

# NFC ESSENTIALS

JORDI JOFRE  
NFC EVERYWHERE  
MARCH 2018



PUBLIC



SECURE CONNECTIONS  
FOR A SMARTER WORLD



# Learn all about NFC

Session I, 15th March

## **NFC applications and use cases**

<https://attendee.gotowebinar.com/rt/1059402932312036099>

Session II, 22th March

## **NFC essentials**

<https://attendee.gotowebinar.com/rt/6461366231742998273>

Session III, 28th March

## **NFC product portfolio**

<https://attendee.gotowebinar.com/rt/8452313508808186113>

Session IV, 12th April

## **Product support package**

<https://attendee.gotowebinar.com/rt/3965453945970616321>





# Agenda

- NFC tech essentials
- NFC Forum in the NFC ecosystem
- NFC Forum certification program
- Relevant standards and specs
- NFC product portfolio and support package snapshot

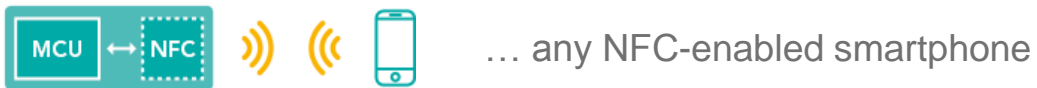
# NFC tech essentials





# NFC in short

## An NFC device can interact with ...



## Big reason to consider NFC



### More intuitive than any technology

It's like shaking hands



### Use Power Very Efficiently

Only one of the two devices needs to be powered



### Trusted addition to other technology

Especially for pairing devices

# RFID, proximity cards and NFC

## RFID



Generic term for **contactless** technology

**Wide** reading range  
(few cm to several meters)

Standardized in  
**ISO/IEC 18000**

## Proximity cards



Subset of RFID  
**HF 13,56 MHz**

**Short** reading range  
(few cm)

Standardized in  
**ISO/IEC 14443**

## NFC



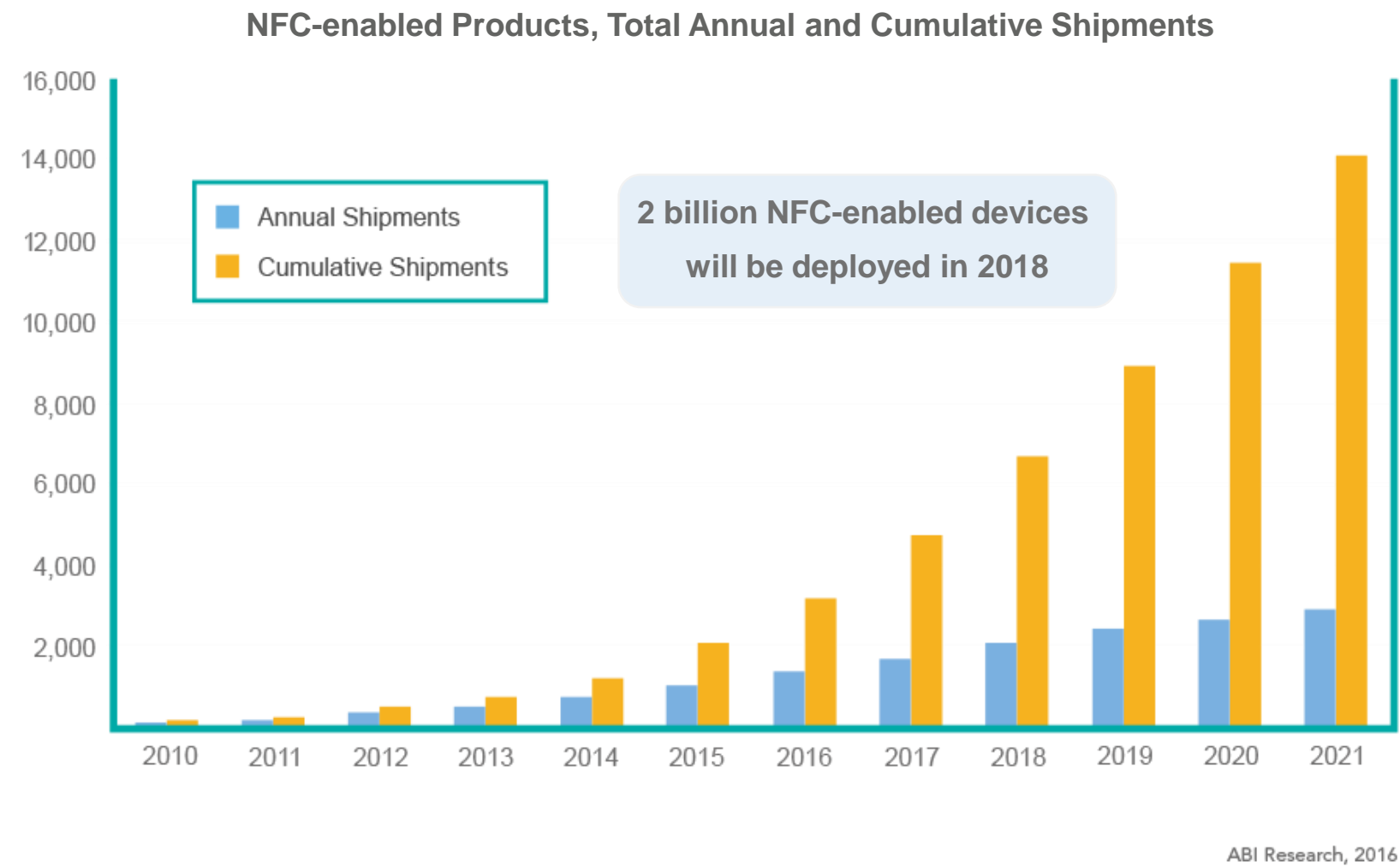
Adds a **two-way** communication  
between NFC-enabled devices

NFC-enabled device can behave as a  
contactless smartcard

Standardized in  
**ISO/IEC 18092** and **ISO/IEC 21481**

Act of will (“Tap to initiate an action”) • Zero-power • Highest Security

# NFC in numbers

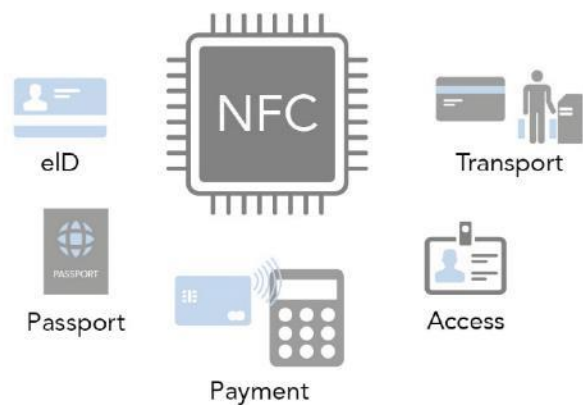


Every major smartphone OS supports NFC tag reading



# NFC brings secure connectivity to the IoT

Essential technology powering trusted contactless applications



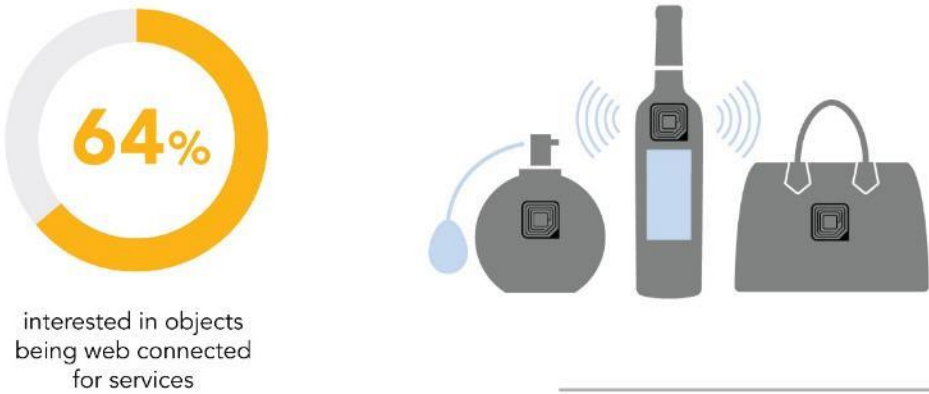
Ubiquitous NFC reader phones: annual shipments 2.2 Bn by 2020



