



NFC is the double click in the internet of the things

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Content

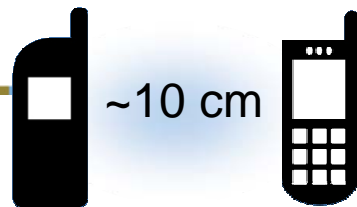
- ▶ NFC Introduction
- ▶ NFC Technology Review
- ▶ How NFC differs
- ▶ NFC System Architecture in mobile phones
- ▶ Standardization
- ▶ Summary and Outlook

The slide features a vibrant yellow background. On the left side, there is a vertical light blue bar. Two olive green triangular shapes are positioned on the left, one pointing towards the top and one pointing towards the bottom, meeting at a point on the blue bar. The text 'NFC Introduction' is centered in the yellow area.

NFC Introduction

NFC Technology

- ▶ Wireless short-range communication technology
 - Operates in the unregulated 13.56-MHz RF band
 - Operating distance typical 4 inches
 - Set-up time < 0.1s
 - No login, i.e. PIN
 - No device selection
 - Half-duplex ('Listen before talk')
 - Data exchange rates: 106, 212, 424 kbit/s
- ▶ Compatible with existing ID infrastructures
 - Contact-less smart cards ISO14443
 - Mifare
 - FeliCa



NFC: Target markets/Segments



Mobile phones



Computing

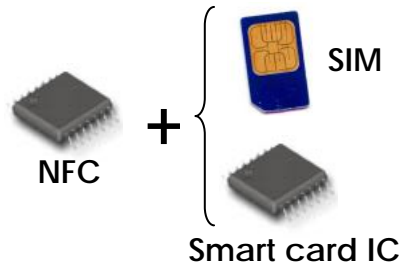


Consumer electronics

Infrastructure



Main NFC Application Categories



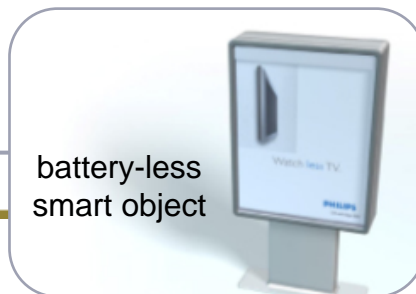
SECURE 



Card emulation
Mobile payment & Transaction



Peer-to-Peer communication
Data transfer



Reader & Writer mode
Information access

Timeline of NFC evolution: next steps

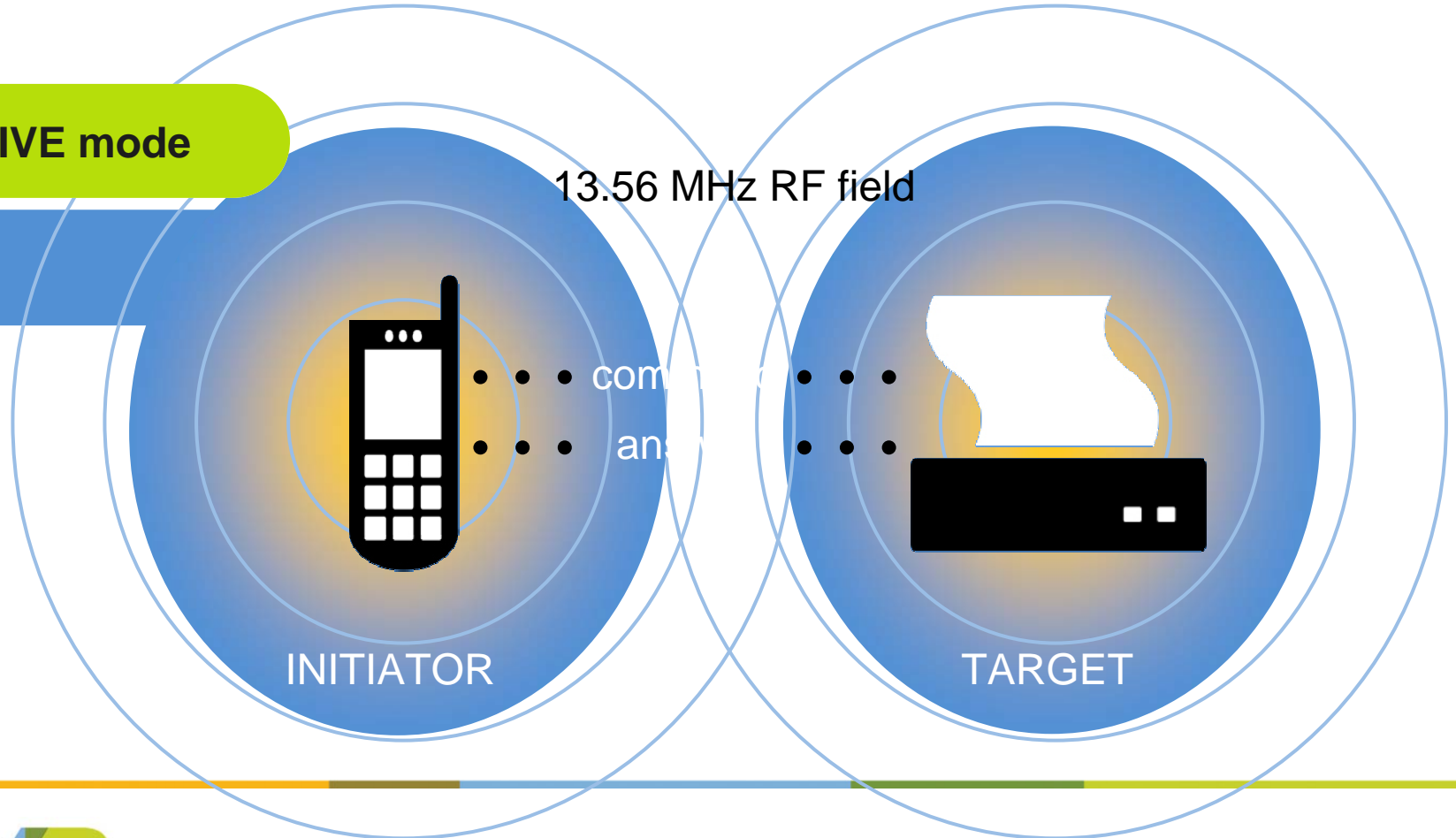
2002	Philips and Sony invent NFC
2004	NFC Forum established
2005	Field trials become prominent
2005	Commercial phone available
2006	NFC Forum reaches 70+ members in February
2006	Commercial roll outs expected in at least two regions
2007	NFC specification on most high-medium end phones
2010	NFC in 50% of phones (ABI Research)

