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## Possible Future Direction of Mobile Commerce for Near Field Communication in Malaysia

A. Hanyza, J. Najihah, A.A. Noraniah

Faculty of Computer, Media &amp; Technology Management, TATI University College, 24000 Terengganu, Malaysia.

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### ABSTRACT

Near Field Communication (NFC) is an emerging and promising technology and yet favorable area which will have a great impact on the financial ecosystem as well as mobile technology throughout the world. Industry stakeholders such as mobile phone manufacturers, mobile operators (MOs), financial institutions and information technology firms are NFC key player in performing R&D activities to increase their share. The goal of the paper is to line out NFC features in brief in term of NFC technology and business ecosystem in mobile payment. A proposal on integration and management of secure NFC-based mobile payment architecture and model based on existing model developed by other researcher at the end of paper will be a stepping stone on participating stakeholder involved in Malaysia. Widespread adoption of NFC has yet to emerge in the Malaysia; NFC stakeholders' has to take an action in balancing technological sufficiency and ecosystem agreement by the interested parties' success factor for NFC adoption.

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## INTRODUCTION

Near Field Communication (NFC) is a currently developing and yet favorable area which will have a great impact on the financial ecosystem as well as mobile technology throughout the world nearly a decade since 2004 (Curran & Garvey, 2012). Mobile phone manufacturers, mobile operators (MOs), financial institutions such as banks, and information technology firms are NFC key player in performing R&D activities to increase their share. NFC, is a short range within 10cm wireless communication technology that potentially facilitates mobile phone usage of billions of people throughout the world offers an enormous number of applications including credit cards, debit cards, loyalty cards, car keys, access keys for hotels, offices and houses, that integrating all the said elements into one single mobile phone.

Several NFC experimental and researches have been launched all over the world. According to Frost&Sullivan, by 2015 the NFC technology will be the most widely used solution for mobile payment, with a global value of nearly \$120 billion, an European value of 41.87 billion and a growth rate from 2010 to 2015 of 118% (2011). Nokia, Citigroup, and MasterCard launched a NFC trial in New York in 2007. They equipped handsets with MasterCard PayPass contactless payment capability (Hsu-Chen Cheng, et.al, 2009). In London, an NFC trial was launched by Transit Operators in November 2007 (Curran & Garvey, 2012). Indian government plans to give rural pensions via NFC-based handsets (Bhatnagar, 2008). In Taiwan, NFC is a maturing market whereby Chunghwa Telecom has launched an NFC trial in the public transportation system and collaboration with banks and Mastercard in mobile credit card services (Boden, 2013). Google incorporate NFC technology into the Android 2.3 operating system (T. Conneally, 2010). In Malaysia, NFC technology initiate by Maxis, Nokia, Maybank, and Touch 'n Go in providing mobile payment through Maxis *FastTap* service in 2009 (Clark, 2010).

The goal of the paper is to line out NFC features in brief in term of NFC technology and business ecosystem in mobile payment. A proposal on integration and management of secure NFC-based mobile payment architecture and model based on existing model developed by other researcher at the end of paper will be a stepping stone on participating stakeholder involved in Malaysia.

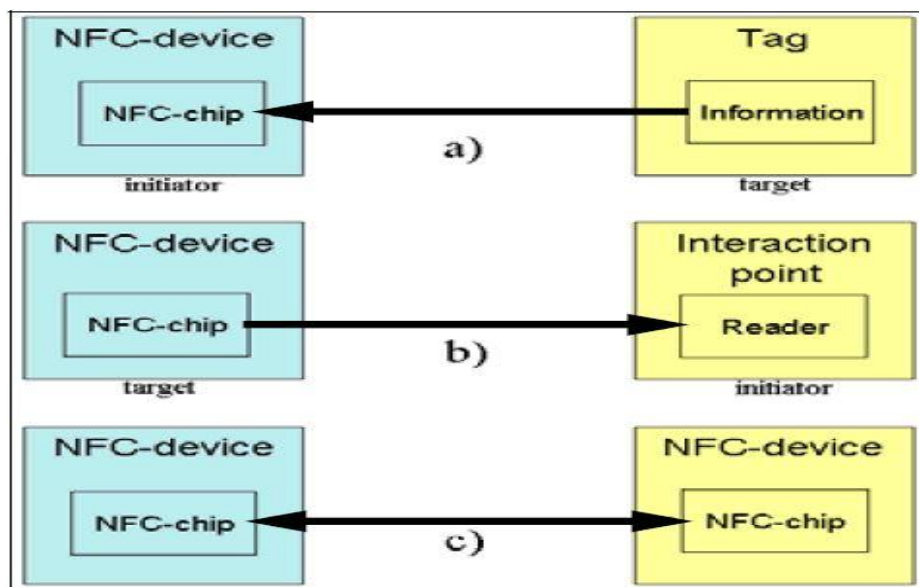
### 2. NFC technology overview:

NFC is a contactless communication between two devices, based on the technology used for radio

frequency identification (RFID), standardized in ISO/IEC 18092 and maximum distance to communicate between devices is up to 10 cm with a touch (Curran & Garvey, 2012). NFC operates at 13.56 MHz (Timalsina & Moh, 2012) and has been developed jointly between NXP Semiconductors (formerly Philips Semiconductors) and Sony Corporation. NFC has the ability to read and write to devices which involves an initiator and a target. Initiator is an active NFC device which is responsible for starting the communication. Target is an embedded energy component which can be either a tag, RFID card or an NFC device which responds to the initiator's requests.

#### **NFC Modes of Operation:**

NFC protocol works in two modes in communication which are active and passive (Curran & Garvey, 2012). In an active/passive device mode, when an NFC component has an embedded power source, it can generate its own RF field, and naturally initiates and leads communication. This device is called an active device. On the other hand, if it does not have any embedded power source, it is called a passive device and can only respond to the active device. The initiator always needs to be an active device, because it requires a power source to initiate the communication. The target, however, may be either an active or a passive device. As shown in Figure 1, three different operating modes based on the ISO/IEC 18092 NFC IP-1 and ISO/IEC 14443 contactless smart card standards were formed to advance and standardize the use of NFC technology (Coskun & Ozdenizci, 2012).



**Fig. 1:** Operation modes in NFC (Falke & Dietz, 2007).

- Card Emulation mode - the NFC device appears to an external reader much the same as a smart card. This enables contactless communication for example contactless credit card payments, loyalty cards and transport ticketing. One NFC mobile may store multiple contactless smart card applications simultaneously.
- Reader/writer mode – an active NFC device is capable of reading passive NFC tag types, such as a tag embedded in an NFC smart poster. It is a one way communication.
- Peer-to-Peer mode - two active NFC devices can exchange data such as virtual business cards or digital photos.

#### **NFC Application:**

NFC has several areas of usage. The main concern is to replace people's wallets with digital payments through the mobile phone or called as e-wallet. Mobile phones and SIM cards that can store and run various software applications make a powerful platform to be utilized together with NFC. The three most favorable areas are public transport payment, credit card replacement and advertising. Further possibilities are identity cards, electronic keys, configuration and setting up other communication protocols such as Bluetooth and WLAN. The magnetic strip and chip cards used today have limited lifetime and are susceptible to demagnetizing and breakage. These can be replaced by the card emulation mode of NFC and in that way the number of cards used in the everyday life will also can be reduced. Advertising in the form of smart posters is also an interesting feature. For these services, the phone acts as an NFC reader, and collects information from the tags through load modulation. The tag can contain all the information needed, or the tag can give a Uniform

Resource Locator (URL) combined with a phone command so that the user is redirected to a phone number or a website to complete the service (Y.Pigneur, 2008) (Kadambi & Karp, 2009).

Among a wide range of NFC applications said above, mobile payment and commerce application is one of the popular since NFC-enabled mobile phones can install several applications to utilize NFC capabilities such as emulate credit cards, point cards, identity cards etc. Hence, a user is given experience of these traditional schemes within a single mobile.

