



Current Issues in Near Field Communication Technology

Dr. Vedat Coskun & Kerem Ok

www.NFCLab.com

ISIK University, Istanbul

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Outline

- Introduction to Near Field Communication (NFC)
- NFC Applications
- NFC Operating Modes
- Conclusion

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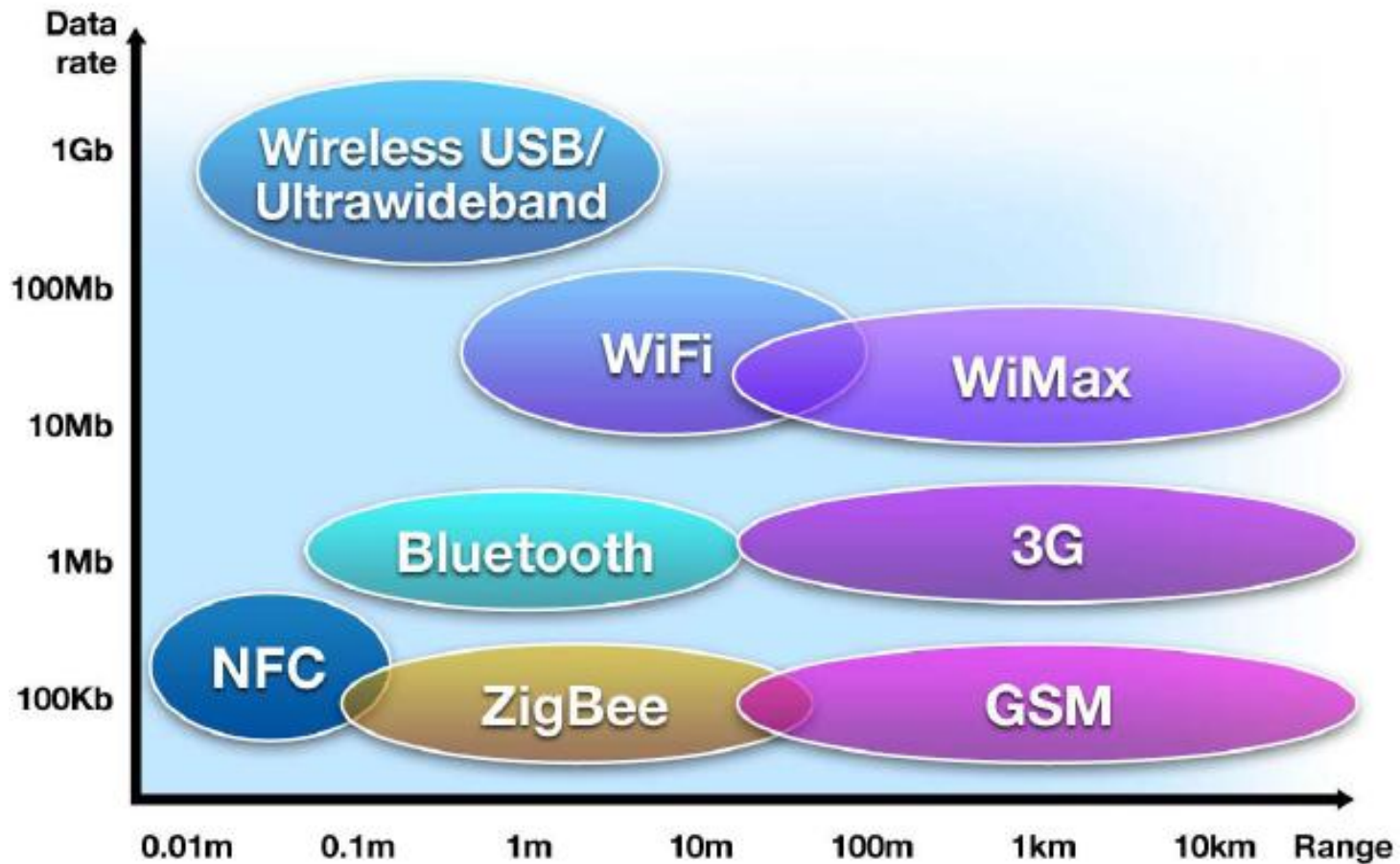
Mobile Technologies

