

# Near Field Communication

Mobile and Ubiquitous Computing

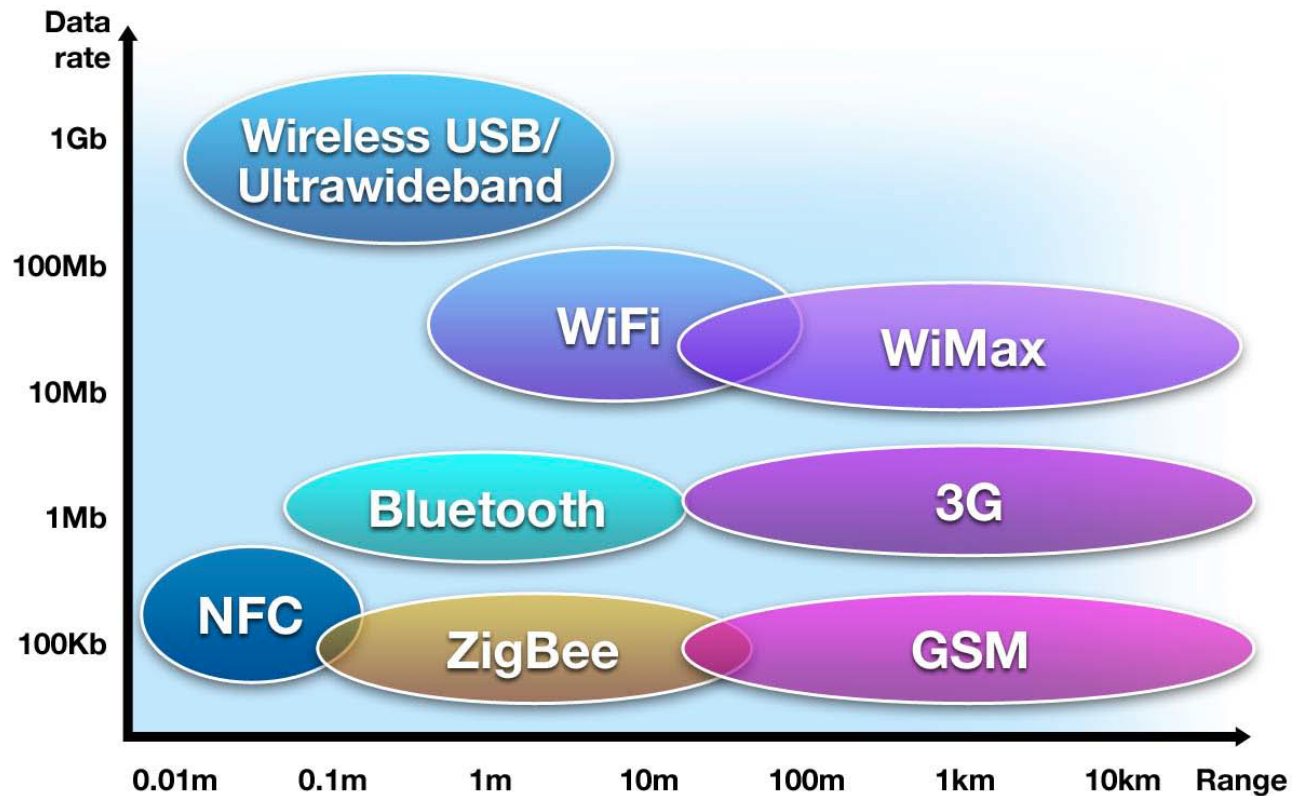
# Overview

- NFC applications
- Relationship with RFID
- NFC Architecture
- NFC and Android

Sources:

1. Jonathan Main, NFC Technology Overview:  
[http://www.nfc-forum.org/events/oulu\\_spotlight/Technical\\_Architecture.pdf](http://www.nfc-forum.org/events/oulu_spotlight/Technical_Architecture.pdf)
2. Richard Grundy, How to Build an NFC application:  
<http://www.slideshare.net/traceebeebe/nfc-bootcamp-seattle-day-2>

# Wireless technologies



# Standard applications

Get information  
by touching  
smart posters



Use your NFC  
phone as an  
event ticket

Set up your  
wireless home  
office with a  
touch



NFC  
Consumer  
Device



Print from your  
camera by  
holding it close  
to the printer



Share business  
cards with a  
touch

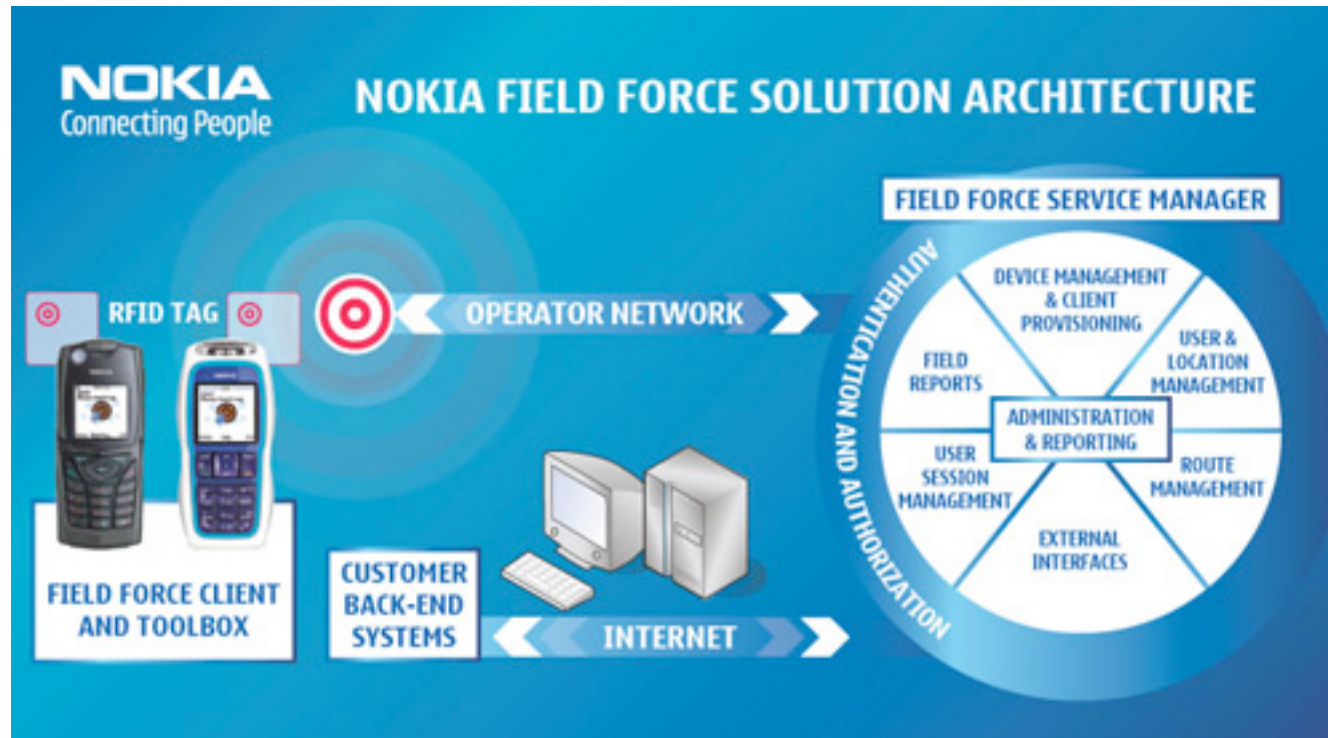
Get on the bus  
by waving your  
NFC phone



Pay for goods  
with a tap of your  
NFC phone



# Elements of NFC applications



# Payment

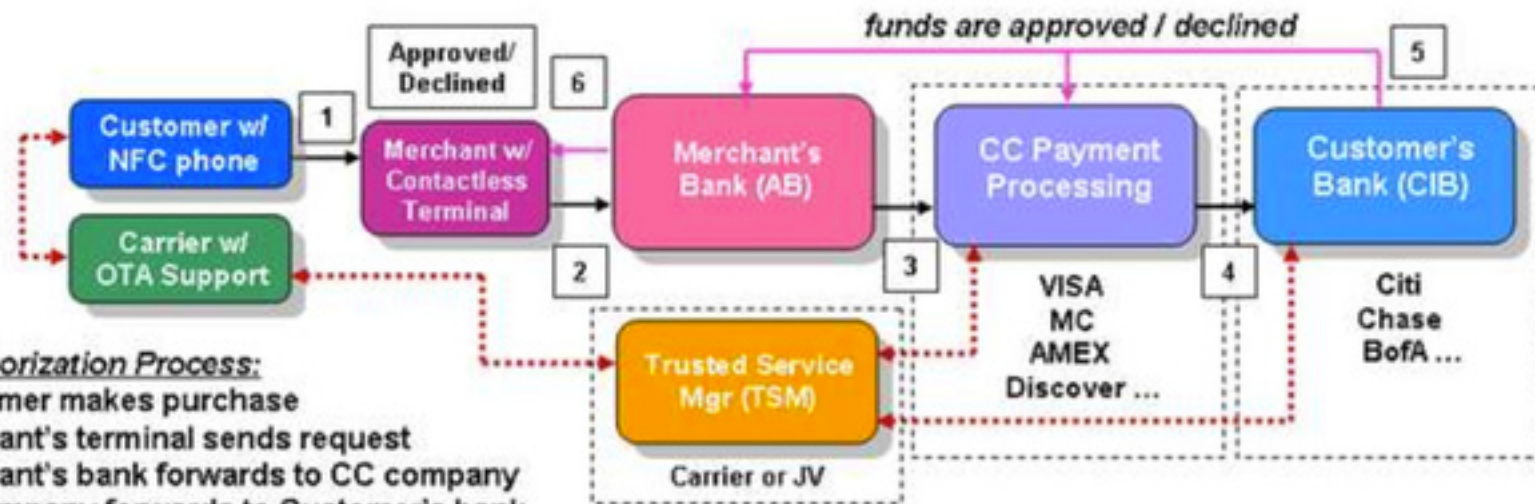


# RFID standards

- ISO/IEC 14443
  - Included as a base standard in Digital Protocol and Analogue specifications.
- ISO/IEC 18092 –NFCIP-1
  - Included as a base standard in Digital Protocol and Analogue specifications.
- JIS X 6319-4 –FeliCa
  - Included as a base standard in Digital Protocol and Analogue specifications



