Near Field Communication (NFC) for Mobile Commerce and beyond
Why e-Wallet?

http://www.youtube.com/watch?v=yoPf98i8A0g
Agenda

• NFC History, evolution, and key players
• NFC technologies
• NFC Applications
• Myths, Hypes and Facts
• Resources for NFC
• Q & A
NFC Evolution

Prior to 2003: R&D by INSIDE Secure, Nokia, Sony & Philips

2004 - NFC Forum formed

2003 - NFC becomes approved ISO / IEC Standard

2007-2010 Technology specification developments

2007 GSMA body endorsement

2006 - Present Increasing NFC ecosystem

2010-2011 Mass rollout announcements

The NFC Forum

- Established in 2004
- Currently has >140 members across the NFC ecosystem
- Encourages and promotes development of products using NFC Forum specifications
- Develops standards-based NFC specifications and interoperability parameters

11/7/2011  NFC for Mobile Commerce & Beyond 4
Wireless Technologies

Data rate

- Wireless USB/Ultrawideband
- WiFi
- WiMax
- Bluetooth
- 3G
- NFC
- ZigBee
- GSM

Range

- 0.01m
- 0.1m
- 1m
- 10m
- 100m
- 1km
- 10km
Technologies Comparison

Compared to other wireless technologies such as Bluetooth or WiFi, NFC provides much lower bandwidth and range, but enables low-cost, un-powered targets and does not require discovery or pairing. Interactions can be initiated with just a tap.

NFC vs. RFID
• NFC is compatible with existing passive RFID (13.56 MHz ISO/IEC 18000-3) infrastructures. Unlike RFID, NFC is read/writable

NFC vs. ZigBee
• ZigBee requires greater than 1 sec setup time, supports only up to 250kbit/s, and no passive mode
NFC vs. Bluetooth

NFC vs. Bluetooth Range

NFC: less than 0.2 m  
Bluetooth: 10 m

NFC vs. Bluetooth Setup Time

NFC: Less than 0.1 seconds  
Bluetooth: 6 seconds

NFC vs. Bluetooth Data Speed

NFC: 424 kbits/sec  
Bluetooth: 2.1 mbits/sec

*Source: ISO, 2008
### NFC vs. Bluetooth

<table>
<thead>
<tr>
<th></th>
<th>NFC</th>
<th>Bluetooth</th>
<th>Bluetooth Low Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RFID compatible</strong></td>
<td>ISO 18000-3</td>
<td>active</td>
<td>active</td>
</tr>
<tr>
<td><strong>Standard body</strong></td>
<td>ISO/IEC</td>
<td>Bluetooth SIG</td>
<td>Bluetooth SIG</td>
</tr>
<tr>
<td><strong>Network Standard</strong></td>
<td>ISO 13157 etc.</td>
<td>IEEE 802.15.1</td>
<td>IEEE 802.15.1</td>
</tr>
<tr>
<td><strong>Network Type</strong></td>
<td>Point-to-point</td>
<td>WPAN</td>
<td>WPAN</td>
</tr>
<tr>
<td><strong>Cryptography</strong></td>
<td>not with RFID</td>
<td>available</td>
<td>available</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>&lt; 0.2 m</td>
<td>~10 m (class 2)</td>
<td>~100 m</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td>13.56 MHz</td>
<td>2.4–2.5 GHz</td>
<td>2.4–2.5 GHz</td>
</tr>
<tr>
<td><strong>Bit rate</strong></td>
<td>424 kbit/s</td>
<td>2.1 Mbit/s</td>
<td>~1.0 Mbit/s</td>
</tr>
<tr>
<td><strong>Set-up time</strong></td>
<td>&lt; 0.1 s</td>
<td>&lt; 6 s</td>
<td>&lt; 0.006 s</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td>&lt; 15mA (read)</td>
<td>varies with class</td>
<td>&lt; 15 mA (transmit or receive)</td>
</tr>
</tbody>
</table>
NFC Specifications

Wireless Short Range Communication Technology

– Based on RFID technology operates at 13.56 MHz
– Operating distance typical up to 10 cm
– Data exchange rate of 106, 212, 424 or 848 kbit/s
– ISO/IEC 18092 for Interface and Protocol
– ISO 14443-A and 14443-B for proximity card
– ISO 15693 for extending the distance of ISO 14443
NFC: Three Modes of Operation

Card Emulation Mode
Transactions:
- Mobile payment
- Ticketing
- Access control
- Transit
- Top-ups
- Toll-Gate

Peer-to-Peer Communication
Connectivity:
- Data transfer: Fast, easy & convenient device association, setup & configuration

Reader Mode
Service Discovery:
- Content distribution
- Information access
- Smart advertising
NFC Architecture

NFC Card Emulation Mode

Card Emulation
Smart Card Capability for Mobile Devices

Peer-to-Peer Mode

NFC Forum Protocol Bindings
IP, OBEX, ....

LLCP
Logical Link Link Protocol

Reader/Writer Mode

RTD
Record Type Definition
&
NDEF
Data Exchange Format

Tag type 1,2,3,4

Mode Switch

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
NFC Communications

Passive Communication Mode:
– The Initiator device provides a carrier field and the target device answers by modulating the existing field. In this mode, the Target device may draw its operating power from the Initiator-provided electromagnetic field, thus making the Target device a transponder.

