, and possibly a PIN code, to complete transaction settlement. Jupiter Research estimates that ten percent of all US payments will be contactless by 2010; a significant increase within a short time period (Kountz, Evans, and Sehgal, 2008). There appears to be strong support that contactless payments are the precursor for the eventual development of an electronic wallet (e-wallet) capable of storing payment media, loyalty affiliations, e-coupons, and more (Javelin, 2008).

Payment Trends

Consumer payment trends are divided among card payments, micro payments, and online (Internet) payment options. The use of credit and debit cards is a popular settlement option for purchases of goods and services at a variety of merchants and retailers while online shopping, or e-procurement, represents non-cash based transaction that can be reconciled by online bill payment. Micropayments, transactions of \$5.00 US or less, are the target of contactless payment technology and can be embedded in mobile devices as well as contactless payment cards and fobs (Crowe, 2007).

Figure 1: Payment Trends: Consumer Perspective (Crowe, 2007)

Mobile Payments

Accompanying the expanded implementation of contactless payments is the advent of mobile payments. The evolution of mobile payment (m-payment) devices has led to two distinct modes of operation: 1-remote mobile

payments and 2-proximity mobile payments (Crowe, 2007). While remote m-payments can be made anytime, anywhere, the unique nature of this platform is that transactions are initiated via text messaging (SMS) or via a wireless web browser. In a remote payment scheme the consumer first establishes an account with a mobile payment service provider (e.g. PayPal or Google Checkout) and the account is then associated with a mobile phone number and linked to an authorized bank account, credit card account, or debit card account. Applications include e-commerce procurement, peer-to-peer (P2P) remittance, and electronic bill payment services.

In a proximity m-payment structure a NFC chip is installed in a mobile phone. Also stored on the NFC chip is an accessible credit or debit account. Proximity application software secures the equivalent of payment formats normally carried in a physical wallet, and hence often are referred to as forming a digital wallet, e-wallet, or m-wallet. In any case, the electronic purse basically holds digital money that can be used to purchase items at compatible point of sale (POS) outlets. The consumer waves the phone within close proximity to a contactless POS reader to initiate and complete the transaction.

NFC Defined

NFC technology evolved from a combination of existing and evolving contactless identification and interconnection technologies. NFC is intuitive and secure and provides a platform for both reading and writing data. Communication between two NFC-compatible devices occurs when they are brought within close proximity and automatically establish connectivity. NFC provides a platform that allows users to complete contactless financial transactions, access digital content, and connect compatible wireless devices, involving such technologies as:

- a) Bluetooth – digital wireless protocol for connecting and exchanging information between multiple devices without the need for device synchronization processing. Works best within a 10-meter range.
- b) Ultraband -- radio technology that can be used at very low energy levels for short-range high-bandwidth communications by using a large portion of the radio spectrum.
- c) ZigBee -- wireless technology with monitoring capabilities for industrial and residential applications within 100-meter range; targeted at users seeking low data rates and secure networking
- d) IrDA - short range (< 1 meter), line-of-sight communication standard for exchanging data over infrared light. IrDA interfaces are frequently used in PCs and mobile phones.
- e) RFID -- Radio Frequency Identification -- automatic identification method relying on remote retrieval of data from an RFID tag containing a silicon chip designed to enable passive functionality.
- f) Contactless Smart Card -- a microprocessor is embedded in a plastic card that can communicate with a card reader using RFID technology.
- g) Barcode – an inexpensive form of optical machine-readable data represented by lines, spaces, and symbols in the form of squares, dots, hexagons and other geometric patterns

NFC Standards

NFC standards are supported by all major payment providers and maintained by the non-profit entity known as the NFC Forum. The NFC Forum began in 2004 and includes leading mobile communications, semiconductor and consumer electronics companies and others working collaboratively to develop international NFC interoperability specifications. In 2006, the NFC Forum introduced a comprehensive set of standardized technology architecture, initial specifications, and tag formats for NFC-compliant devices (NFC Forum, 2007). The specifications dealt with data exchange formatting, smart poster requirements, and accessible Internet applications. Since NFC technology operates in the 13.56 MHz frequency range, over a typical distance of a few centimeters, it is considered inherently secure. The underlying layers of NFC technology are based on ISO 14443 (contactless smart card protocols), ECMA (European Computer Manufacturer's Association), and ETSI (European Telecommunications Standards Institute) guidelines.

