Specifications and Application Documents

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NFC Forum Architecture

Peer-to-Peer Mode
- NFC Forum Protocol Bindings
  - IP, OBEX, ...

Reader/Writer Mode
- LLCP
  - Logical Link Link Protocol
- NFCIP-1
  - Data Exchange Protocol
- RTD
  - Record Type Definition
  - NDEF
    - Data Exchange Format
- Tag type 1,2,3,4

NFC Card Emulation Mode
- Card Emulation
  - Smart Card Capability for Mobile Devices

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
Device Level Specifications
Digital Protocol Specification

- **Aim of specification:**
  - Define the “building blocks” to set up and maintain an NFC connection between two devices

- **How it does this:**
  - An implementation specification of NFCIP-1 incorporating ISO/IEC14443
  - Narrows down options in the base specifications to ensure interoperability

- **Implementation issues:**
  - Typically implemented in NFC chipsets and firmware

- **Where it is based in the device architecture:**
  - Part of the RF layer and Mode Switch
NFC Forum Architecture

Peer-to-Peer Mode

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  - IP, OBEX, ...

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  Logical Link Link Protocol

- NFCIP-1
  Data Exchange Protocol

Read/Write Mode

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  Record Type Definition

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Digital Protocol Specification

- MIFARE Classic 1K, 4K
- MIFARE Plus
- MIFARE DESFire
- Micros 443 Type A, Type B + FeliCa

Analogue Specifications
Activity Specification

- Aim of specification:
  - How to use the building blocks of the Digital Protocol specification for particular use-cases

- How it does this:
  - Defines a number of profiles that define the sequence of activities required to fulfill a set of use-cases.
  - E.g., establishing a peer-to-peer connection to another NFC device, reading NDEF data from a tag

- Implementation issues:
  - Possible for a device to implement proprietary profiles to support specific use cases

- Where it is based in the device architecture:
  - Mode switch
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NFC Activities Specifications
Digital Protocol Specification
- 1443 Type A, Type B + FeliCa
Analogue Specifications
Logical Link Control Protocol (LLCP)

- **Aim of specification:**
  - Provide reliable peer-to-peer communication over NFC

- **How it does this:**
  - Defines a logical link control layer on top of the Digital Protocol Specification peer-mode
  - Provides support for peer-to-peer communication, connection oriented and connectionless transport, and protocol multiplexing

- **Implementation issues:**
  - May be implemented in NFC chip sets or in software in the device

- **Where it is based in the device architecture:**
  - Between Mode Switch and Application layer
  - Applicable to Peer-to-peer mode only
NFC Forum Architecture

Peer-to-Peer Mode
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  IP, OBEX, ...

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  Logical Link Control Protocol
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NFC Activities Specifications

Digital Protocol Specification
- ISO/IEC 14443 Type A, Type B + FeliCa

Analogue Specifications
Tag Type Specifications

- **Aim of specification:**
  - Defines how to read NDEF messages from NFC Forum Tags

- **How it does this:**
  - Defines 4 tag types
  - Defines the commands and parameters to read and write data to tags

- **Implementation issues:**
  - An NFC Forum device is required to be able to read and write to all tag types

- **Where it is based in the device architecture:**
  - Sits above mode switch and provides support to applications
  - Applicable to Reader/Writer mode only
NFC Controller Interface (NCI) Candidate Release

- **Aim of specification:**
  - Defines an interface within an NFC device between an NFC controller and the device's main application processor.

- **How it does this:**
  - NCI offers users a logical interface that can be used with different physical transports, such as UART, SPI, and I2C.
  - NCI supports routing traffic to different secure elements in the device.

- **Implementation issues:**
  - Require software implementations in both NFC controller and device main application processor (linked with running OS).