POS as the Initiator

NFC phone as the Initiator
NFC Communications

Active Communication Mode:

- Both Initiator and Target device communicate by alternately generating their own fields. A device deactivates its RF field while it is waiting for data. In this mode, both devices typically have power supplies.
NFC Tag

The tag is a thin simple device containing antenna and small amount of memory. It is a passive device, powered by magnetic field. Depending on the tag type the memory can be read only, re-writable, and writable once.
NFC Tag Types

• **Passive NFC Forum Tags**
  – Type 1: Topaz™
  – Type 2: MIFARE Ultralight™
  – Type 3: Felica ™
  – Type 4: MIFARE Desfire™

• **Proprietary NFC Tags**
  – MIFARE Classic™ (support by Nexus S)
NFC Architecture & Secure Element

• Dynamic environment for programs and data

• Secure Element (SE) can be accessed through
  – Baseband Controller (internal)
  – RF Field (external)

• NFC Handsets Bridge the Gap
Requirements for a Secure Element

• Portability: If handset is changed applications need to be available on new phone again
• Security: Certified TTP (Payment Industry/EMVCo)
• Multi-application: each application provider has access to its own security domain in SE
• Remote Management: download of tickets or top-up OTA should be possible
Implementation of SE

• SIM Card
  – Business of/belongs to the Operator
  – SIM more expensive/but no “Card-Slot” needed
  – “NFC” SIMs can be used in “non-NFC” handsets

• Secure Memory Cards
  – Issuer: ?
  – Card Slot Required

• Additional Smartcard Chip (integrated in Handset)
  – Handset belongs to consumer
  – SmartCard Chip always in Handset
Multiple Applications on Card

Issuer Security Domain
- MNO
  - SIM/UMS Applet
  - Certificates for Smartposter
  - Roaming Tables

Applications Firewall
- 3rd Party Domain
  - Bank A
    - Prepaid Card Applet
    - Credit Card Applet
  - Application Firewall

- 3rd Party Domain
  - Merchant B
    - Tickets
    - Loyalty Points
    - Identification

Card Manager

OTA Link
NFC - Bridging the Physical and the Virtual Worlds
Many Mobile Applications with NFC

- Get information by touching smart posters
- Use your NFC phone as an event ticket
- Set up your wireless home office with a touch
- Print from your camera by holding it close to the printer
- Share business cards with a touch
- Get on the bus by waving your NFC phone
- Pay for goods with a tap of your NFC phone
Latest Sample of NFC Applications

- Wallets launching
- Transit: Not Just Pilots
- Room key for home, office and hotels
- Single Top Location Based
- Peer 2 Peer Social Networking
- Creative Gaming Use Cases
New NFC Applications

Anti-Counterfeiting
Food, Pharmaceuticals, Consumer Products

M to M
Personalized PC, TV and other devices
NFC Symbols – Needs to be unified

Official symbol for NFC by NFC Forum

Un-Official symbol for NFC
Why many companies’ focus is on mobile commerce?
High Growth in Mobile Commerce

World e-commerce sales in 2009

- $1.2 billion via mobile
- $210 billion online

Stores with mobile-specific websites

- 51% of smartphone users are more likely to purchase from retailers with a mobile-specific website: however, only...

Predicted 2015 world e-commerce sales

- $119 billion via mobile
- $1.4 trillion online

Groupon

- 50% of Groupon’s business is expected from mobile in the next two years
Retail 2.0 is already on the way...

• 90% of the overall installed handset base will be smartphones by 2014*
• 70% of shoppers use smartphone while shopping in-store**
• 74% of smartphone shoppers made a purchase as a result of using smartphone**
• The smartphone is becoming the platform for shopping experience AND a unique opportunity for retailers to engage with customers in the store

*A New Age of Mobile Services, Gartner Inc., (Oct. 29, 2010)
** The mobile movement study (April 2011)
Mobile Wallet with NFC
Myths, Hypes and Facts
Myth #1 - NFC phones are not secure for mobile payment

• NFC phones with Secure Element offer much more security with pin, tokens etc., as compared to magnetic stripe or contactless credit cards

• Contactless transit cards are based on NFC technologies and have been in used for many years without major security issues
Myth #2 - Not enough POS terminals

• Over 1 million contactless POS terminals will be installed in 2011 globally*
• 15% of top 150 US Merchants are equipped with Contactless POS terminals*
• Visa and Mastercard have issued statement to shift card fraud risks to the merchants who do not upgrade their POS by Oct. 2015
• By 2016, 85% of POS terminals will support contactless payment**

* Source: Vivotech, Apr. 2011
** Source: ABI Research, Aug. 2011
Myths #3 - Not enough NFC phones

• Less than 40 million NFC handsets in 2011*
• Smartphones are expected to represent 44% of all mobile handset shipments by 2014**
• 31% of all mobile phones or 580 million NFC handsets in 2015***
• 630 million handsets, representing 40% of all mobile phones shipped, will come with NFC in 2015****

* NFC Times
** Gartner
*** iSupply Aug. 2011
**** Informa Telecoms & Media
Hypes – explosive growth in NFC phones

• Initial forecast of 90 million smartphones in 2011 with NFC is now reduced to around 40 million units

• Rumors of Apple iPhone 5 with NFC which turned out to be iPhone 4S with no NFC

• Many other choices for mobile payment that don’t need NFC phones
  – M-Pesa in Kenya is based on SMS
  – 90+% of residents of Hong Kong uses Octopus contactless cards for transit and payments daily

***Source: iSupply Aug. 2011***
Fact #1 – Large number of NFC patents
Facts 2 – Patents dominated by larger players
Fact #3 - NFC will be in many devices
Fact #4 – Growing number of places supporting NFC Payment

NFC Resources

http://www.meetup.com/NFC-App-Dev-Silicon-Valley
http://www.nearfieldcommunication.com
http://www.open-nfc.org
http://developer.sprint.com/dynamicContent/nfc/
http://www.nfc-forum.org
http://en.wikipedia.org/wiki/Near_field_communication
Q & A

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