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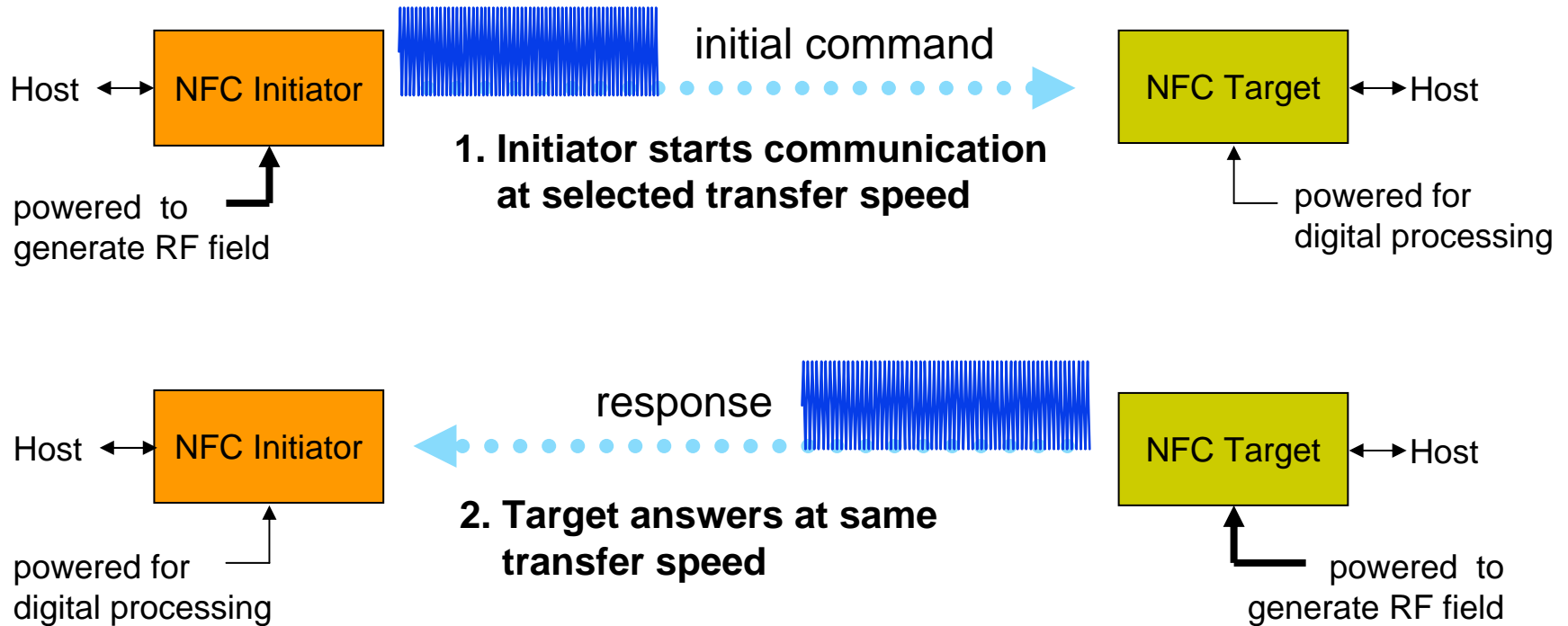
NFC technology review