500 Mn people using NFC phones to make a purchase by 2021



Potential for connected products and packaging: 1.2 trillion units by 2021





# The three modes of NFC: a tap is all it takes



## Read/write

The system performs the functions of a contactless reader



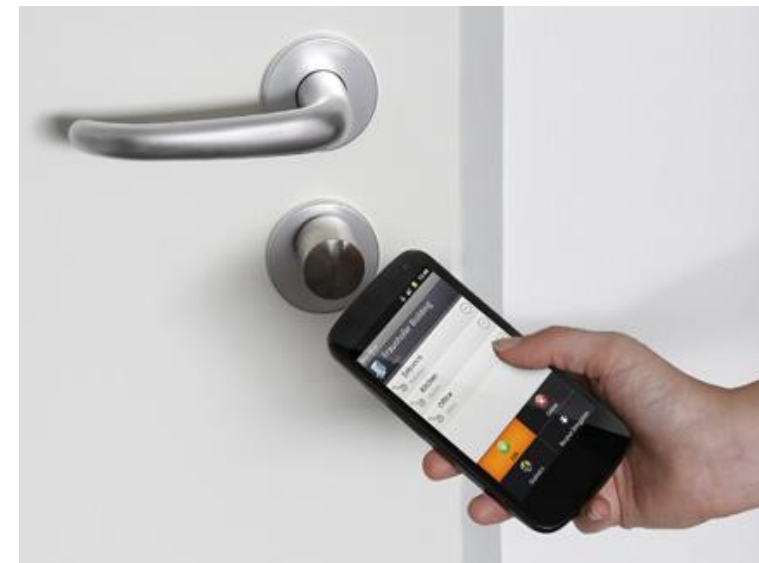
## Peer-to-peer

Establishes a two-way communication channel between a pair of NFC devices