NFC can be used with a variety of devices, from mobile phones that enable payment to transferring information to digital cameras that transmit digital content to a remote device by contactless connectivity. It is important to note that smart posters are billboard displays with an embedded NFC tag that provides access to stored text, audio, and/or video clips (for example, a movie poster capable of downloading a movie trailer or a sign capable of transmitting a discount

coupon to a consumer's cell phone). NFC is designed to simplify complex applications by providing a uniform connectivity protocol for compatible devices.

Interoperability

NFC is based on an array of wireless technologies, including RFID technology. NFC uses magnetic field induction to enable communication between compatible devices brought in close proximity. NFC is an intuitive methodology that provides a seamless platform for completing secure data transfer, accessing digital content, and connecting devices by proximity interaction. For two devices to communicate, one must have an NFC read/write capability and the other an NFC tag. The tag is basically an integrated circuit containing data, connected to an antenna that can be read and written to by the NFC reader. An NFC configuration is similar to RFID except NFC can support two-way data exchanges. Also similar to RFID applications, there are two operating modes for NFC technology: active and passive. In active mode both devices generate a radio field to transmit data compared to a passive mode that necessitates only one device generating a radio field with the second device incorporating signal modulation for data transfer. NFC protocol requires that the initiating device generates the radio field. The passive mode is important in battery powered m-commerce devices like cellular phones and PDAs that prioritize energy usage based on available features.

To exchange information between two mobile devices, for example, the user simply places the devices in close proximity (normally a few centimeters or less) and interoperability follows. With an NFC-based interface there is no need to enter pass codes, adjust device settings, or scan the operating components of the connected unit. The two devices directly communicate without interference or synchronization issues. As a result, NFC is expected to transform standalone wireless networking resources into interoperable communications media capable of completing making retail transactions, accessing public transportation, transferring data, and gaining acquiring sought-after information (NFC-Forum, 2007).

NFC Applications

Given internationally agreed upon standards that have been published and disseminated by the NFC Forum, industry experts point to three major areas of application concentration: 1-application enabler (open links for data transfer), 2-peer to peer communications (enabling exchange between multiple devices), and 3-settlement services (electronic transaction reconciliation). It is expected that most NFC applications will be built upon existing infrastructure where available. A wide range of devices and machines are likely to become NFC enabled. NFC technology allows mobile devices to download information stored in smart tags lodged on a variety of objects. Tags can be affixed to physical objects such as posters, transportation signs, street signage, specialty products, medicines, certificates, hazardous materials, food packaging, and others. Application examples include:

- Mobile phones
- Entry turnstiles
- Vending machines
- Parking meters
- Check-out cash registers
- POS equipment
- ATM terminals
- Office, house and garage doors
- Laptop/Desktop computers
- Promotional poster tags
- Street sign tags
- Product packaging

Consider the potential implication of these NFC aided scenarios:

- Embedded NFC tags can be built into billboards and posters containing an advertisement or product promotion, when an NFC-enabled handset reads the tag it enables the user to actively engage with the content of the tag.

- NFC tags can be used on special documents like parking permits, credit cards, and other proprietary forms of payment to prove authenticity; NFC contains a copy-resistant hologram that can be remotely disabled if a NFC device is lost or stolen.
- NFC establishes easy to interface connections. For example, holding an NFC-enabled cell phone within close proximity to a Bluetooth headset will lead to automatic initiation of connectivity.
- NFC enables the downloading of paperless tickets, coupons, discounts, and related promotions to be stored in a NFC-enabled mobile phone and kept until redeemed
- NFC technology can enhance contactless payment at self-check-out terminals or unattended points of sale.

NFC applications typically are divided into four broad application categories.

1. Touch and Go -- Applications that require that a device equipped with access information be brought into proximity of a reader. Examples: transportation and event ticketing, security access coding, and smart tag reading.
2. Touch and Confirm – Applications such as mobile payments where the user has to confirm acceptance of a transaction and/or enter a password or PIN code to verify and authorize payment.
3. Touch and Connect -- The linking of two NFC-enabled devices for peer-to-peer data transfer. For example, music downloads, image exchanges, and address book contents.
4. Touch and Explore -- Offers multiple functionality that enables the user to explore device capabilities and select the most appropriate NFC function or service.

m-Wallet

With NFC payment technology, the amount of the purchase can be immediately deducted from the consumer's bank account or charged against a deferred form of payment. NFC devices can be linked to a bank account so money can be debited directly from a user to the retailer. Alternatively, NFC cards or phones can be stocked up in advance with credit to be used as payment. Similarly, NFC devices can be used for proof of purchase as in the case of admission ticketing. The certificate of purchase is stored on an NFC chip and redeemed by simply pointing the NFC device at the entry gateway. Unlike other technologies, NFC provides global interoperability of contactless identification and interconnectivity. The underlying layers of NFC technology are based on ISO, ECMA, and ETSI standards.