# Payment application

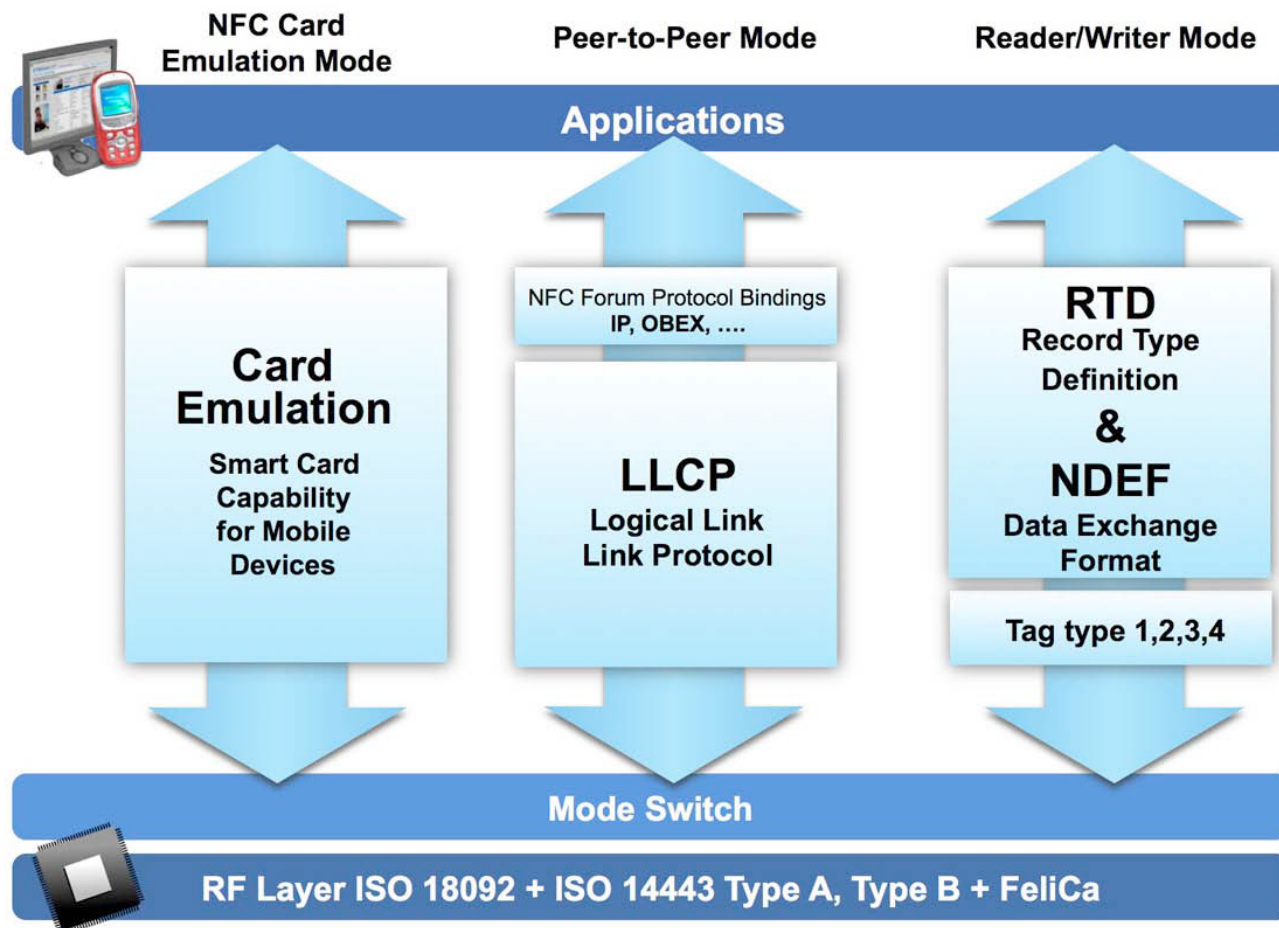


## Basic Authorization Process:

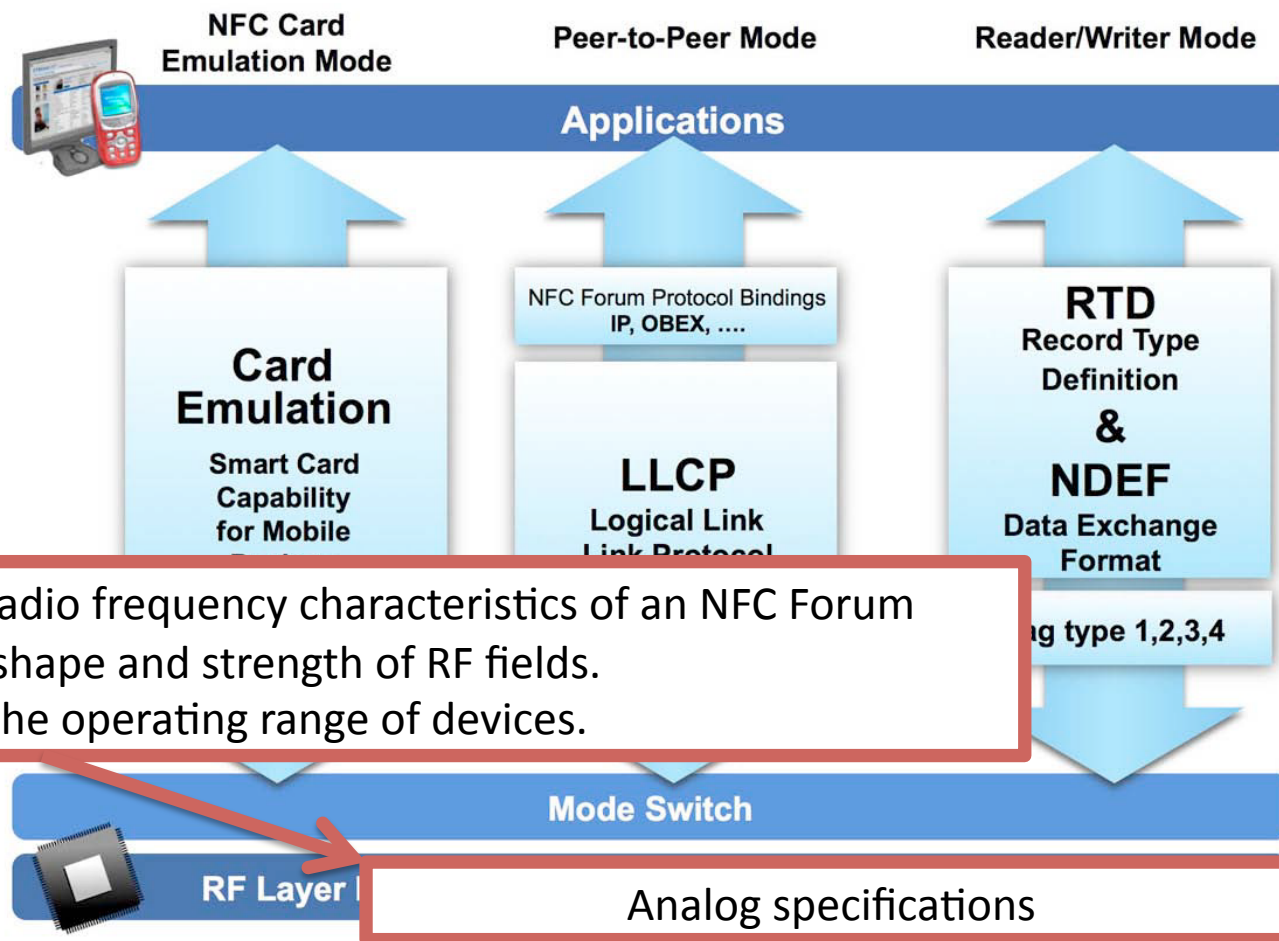
1. Customer makes purchase
2. Merchant's terminal sends request
3. Merchant's bank forwards to CC company
4. CC company forwards to Customer's bank
5. Customer's bank (determines: approval or decline) and CC company and merchant's bank are notified
6. Merchant's terminal is sent a message