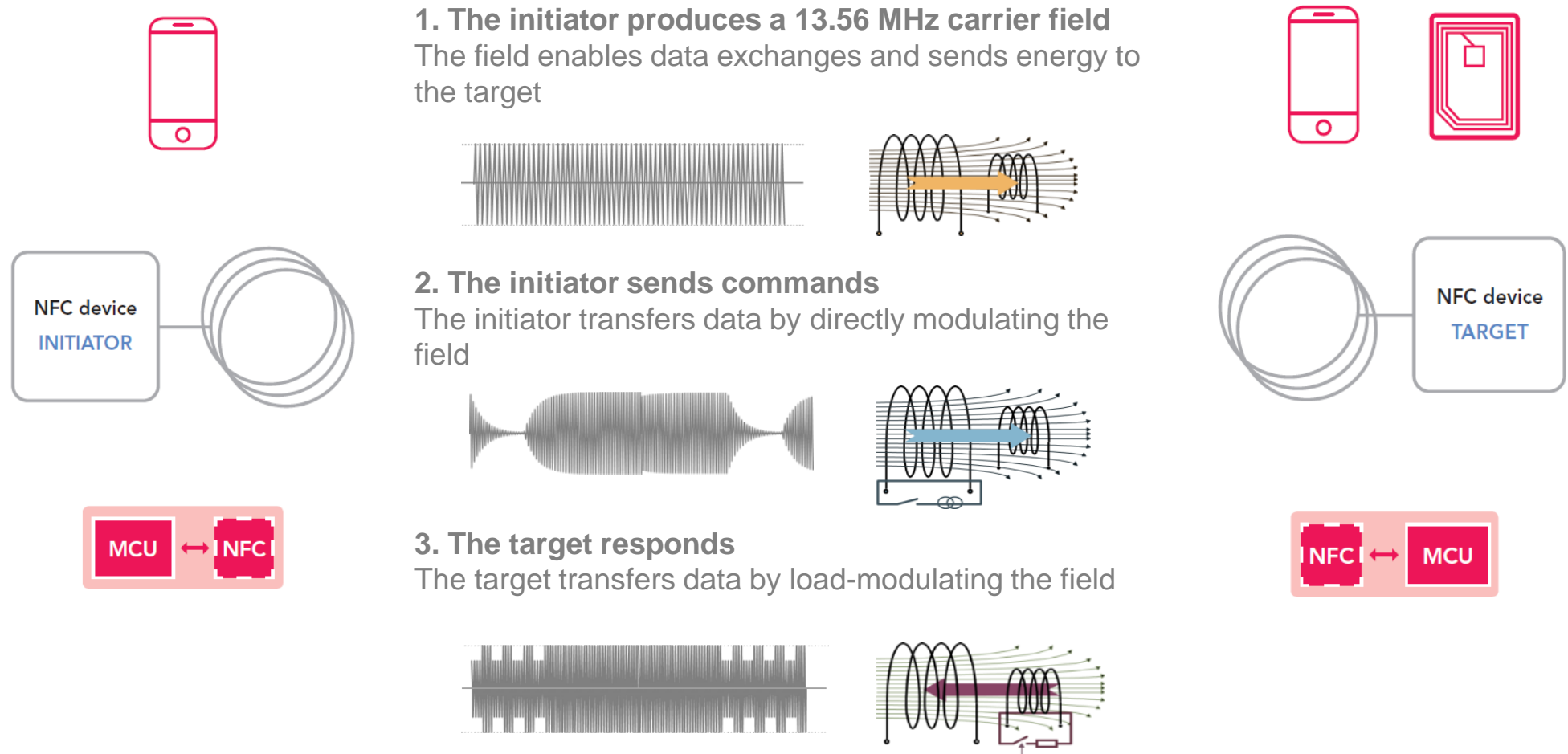


## Card emulation

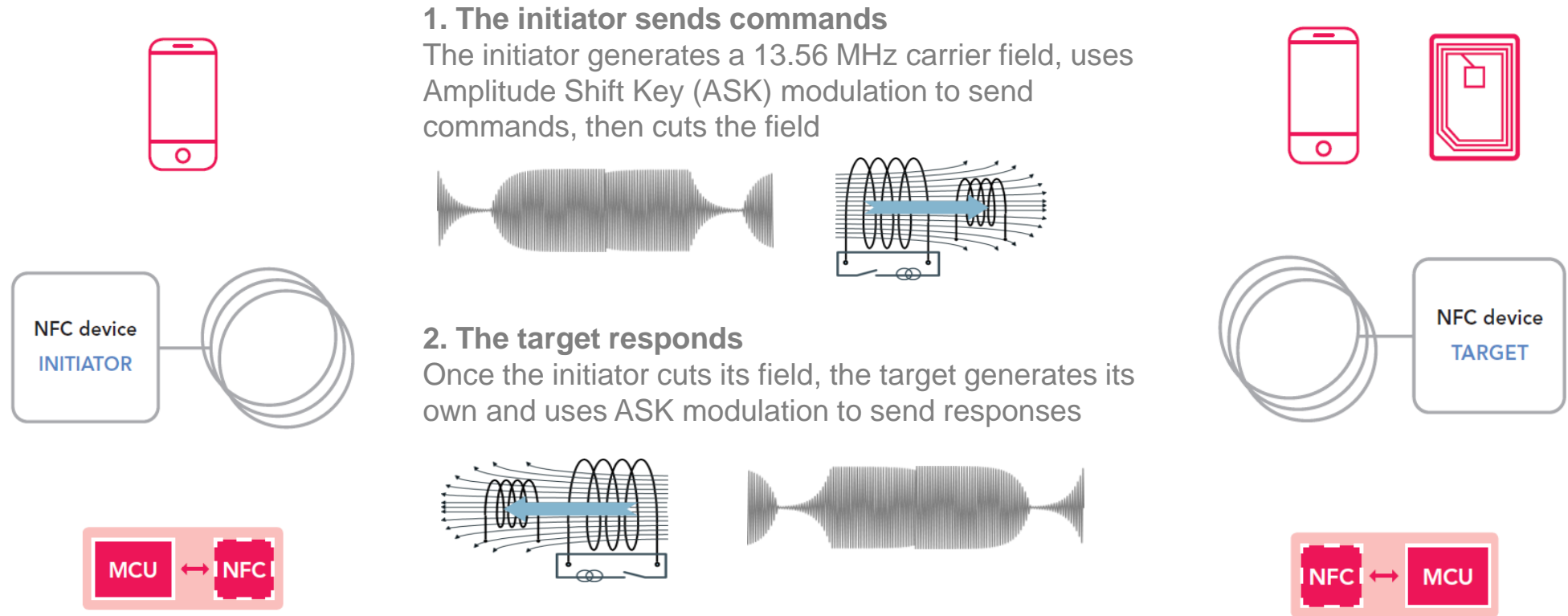
The system behaves as a contactless smartcard



# NFC passive communication scheme

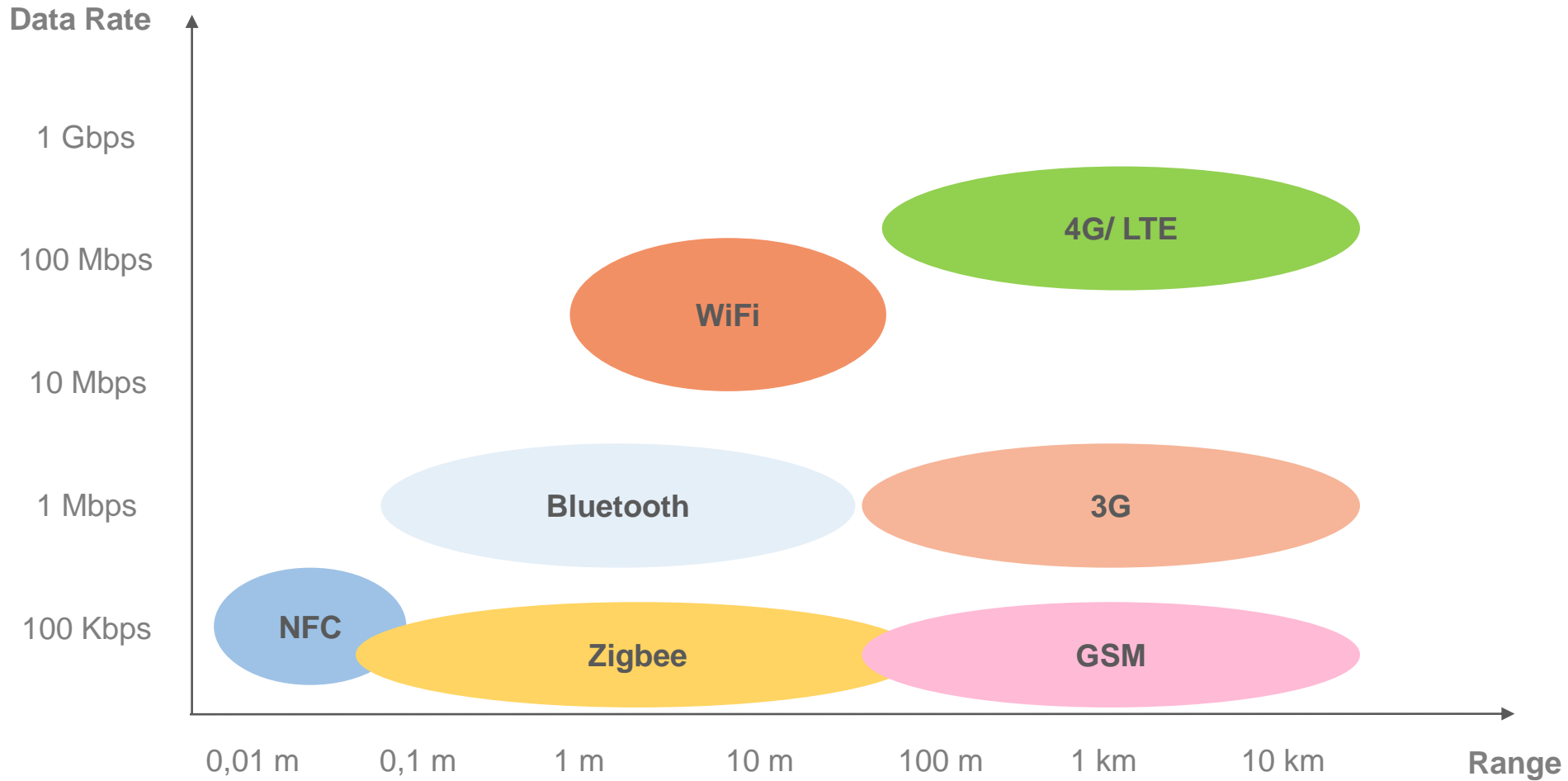


# NFC active communication scheme



To avoid collisions, only the sending device emits an electromagnetic field. The send / receive roles are reversed as needed to support the transaction