NFC technology is supported by major communication device manufacturers, semiconductor producers, network operators, information services firms, and financial services organizations. An important feature of NFC is its automatic compatibility with all forms of contactless cards and readers, even legacy media, deployed worldwide. Given that the NFC transmission range is so short, NFC-enabled transactions are inherently secure; additionally, physical proximity of the devices also reassures the consumer of maintaining control of the process. Products with built-in NFC dramatically simplify the way consumer devices interact with one another, helping speed connectivity to receive and share information, including fast and secure financial transactions. NFC provides intuitive and safe communication between electronic devices. NFC is both a read and write technology.

For example, Nokia, the world's largest mobile handset manufacturer, recently announced that beginning with the Nokia model 6212 (expected by 2009) its phones will be embedded with Visa International application software linking the consumer with the host financial institution. Directly linking to a consumer's Visa account through a cell phone empowers the user to make payments for goods and services, initiate mobile money transfers, receive near real-time account notification, and decide to 'opt in' to receive offers and discounts from merchants. 'M-payments and services are one of the most vibrant areas of innovation at Visa, as we seek to accelerate the migration from paper forms of payment to digital money,' said Tim Attinger, Visa International's Senior Vice President of Internet and e-Commerce Service. 'Visa is better money - convenient, reliable and secure than cash. Putting Visa payments and new services into the NFC-equipped Nokia 6212 classic adds another layer of convenience and security for Visa account holders and Nokia customers around the world.' The Nokia 6212 includes integrated NFC chipsets that allow the mobile device to emulate a contactless payment media as the consumer merely waves it within a few inches of a special POS reader to complete a Visa transaction (Business Wire, 2008).

Operating Modes

NFC applications are generally classified into three types: 1-peer-to-peer, 2-payment and ticketing, and 3-service initiation. NFC has several different operating modes, each based on the uniform standards established by the NFC Forum.

Peer-to-Peer – NFC can be used to enable communication between two devices. Data exchange between two proximate devices occurs when the devices perceive each other as peers. One kilobyte is typically mentioned as the capacity for rapid data exchange between two NFC devices. While NFC is often used to carry the data for exchange, whenever large amounts of data need to be transmitted, NFC is used to open the transmission channel but a secondary technology is used to move the information (usually Bluetooth or WiFi). For example when linking an NFC-enabled digital camera to an NFC-compliant printer, it is often best to have NFC open the channel but subsequently employ a higher capacity protocol to actually transport the contents. By tapping the camera to the printer an NFC link can be established. Once connected, a Bluetooth connection can be initiated for transmission of the digital photos to the printer. Peer-to-peer applications can also be used in conjunction with a WiFi access point as the NFC connectivity can be used to capture the wireless settings needed by the host device to gain network access. Once connected to the web, subsequent data exchange will be controlled by the WiFi environment.

Payment and Ticketing – NFC is designed to be used to build on a smart ticketing and electronic payment infrastructure. The original driver for NFC technology was to create a convenient and rapid payment platform for micropayment (small dollar) transactions. NFC-enabled mobile phones address the demand for phone-based transactions as an alternative to cash-based transactions. Since there are a number of payment infrastructures in existence, NFC devices are being programmed to support compatibility with established electronic payment readers and smart card settlement mechanisms. As a result, any NFC-enabled device can be used as a form of payment and ticketing device (ticket equivalent data is stored on the NFC device for access) leading to a reduction in dependency on plastic cards. Payments at vending machines, movie theatres, parking meters, and transportation kiosks are popular examples of NFC applications. NFC-enabled payment and ticketing are much easier and less costly to handle than cash and other traditional payment methods (Schuman, 2008).

