Near Field Communication for Handset-Based Ticketing in Public Transportation

Thesis work Presentation
06.02.2007

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Agenda

• Basics of Near Field Communication
  • What is it?
• NFC-enabled mobile phones
  • What devices are available?
  • How can NFC be used?
  • How can it be used in public transportation?
• How does NFC-enabled mobiles change the existing public transportation ticketing landscape?
  • Benefits of NFC ticketing
• Over the Air (OTA) Ticket Purchase
  • Would this increase the ticket costs?
• Conclusions
Basics of Near Field Communication

What is it?

• NFC is based on Radio Frequency Identification (RFID)
  • Communication distance is limited to only few centimeters
  • Two way communication
  • New use cases (e.g. contactless smart cards)

• NFC is not a proprietary technology
  • Standardization is done in NFC-Forum which has today more than 100 members including handset manufacturers, semiconductor vendors, operators, CC companies, banks etc.
  • Communication is based on ISO14443

• NFC is not only used with mobiles (but in this Thesis I have concentrated on NFC enabled phones)
**NFC-enabled mobile phones**

**What devices are available?**

- Nokia is a clear leader, but also other manufacturers are active
  - So far two commercial products that contain also the secure chips has been announced

Nokia 3220 with the Nokia NFCshell for p&;t
(used as the reference product in this Thesis)

Nokia 6131NFC, Announced 01/07
(not included in this Thesis)
NFC enabled mobile phones

What is a secure chip?

• Mobile phones memory is not safe enough for storing business critical applications like credit and/or traveler cards

• These applications are stored on a separate chip
  • High-security multi-application smart card
  • Encryption handled by the chip itself

• The chip can be located in several places
  • Embed it into the phone (Non transferable)
  • Include it in a SIM card (standardization missing)
  • Include it in a removable flash card (standardization missing)
NFC enabled mobile phones

How can NFC be used?

• Examples of NFC mobile use cases
  • Turn the phone into a contactless credit card
  • Use the phone as a contactless traveler card
  • Easy access to services by reading shortcuts from RFID tags
  • Share and get information by touching
  • Pair devices (e.g. Bluetooth, Wi-Fi)
**NFC-enabled mobile phones**

**How can NFC be used in public transportation?**

- Contactless traveler card systems are built around the world
  - Mifare-based ticketing is the most common card type used
    - NXP proprietary technology, based on ISO14443
    - Currently in use e.g. in London, Moscow, Belfast, Tampere…
- Phones announced so far have a secure chip that can emulate Mifare 1k or 4k cards
  - Phones are interoperable with the existing ticket infrastructures
- Mobile phones screen, key pad & connectivity features can be used to develop new innovative and more user friendly services
  - Check the ticket validity or amount of money left from the phone screen
  - Buy new tickets or top-up new value Over the Air (OTA)
How does NFC enabled mobiles change the existing public transportation ticketing landscape?

- Currently most of the tickets are “charged” at physical locations (kiosks, vending machines, service points) by using “physical currency” (cash, credit / debit cards)
- The OTA ticket delivery needs new stakeholders
  - OTA ticket purchase service providers
    - Public transportation companies rarely develop their own ticketing systems
    - Develop and run a service for enabling OTA ticket purchase
    - Connections to the different payment providers
  - Banks / CC companies to enable real time electronic payments
  - Mobile operators to “host” the secure element
    - Act as the “owner” of the secure element
      - Manage the use of the secure chip
    - Trusted third parties e.g. to enable secure access key handling
      - Offer secure application installation services
      - Additional trust
- Who suffers?
  - Kiosks, plastic traveler card manufacturers
Over the Air (OTA) ticket purchase

1. Update request
2. Credit Check Confirmation
3. Ticket update
4. Payment approval
5. Payment
How does NFC-enabled mobiles change the existing public transportation ticketing landscape?

Benefits of NFC ticketing (1/2)

• Public transportation companies
  • The “first generation mobile tickets” (mainly SMS based) has shown that people like to use the mobile phone as a ticket
    • So far almost 10M SMS tickets have been sold in the Helsinki region
  • Increase ticket sales by offering more user friendly ticketing
  • Decrease the amount of people traveling without a ticket

What would have been the alternative for a SMS ticket?
How does NFC enabled mobiles change the existing public transportation ticketing landscape?

Benefits of NFC ticketing (2/2)

• Mobile operators
  • New business potential
  • Increase the mobile data usage

• Banks & CC companies
  • Increase the amount of processed payments

• OTA service providers & trusted 3rd parties
  • New business potential

• Users
  • New services
  • Ease of use
Over the Air (OTA) ticket purchase
Will this increase the ticket costs?

• Phone replaces the plastic cards
  • Saved money can be used to pay the operator “hosting fee”
• The amount of kiosk & vending machine sales decreases and the total amount of sold tickets increases
  • Saved service fees & part of the increased money flow can be used to pay the OTA Service provider and payment provider fees
Conclusions

• Mobile phone based ticketing is here to stay
• NFC enabled mobiles based will make it possible to develop new innovative ticketing solutions
• Although the amount of stakeholders increases and the business model is more complex, NFC based ticketing does not increase the overall ticketing costs
• It will still take some time until NFC becomes widely adopted
  • Most likely until the NFC-SIM card standardization has been completed
Thank you!

Questions? Comments?