### ***NFC and Mobile Commerce Technology:***

Mobile phones have become ubiquitous companions in our life, enabling communication everywhere; simplify information access to mobile services and the internet. While mobile payment trials have got more attention from the industry and the media recently (Y.Pigneur, 2008). This growing interest can be explained by the approaching launch of commercial mobile phones NFC-enabled such as Nokia and Samsung. Having a mobile phone fitted with an NFC chip will enable users to send and exchange data just by touching, or bringing together the two devices. These phones are expected to transform the mobile proximity services such as mobile payments, couponing, and ticketing. NFC brings some new capabilities to mobile phones such as easier device-to-device communication, reading of other contactless chips RFID, and emulation of contactless cards.

The integration of NFC mobile devices has improved capability mobile phones from its source of bridging mobile commerce to consumers (Timalsina & Moh, 2012). Compared to other mobile payment services and systems, the NFC-based mobile payment exhibits the four core technical innovations (Kadambi & Karp, 2009). NFC support end-to-end secure transaction over a point-to-point secure communication channel, single user-trusted touch point for mobile phone, closed proximity transaction capability for mobile commerce and NFC enable mobile phone can become a single point of mobile spending.

Many mobile users consider mobile payments as an impressive application that will take NFC into the mainstream. According to a survey conducted by MasterCard (Timalsina & Moh, 2012), nearly two out of three people surveyed are accepting the idea of using their mobile phones to make payments. Even though mobile payment implementations bring in the most attention, there are NFC-enabled implementations for loyalty cards, discounts, coupons, and e-shopping carts, as well as smart tags for product information, pricing, and comparison shopping. For mobile payment retailers, such non-payment applications can generate additional revenues and provide their customers with extra value.

### ***3.NFC – Business Eco-system:***

NFC usage was expected to be successful since 2011 as a predominant technology when 35 million mobile phone NFC-enabled was roll-out. However, this seems to have been postponed repeatedly and has made various industries or suspicious about the potential success of NFC. In fact, there are two major stumbling blocks to the success of NFC. The first is that of technological sufficiency, and the second is the ecosystem agreement by the interested parties or called stakeholders. As the involved stakeholders become more convinced about the technical success of the new model, they tend to invest more resources for development, and as new technical improvements occur, the ecosystem becomes more established and ready for the boom. Also, when a stakeholder puts more investment into a project, it seems more eager to make an agreement with the other stakeholders involved, in order to get their money back and hence to provide better Return of Investment (RoI). In other words, the leading factor of the success of NFC adaptation is actually more financial than technological because economical motivations enable technical sufficiency over a period of time. Moreover, with Apple remains as the only major mobile manufacturer that omitted NFC technology in its devices due to security and competitive strategy reasons.

### ***Stakeholders in the NFC Mobile Payment Environment:***

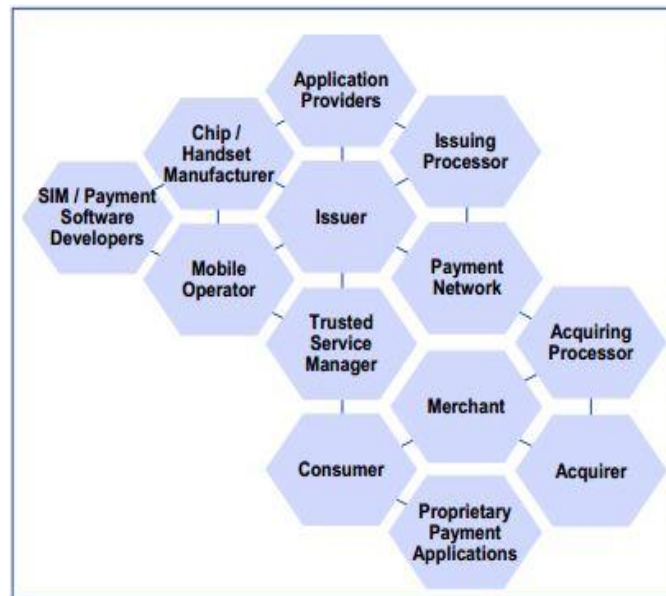
A mobile payment is any payment where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return for goods and services. Mobile devices with applications that use NFC technology for payments will help consumers pay for products and services more easily, the reason why mobile manufacturers are teaming up with financial companies and service providers to provide this service in the near future. The implementation on NFC mobile payment is complicated by the number of stakeholders that are involved in establishing the ecosystem. Consumers, merchants, payment brands, issuing banks, mobile operators, mobile handset manufacturers and other application and service providers must collaborate to deploy a fully functioning system that delivers benefits to all parties. Figure 2 illustrates stakeholders that may be involved in NFC mobile payments (Smart Card Alliance, 2007).