NFC Communication Modes

ACTIVE mode



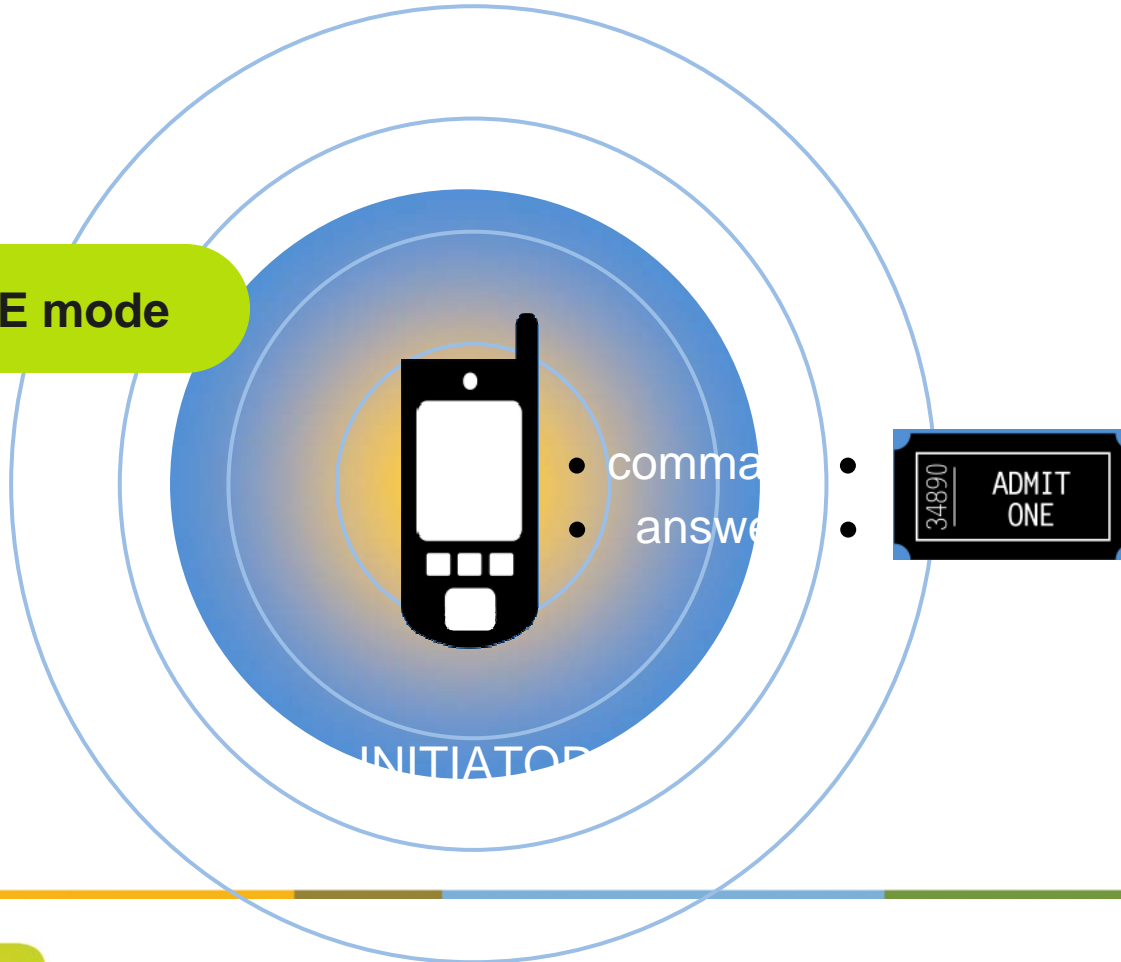
Active mode (106 / 212 / 424 kbit/s)



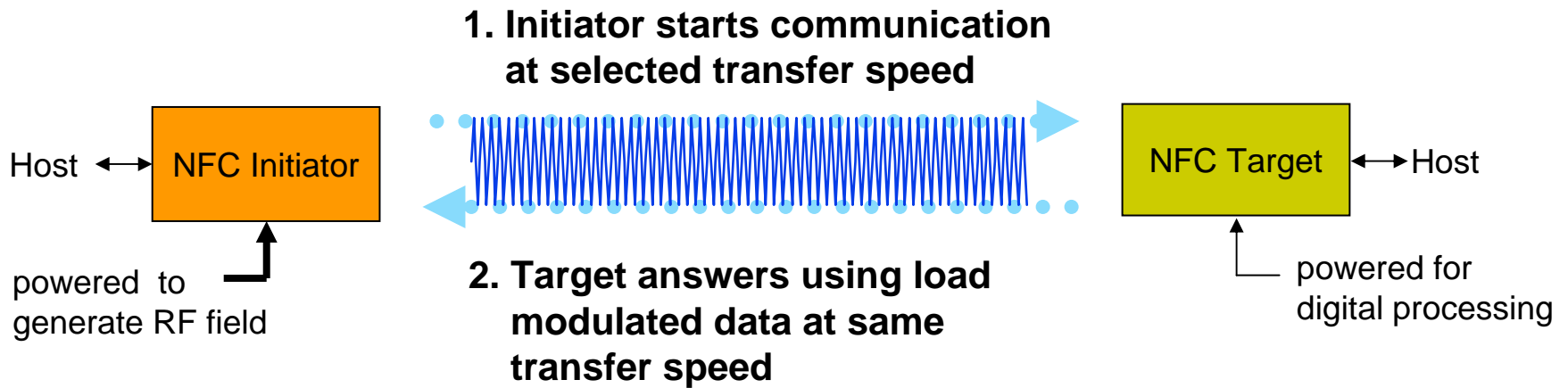
NFC Communication Modes

Low Power / No Power

PASSIVE mode



Passive mode (106 / 212 / 424 kbit/s)





How NFC differs

NFC

Comparison with Bluetooth and IrDa

	NFC	NFC Benefits	Bluetooth	IrDa
Network Type	peer-to-peer	Easy set-up and pairing easy to use	Point-to-multipoint	peer-to-peer
Range	Touch paradigm Up to 0.1 m	Safe, suitable for crowded areas	Up to 10 m	Accurate pointing Up to 1 m
Speed	Up to 424 kbps	Lightweight and low overhead	721 kbps	115 kbps
Set-up time	< 0.1 s	Fast transactions, e.g. for public transport	6 s	0.5 s
Security	yes, hardware in combination with secure IC	Flexible architectures possible	yes, software	no
Communication modes	active-active active-passive	Card-emulation, peer-to-peer, and reader modes	active-active	active-active
Infrastructure	yes, contactless ticketing, e-payment Works with MIFARE; Felica	Low roll-out costs, compatible with existing infrastructure	yes, mobile phones, CE	yes, CE & PCs & mobile phones
Costs	Low	Affordable for most devices	Moderate	Low