# Other wireless protocols



# NFC Forum

## Leading the way to NFC innovation



# NFC Forum

## Leading the way to NFC innovation

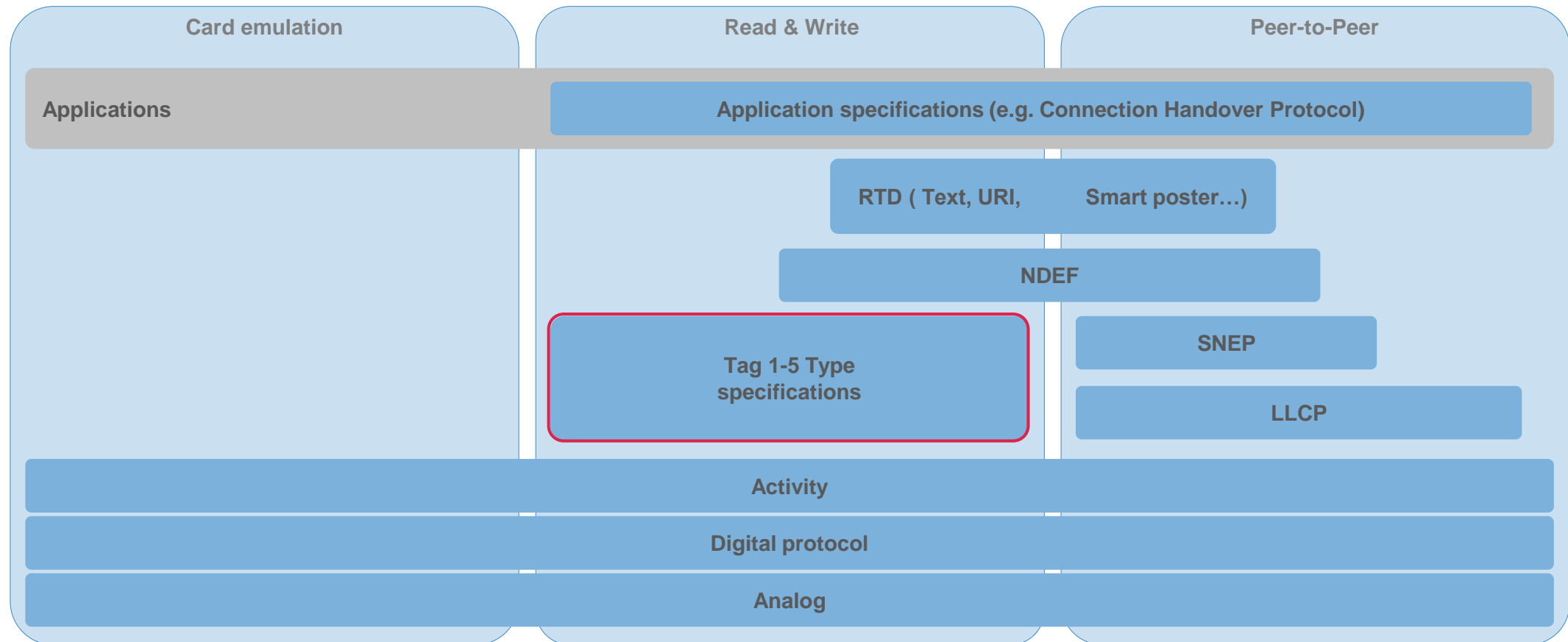
- The NFC Forum is a non-profit organization established to promote the use of NFC technology in consumer electronics, mobile devices, PCs, and more.
- The NFC Forum represents all of the world's major:
  - Chip vendors.
  - Payment service providers.
  - Smart phone manufacturers.
  - Mobile operating system providers.
- The NFC Forum's missions are:
  - Develop standards-based NFC specs.
  - Encourage the development of products based on NFC Forum specifications.
  - Work to ensure that products claiming NFC capabilities comply with NFC Forum specs.
  - Educate consumers and enterprises globally about NFC.





# NFC Forum specification architecture

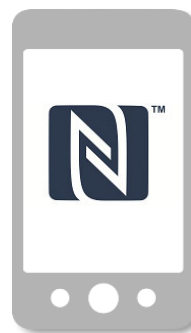
Build solutions and ensure the global interoperability



# The 5 NFC Forum Tag Types



NFC-Forum compliant device



Read & Write



**Tag 1 Type**  
ISO14443-3A  
(Broadcom Topaz)



**Tag 2 Type**  
ISO14443-3A  
(MIFARE Ultralight®  
contactless IC &  
NTAG)



**Tag 3 Type**  
JIS X 6319-4  
(Sony FeliCa)



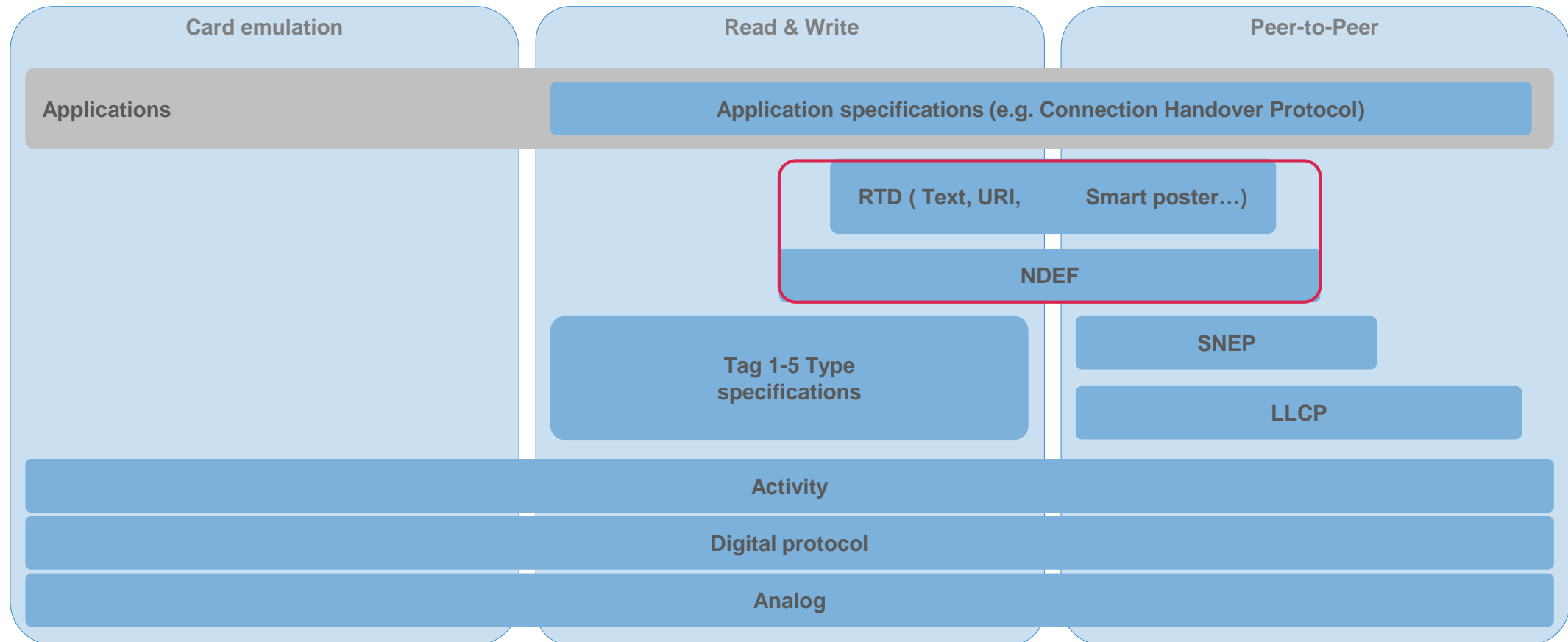
**Tag 4 Type**  
ISO/IEC14443-4  
(MIFARE® DESFire®  
contactless IC)



**Tag 5 Type**  
ISO/IEC15693  
(ICODE)

# NFC Forum specification architecture

Build solutions and ensure the global interoperability



# Formats for data exchange

## NFC data exchange format (NDEF)

- Specifies a common data format for NFC Forum-compliant devices and NFC Forum-compliant tags.
- It is used to describe how a set of actions are to be encoded onto a NFC tag (e.g. open a URL, create an SMS, create an email, etc.).
- The benefit of using NDEF is that you do not need to have custom software running on the touching device.