Service Initiation – NFC can also perform service discovery or enable access to another service via a data transfer link. In essence, service is initiated when an NFC-enabled device (receiving component) makes contact with an NFC-embedded smart tag (sending component). Almost immediately information can be transmitted from the smart tag to the NFC device. For example, a smart poster tapped by an NFC mobile phone in a clothing store may lead to information related to discounts and promotions appearing on the cell phone's display. Furthermore, if the consumer is a registered customer of the store, additional information consistent with the customer's profile may also be included in the data transmission. Information received may be text only or some combination of graphics, audio, and video. Consider the scenario in which a consumer comes in contact with a restaurant smart tagged poster. The data exchange may include special promotions, discounts, and a location map. Smart posters are most often used for promoting interest in products, services, or events. Similarly, an unfamiliar product may be tagged. Tapping the product or its shelf label could lead to the downloading of product data, discount pricing, and/or links to additional, more detailed information.

Numerous media reports cite handset makers such as Nokia, Samsung and Sony Ericsson developing and field testing NFC-enabled cellular phones for widespread commercial release in 2009. NFC-enabled handsets are designed with a portable memory chip termed a subscriber identity module (SIM) that enables the mobile device to serve as a platform for transaction settlement and related functionality. The consumer simply uploads payment or bank information onto a SIM card, then completes a transaction by waiving the phone within close proximity (four centimeters) of an NFC-enabled contactless payment reader. Lost or misplaced phones can be disabled remotely to avoid fraudulent transactions As author Peter Lucas (2008) observed, "Commercial production of mobile devices that allow consumers to pay for things at the point of sale and download coupons and other content is now not far off, say experts, who cite plunging chip prices and new security technology among reasons for burgeoning optimism."

NFC Trials

There have been numerous NFC trial projects worldwide that are designed to test its protocols to ensure interoperability, security, and reliability. Within many of these geographic locations there have been multiple operational trials and commercial deployments, each experiencing high levels of satisfaction for adoption and positive consumer feedback relative to ease of use. In a recent issue of Cellular News (2008), Visa's General Manager for Australia and New Zealand, Mr. Chris Clark, summarized his company's trial work quite succinctly, "Mobile phones are one of the most promising new forms of payment in the world today. Research indicates that contactless mobile payments are two to three times faster than an average cash transaction. As the technology evolves, we expect it will be possible for consumers to use their mobile phones to download electronic coupons tailored to their interests, monitor their accounts, make mobile Internet payments and access other applications that provide a compelling customer experience. We are very positive about the opportunities." Key focus areas of the worldwide trials include electronic settlement, contactless ticketing, and service discovery. Following are summaries of six recent NFC trials:

- 1. Switzerland** (2008) – Telecommunications provider Swisscom has partnered with contactless smart card manufacturer LEGIC and vending machine operator Selecta to trial NFC-enabled cellular phones in multiple Swisscom office building locations throughout the city of Bern. Trial users are able to purchase refreshments from Selecta brand vending machines with an NFC-enabled cellular phone with an embedded LEGIC smart chip. The application provides a platform for quick, secure, and contactless transactions at an unattended point of sale device. The trials began in May 2007 and reinforce the capability to connect a mobile phone to a contactless application using an electronic purse or m-wallet. Findings include discovery that NFC technology enables mobile phones to behave as conventional contactless cards but with connectivity to a mobile network. Contactless applications have also been shown to work when the phone's battery is low and/or no network is available. These applications combine the advantages of NFC and contactless technologies and set the stage for the participating partners to convert the project into an actual business model. The partners are also considering the integration of Adasoft secure entry applications (doorway controllers) as an NFC-based application. ["LEGIC participates in NFC pilot in Switzerland" at www.contactlessnews.com/2008/09/18/legic-participates-in-nfc-pilot-in-switzerland]
- 2. Australia** (2008) - National Australia Bank (NAB), Visa, and Australia mobile telephone operator Telstra are trialing NFC-enabled devices with approximately 200 consumers and twelve merchants in the Docklands area of Melbourne. Participants are able to remotely download NAB Visa credit card software onto a mobile phone SIM card to allow the user to settle transactions up to AU\$31 (\$35 USD) by waving the phone over a contactless reader. Charges above U\$31 require PIN code entry to complete the transaction. While speed and simplicity of cashless purchase transactions has been the focus, future developments include the ability to add multiple credit card accounts as settlement options.
["Mobile operator Telstra testing NFC payments" at www.contactlessnews.com/2008/08/27/mobile-operator-telstra-testing-nfc-payments]
- 3. Singapore** (2008) – Electronic payment provider NETS, SingTel, United Overseas Bank, and Nokia are trialing NFC-enabled cellular phones for transaction settlement. The focus of the trial is to observe the use of NFC phones for transaction payment as well as test the feasibility of an electronic coupon that users can open on the handset via the mNETS Coupon Initiative. The coupon can then be flashed on a NETS FlashPay reader for automatic redemption. The coupon initiative enables the merchant to offer targeted customers discounts, promotions and other privileges in a sustainable eco-friendly manner. The rate and use of transmitted coupons represents an important trial dimension. In this trial the NFC-enabled Nokia 6131 phone functions as the mNETS Wallet.
["NFC trial launched in Singapore" at www.contactlessnews.com/2008/08/13/nfc-trial-launched-in-singapore]
- 4. United Arab Emirates** (2008) – Telecom operator Etisalat and Emirates NDB (Emirates Bank and National Bank of Dubai) are trialing contactless NFC-enabled mobile phones with a select group of customers to make payments at various points of sale as well as purchase transportation services. Although the technology is not widespread in the UAE, the companies have partnered with several merchants in order to expand the reach of the program. Many business observers feel that the adoption of NFC technology could be especially quick in the UAE given the close relationships and solid cooperation between government-owned banks and mobile phone providers. Based on trial outcome, Etisalat will consider subsidizing NFC-enabled phones to encourage purchasing. ["Phones that act like wallets considered" at www.thenational.ae/article/20080609/BUSINESS/971036403/-1/NEWS]