- Mobile phones are today's easy to use and comfortable communication equipments
- Nearly all people owns a mobile phone
- Benefits of mobile phones and mobile communication technologies
 - Provides easy communication
 - Mobility
 - Help users to operate daily functions such as e-mails on the go, navigation etc.
- An essential device for our lives for current decades

Near Field Communication

- Developed by Sony and Philips in late 2002
- Evolved from Radio Frequency Identification (RFID) technology
- Short Range Radio Communication Technology
- Frequency: 13.56 MHz.
- Max. Bandwidth: 424Kbits/sec
- Communication starts when two NFC-compatible devices brought together less than four centimeters
- NFC Forum is the leading organization that organizes the efforts
- By 2011 NFC-enabled mobile phones are expected to reach 500 million worldwide

NFC - Data Rate



Advantages of NFC Technology

- NFC technology can benefit from mobile phones
- The technology is compatible with existing RFID structures, existing RFID tags and contactless smart cards
- Encoupling
- Short range communication (4 centimeters)
 - Automatic coupling
 - Inherent security
- Ease of use (Very familiar to people, only touch)
- Mobile phones can be used both as an information storage devices or an NFC reader.
 - They can read information from NFC tags
 - They can be used as a digital storage e.g. storing credit card information.

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Information Gathering*



* Peter Preuss, NFC Forum and NFC Use Cases presentation, <http://www.nfc-forum.org/>

NFC Ticketing*



* Peter Preuss, NFC Forum and NFC Use Cases presentation, <http://www.nfc-forum.org/>

NFC Payment*

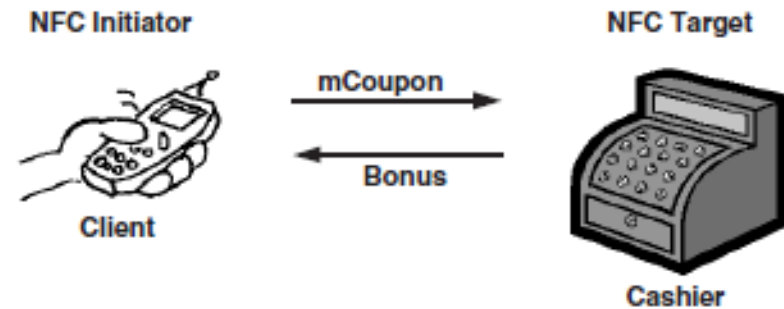


* Peter Preuss, NFC Forum and NFC Use Cases presentation, <http://www.nfc-forum.org/>

