

# Near Field Communication For Secure Applications

If you find someone using a mobile phone to make a payment at the cash counter, or see a policeman charging penalty for a traffic violation through his handset, don't get surprised. NFC-enabled mobile phones are all set to become popular for applications that need security and ease of operation



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It is an invisible part of our lives, yet wireless short-range communication is emerging as one of the most important technologies for intuitive, simple and safe communication. The new short-range radio frequency technology, near-field communication (NFC), enables exchange of data between devices held in proximity of each other. Using NFC, one can 'pick' information from the environment,

as per the NFC forum, co-founded by NXP, Sony and Nokia, to promote the NFC technology.

"NFC can be defined as a combination of already existing technologies. It is compatible with radio frequency identification (RFID) standards, based on ISO 14443A and 14443B. It also complies with the Smart Card technology for contact-based systems defined in ISO 7816," says Kandasamy S, senior manager-portfolio, Sasken.

According to Kandasamy, NFC

itself has been standardised as a technology in ISO 18092, which includes the Felica standards of Japan. Besides, the unification of various standards allows NFC to be used in all major geographies.

"Nxp India has conceptualised, promoted and implemented the innovative idea of NFC phone/terminal and smart card as a system for financial inclusion," says Ashok Chandak, senior director-global sales and marketing, NXP Semiconductors. The company is involved in multiple pilot projects on financial inclusion like ALW, Integra, C-Sam/NIC, etc.

## Short-range wireless technologies

Wireless technologies have brought revolutionary changes not only in gadgets but also the way we carry out various tasks. As every product or application has its own unique requirements, it is a tedious job for an application/product designer to choose the right technology from a plethora of evolving standards and specifications in new technologies. To choose a technology from the existing pool, common criteria are: operating range, interoperability, security, power requirement, data rate and cost.

There are many short-range wireless technologies like Bluetooth, NFC, Zigbee, IR, Wireless USB and Z-Wave. All these work on different operating frequencies and offer different data rates. Of these, Bluetooth is one of the widely-accepted technologies, as it has replaced cables and the need for

	NFC	RFID	IR	Bluetooth
Set-up time	<0.1ms	<0.1ms	~0.5s	~6 sec
Range	Up to 10cm	Up to 3m	Up to 5m	Up to 30m
Usability	Human centric Easy, intuitive, fast	Item centric Easy	Data centric Easy	Data centric Medium
Selectivity	High, given, security	Partly given	Line of sight	Who are you?
Use cases	Pay, get access, share, initiate service, easy set up	Item tracking	Control & exchange data	Network for data exchange, headset
Consumer experience	Touch, wave, simply connect	Get information	Easy	Configuration needed

Fig. 1: Courtesy – Seale Technologies

synchronisation for data transfer. It, however, does not exhibit inherent security. But NFC, which operates in the radio frequency of 13.56 MHz within a distance of 10 cm, provides a high degree of security due to its short range. The communication between two NFC enabled devices takes place through magnetic field induction in an air-core transformer that is formed between the antennae of both the devices.

### Application modes

**Peer-to-peer model.** The peer-to-peer communication model allows you to transfer data between two devices using short-range wireless technologies, for example – Infrared (IR) and Bluetooth.

For infrared communication, IR ports of two communicating devices like mobile phones or laptops need to be in the line-of-sight. In Bluetooth data transfers, you don't need line-of-sight, but you have to undergo the tedious process of configuration setting, searching of another Bluetooth device and then selecting it.

NFC, however, combines the convenience of both IR and Bluetooth. It does not require the line-of-sight or setting configuration, searching and then selecting another device, yet provides a secure channel for data communication.

When you bring two NFC-enabled devices near each other, a secured p2p communication is established that can be used for fast, easy and convenient

data transfers.

### Tag reader or card emulator.

Consider a situation where you come across a 'smart' poster of a live concert happening in your city. Being a smart poster it incorporates an NFC tag that has all the details of the event. When you bring your NFC-enabled cellphone close to it, it reads and captures all the information.

Your NFC-enabled cellphone can also detect a phone number and ask you to initiate a call to the number, or open the Internet link directly on your mobile Internet browser.

The card reader mode of NFC cellphone is useful for content distribution, information access, etc. and can be linked to other applications like initiating a call or opening the Internet link through mobileweb.

In card emulation mode, the NFC device acts as a tag itself with some

stored information. For example, you can store all your credit card details on your NFC cellphone and make payments by scanning it on NFC readers.