5. Canada (2008) – Bell Mobility and MasterCard Canada are conducting a trial of NFC-enabled devices for use at MasterCard PayPass contactless terminals. The objective of the trial is to test contactless payments in the Canadian marketplace by allowing customers to conduct secure purchases at any PayPass-equipped merchant. It is important to note that there were approximately 28 million MasterCard PayPass holders and 109,000 PayPass equipped merchants in Canada at the time this trial began. The process involves the customer using a mobile phone with the PayPass application stored into its secure and optionally password-protected memory. Part of the trial involves MasterCard evaluating the security, simplicity, and convenience of transaction processing, as well as over-the-air (OTA) provisioning of payment card credentials. In addition to contactless payments, another NFC application under consideration is coupon redemption.

[“MasterCard to Trial NFC Payments in Canada” at www.marketnews.ca/news_detail.asp?nid=3765]

6. Washington (2008) – U.S. Bank, MasterCard Worldwide, and Nokia are trialing NFC-enabled mobile phones to use with MasterCard PayPass readers throughout the city of Spokane. Program participants receive a Nokia 6131 NFC-enabled phone to communicate with MasterCard PayPass readers. Payments made via a mobile phone are processed using the same secure network through which billions of other MasterCard transactions are processed each year. In addition, consumers are able to protect payment account information stored in the phone by applying password protection. A misplaced phone can be remotely disabled via a telephone call to US Bank.

Contactless PayPass readers are located in various locations throughout the city, including gas stations, movie theatres, sports arenas, quick-service restaurants, taxi cabs, and vending machines. [“New NFC trial launched in Spokane” at www.contactlessnews.com/2008/01/28/new-nfc-trial-launched-in-spokane?tag=Technology_101]

Adoption Barriers

A recent study by ABI Research projects that 450 million mobile phones will be NFC-enabled by 2011, representing nearly 30% of handsets shipped worldwide in that year (ABI Research, 2008). Strategy Analytics forecasts mobile phone-based contactless payments will facilitate over \$36 billion of worldwide consumer spending by 2011. While there has been a growing interest in mobile proximity payments leveraging NFC technology, ongoing trials have delineated some unanticipated hurdles leading to slower than anticipated rates of adoption, including security concerns (Kountz, 2008). In some countries, the introduction of NFC-enabled technology has been slowed by disputes over control between the mobile phone manufacturers, the mobile networks and participating banks or business entities (Frost & Sullivan, 2008). In the United States, some payment industry executives are blaming the media, and select consumers, for the slow adoption of mobile payment systems. “I think the media, because they don’t understand the technology, and consumers, because they don’t understand the technology, have created a hysteria around this,” said Barry McCarthy, President of Product Innovation at First Data, a worldwide leader of payment solutions (Cnet News, 2008). ‘I don’t think it’s necessarily about people being concerned about security as it is understanding just exactly what it is, how it works, and the security that is present there. Security is an excuse that a merchant might throw out’ not to adopt contactless POS equipment today”, stated James Anderson, International Vice President of Mastercard. Spencer White, Director of AT&T Mobility’s mobile financial services argues that NFC is relatively secure compared to the physical handling of a credit card which can expose its account number. Mobile NFC data exchanges can be encrypted using authenticating token exchanges or via PIN code (Cnet News, 2008).

