NFC
Near Field Communication

– Easy to use wireless communication interface for the last few centimeters
– Easy to use target selection, by simply holding two devices close to each other

NFC is as easy as...

... a touch
Near Field Communication

• Wireless short range communication technology
  – NFC is designed for short distance wireless communication
  – Allows intuitive initialization of wireless networks
  – NFC is complementary to Bluetooth and 802.11 with their long distance capabilities
  – NFC also works in dirty environment
  – NFC does not require line of sight
  – Easy and simple connection method
  – Provides communication method to non-self powered devices
NFC - Technical Basics

- Wireless Short Range Communication Technology
  - Based on RFID technology at 13.56 MHz
  - Operating distance typical up to 10 cm
  - Compatible with today’s field proven contactless RFID technology
  - Low bandwidth: data rate today up to 424 kilobits/s
NFC – Technical Basics (Cont.)

• It’s a contactless card and a contactless reader in one chip

• Applications aimed for are
  – Ticketing
  – Payment
  – Device Pairing

Short Range
13,56MHz
RF Link
Near Field Communication Applications

- Smart Key
  - for mobile local payment

- Peer to Peer communication, Virtual Connector
  - either directly or by establishing wireless links

- Low cost solution to distribute info / services
  - e.g. by passive loops embedded in paper media

NFC enables a unique blend of valued applications
Differences from other wireless technologies

• **Bluetooth:** Although both Bluetooth and NFC can be used to transfer data, Bluetooth has been designed to transfer data over much greater distances. NFC is designed to be close proximity only.

• **Wi-Fi / IEEE 802.11:** Wi-Fi is designed for local area networks, and is not a short range peer to peer technology.

• **RFID:** Although RFID is very similar to NFC in many respects, RFID is a much broader technology. NFC is a specific case which is defined by standards enabling it to be interoperable.
Two Operation modes

• There are dedicated roles
  – **Initiator** and **Target**
  – Any data transfer is a message and reply pair.

  ![Diagram showing Initiator and Target with Message and Reply arrows]

• There are dedicated modes of operation
  – **Active** and **Passive**
  – Active means the device generates an RF field
  – Passive means the device uses the RF field generated by the other device
Three communication modes

• **Read / Write:**
  – allows applications to transfer data in an NFC Forum-defined message format
  – not secure
  – supported the Contactless Communication API

• **NFC card emulation:**
  – enables the NFC device to behave as a standard Smartcard
  – data transfer is secure
  – supported by the Contactless Communication API.

• **Peer to peer:**
  – device to device link-level communication
  – not supported by the Contactless Communication API.
## More details

<table>
<thead>
<tr>
<th></th>
<th>Active</th>
<th>Passive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initiator</strong></td>
<td>Possible</td>
<td>Not Possible</td>
</tr>
<tr>
<td><strong>Target</strong></td>
<td>Possible</td>
<td>Possible</td>
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<table>
<thead>
<tr>
<th>Baud Rate</th>
<th>Active</th>
<th>Passive</th>
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<tbody>
<tr>
<td>106 kBaud</td>
<td>Modified Miller, 100% ASK</td>
<td>Manchester, 10% ASK</td>
</tr>
<tr>
<td>212 kBaud</td>
<td>Manchester, 10% ASK</td>
<td>Manchester, 10% ASK</td>
</tr>
<tr>
<td>424 kBaud</td>
<td>Manchester, 10% ASK</td>
<td>Manchester, 10% ASK</td>
</tr>
</tbody>
</table>
Manchester coding

Manchester Coding, 10% ASK

Low -> high: 0
High -> low: 1
Modified Miller coding
NFC Security

• Eavesdropping
  – No protection
    • Use a Secure Channel

• Data Modification
  – No protection
    • Use Secure Channel

• Replay attacks
  – No protection

• Man in the Middle Attack
Man in the Middle Attack

Man-in-the-Middle

Alice

Bob

Eve
Man in the Middle Attack

- Alice
- Bob
- Eve

Message

Man-in-the-Middle

Contents
Man in the Middle Attack

Message

Alice

Bob

Eavesdropping

Eve
Man in the Middle Attack

- Alice
- Bob
- Eve

Man-in-the-Middle

Message

Disturb

Eavesdropping

Contents
Man in the Middle Attack

Alice detects the disturbance and stops the protocol
• Check for active disturbances!
Man in the Middle Attack

Man-in-the-Middle

Alice

Bob

Eve

Message

Contents
Man in the Middle Attack

Eve cannot send to Bob, while RF field of Alice is on!
• Use Active – Passive connection!
• Use 106 kBaud!
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  – Protection