The major stakeholders are the ones who effectuate the NFC enabled applications and services in a secure, trusted environment. They can be described as follows (Coskun & Ozdenizci, 2012):

- Mobile Operators (MOs) provide mobile phone owners access to the communication and data network. They are actually responsible for providing all kinds of mobile services to their subscribers. MOs, in the

meantime, can deliver and maintain the network infrastructure that enables the secure Over-The-Air (OTA) solutions to provide remote management and maintenance of applications stored on Security Elements (SEs).

- Trusted Service Manager (TSM) is required to create and manage a trusted environment among key players of the NFC ecosystem. TSM generally offers a single point of contact with MOs for service providers such as financial institutions, banks, transit authorities, retailers and others who want to provide a payment, ticketing, or loyalty application to customers with NFC enabled mobile phones.
- Payment network deploys as well as manages a service to the mobile devices of its customers. A payment network may be a financial institution, bank, transport authority, or some other organization.
- Merchant, issuer and acquirer are the stakeholders who are accepting NFC mobile payment services. Issues such as expensive NFC tags, re-design of products, lack of device as well as users acceptance need to be thoroughly addressed before the overall usage of the system take place. Country like Japan has seen the implementation of the NFC in outlet such as McDonald as early 2010.



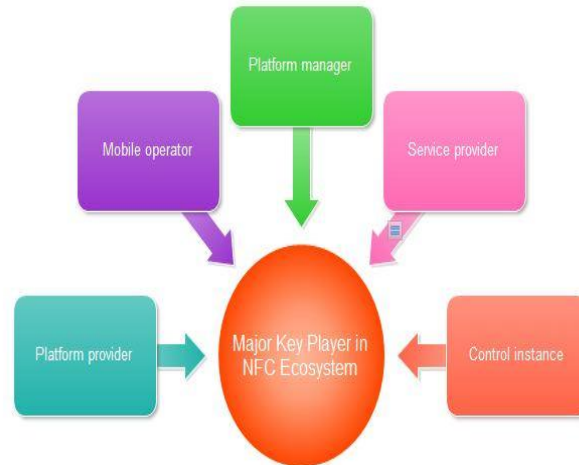
**Fig. 2:** Stakeholders That May Be Involved in NFC Mobile Payment (Smart Card Alliance, 2007).

From the consumers' point of view, one of the main problems to be resolved is the acceptance of NFC technology of services and the possible strategies to be achieved at high level of satisfaction. It is essential that the various stakeholders create a unified strategy for bringing the NFC technology to market

## RESULT AND DISCUSSION

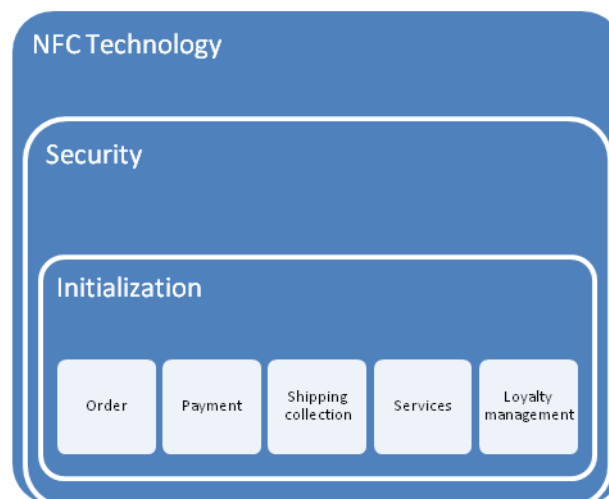
In order to implement successful mobile commerce in NFC-based, a solid architecture and model should be proposed to NFC key players or stakeholders to make it reality. On the researcher point of view, the Mobile trusted computing architecture for a NFC Ecosystem and a NFC-based Mobile Commerce (NMC) are seemly appropriate to be carry out for NFC environment. The approach of a Mobile trusted computing architecture for NFC Ecosystem consists out of five major key players in NFC ecosystem as shown in Figure 3(Madlmayr, 2008).