# NFC Forum architecture



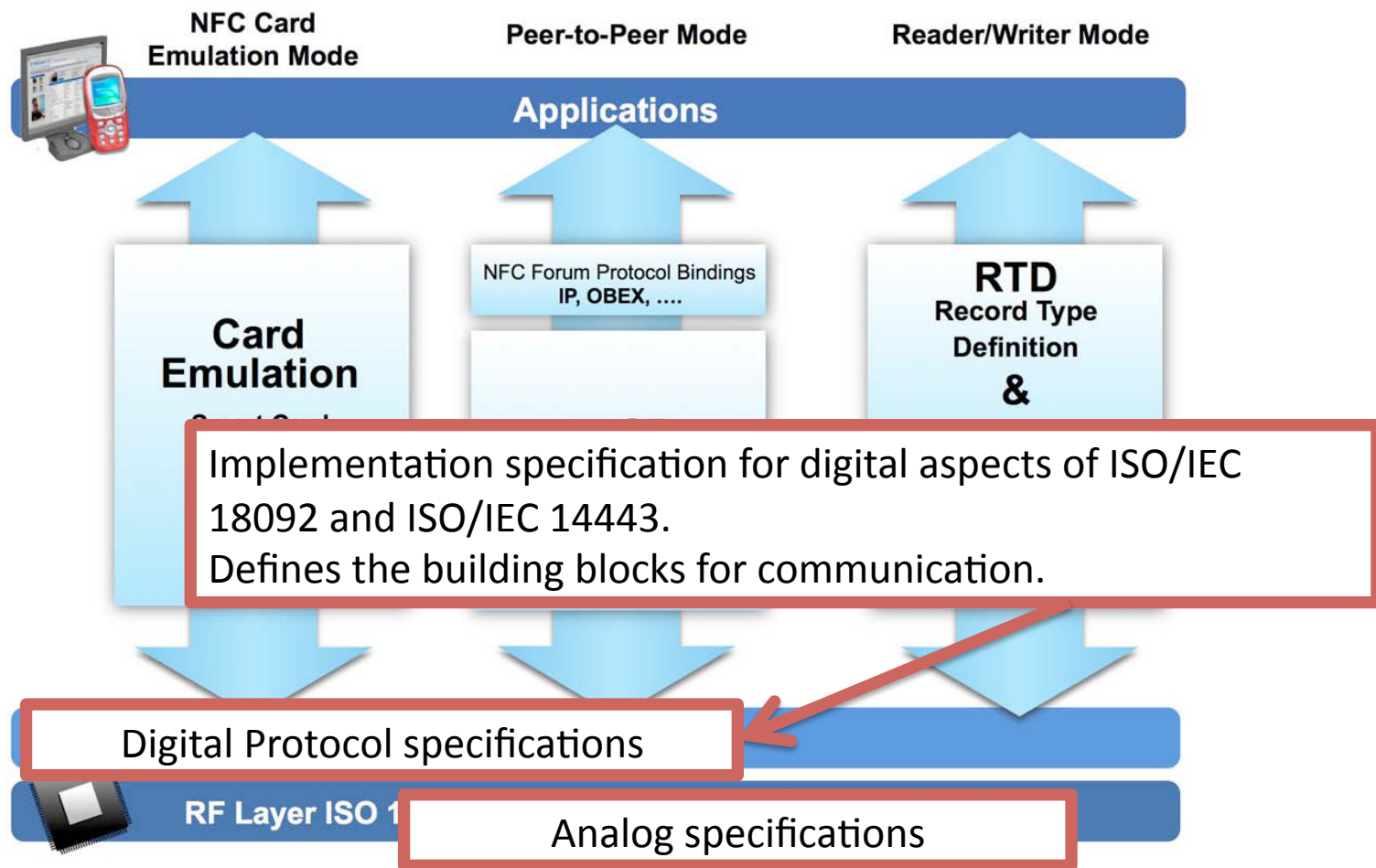
# NFC Forum architecture



Defines the radio frequency characteristics of an NFC Forum device. e.g., shape and strength of RF fields. Determines the operating range of devices.