NFC

Comparison with RF-ID

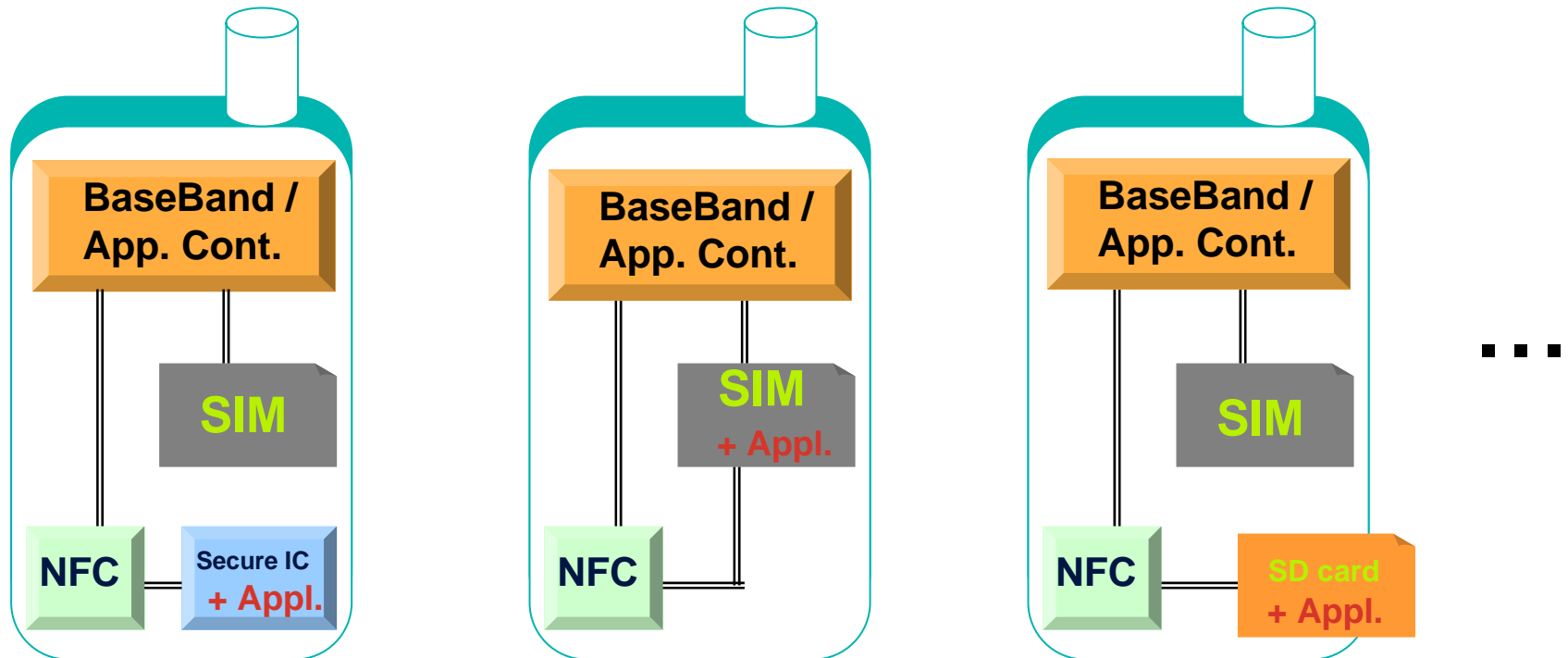
	NFC	RFID
Purpose	Easy-to-use contactless interface for consumer electronics, communication and computing devices	Primarily, RFID is used to identify and track objects by storing / reading small amounts of data Supply chain and asset management applications
Operating Distance	Up to 0.1 m With a range of about 10cm, NFC devices only communicate if they are intentionally brought close together	Many RFID systems operate at 50 - 100 cm or more, and often without special positioning of the transponder towards the reader
Processor	NFC-enabled devices are usually 'smart', e.g. they have a microprocessor on board	Transponder has only a read-only or read / write memory, but no microprocessor or calculation unit
Security	yes, hardware in combination with secure card IC Secure NFC uses the secure hardware and advanced encryption technology of smart cards to safeguard, manage, store and provide access to data, and to perform complex functions such as encryption or protection from hacking	Access to data on the RFID chip works with or without passwords, or with simple encryption
Communication modes	active-active active-passive	An active reader / writer talks to one or more transponders
Standards	Compliant to ISO 18092, ISO 21481 and future NFC Forum specifications	Compliant to RFID standards