- Platform Provider (PP): This key player issues the Security Element (SE). Banks, merchants, ticket vendors and MOs are possible PPs.
- Mobile Operator (MO): The MO has a direct link to the mobile device through the GSM/UMTS network. The MO also provides the data link between the mobile device and the PM/PP.
- Platform Manager (PM): A PM acts as a mediator between the service providers and the platform PP. It'shis task to manage the data and applications in theSecurity Element (SE).
- Service Provider (SP): The service provider is an instance making use of the tamper proof data container in the mobile device. By that, the SP does not have toissue smartcards anymore and is able to update thedata in the smartcard chip remotely.
- Control Instance (CI): The CI represents a hub in the mobile device for the secure elements attached. The CI is needed for activating and locking the Security Element as well as routing the data streams from the PPs/PMs to the according Security Element (SE).



**Fig. 3:** Mobile trusted computing architecture for a NFC Ecosystem (Madlmayr, 2008).

NMC been developed by a group of researcher from Taiwan which characterizes the issues and technologies involved in NFC technology. As shown in Figure 4, the NMC model includes six phases which are initialization, order, payment, shipping/collection, services, and loyalty management. In initialization phase, it needs four component; back-end services, terminal service, tags and mobile phone for constructing an NFC mobile commerce environment. In ordering phases, the customer can start to use NFC-enabled handset to download the catalog and place the order. There are two mode in payment phases; e-wallet mode and credit card mode. In e-wallet mode, user must use the token stored in secure element to pay the order while in credit card mode, it mimics common credit card process such as Visa Wave and MasterCard PayPass. In shipping/collection phase, customer can choose how they receive the products or services. In loyalty phase, a loyalty tool like coupon introduce to customer as a marketing tool to attract a customer to purchase again(Cheng, Chen, & P.Chen, 2009). Security measure must be taken into account while modeling NMC. Authentication and authorization approves the identity of a person, a process, or a device based on the provided information and allows different actions on the application, or NFC enabled devices by the user after authentication is provided. Availability ensures that the system responds correctly and completely to the requests of the authorized users at any given time. While data integrity ensures that the received information is accurately the same as the information sent, and thus confirms that it has not been unintentionally or maliciously modified or destroyed.



**Fig. 4:** NFC-based Mobile Commerce (Cheng, Chen, & P.Chen, 2009).

It is important to make clear that this ecosystem architecture and model will no nurtured firm unless the presence of the following elements would be needed(Ceipidor & Opromolla, 2012):

- The most engaged people are sensitive to shopping and prone to try new solutions.
- The companies involved must have a good brand reputation, being well-known throughout the country and medium-large sized.

- Companies will have to organize themselves into multi operator initiatives. This allows not only to achieve a good level of mass market, making these services attractive to those involved, but also to obtain a high level of satisfaction for the consumers.
- Beyond the companies, the involvement of a sufficient number of other players of the system (banks, payment networks, MO) will be required, so that potential customers will increase.
- The developed system should be scalable, i.e. it should be subject to increase of the number of involved players and affected customers. For example the implementation of electronic transactions instead of manual to facilitate business process in Universities and also business model of 'deal of the day' in marketing coupon.

### Conclusion:

Extensive adoption of NFC as a basis for mobile payments requires collaboration throughout a particularly complicated ecosystem. However, extensive adoption of NFC has yet to emerge in the Malaysia. At the very least, it has been slower than many had anticipated especially with regard to large-scale commercial and consumer-facing implementations. Researchers and businesses are waiting for large-scale infrastructures to develop mass-market application to drive demand. Entrepreneurs, intrapreneurs, and innovators see opportunity in reimagining what is possible in an NFC ecosystem in Malaysia. Disagreements arose over which stakeholders in the ecosystem mobile operators, merchant, and / or credit card companies, service provider for example should profit from mobile payments applications in order to stabilize financial and technological factors in NFC ecosystem. For mobile commerce with NFC technology to take off, industry stakeholders must harmonize their effort in the same way that led up to proliferation of SMS and MMS technologies.

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