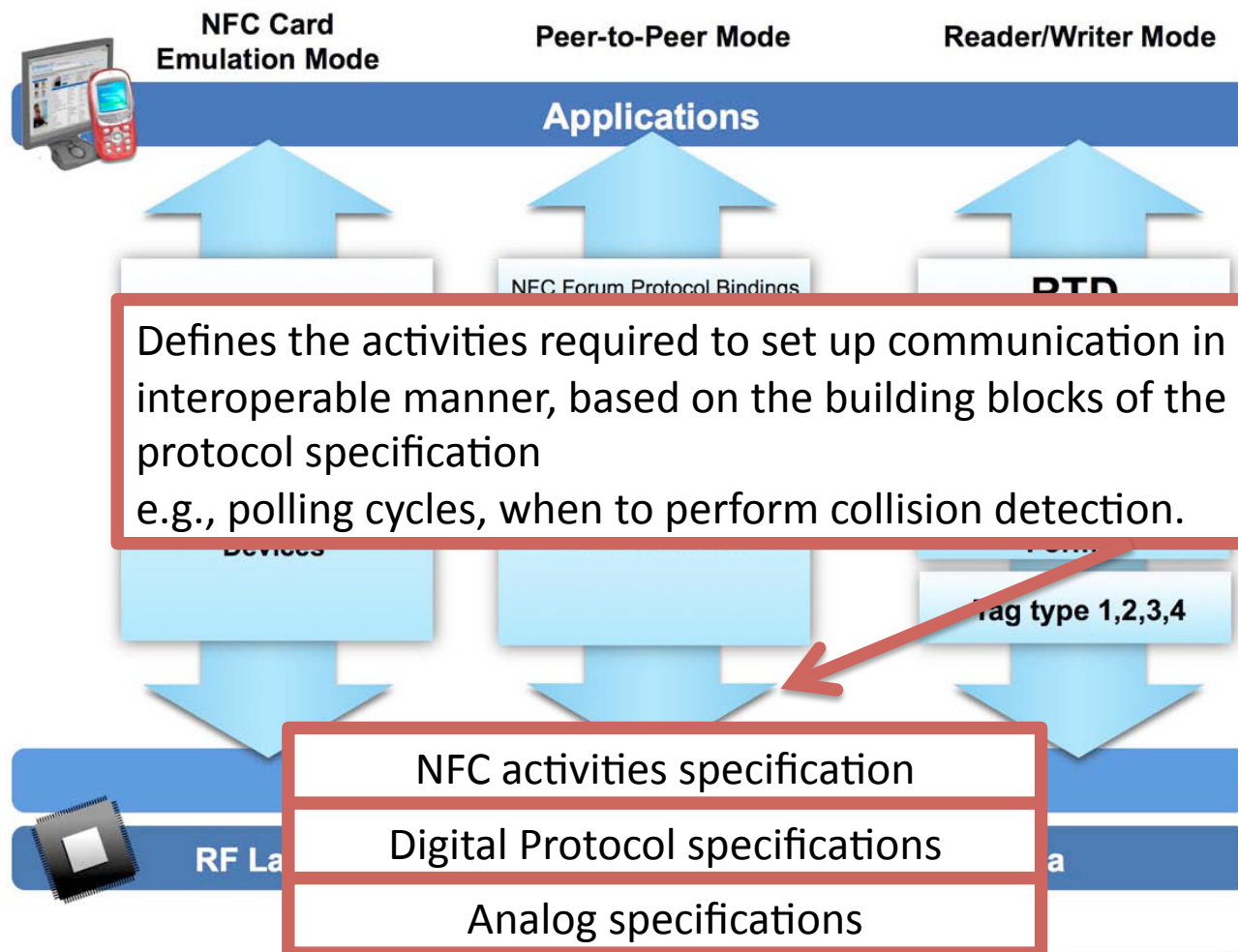
Analog specifications

# NFC Forum architecture

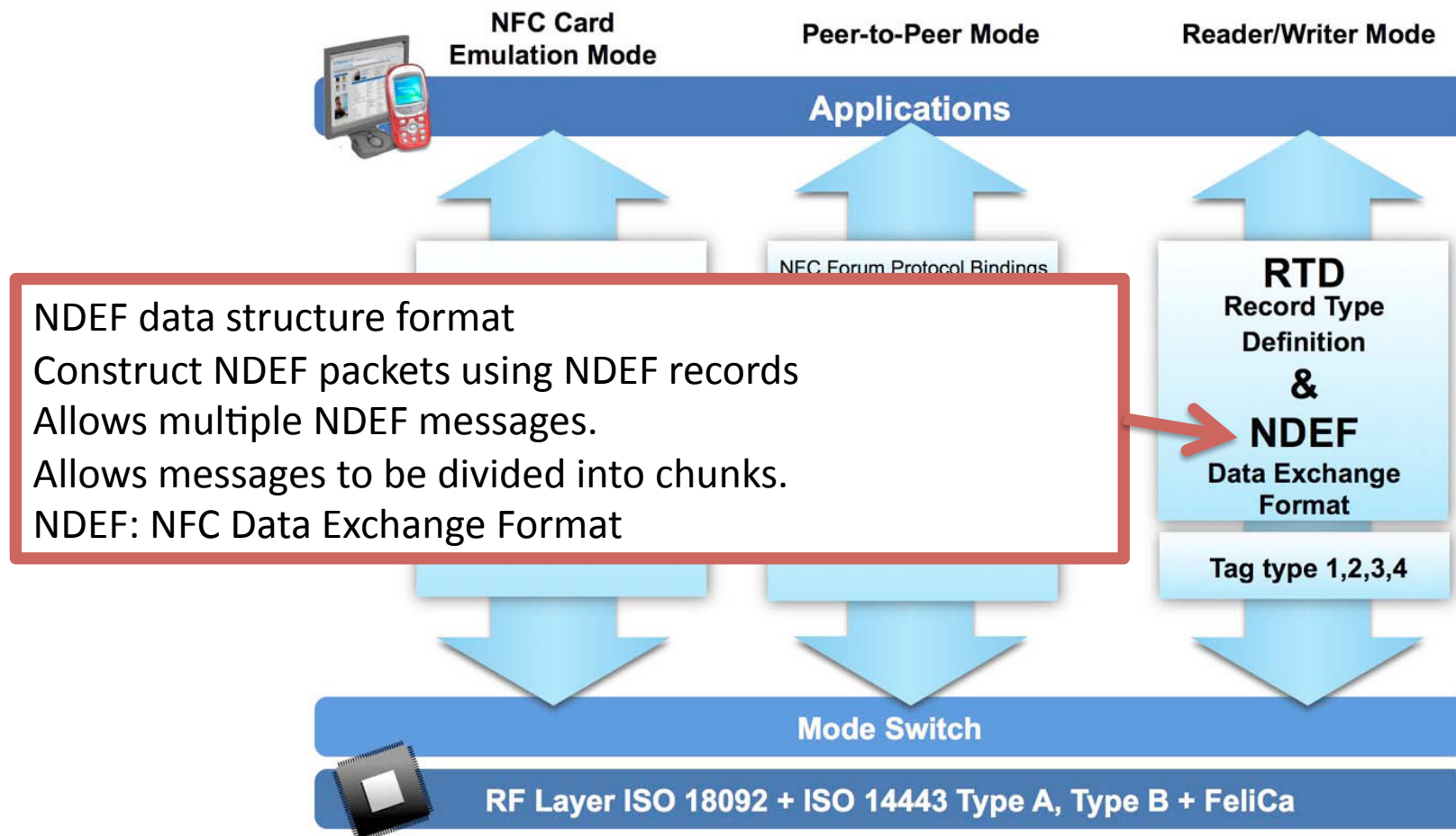




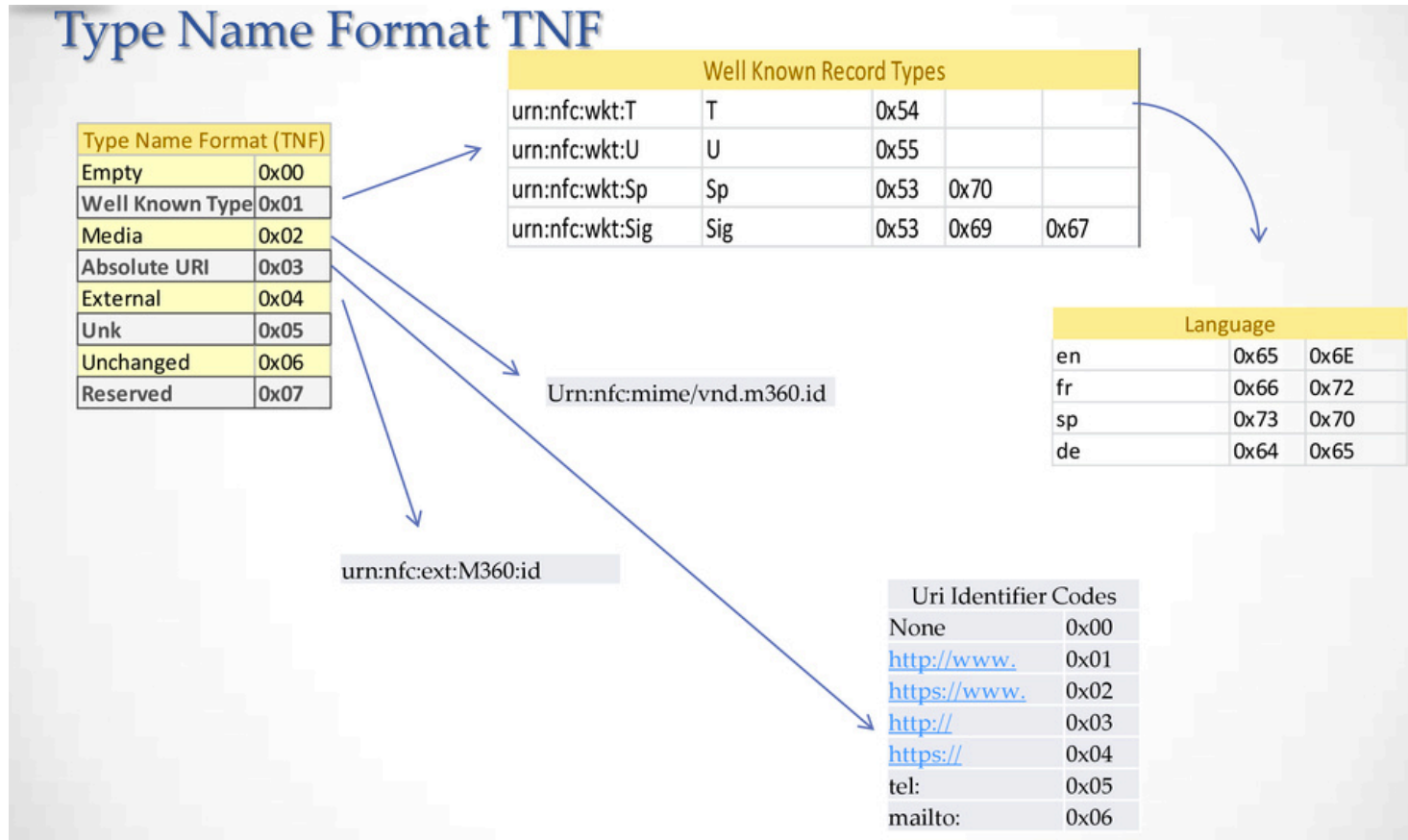
# NFC Forum architecture



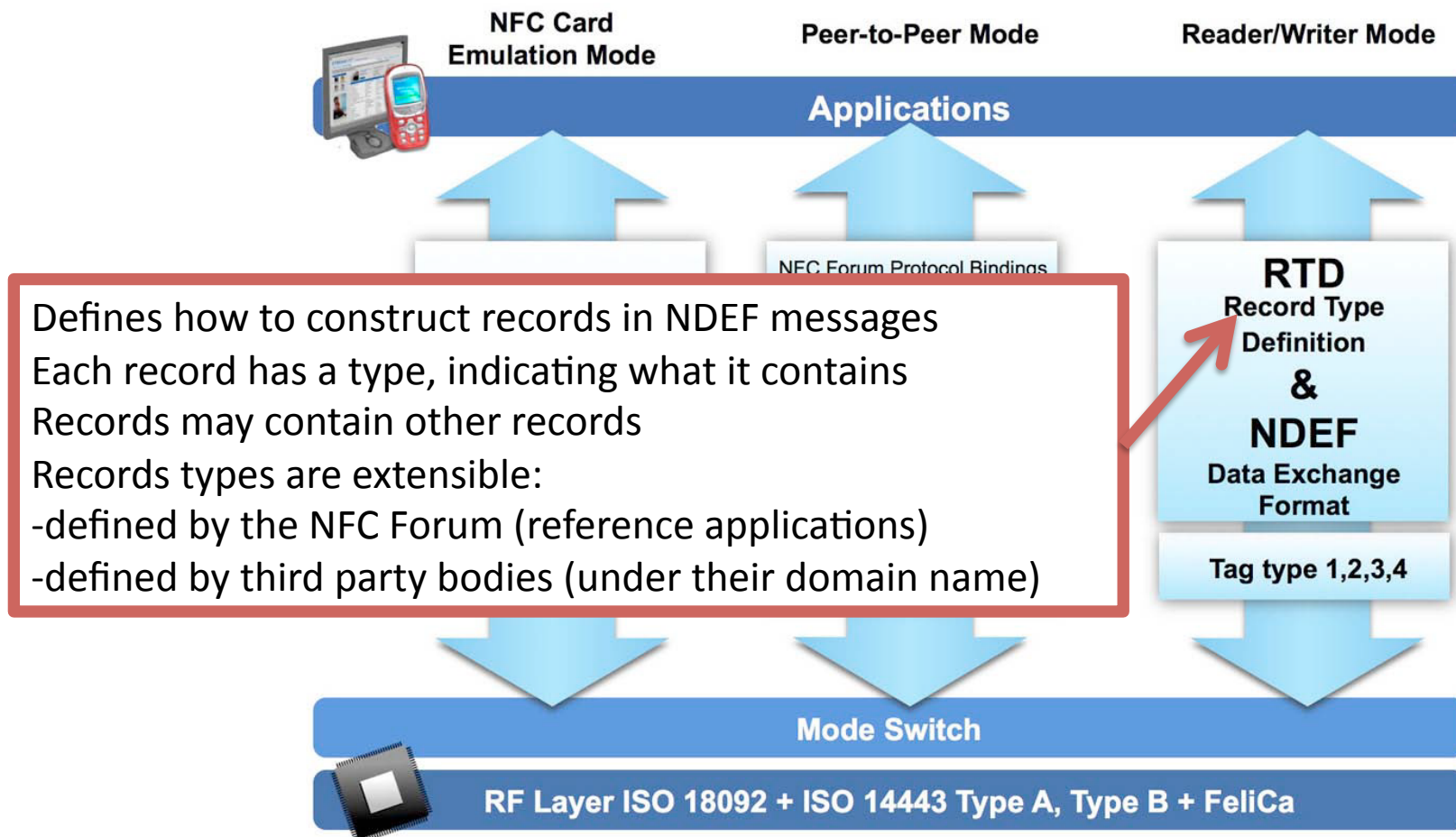
# NFC Forum architecture



# NDEF types



# NFC Forum architecture



# RTD types

## NFC Forum Defined

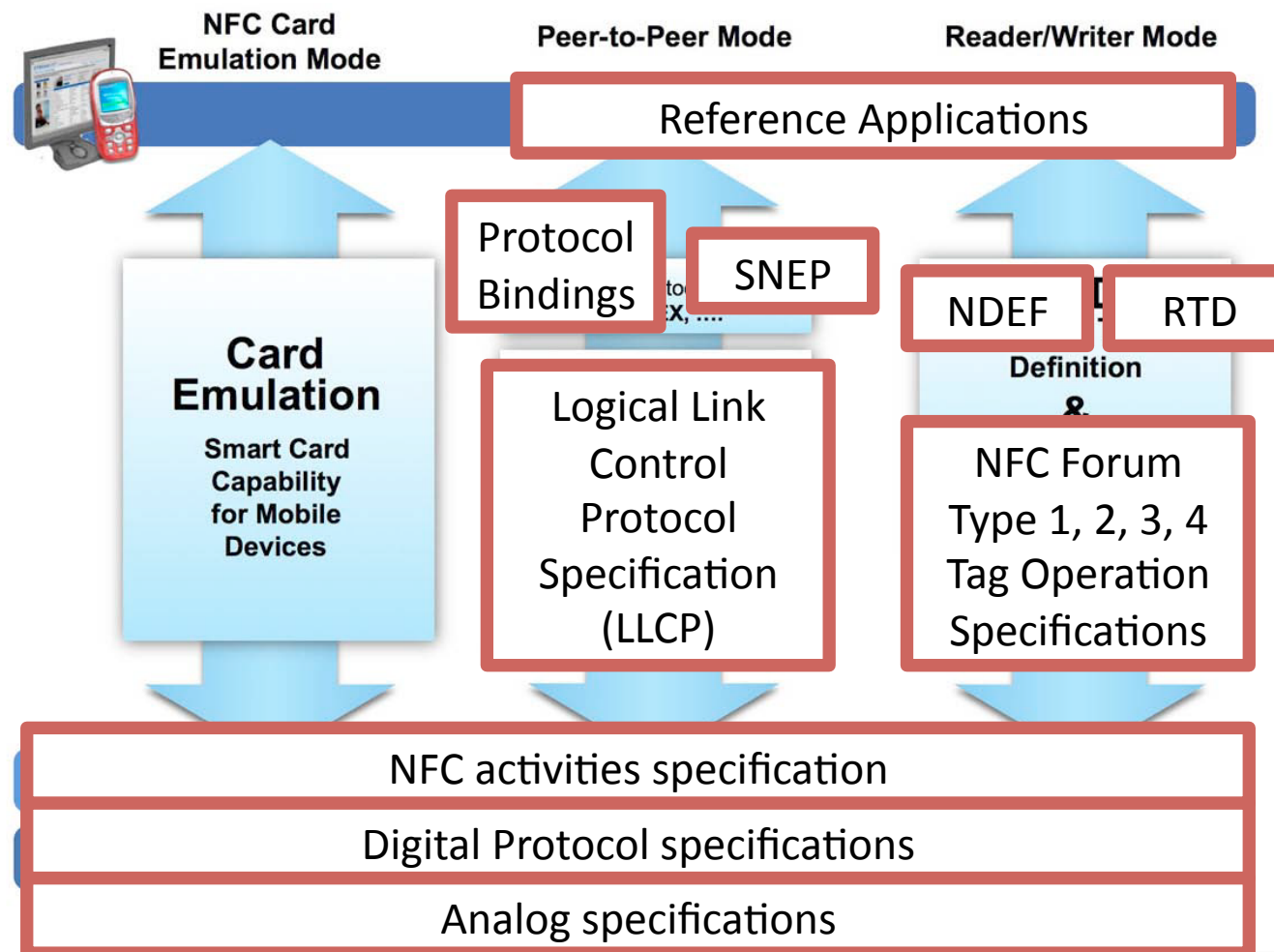