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NFC System Architectures

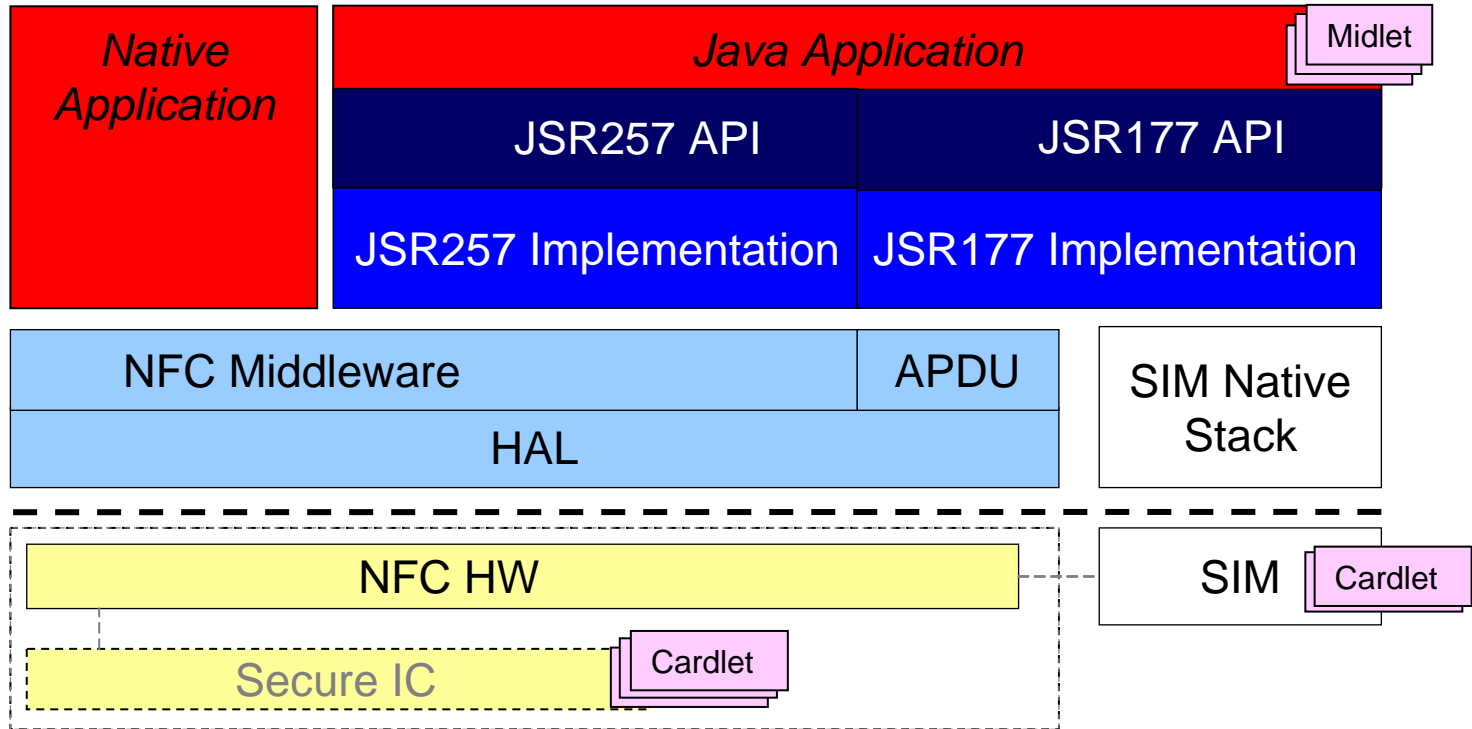
NFC & security

System partitioning in mobile phones



- non removable smart card IC (functional cover, phone PCB,...)
- SIM (Subscriber Identifying Module)
- SIM card + separate smart card IC ...

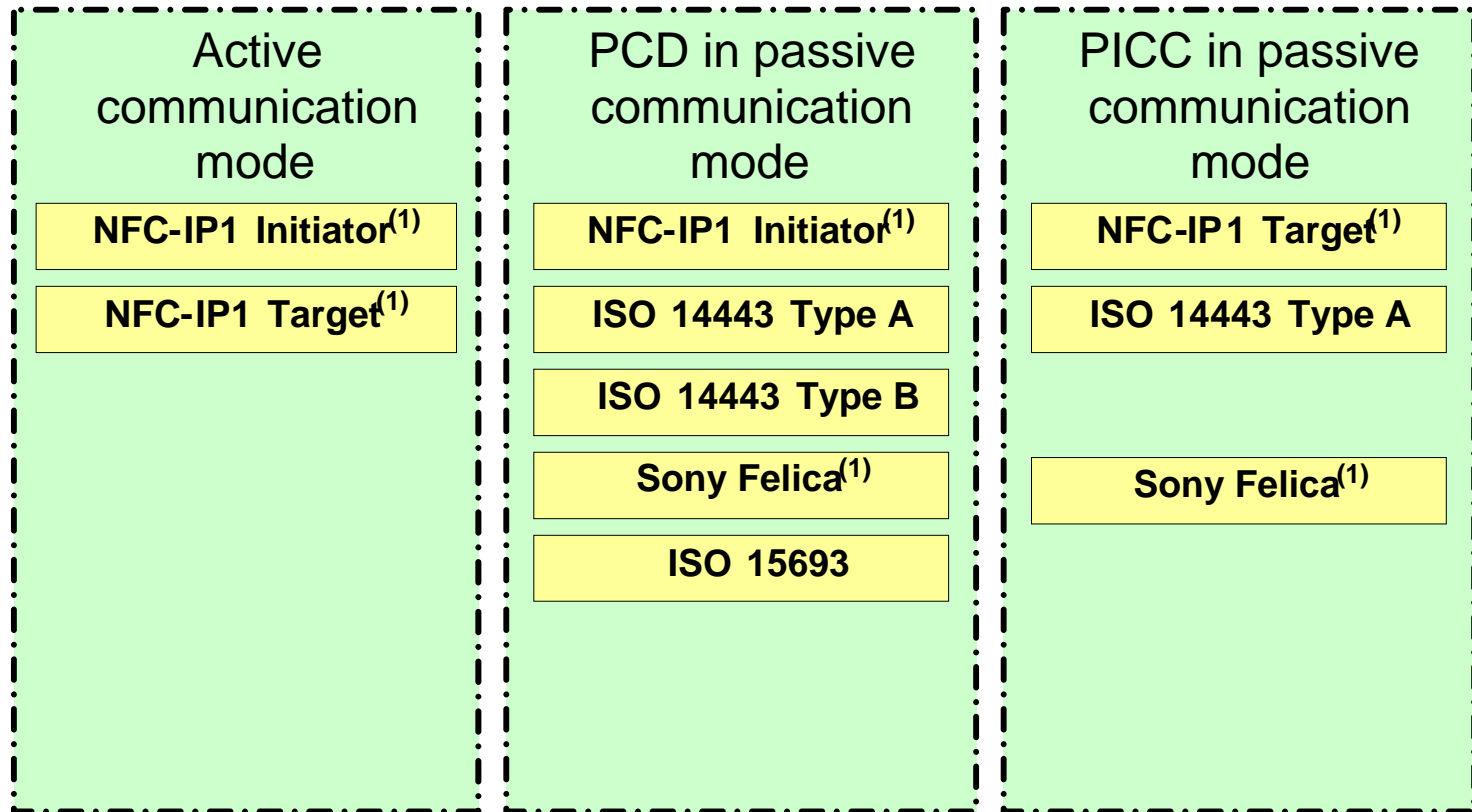
NFC Integration in Mobile phone Platform