Mobile Coupons*

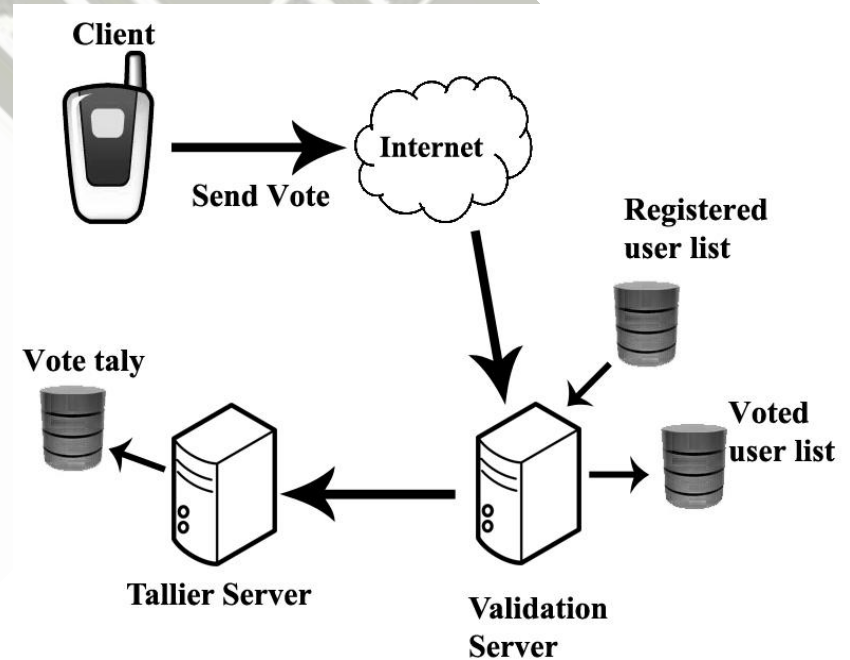
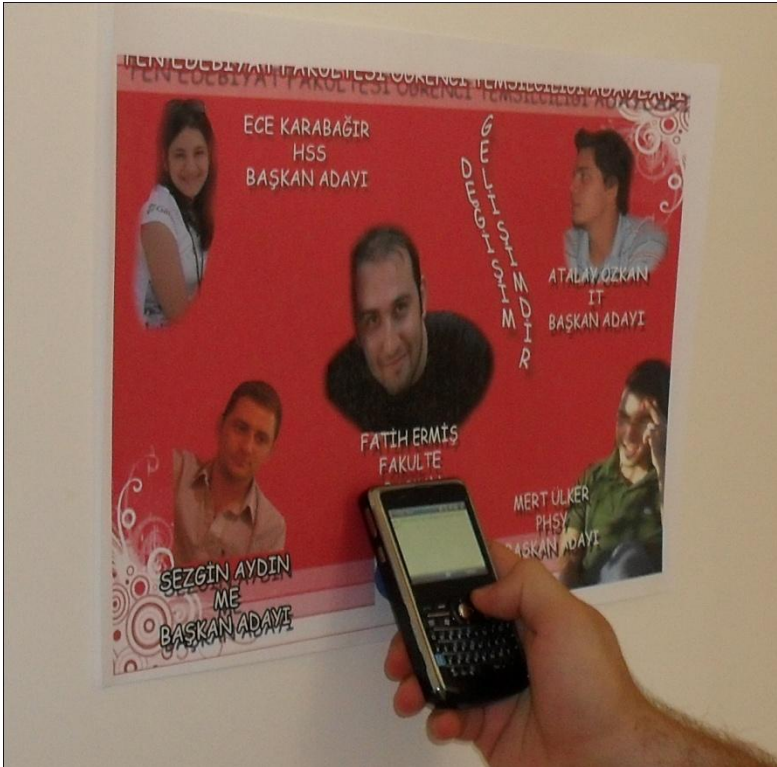


