Putting NFC Forum Specifications to Work

Gavin Shenker
NFC Forum Member
Visa

May 23, 2012
NFC Forum Architecture

Peer-to-Peer Mode

Reader/Writer Mode

NFC Card Emulation Mode

Reference Applications

Protocol Bindings

SNEP

LLCP

Logical Link Control Protocol Specification

NFCIP-

Data Exchange Protocol

NDEF & RTD

Record Type Definition

NFC Forum Type 1-4 Tag Operation

RTD

Card Emulation

Smart Card Capability for Mobile Devices

NFC Controller Interface Specifications

Digital Protocol Specification

RF Layer ISO 16092 + ISO 14443 Type A, Type B + FeliCa
Device Level Specifications
NFC Forum Architecture

Peer-to-Peer Mode

Applications

Reader/Writer Mode

NFC Card Emulation Mode

NFC Forum Protocol Bindings
IP, OBEX, ...

LLCP
Logical Link Protocol

NFCIP-1
Data Exchange Protocol

RTD
Record Type Definition
&
NDEF
Data Exchange Format

Tag type 1,2,3,4

Card Emulation
Smart Card Capability for Mobile Devices

Mode Switch

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

Reader/Writer Mode

Peer-to-Peer Mode

Applications

NFC Forum Protocol Bindings
IP, OBEX, ...

LLCP
Logical Link
Link Protocol

NFCIP-1
Data Exchange Protocol

RTD
Record Type
Definition
&
NDEF
Data Exchange
Format

Tag type 1,2,3,4

Card
Emulation
Smart Card
Capability
for Mobile
Devices

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa

NFC Activities Specifications
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.
- For example, establishing a peer-to-peer connection to another NFC Forum 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
NFC Forum Architecture

Peer-to-Peer Mode

Logical Link Control Protocol Specification

Reader/Writer Mode

NFC Card Emulation Mode

Applications

RTD
Record Type Definition
&
NDEF
Data Exchange Format

Tag type 1,2,3,4

Card Emulation
Smart Card Capability for Mobile Devices

Mode Switch

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
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

Reader/Writer Mode

NFC Forum Type 1-4 Tag Operation Specifications

NFC Card Emulation Mode

Peer-to-Peer Mode

RTD
Record Type Definition & NDEF
Data Exchange Format
Tag type 1,2,3,4

Applications

LLCP
Logical Link Link Protocol

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

NFCIP-1
Data Exchange Protocol

Mode Switch

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
Tag Type Specifications

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

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

- **Implementation issues:**
  - An NFC Forum device is required to be able to read from, 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 Forum Architecture

Reader/Writer Mode

NFC Controller Interface Specifications

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

Card Emulation
Smart Card Capability for Mobile Devices

Mode Switch
RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
NFC Forum Protocol Bindings
IP, OBEX, ...
NFC Controller Interface (NCI) Candidate Release

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

- **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 within 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:**
  - Shifting and dependent on the RF interface being used
Application Level Specifications
NFC Forum Architecture

Peer-to-Peer Mode

Reader/Writer Mode

NFC Card Emulation Mode

Applications

NFC Forum Protocol Bindings
IP, OBEX, ...

LLCP
Logical Link
Link Protocol

NFCIP-1
Data Exchange Protocol

RTD
Record Type Definition
&
NDEF
Data Exchange Format

Tag type 1,2,3,4

Card Emulation
Smart Card Capability for Mobile Devices

Mode Switch

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa

NDEF
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 the size of tag)

- **Use Cases:**
  - Smart Poster
  - Exchange of control information (e.g., remote controls)
NFC Forum Architecture

Peer-to-Peer Mode

- NFC Forum Protocol Bindings
  - IP, OBEX, ...
- LLCP
  - Logical Link Link Protocol
- NFCIP-1
  - Data Exchange Protocol

Reader/Writer Mode

- 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

Mode Switch

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
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
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

Reader/Writer Mode

NFC Card Emulation Mode

Reference Applications

Applications

LLCP
Logical Link Link Protocol

NFC Forum Protocol Bindings
IP, OBEX, ...

RTD
Record Type Definition

&
NDEF
Data Exchange Format

Tag type 1,2,3,4

Card Emulation
Smart Card Capability for Mobile Devices

Mode Switch

RF Layer ISO 18092 + ISO 14443 Type A, Type B + FeliCa
Connection Handover

- **Aim of specification:**
  - Use NFC to initiate a connection on an alternative wireless 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
Technical Committee
Potential New Work Streams

- 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
THANK YOU!