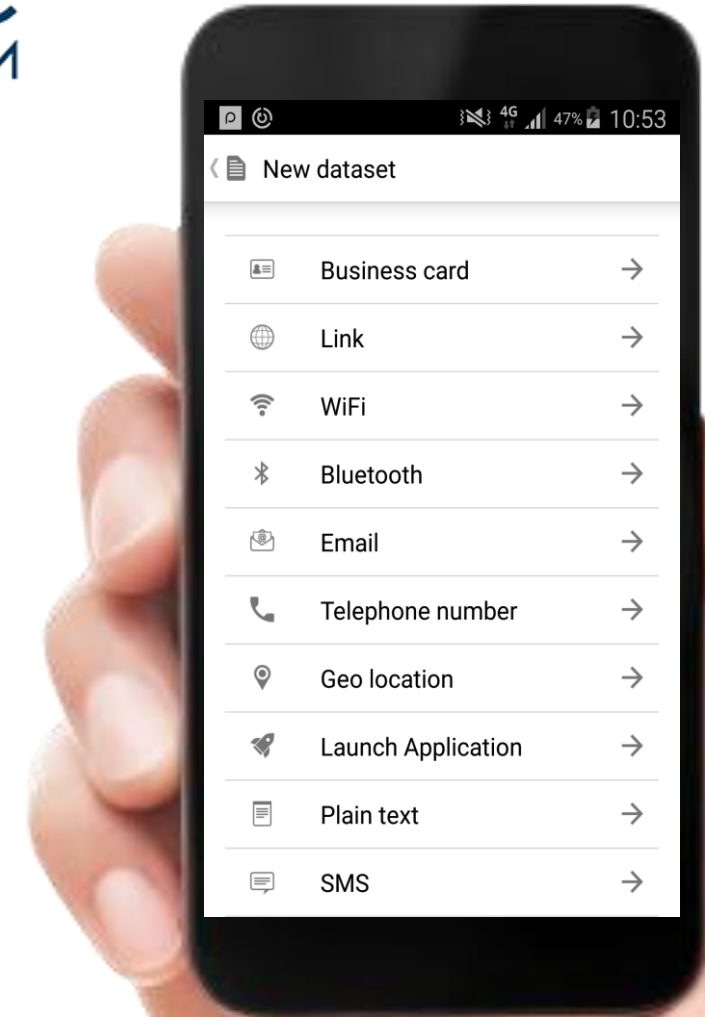
# Formats for data exchange

## NFC record type definition (RTD)



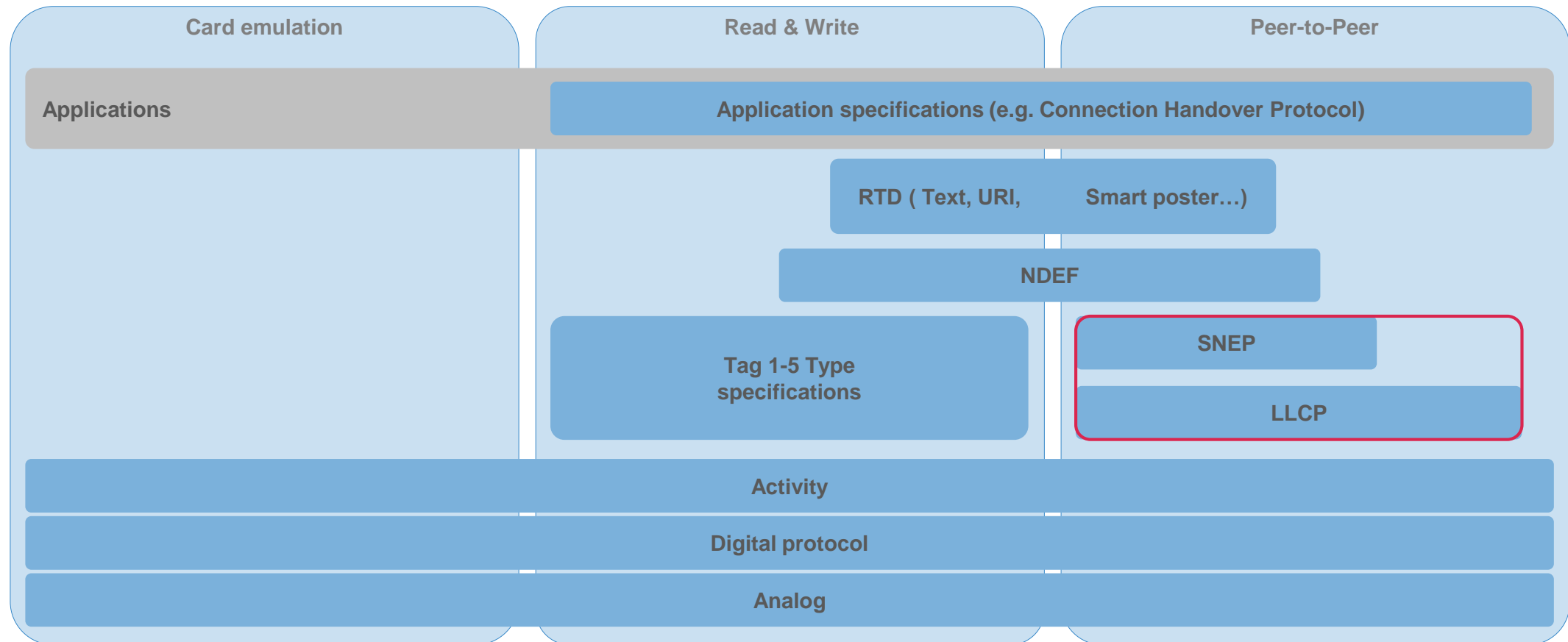
- Specifies the format and rules for building standard record types used by NFC Forum application definitions and third parties that are based on the NDEF data format.

NDEF RTD	What it covers
<b>Device Information (Di)</b>	Basic details about the device model and its identity, for use when the device acts as host
<b>Smart Poster (Sp)</b>	Text strings, such as URLs, SMS messages, or phone numbers stored in an NFC tag
<b>Text (T)</b>	Text strings in multiple languages
<b>URI (U)</b>	Universal Resource Identifiers (URIs), which include web addresses (URLs) and other network resources and files
<b>Connection Handovers (Hr/Hs/Hc)</b>	Pairing with Bluetooth, Wi-Fi, or other protocols. Includes record formats for handover request (Hr), select (Hs), and carrier (Hc).
<b>Signature (Sig)</b>	Provides an algorithm or certificate type for use as a digital signature



# NFC Forum specification architecture

Build solutions and ensure the global interoperability





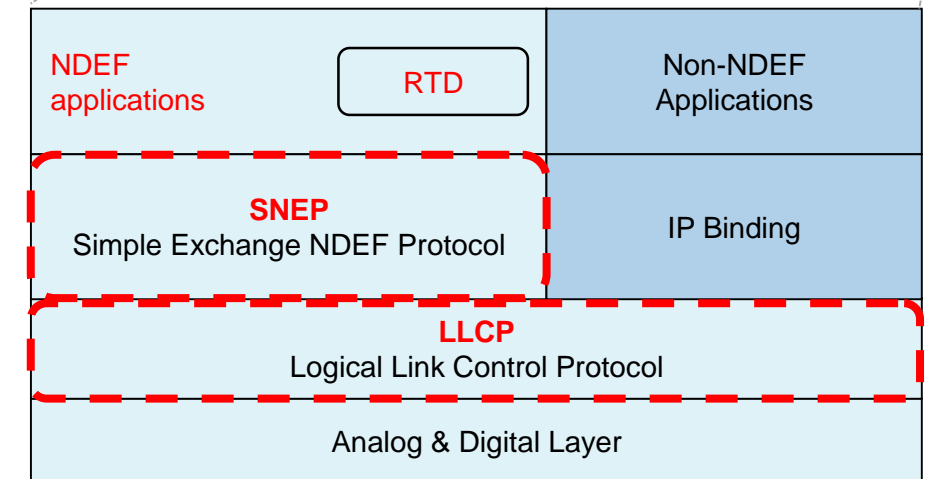
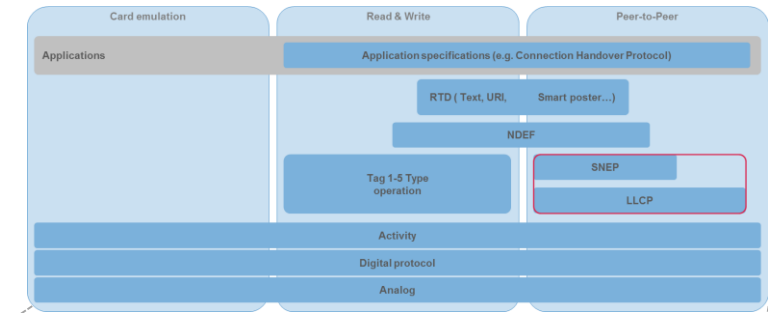
# NFC peer-to-peer mode