- Text
  - urn:nfc:wkt:T
- URI
  - urn:nfc:wkt:U
- Smart Poster
  - urn:nfc:wkt:Sp
- Signature
  - urn:nfc:wkt:Sig
- Handover
  - urn:nfc:wkt:HO
- ...

## Not NFC Forum Defined

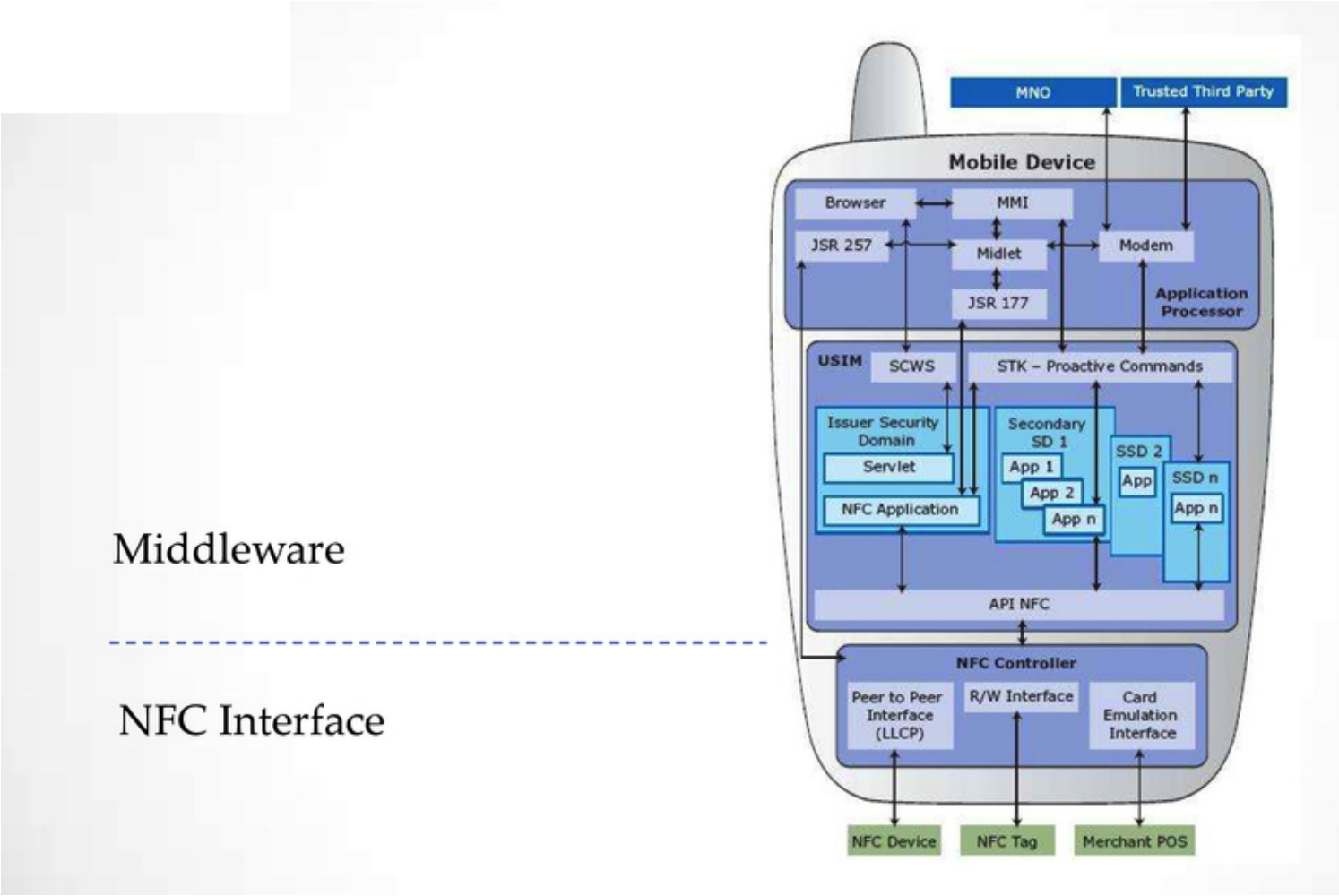
- Payment
- Mime Types
- Coupon
- Vendor
- Start a Car Application
- Etc.