### Targeting mobile phones

NFC is primarily aimed at the mobile phones. It is best suited for them, as they are capable of downloading information, songs, ticket information, top-up a travel card, banking applications, etc. And, the most important fact is that NFC readily fits in mobile handsets.

"In more than 30 NFC field trials in various countries, we have observed that consumers show a strong desire to use their cellphones for mobile banking, money transfer, payments, shopping savings/discounts, and shopping assistance," says Mohammad Khan, president, Vivotech.

"More than 75 per cent of consumers responded positively after participating in mobile payment trials. They prefer to use their NFC phones to pay at participating merchant locations. This is because of convenience factor and easy accessibility of payment instrument through mobile phones. They also find mobile phone to be a dynamic device with a user-friendly interface as compared to a passive card," he adds.

### Application areas

**Initiating a connection.** Data transfer can take place between an active pair of NFC devices. You can display pictures from your NFC digital camera by bringing it close to your digital

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#### NFC technology specifications

- A short-range wireless communication – 10 cm
- Standards based (RFID 13.56MHz, ISO 14443A/B, 18092, ETSI, ECMA)
- Consumes low power
- Speed – 106, 212, 424 kbps

#### NFC Forum specifications

- NFC data exchange format (NDEF) defines common data format for NFC compliant devices
- Four specific record type definitions (RTDs) for building standard record type
- Four tags type (type 1/2/3/4), which enables core interoperability
- Connection handover defines structure and sequence of interactions between NFC devices



Applications of NFC during A Little World project (Courtesy: NXP Semiconductors)

photo frame, or print them directly by placing it near the NFC-enabled printer. Setting up wireless home office network is also possible by using NFC mobile phone.

"NFC is not meant for bulk data transfer. The data dump therefore is not very high. If you want to do video streaming or music streaming you will have to use some other mode like Bluetooth," says Ashok Chandak, senior director-global sales and marketing, NXP Semiconductors.

But setting up Bluetooth connection is a cumbersome process. However, you can initiate a connection using NFC and then transfer data via Bluetooth. While NFC can ease the connection, Bluetooth can provide higher data transfer rate.

"During an NFC handshake, a device can detect Bluetooth to synchronise, as the standard is defined in NFC as well as in Bluetooth. The connection can be set up through NFC, and information can be passed from the NFC software to Bluetooth software. The Bluetooth Forum has the information on how to receive the connection information when the connection is initiated," explains Kandasamy.

For Bluetooth 2.0, you can get speed of up to 3 MBps as compared to NFC which offers only up to 424 kbps. "So, there is a connection speed hierarchy. It starts with NFC, which is secure and easy to establish, then comes Bluetooth with medium speed, and finally we have WLAN, which gives the highest data rate," he adds.

**NFC for secure transaction.** The most useful feature of NFC is its secure application in combination with smart card. NFC enables users to make payments through its point-of-sale (POS) application. A mobile phone can be used as a

transport card, debit card, credit card, discount card, and behave as the all-in-one financial services device. Thus, these types of applications require the highest level of security.

The banks offering transaction services via NFC program credit card details onto a secure element in mobile phone. You can store information of multiple credit cards on the same device. There is an agreement between the bank and the service provider for all the communications, which are

further encrypted. Mobile payment offers expanded payment functionality, increased convenience, enhanced security and faster transactions. Hence, the inherent security feature of NFC-enabled mobile phones is a powerful tool for payment and financial services.

"NFC phone allows instant transfer of money, irrespective of recipient's location," says Khan.

"The same can be done using SMS banking services. However, you cannot use the money received through SMS right away. But with NFC, the recipient can use the money right away by using the NFC phone at NFC-enabled merchants, ATMs, or further transfer the money to another person's NFC phone," he adds.

NFC credit card payment or debit card use is also programmed for access using personal identification number (PIN). When you bring your mobile phone in the proximity of a reader, it detects the device, but will debit the amount only when you enter a valid PIN.

### NFC hardware and software

In an NFC-enabled mobile phone, the most important component is the NFC controller IC with an antenna for RF

### What is NFC Forum?

NFC Forum was co-founded by NXP, Sony and Nokia in 2004 to promote the NFC technology. It works jointly with other 140 members to develop specifications and standards and ensure inter-operability between various manufacturers. The forum, which comprises chip manufacturers, telecom operators, OEMs, applications developers and financial service providers, aims to promote the NFC technology in consumer electronics, mobile phones and PCs.