## Technology aspects

- **Target & Initiator** : The device sending commands and receiving the answers is called the “Initiator“. The device receiving the commands is called the “Target“. Both devices can act as Target or Initiator.
- **Passive and Active** :They are related to electromagnetic field management (modulation) used between the 2 devices.
- **Hint**: only a “Passive Initiator“ is needed to communicate with an NFC compliant device

## SNEP & LLCP protocol stack

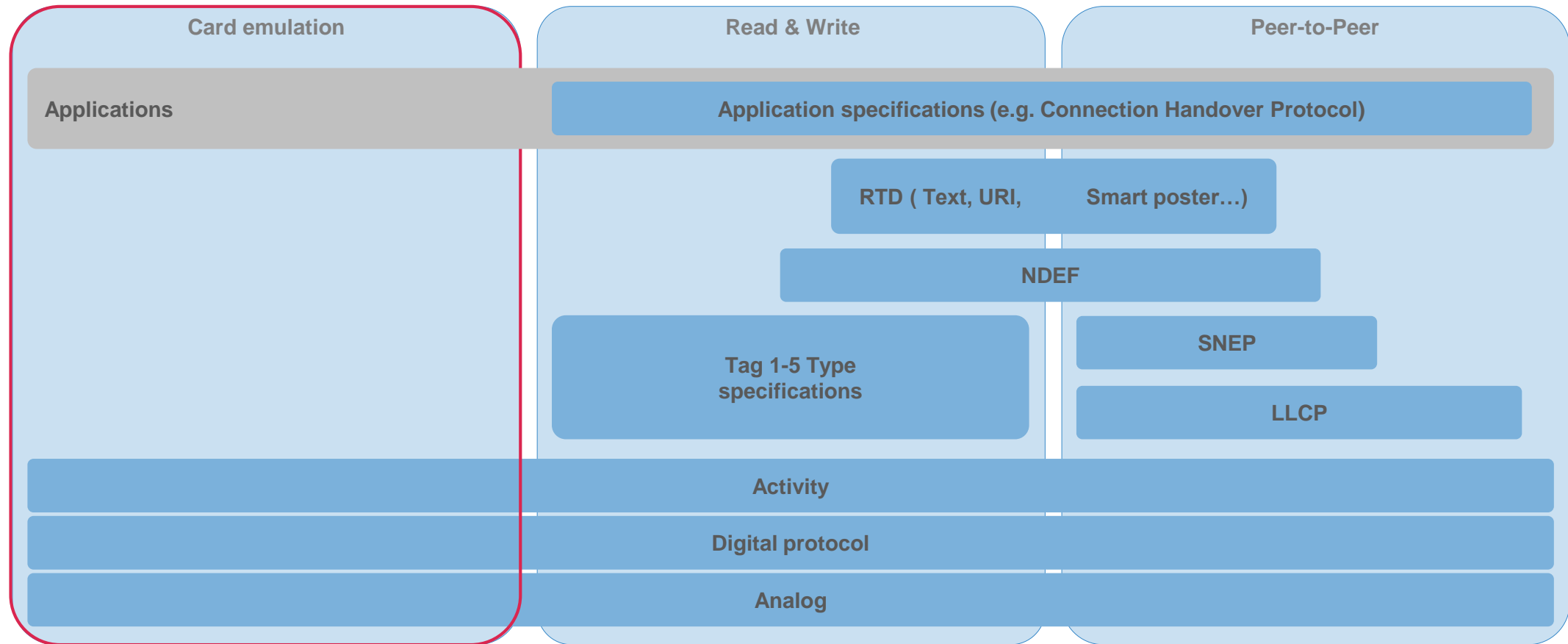
- SNEP & LLCP describe the high layer protocol which is used by two NFC devices to exchange NDEF data.
- SNEP Leverages on LLCP functionalities (connection-oriented Service Class).



LLCP and SNEP enable the exchange of NDEF messages between NFC devices using P2P mode

# NFC Forum specification architecture

Build solutions and ensure global interoperability



# NFC card emulation mode configurations

Based on secure element

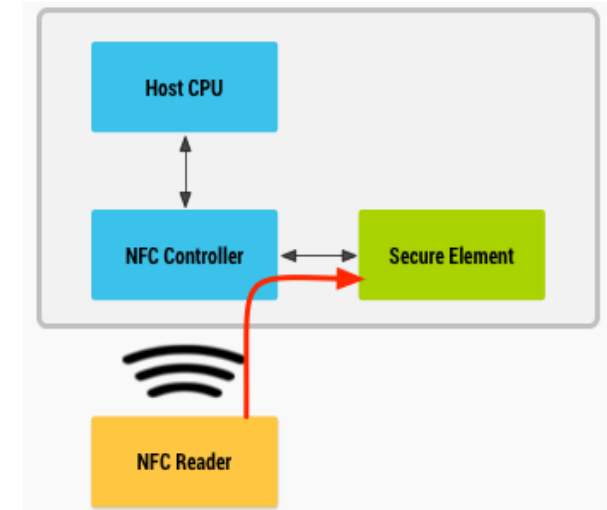
*The card to be emulated is provisioned into the SE.*

## Recognized level of full HW security

- Most secure solution with no dependence on external parties
- More mature integration processes
- Efforts made to simplify end-to-end processes and emergence of TSM Hubs.
- Totally seamless user experience

## More complex integration

- Mobile device requires an eSE
- More advanced ecosystem, involving the eSE issuer, MNOs, TSMs etc.
- Adds complexity to integration



**GLOBALPLATFORM<sup>®</sup>**  
THE STANDARD FOR SECURE DIGITAL SERVICES AND DEVICES



# NFC card emulation mode configurations

Based on host card emulation (HCE)

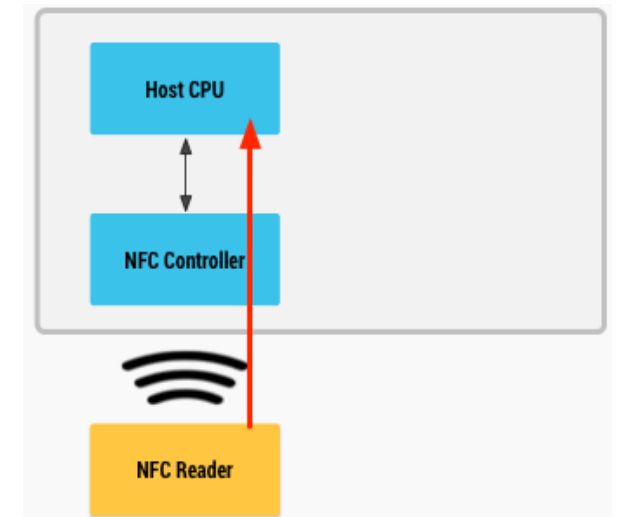
*Enables the device host processor to emulate the card.*

## Reducing costs and complexity

- Remove complexity associated with eSE integration
- Very simple provisioning process

## Dependence on Android OS and cloud system to ensure security

- Additional layers of security required to bolster the security of payments
- Network connectivity required to process a transaction
- Security relies on Android OS vulnerabilities



# NFC Forum certification program



# About the NFC Forum tag certification program

## Objective:

- NFC Forum's comprehensive certification program ensures consistency and sets the foundation for interoperability.
- The program applies to all tag types specified by the NFC Forum to deliver a consistent, satisfying user experience.
- Manufacturers can test and verify the performance of all key components of the NFC eco-system: handsets, NFC tags, and readers with NFC Forum Certification testing



## NFC Forum Tag Certifications with the following ICs

- NTAG 210μ (T2T)
- NTAG 213 (T2T)
- NTAG 213 Tag Tamper (T2T)
- NTAG 215 (T2T)
- NTAG 216 (T2T)
- ICODE SLIX 2 (T5T)
- NTAG 413 DNA (T4T)
- NTAG 213F (T2T)
- NTAG 216F (T2T)
- NTAG I<sup>2</sup>C plus (T2T)
- NTAG SmartSensor NHS3100 (T2T)
- NTAG SmartSensor NHS3152 (T2T)



<https://www.nxp.com/docs/en/supporting-information/NFC-Forum-Tag-Certifications-NFC-ICS.pdf>

<https://nfc-forum.org/wp-content/uploads/2017/08/NFC-Certified-Logo-Usage-Guidelines-2017-08-1.pdf>

NXP was #1 to achieve NFC Forum Tag Certification for their ICs.