According to a Venture Development Corporation (VDC) report, NFC is likely to experience similar technology hurdles that negatively impacted early RFID adoption. While bullish on the long-term prospects of NFC, a research note to the 2008 VDC report states, “Market adoption of NFC will likely follow a progression similar to RFID, and that means market development is likely to be slower and more niche oriented than most NFC investors and adopters would prefer.” The VDC report (RFID Update, 2008) points to three primary barriers to adoption:

1. Lack of supporting infrastructure – there remain comparatively few NFC components in the market either at the enterprise or consumer level and therefore developers are reluctant to provide additional NFC applications or infrastructure. This circular dynamic is the classic dilemma of which comes first, the ecosystem or the application.
2. Complex ecosystem of stakeholders – an uncommon variety of stakeholders must be included to produce widespread NFC adoption. Participation by phone manufacturers, network operators, card issuers, public transportation

companies, contactless ticketing providers, payment processors, media vendors, and merchants and retailers, among others. Since each participant brings its own interests and perspective, a globally accepted NFC business model is an uncertainty.

3. Standards – while the NFC Forum has been credited with having completed much of the standards development, there remains much work to do. The next phase of standards may well be focused on specific applications and niche vertical markets.

For Prag Shah, CEO of Mobilians International a leading mobile payments company, frustration rests with the overall pace of mCommerce adoption in the United States; especially when compared to the momentum of the highly successful online payment campaign in South Korea. Similar to the VDC report, Shah emphasizes that the real barrier to marketing NFC-enabled mobile commerce "is not the technology—it is all about the business model" (Sybase Worldwide, 2008). Suffice it to say there's inherent reluctance and uncertainty with the introduction of an innovative payment technology and NFC is feeling the effects. While the long-term forecasts remain bright, in the short term NFC may take more development time than once projected.

NFC Forum

The NFC Forum, www.nfc-forum.org, was launched as a non-profit industry association in 2004 by leading mobile communications, semiconductor and consumer electronics companies. The Forum's mission is to advance the use of Near Field Communication technology by developing specifications, ensuring interoperability among devices and services, and educating the market about NFC technology. The Forum's global member companies (more than 150) are cooperatively developing broad specifications for modular architecture and protocols for interoperability and device-independent service delivery.

NFC Forum sponsors include leading payment industry representatives in key industries around the world. Sponsor members include: Hewlett Packard, MasterCard Worldwide, Microsoft Corporation, NEC, Nokia, NTT DOCOMO, Inc., NXP Semiconductors, Panasonic, Renesas Technology, Samsung, Sony Corporation, and Visa International. Interoperability is an important goal of the NFC Forum as NFC devices are intuitively interoperable since NFC has been based on pre-existing contactless payment and ticketing standards adopted worldwide. Such standards define the contactless operating environment and requisite equipment as well as the format of data to be transferred and data rates for transference.

Consumer Devices

There is a wide array of consumer devices expected to be NFC-compliant in the future. These devices include an event ticket kiosk, digital camera, personal digital assistant, POS terminal, and smart tag poster. Figure 2 contains a graphic representation of forthcoming NFC consumer devices as presented by the NFC Forum.

Figure 2: NFC Consumer Devices (Source: NFC Forum, Inc.)

Summary

NFC is a short-range wireless connectivity technology standard designed for intuitive, simple and safe communication between electronic devices. It appears innovation is inevitable and industry practitioners are fearful that in order for NFC application to reach potential usage there must be a mass deployment of contactless payment infrastructure, including media issuance and consumer and retailer acceptance of both payment and information access. NFC is a wireless industry standard that allows mobile phones to communicate with other electronic devices essentially rendering the handset a contactless m-wallet. NFC relies on radio frequency identification (RFID) technology embedded into a mobile phone SIM card to transmit account information to a contactless POS reader. The reader, in turn, relays the signal and completes the purchase transaction. Strategy Analytics (2006) speculates that mobile phone-based contactless payments will facilitate over \$36 billion of worldwide consumer spending by 2011. Research firm Frost & Sullivan (2008) estimates that globally one-third of all mobile phones will be NFC-enabled by the year 2013. In response to these forecasts, there is an urgent need for a collaborative business model based on the compelling NFC applications and architecture.

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