Figure 1. Issuing an mCoupon



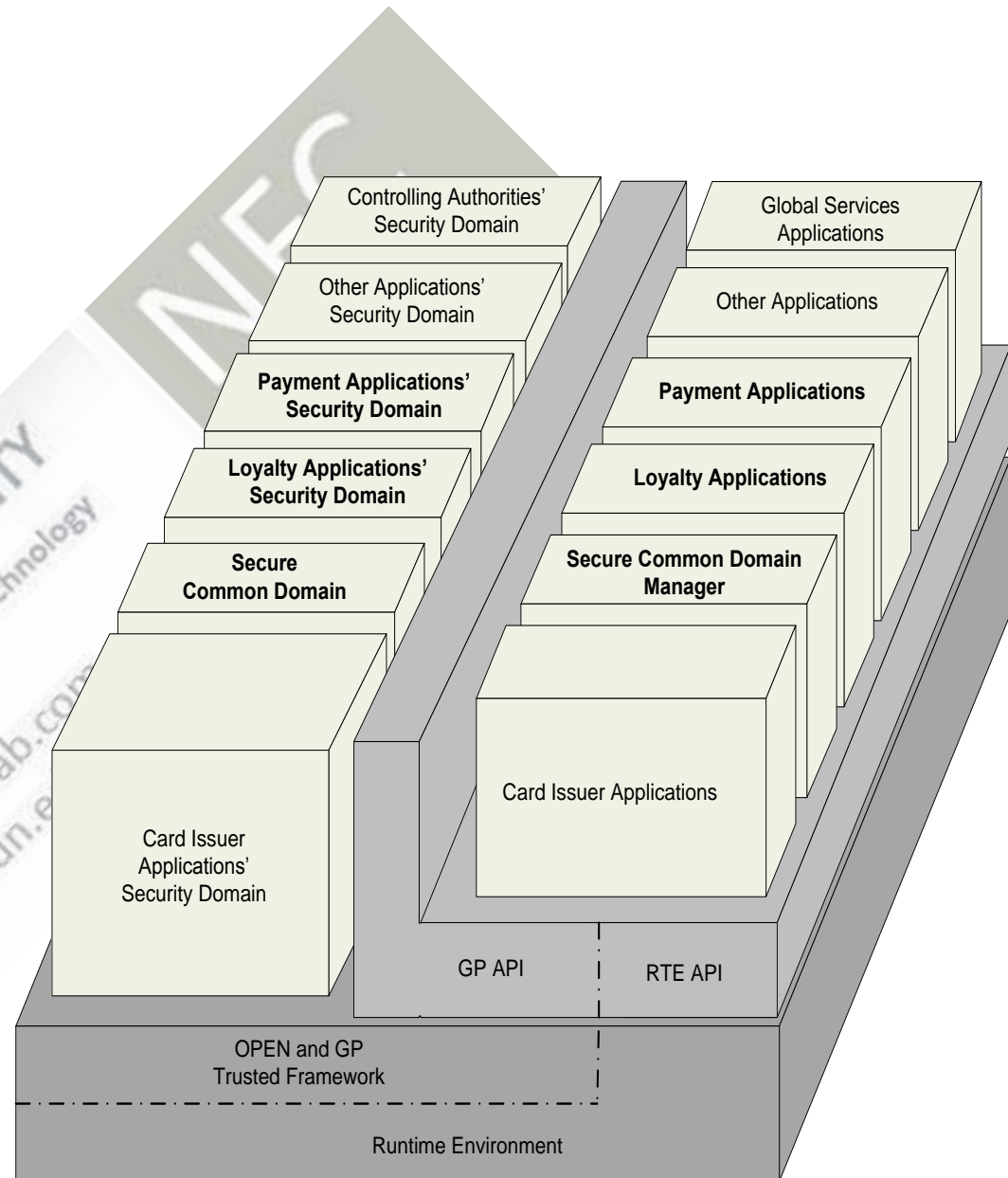
* S. Dominikus, M. Aigner, mCoupons: An Application for Near Field Communication (NFC), *Proc. 21st International Conf. on Advanced Networking and Applications Workshops/Symposia*, Niagara Falls, CANADA, 2007, 421-428.

NFC Voting*



* Ok K., Coskun V., Aydin M. N.; Usability of Mobile Voting with NFC Technology, Proc. of the PUBLICATIONS IASTED International Conf. on Software Engineering, Innsbruck, AUSTRIA, 16-18 February 2010, pp. 151-158.