Innovision Research and Technology, Inside Contactless, Mastercard Worldwide, Microsoft Corp, NEC Corp, NTT Docomo, Panasonic, Renesas Technologies, Samsung Electronics, Visa, are some of the members of the NFC Forum.

communication. This is essential, as mobile has to talk over RF interface to the external world. It gets added during the phone design itself.

The second important component is the Secure Element (SE). It is highly secured crypto memory chip that stores all the information. "Presently, SE is different from a SIM card. But in future, with the standardisation in Single Wire Protocol (SWP), it can be merged with the SIM card," says Dhananjay Dixit, associate manager, NXP Semiconductors.

From the software perspective, an application is written inside a Java J2ME compliant mobile phone. On the other hand, the trusted service manager (TSM) is written/loaded in the secure element where the data is stored. The basic principle it works on is the 'challenge-response' mechanism. In this, when the reader sends the challenge, it is responded in a certain way by the chip on other device. The chip and the reader authenticate each other.

NFC device has the capability to read as well as write without any modification in the existing infrastructure or hardware. "For every application, there is a separate encryption algorithm and a communication protocol that only a dedicated reader can read. So, we can run multiple applications on the same NFC device," states Kandasamy.

"The Secure Element can house multiple secure execution environments. If you have a Citibank credit card application installed on SE, you can use the same SE for transport card or any other card. Multiple applications are separated by application firewalls," Kandasamy adds.

The applications can be tied up with the service operator where over the air (OTA) transactions are required. "It means that data like credit/debit/prepaid/loyalty card, coupon/promotion, product information and others could be provisioned remotely into mobile phones through wireless (3G, 4G) data networks. So, in future, when

## A Little World project

A Little World (ALW) had launched its first pilot project for microfinance using NFC technology in India. It used ALW's Zero platform and NFC chip from NXP Semiconductors to convert an NFC mobile phone with large storage capability into a bank branch. It used biometrics for customer identification, mobile phones to open new accounts on the spot, voice prompts for enrolment and transaction and provided printout for each transaction. The breakthrough project was deployed by seven major banks in over 450 villages across four states in India. The project had brought full featured banking services to over 45,000 people right inside their villages.

At present, there are about 8,000 NFC mobile phones in the field and about 200,000 customers satisfactorily using them for financial transactions.

## Citibank's 'Tap and Pay'

Citibank has initiated a much larger NFC business trial. Its 'Tap and Pay' programme, launched in Bengaluru in July 2009, has introduced the next generation contactless credit card transactions based on the NFC technology. The technology allows customers to tap their mobile phones on a contactless reader at the point of sale to pay for purchases, eliminating the need for the traditional swiping of credit cards.

The programme is being supported by Nokia 6212 Classic 3G phone, which provides capability to conduct NFC-based transactions. The contactless payment and security infrastructure is being provided by MasterCard PayPass.

VIVOTECH is providing NFC wallet, Over-the-Air (OTA) card provisioning software, Smart posters and mobile coupon applications, besides contactless readers to participating merchants.

you buy an NFC phone, you may download your credit or debit card details onto your phone and start making payments through it," says Khan.

## Growth avenues and challenges

"When a new technology is introduced, it is very necessary to create an eco-system," says Ashok.

A technology has a certain acceptance curve, and in recent months, NFC has got positive feedback across the globe.

Inter-operability of the connection is guaranteed if the devices comply to the set standards. The technology can resolve the inter-operability issue, but there has to be a unison in commercial and business logic suggested by parties sharing the same device.

The service operators are still trying to finalise the business issues to enable NFC support infrastructure and to get millions of NFC phones into the market.

Retrofitting in existing phones is another technological challenge. As NFC chip goes inside the mobile phone design, there is no retrofitting arrange-

ment available. One needs to change a non-NFC mobile handset to the NFC-enabled one to avail the functionality of NFC.

Considering that NFC implementation requires the whole ecosystem to be touched/updated (disrupted), it is taking a longer time than any other technology that does not shake up the whole ecosystem.

"But good news is that the desired types of changes to the whole ecosystem are taking place worldwide that will take the payment, retail and transit industries to the next level. They will offer much more personalised and automated services to consumers than ever before," says Khan.

By 2011, nearly 450 million mobile handsets will be NFC-enabled, states an ABI Research's study. Strategy Analytics forecasts that the mobile phone-based contactless payments will facilitate over \$36 billion consumer spending worldwide by 2011. These are significant projections that will change the way consumers live, work and pay. ●

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