# How do you benefit from certified tags?



## Interoperability

Ensure reliable operation in the NFC ecosystem.  
Ensure NFC enabled products are fully interoperable.  
Secure investment in the technology



## Quality assurance

Confirm that tags conform with NFC Forum specifications, which are the most broadly supported tags in the industry. Tag manufacturers can inherit the test results, and therefore save time and money on their certification testing



## Product differentiation

Differentiate your tags from non-certified products and attract customers who prefer to purchase certified tags in order to make tag integrations more seamless

# Relevant standards and specs in the NFC ecosystem

# Relevant standards and specifications

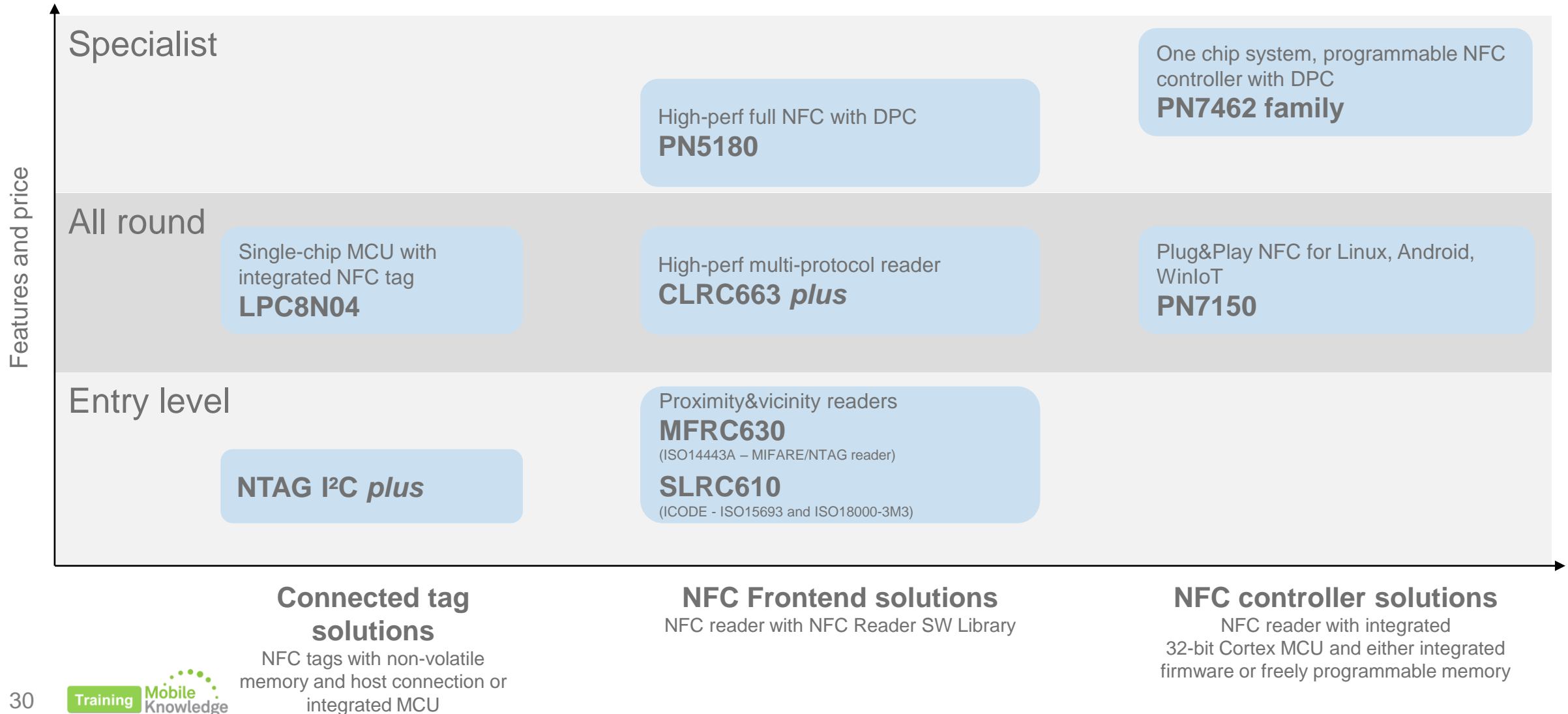
Standard	Subject	Relationship to NFC
EMVCo	Payment	Provides guidelines for NFC systems that accept payments or act as payment cards. Level 1 addresses the conformance of interface modules.
FeliCa	Contactless Smartcard	Developed by Sony and used primarily in Hong Kong, Japan, and Singapore, FeliCa is a contactless RFID smart card system that complies with JIS: X6319-4 and is also included as a condition for compliance with the NFC Forum specification.
GlobalPlatform	Secure Element	Specifies a multi-application architecture for the secure elements used to protect transactions in NFC systems.
ISO/IEC 7816	Contact smartcard	Defines a contact format compatible with NFC and ISO/IEC 14443. Most ISO/IEC 14443 contactless cards use the ISO/IEC 7816-4 command set.
ISO/IEC 10373-6	Proximity Card	Defines test methods specific to proximity cards and objects.
ISO/IEC 14443	Proximity Card	Defines the most widely used standard for proximity cards, objects, and readers in payment, transport, identification, and more. Type A and Type B cards use the same transmission protocol, but differ in their modulation methods, coding schemes, and procedures for protocol utilization. NFC Forum Type 2 and Type 4 Tags are based on the ISO/IEC 14443 series.
ISO/IEC 15693	Vicinity Card	Defines a contactless card that can be read at a range of up to 1 m, a longer distance compared to proximity cards. The NFC Forum Type 5 Tag is based on ISO/IEC 15693, and delivers an expected read range with mobile phones that is slightly longer than with Type 2 Tags.
ISO/IEC 18000-3M3	Item-level RFID	Defines an EPC Global Gen2 HF reader with an air interface at 13.56 MHz, the same operating frequency as NFC. Used for highly stackable tags with fast bulk reading.
ISO/IEC 18092	NFC Interface and Protocol	Defines Near Field Communication. Incorporates portions of ISO/IEC 14443 and FeliCa.
MIFARE	Contactless Smartcard	Refers to a contactless smartcard format compatible with NFC. Includes proprietary technologies based on various levels of the ISO/IEC 14443 A standard.