NFC Loyal*



* Ozdenizci, B., Coskun V., Aydin M. N., Ok K.;
NFC Loyal A Beneficial Model to Promote
Loyalty on Smart Cards of Mobile Devices,
ICITST 2010, London, UK, 8-11 November
2010

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Active vs. Passive Device

- Devices containing power sources are called as active; In NFC model active device options are:
 - Mobile phone
 - NFC reader
- Devices without any available power sources are called as passive; In NFC model there exists only one passive device:
 - RFID tag

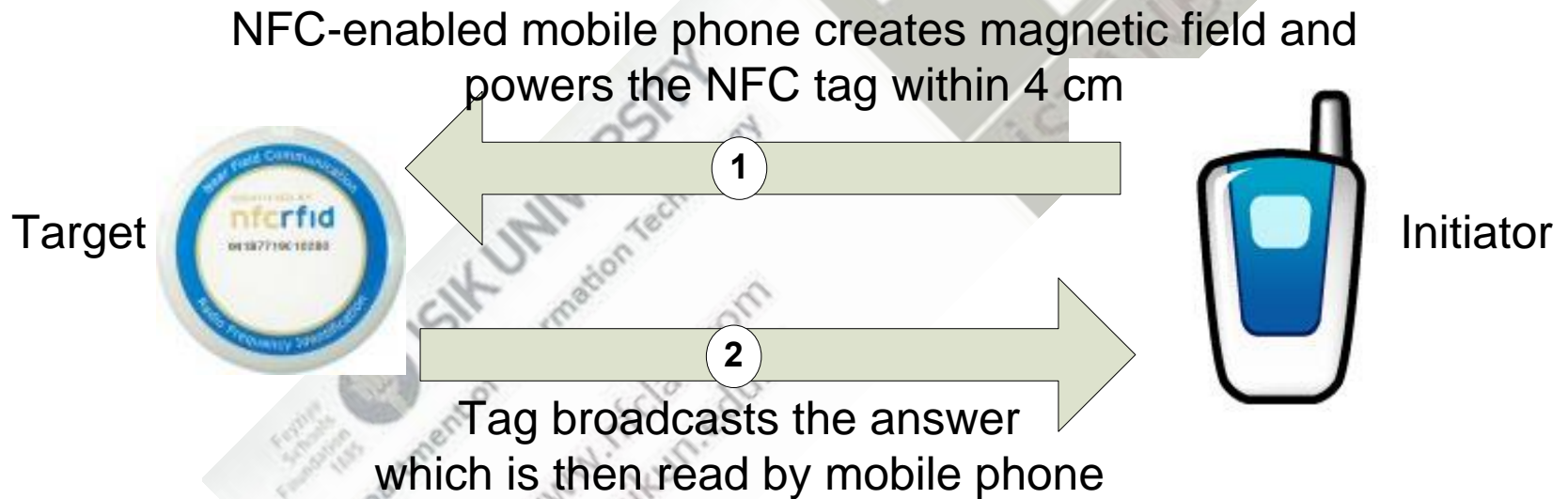
NFC Model

- In an NFC model two devices are involved in the communication
- **Initiator:**
 - Initiator starts the communication
 - Can be either a mobile phone or an NFC reader both of which are active devices
- **Target:**
 - Responds the initiator's requests
 - Can be either a RFID tag or a mobile phone
- Single RF band is used; communication is half-duplex

NFC Operating Modes

- NFC has three operating modes as defined by NFC forum:
 - **Reader/Writer mode**
 - **Card Emulation Mode**
 - **Peer-to-Peer mode**

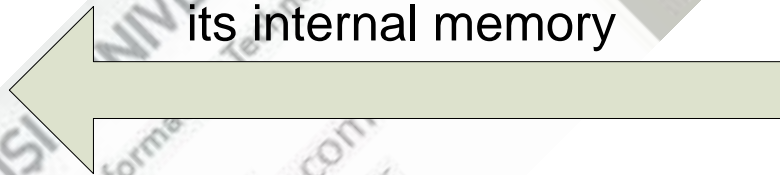
Reader Mode



Writer Mode

NFC-enabled mobile phone
sends a query which also
creates magnetic field and
powers the NFC tag in 4 cm.
NFC tag then saves the data to
its internal memory