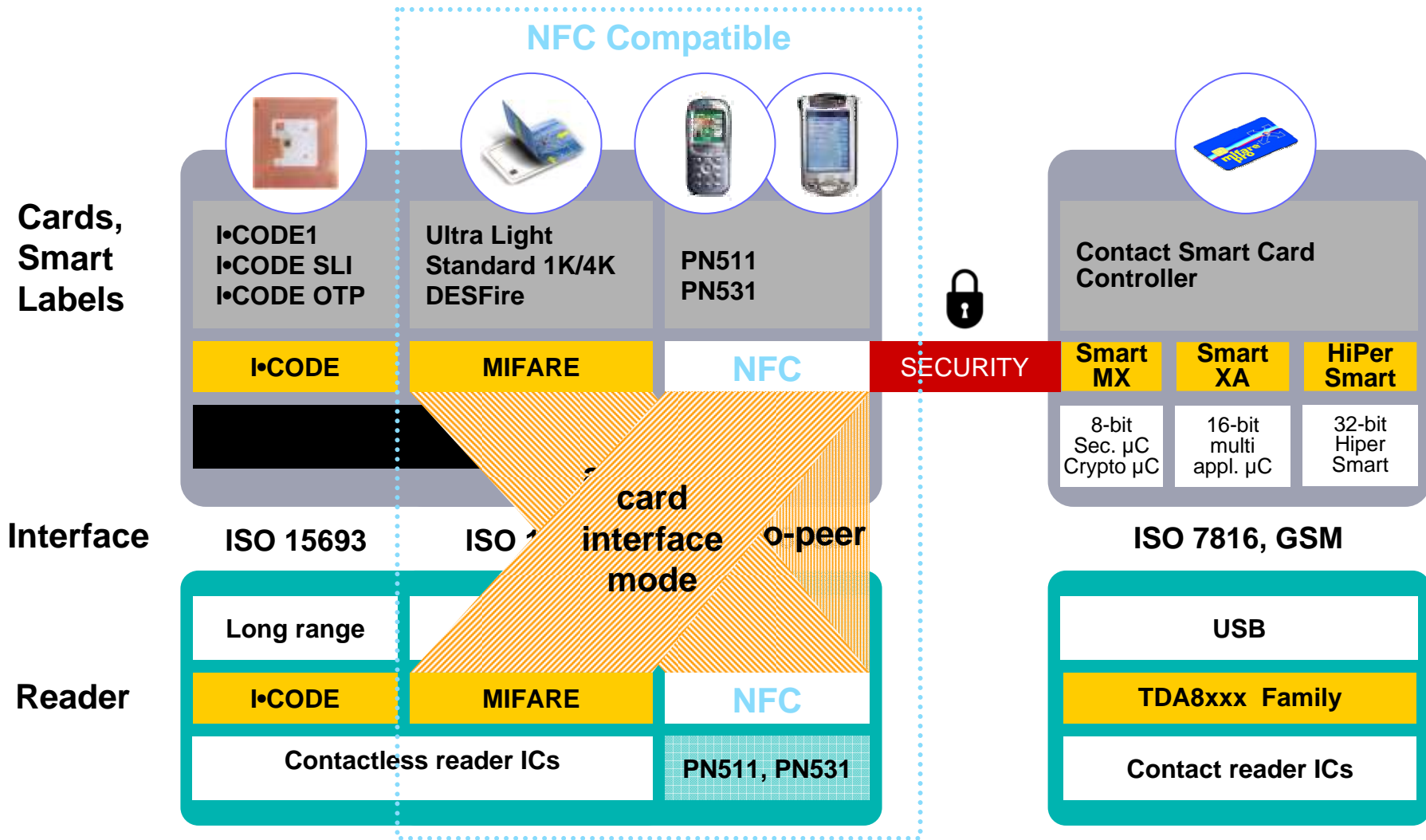
Standards

NFC Standards



(1) According to EMCA 340 and ISO/IEC 18092 standard

RF-ID Technology, and NFC



NFC Standardization

▶ Air interface

- ISO/IEC 18092 NFCIP-1 / ECMA-340 / ETSI TS 102 190 V1.1.1 (2003-03)
- ISO/IEC 21481 NFCIP-2 / ECMA-352 / ETSI TS 102 312 V1.1.1 (2004-02)