# NXP NFC portfolio and support snapshot



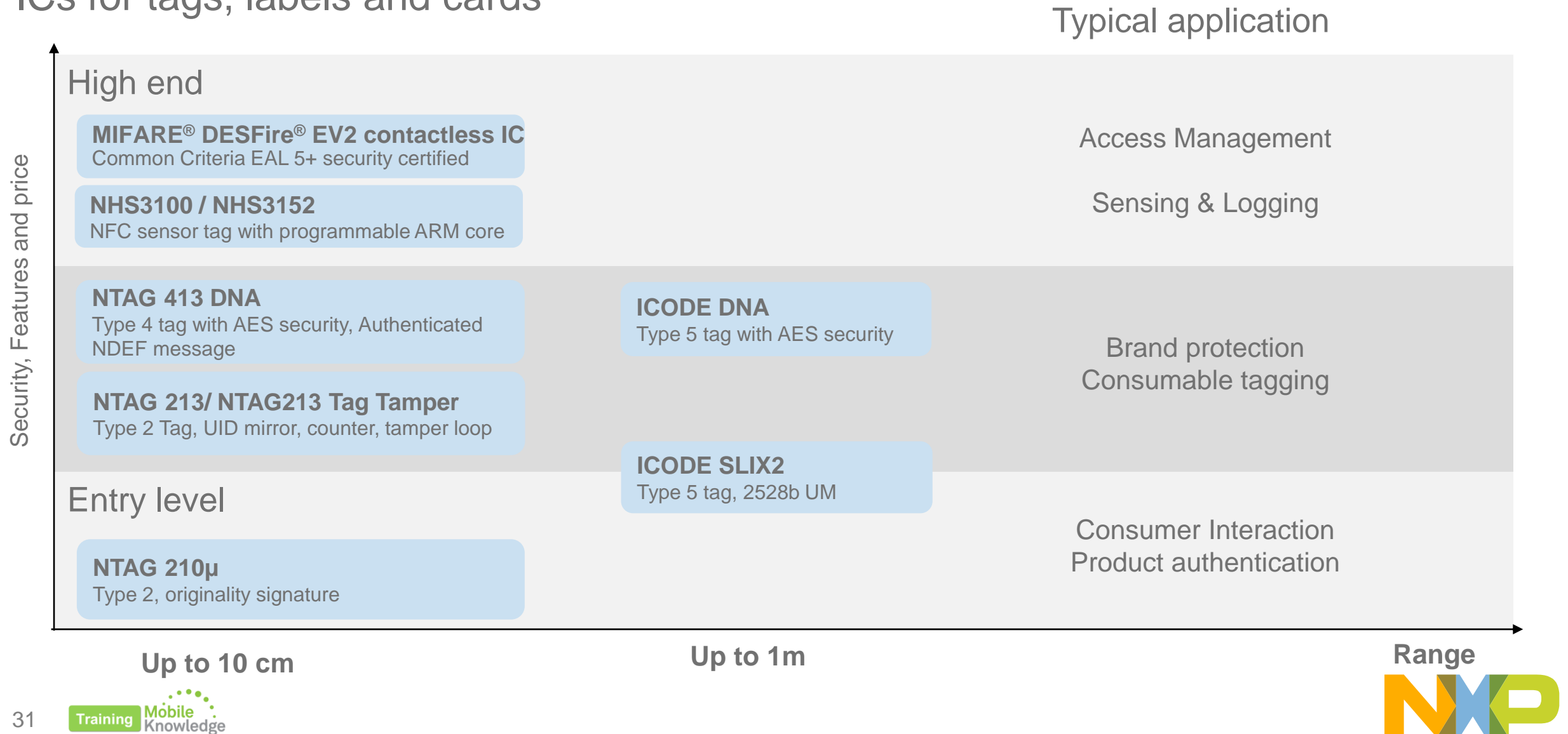
# NFC focus products for each application need –

Readers/connected tags: for embedded electronics




















# NFC focus products for each application need –

ICs for tags, labels and cards





# Support tools

NFC Support				
Decide the functionality		Online selection tools, including selection app, parametric search, and product details on <a href="https://nxp.com">nxp.com</a>		NFC Everywhere brochure
Select IC		Z-card with NFC Reader Portfolio		NFC use case and product webinars
Evaluate Features		Full range of development kits for every NFC Product		Compatibility with common MCU boards and single-board computers
Prototype		NFC Cockpit		NFC product support package and antenna design webinars
Test & Debug		NFC Library		App notes
		Sample code		Tutorials
		NFC Cockpit		Design files for development kits
				Online trainings on software integration and antenna design
Get Certified		DPC, strong RF power generation, RF wave shaping, and HW-based EMD error handling		

Independent Design Houses certified by NXP IDH Partners  
[www.nxp.com/partner](https://www.nxp.com/partner)



Technical NFC Community  
<https://community.nxp.com/community/nfc>



# NFC essentials

**Thank you for your kind attention!**

Please remember to fill out our **evaluation survey** (pop-up)

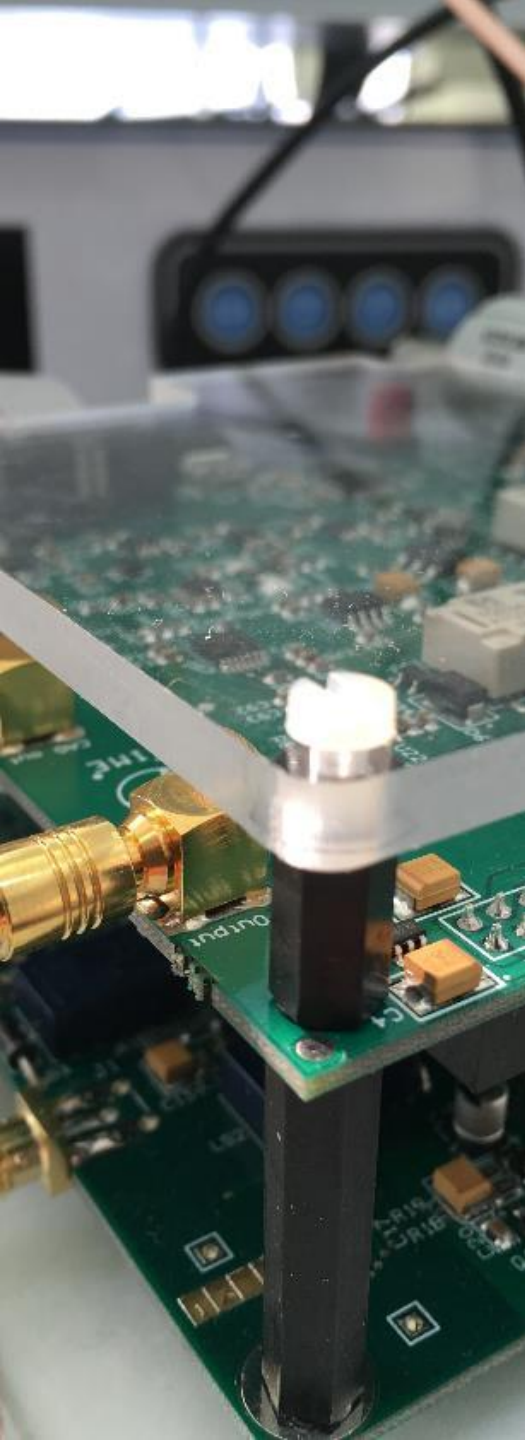
Check your email for **material download** and on-demand **video** addresses

Please check NXP and MobileKnowledge websites for **upcoming webinars** and **training sessions**

<http://www.nxp.com/support/classroom-training-events:CLASSROOM-TRAINING-EVENTS>

[www.themobileknowledge.com/content/knowledge-catalog-0](http://www.themobileknowledge.com/content/knowledge-catalog-0)





## MobileKnowledge

MobileKnowledge is a team of HW, SW and system engineers, experts in **smart, connected and secure** technologies for the IoT world. We are your ideal **engineering consultant** for any specific support in connection with your **IoT** and **NFC** developments. We design and develop secure HW systems, embedded FW, mobile phone and secure cloud applications.

Our services include:

- **Secure hardware design**
- **Embedded software development**
- **NFC antenna design and evaluation**
- **NFC Wearable**
- **EMV L1 pre-certification support**
- **Mobile and cloud application development**
- **Secure e2e system design**

We help companies leverage  
the secure IoT revolution