Target



Initiator

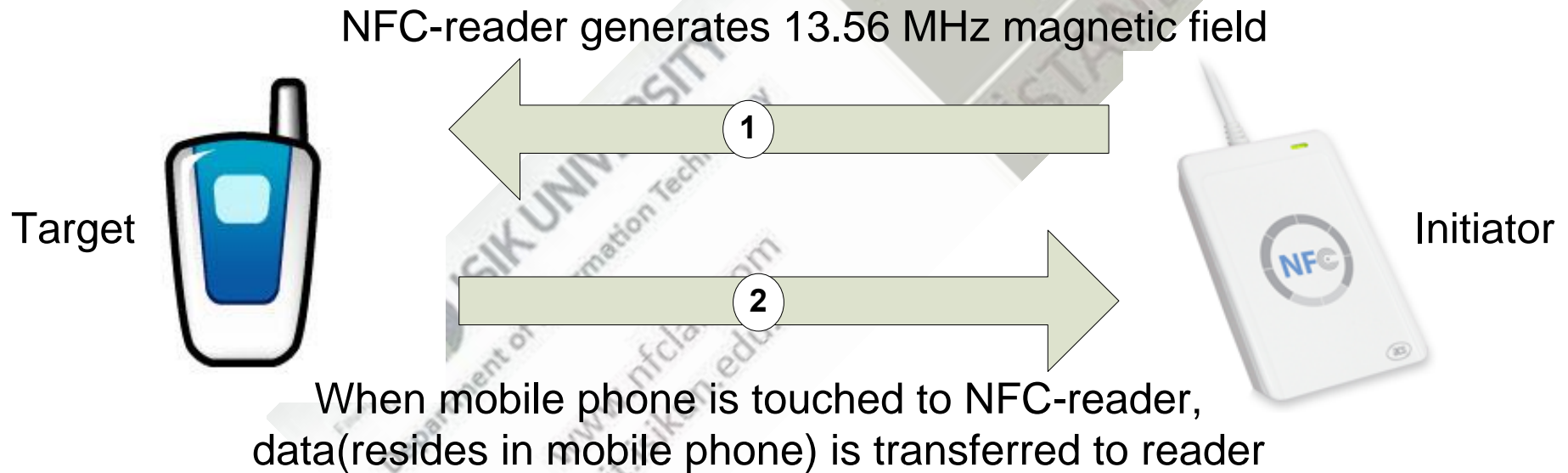
Reader/Writer Mode

- NFC phones can read and write data from/to NFC tags and smart cards
- **Initiator:** NFC-enabled mobile phone
- **Target:** Passive tag
- Passive tag does not need any source of power.
- Active NFC device creates magnetic inductive coupling and transfers energy to smart card. After the smart card is powered, communication starts.
- Applications
 - Information gathering
 - NFC Voting

Reader/Writer Mode

- Our review on previous work on reader/writer mode highlighted these benefits
 - It increases mobility (information gathering)
 - Decreases physical effort (home shopping)
 - Ability to be adapted by many scenarios
 - Easy to implement
- Future Scenarios
 - It is found that many real-life scenarios can be adapted to NFC in this mode.