▶ Test methods

- ISO/IEC 22536 NFCIP-1 RF Interface Test Methods / ECMA-356 / ETSI TS 102 345 V1.1.1 (2004-08)
- ISO/IEC 23917 Protocol Test Methods for NFC / ECMA-362

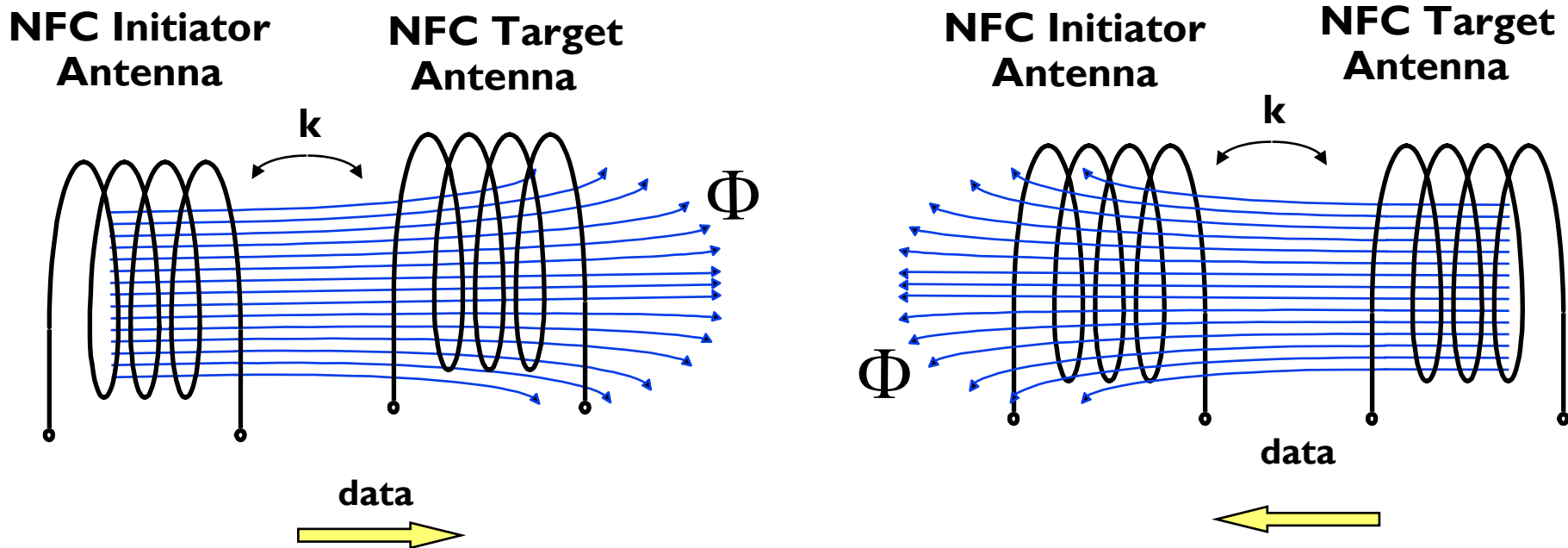
Summary

- ▶ NFC is the double-click in the internet of the things
 - Touch paradigm
- ▶ There are many sensible use cases
 - Traditional identification use cases like payment and ticketing
 - New use cases like easy network setup, giving and sharing etc
- ▶ Market deployment started
 - Field trials are ongoing around the world
 - A large non-profit organization (NFC Forum) promotes further implementation/standardization of NFC.
- ▶ Remote management capabilities are necessary to be able to scale the business
- ▶ Important step to further push NFC to the market
 - Standardization of interface between NFC chip and SIM