- **Where it is based in the device architecture:**
  - Part of the “routing” functions of the NFC controller.
Application Level Specifications
NDEF
NFC Data Exchange Format

- **Aim of specification:**
  - Provide a standard format for NFC application data

- **How it does this:**
  - Defines a message format
  - Messages consist of one or more records, which may be nested
  - A message may be split into multiple chunks

- **Implementation issues:**
  - NDEF messages may be up to 4GB, but are typically limited by memory considerations (such as size of tag)

- **Use Cases:**
  - Smart Poster
  - Exchange of control information (e.g., remote controls)
RTD
Record Type Definition

- Aim of specification:
  - Provide an extensible structure for the identification of the type of data in an NDEF message

- How it does this:
  - Defines a record structure and record type
  - Record type identifies the semantics of the data
  - Record type may be well known (defined by NFC Forum) or external (defined by another organization)

- Implementation issues:
  - External type namespace is based on domain name of organization defining the type

- Use Cases:
  - Well known RTDs include: Text, URI, Smart Poster, and NDEF Signature
NFC Forum Architecture

Applications

Peer-to-Peer Mode

NFC Forum Protocol Bindings
IP, OBEX, ....

LLCP
Logical Link
Link Protocol

NFCIP-1
Data Exchange Protocol

Reader/Writer Mode

NDEF
Record Type Definition
&
NDEF Data Exchange Format

RTD
Tag type 1,2,3,4

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NFC Activities Specifications

Digital Protocol Specification

Analogue Specifications

Layered Protocol Specifications
443 Type A, Type B + FeliCa
Simple NDEF Exchange Protocol (SNEP)

- **Aim of specification:**
  - The Simple NDEF Exchange Protocol (SNEP) allows an application on an NFC-enabled device to exchange NFC Data Exchange Format (NDEF) messages with another NFC Forum device when operating in NFC Forum peer-to-peer mode.

- **How it does this:**
  - SNEP is a request/response protocol. A SNEP client application sends a request to a SNEP server application.

- **Implementation issues:**
  - The protocol uses the NFC Logical Link Control Protocol (LLCP) connection-oriented transport mode to provide a reliable data exchange.

- **Use cases:**
  - Simplified transfer of contact information
  - Collecting movie posters for later use
NFC Forum Architecture

Peer-to-Peer Mode
- Protocol Bindings
- LLCP (Logical Link Control Protocol Specification)
  - NFCIP-1 (Data Exchange Protocol)
- NFC Activities Specifications

Reader/Writer Mode
- SNEP (Session and Network Entities Protocol)
- RTD (Record Type Definition) & NDEF (Data Exchange Format)
  - Tag type 1,2,3,4

NFC Card Emulation Mode
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Digital Protocol Specification
- EMV (European Smart Card Organization) 443 Type A, Type B + FeliCa

Analogue Specifications
Connection Handover

- **Aim of specification:**
  - Use NFC to initiate a connection on an alternative technology

- **How it does this:**
  - Defines the messages for negotiating and exchanging configuration information for the alternative technology

- **Implementation issues:**
  - Configuration information may be defined by organizations defining the alternative technology

- **Use Cases:**
  - Enables quick and easy pairing with Bluetooth devices
  - Creates secure WiFi links
NFC Forum Architecture
New technical work items recently approved:
- Introduction of ISO/IEC 15693 VCD mode technology into NFC Forum specifications
- Integration of Active Communication Mode as defined by ISO/IEC 18092 into the NFC Forum specifications
  - Extension to Peer to Peer mode
- Connection Handover Extension (in RAF WG)
- Hashing Algorithms for Signature RTD
- Evaluation of wireless charging
Application Documents
Application Document - Why

Application Scope

NFC Technology
Application Documents - What

- What application documents are
  - Informative technical documents
  - Published by the NFC Forum
  - Build on NFC Forum Specifications
  - Relate to a specific application domain
  - Often focused toward a vertical market
### Specification vs. Application Doc

#### Specification
- A binding contract
- Defines a solution
- Demands compliance
- Normative wording
- Is the standard
- Is the way of doing

#### Application Document
- A mutual agreement
- Describes a solution
- Proposes best practice
- Informative wording
- Related to the standard
- Is one way of doing
# Example - Bluetooth Secure Simple Pairing using NFC

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- Defined by BT SIG
- Defined by NFC Forum
- Recommended by NFC Forum
THANK YOU!