Card Emulation Mode



Card Emulation Mode

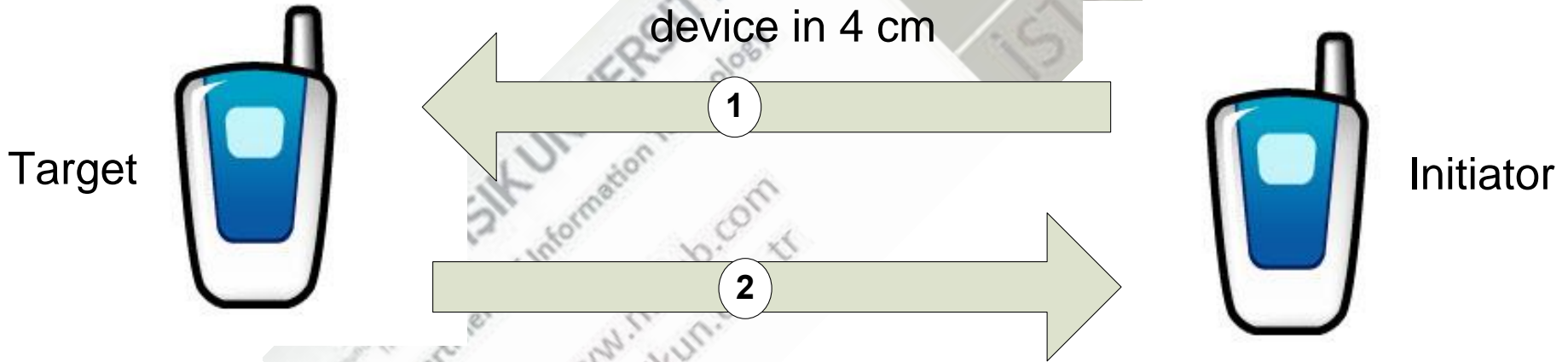
- Most commercial application uses this mode
- NFC phone acts as an RFID card and NFC readers can read data from it.
- **Initiator:** NFC reader (immobile)
- **Target:** NFC-enabled mobile phone
- Sample applications
 - Payment
 - Ticketing

Card Emulation Mode

- Our review on card emulation mode highlights these benefits
 - Physical Object Elimination (Credit cards, debit cards, paper-based tickets, physical keys)
 - Access Control (Authentication through mobile id)
- Future Scenarios
 - Integration of id-cards, passports, finger-prints, driver-license into mobile phones
 - Storage area for critical information to provide user's privacy and authorizing people to access those information (e.g. health information)

Peer-to-Peer Mode

Initiator sends or requests data from target device in 4 cm



Target responds requests of initiator

Peer to Peer Mode

- Two NFC phones can exchange data at link-level.
- **Initiator:** NFC-enabled mobile phone
- **Target:** NFC-enabled mobile phone
- Applications
 - Money transfer
- Our review on previous work on this mode showed that there is not so much work done. Following benefits are highlighted
 - Easy data exchange between devices
 - Device pairing
- Future Scenarios
 - Secure exchange of critical data
 - Gossiping

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Conclusion of NFC

- NFC is an integration of RFID technology with mobile phones.
- Connectivity distance is 4-5 centimeters and it brings inherent security
- NFC has three operating modes; Reader/Writer, Card Emulation and Peer-to-Peer. All of the modes have different usage areas and provides different benefits.
- Integration of NFC technology with mobile phones which consists of mobility, relatively high processing power, Internet access ability etc. has a great potential to bring new opportunities to our lives.



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NFC Lab - ISTANBUL is one of the leading NFC focused research labs in Europe.

NFC Lab - ISTANBUL considers Near Field Communication as an emerging technology that transforms innovative ideas into reality for Future Information and Communication Society.

NFC Lab - ISTANBUL strives for research excellence in focused research areas relevant to NFC. The Lab is aimed to be a catalyst in achieving substantial progress with involvement of key players including MNO, Financial Institutes, Government Agencies, other Research Institutes, Trusted Third Party, other Service Providers.

NFC Lab - ISTANBUL embodies a core team and a network of business and academic partners.

We are committed to work on NFC technologies with multidisciplinary network of expertise all around the world. The core team is accountable for creating and maintaining the business and academic partnerships and dynamically generates networks on project basis.

Featured News



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Vedat Coskun from NFCLab is currently presenting "NFC Loyal" research paper in London, UK in November 8, 2010 ...[read more](#)



Kerem Ok from NFCLab presented "Current Benefits and Future Directions of NFC Services" research paper in Cairo, EGYPT in November 4, 2010 ...[read more](#)



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