Antenna as Transformer

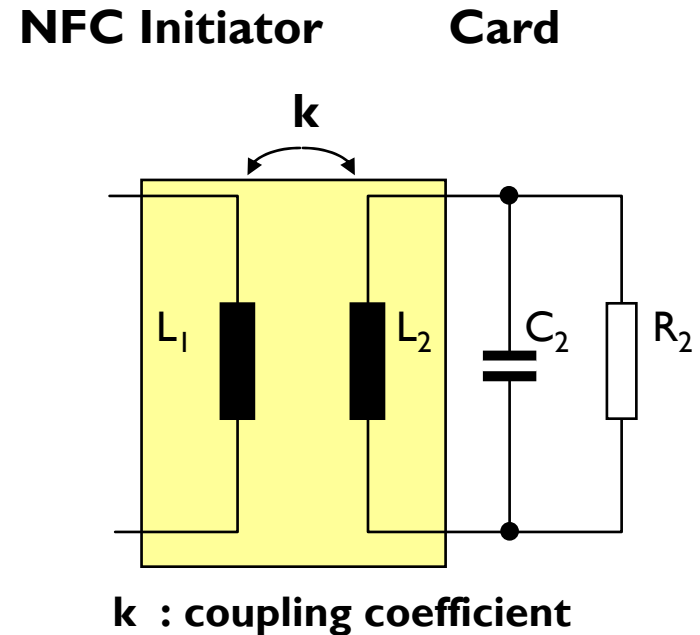
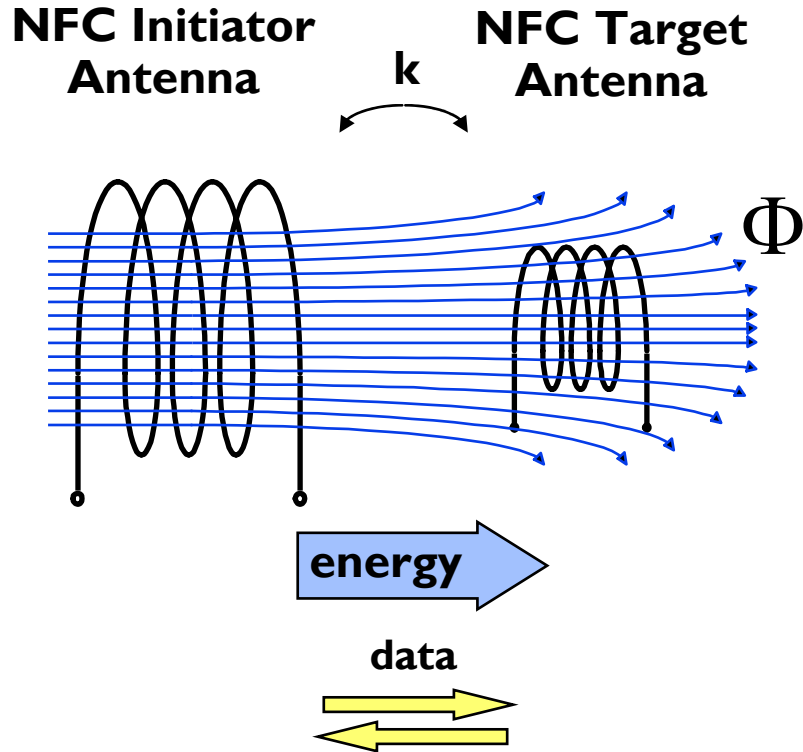
NFC : Active Communication mode



- Initiator generates own RF field and sends data
- Target generates own RF field and sends data
- Data transmission only

Antenna as Transformer

NFC Device: Reader to Card Communication



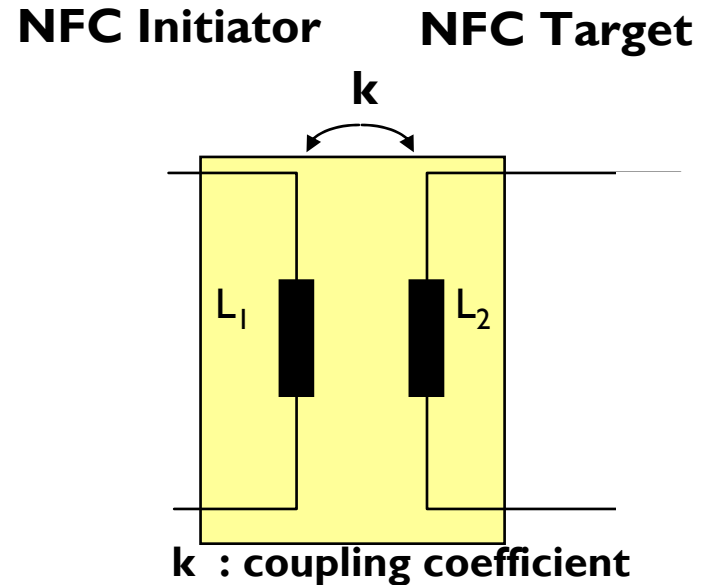
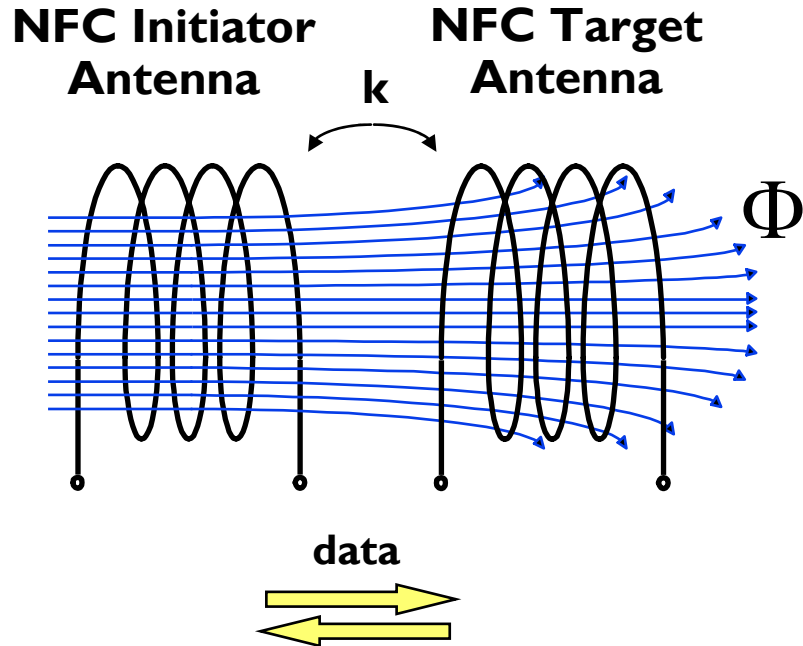
$$k = \frac{\phi_2}{\phi_1}$$

PICC: Proximity Chip Card („Card“)

Index 1: NFC Device = design parameters
Index 2: PICC antenna = fixed parameters

Antenna as Transformer

NFC : Passive Communication mode



$$k = \frac{\phi_2}{\phi_1}$$

- Initiator generates the RF field
- Target answers in a load-modulation scheme
- Data transmission only