Type name format	Type name	Description
MIME	text/x-vCard	Business card
MIME	text/x-vCalendar	Calendar note
NFC Forum RTD	urn:nfc:wkt:Sp	Smartposter
NFC Forum RTD	urn:nfc:wkt:U	URI record
NFC Forum Ext Type	urn:nfc:ext:nokia.com:bt	Bluetooth record (for printing/image frame)

# NFC Forum specifications



# Smartphone software

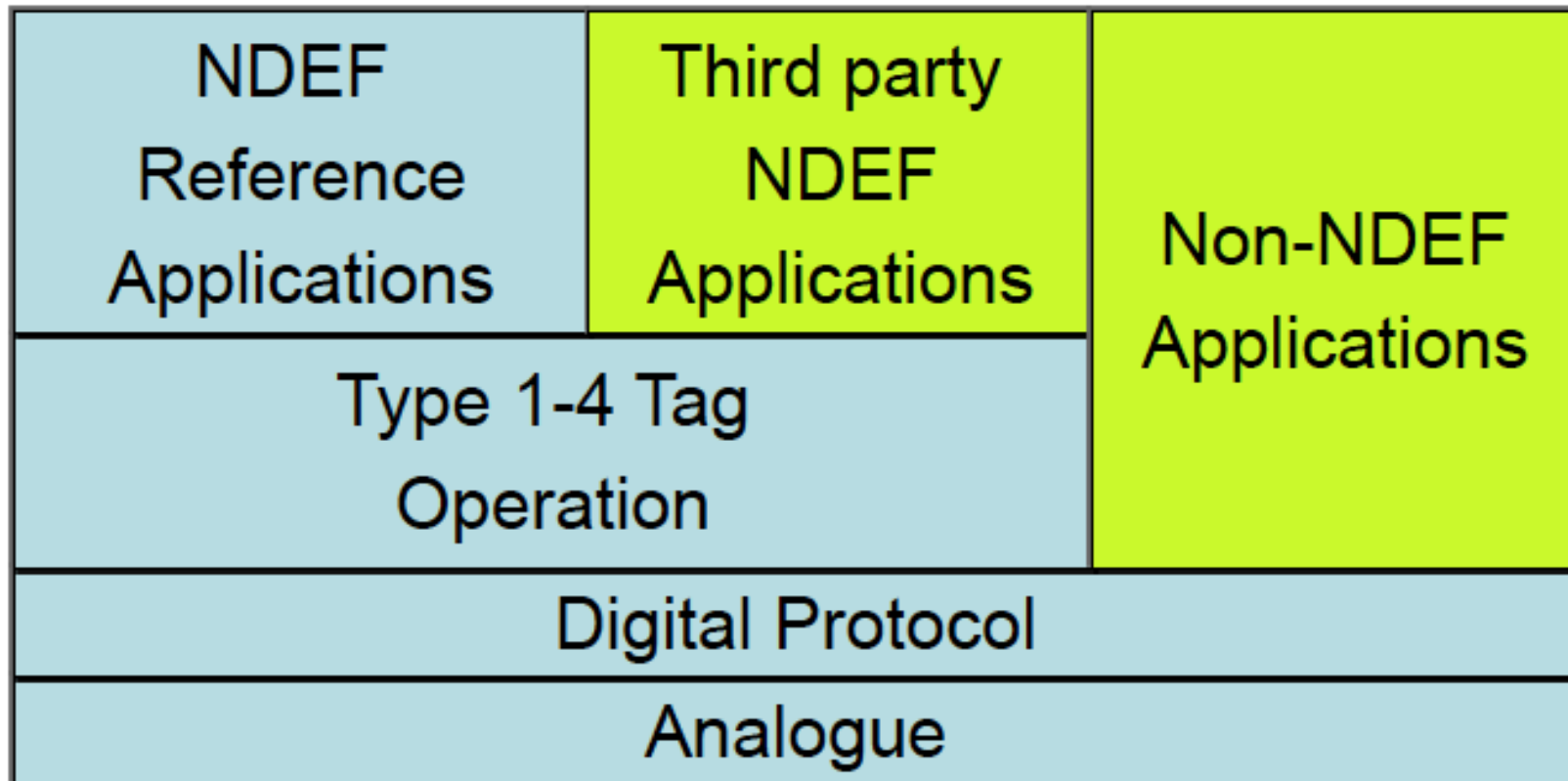


Middleware

NFC Interface

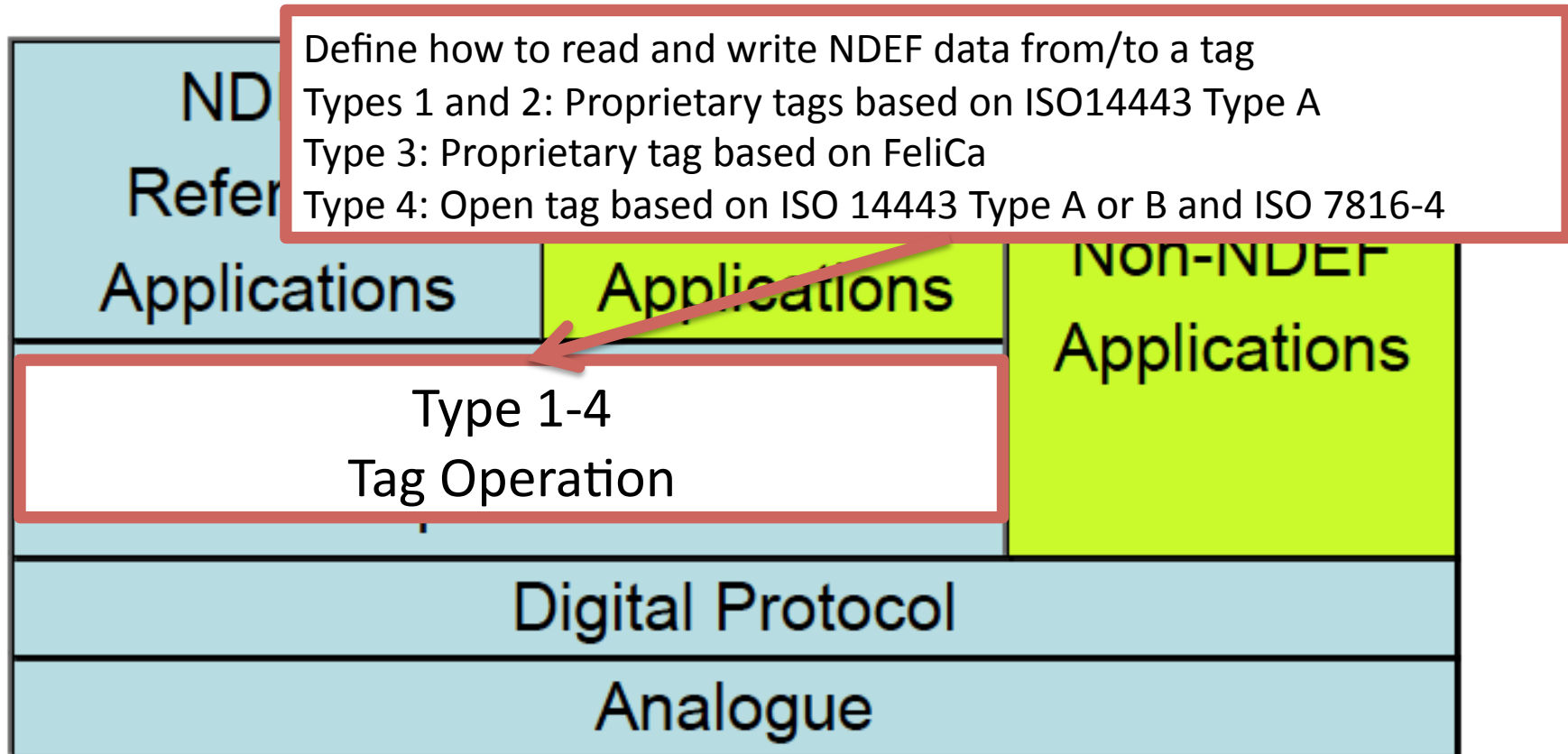


# Reader-Writer Mode

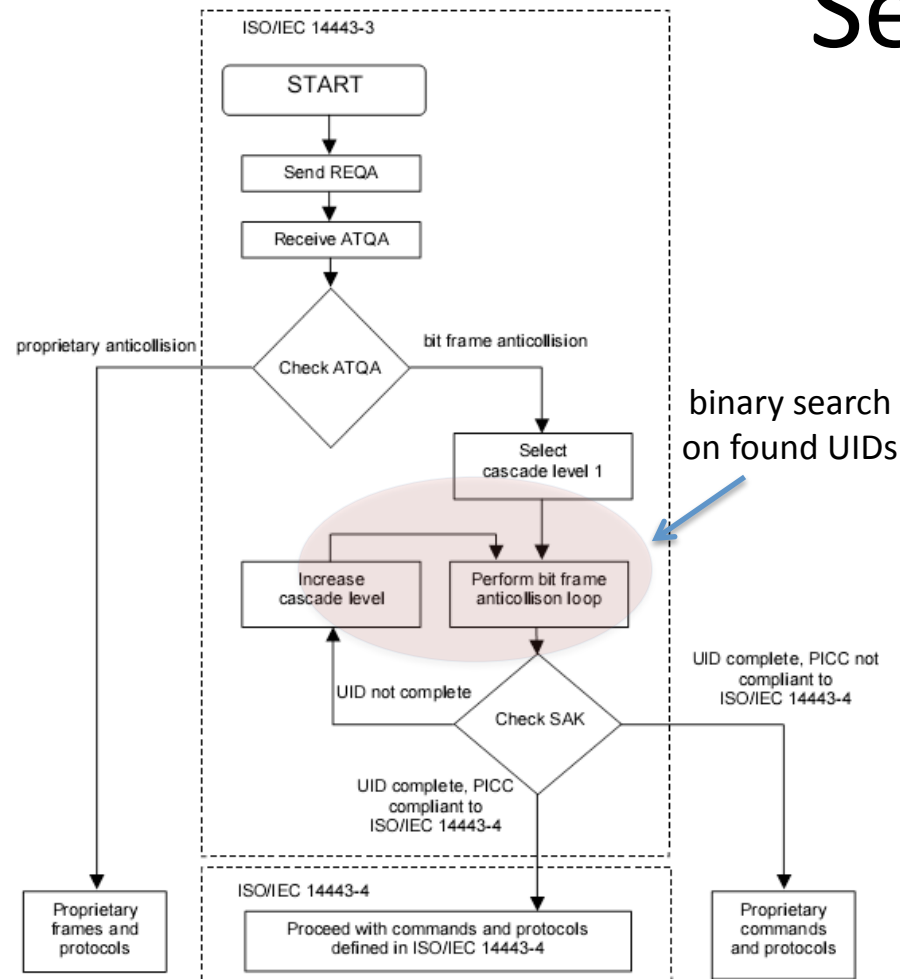




# Reader-Writer Mode

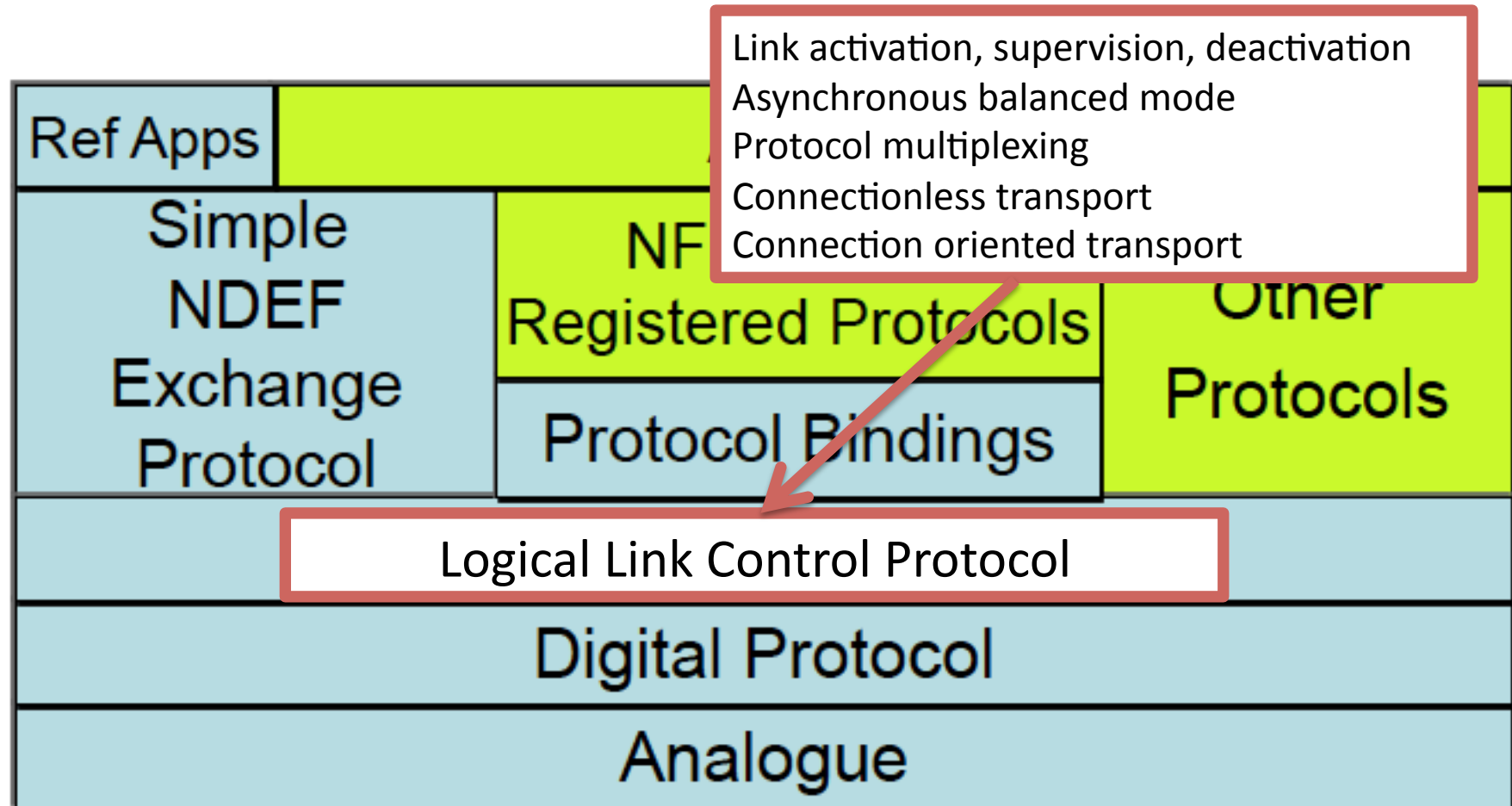


# Selecting a tag type

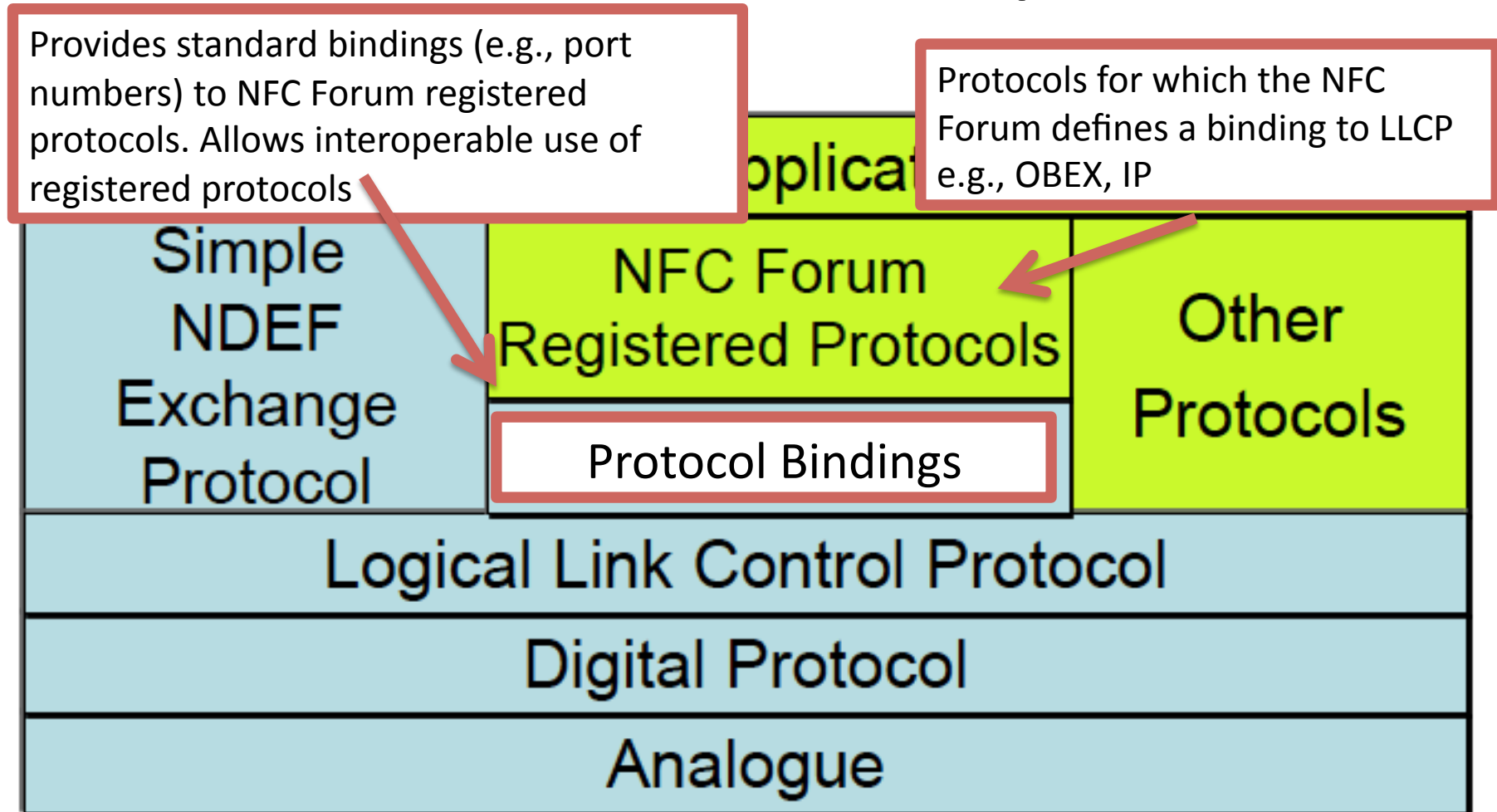


REQA (request) command invites all tags that are new in the field to respond (*new* means here that they have not responded before and are **not** previously disabled) Tags respond with the ATQA block (answer to request). This will initiate the anti-collision procedure in the reader.  
SAK=Select Acknowledged

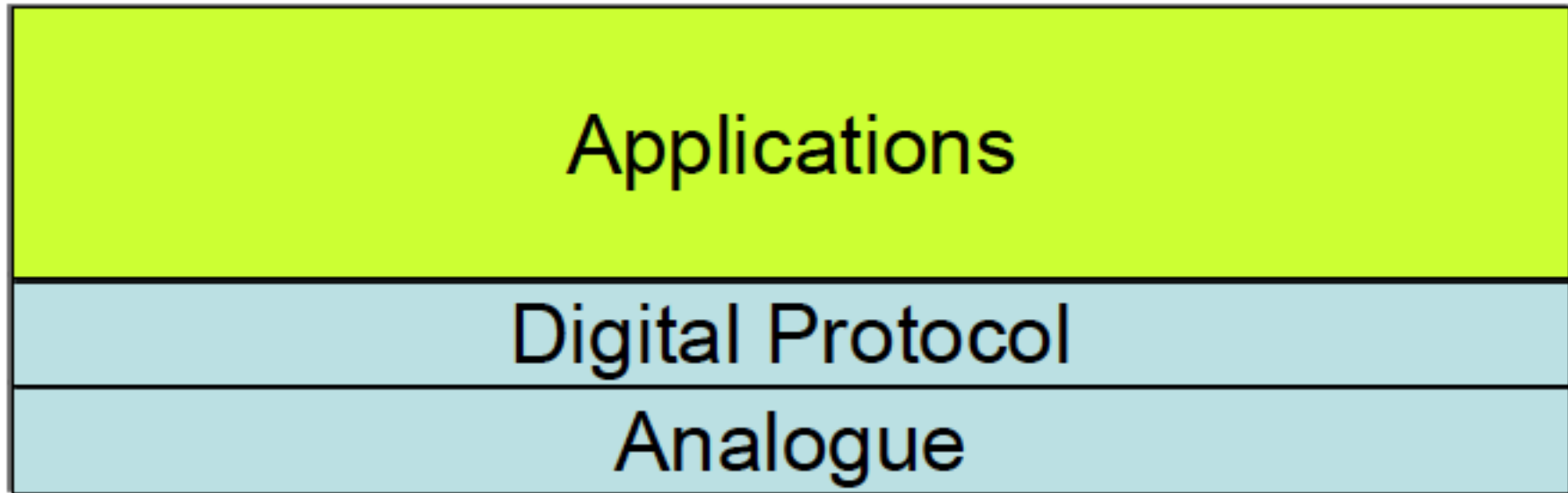
# Peer-to-peer mode



# Peer-to-peer mode

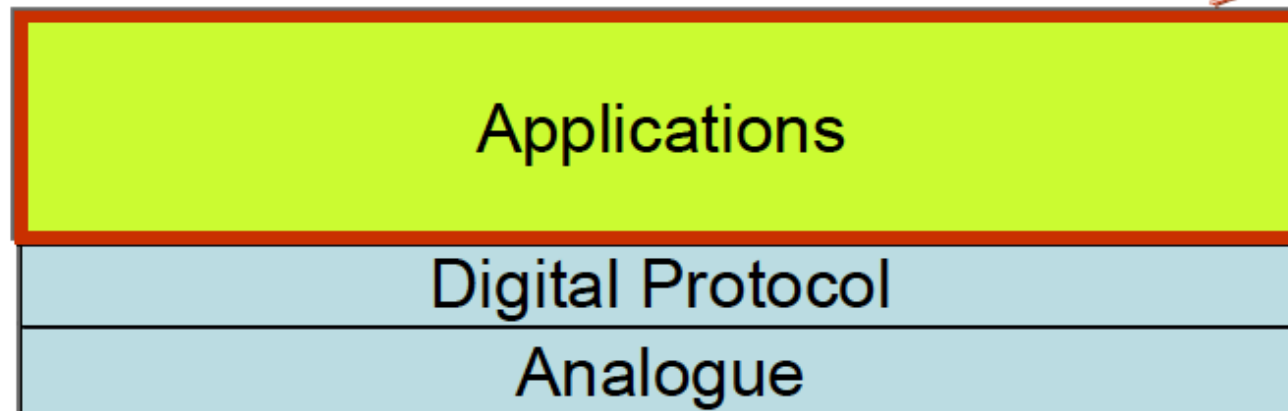


# Card emulation mode

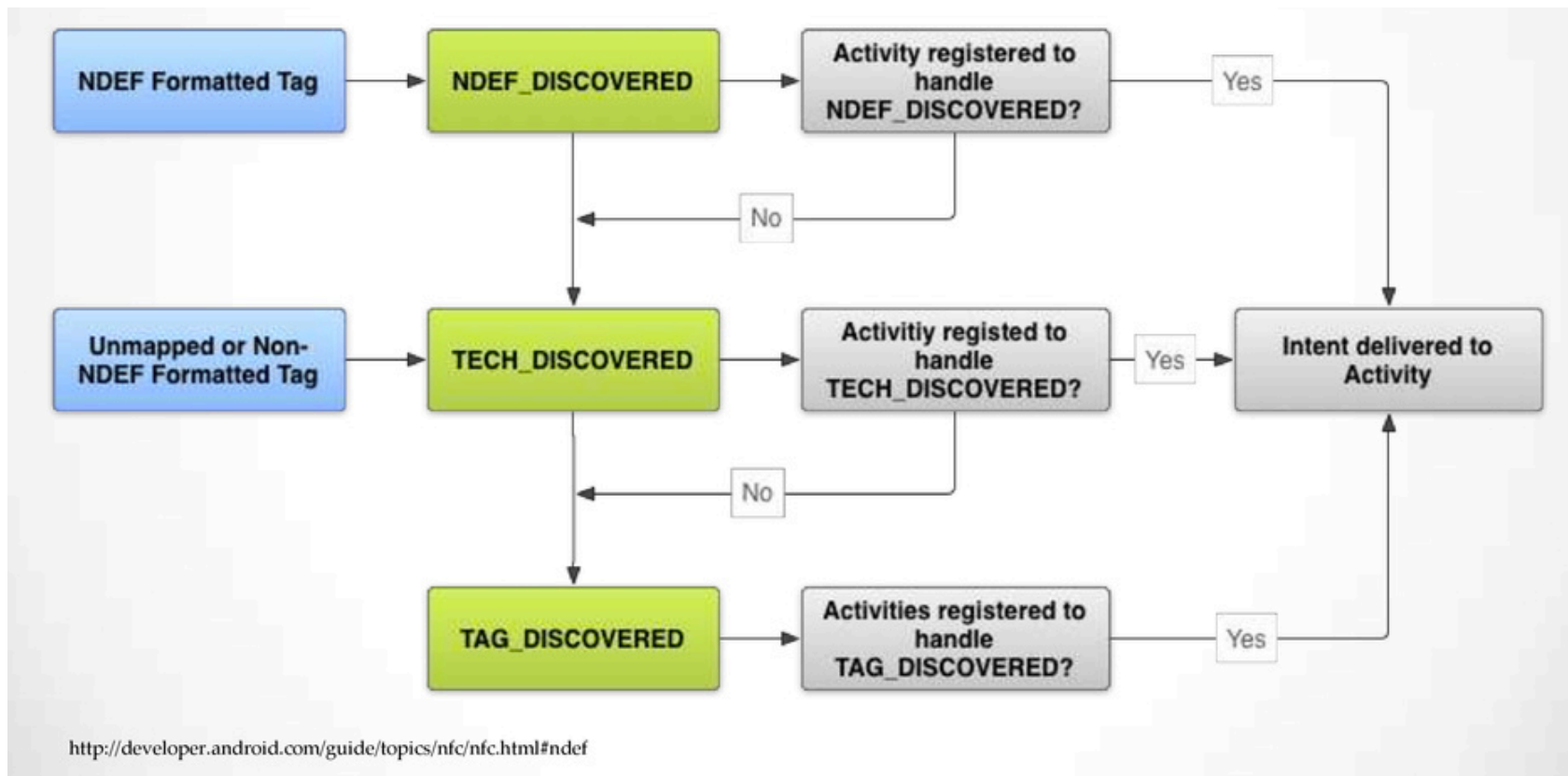


# Card emulation mode

Proprietary contactless card applications  
e.g., payment, ticketing, access control  
Based on ISO 14443 A/B or FeliCa



# NFC on Android



# Intent filter

```
<intent-filter>  
  <action android:name="android.nfc.action.NDEF_DISCOVERED" />  
  <data android:mimeType="mime/type" />  
</intent-filter>
```

```
<intent-filter>  
  <action android:name="android.nfc.action.TECH_DISCOVERED" />  
  <meta-data android:name="android.nfc.action.TECH_DISCOVERED"  
    android:resource="@xml/nfc_tech_filter.xml" />  
</intent-filter>
```

```
<intent-filter>  
  <action android:name="android.nfc.action.TAG_DISCOVERED" />  
</intent-filter>
```

```
<resources  
  xmlns:xliff="urn:oasis:names:tc:xliff:document:1.2">  
  <tech-list>  
    <tech>android.nfc.tech.IsoDep</tech>  
    <tech>android.nfc.tech.NfcA</tech>  
    <tech>android.nfc.tech.NfcB</tech>  
    <tech>android.nfc.tech.NfcF</tech>  
    <tech>android.nfc.tech.NfcV</tech>  
    <tech>android.nfc.tech.Ndef</tech>  
    <tech>android.nfc.tech.NdefFormatable</tech>  
    <tech>android.nfc.tech.MifareClassic</tech>  
    <tech>android.nfc.tech.MifareUltralight</tech>  
  </tech-list>  
</resources>
```