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Part 2: NFC Data Exchange Format

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NFC Forum Specifications - Part 2: NFC Data Exchange Format

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IEC 63652-2 has been prepared by technical area 15: Wireless Power Transfer, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

It is based on NFC Data Exchange Format Version 1.0 and was submitted as a Fast-Track document.

The text of this International Standard is based on the following documents:

Draft	Report on voting
100/4400/FDIS	100/4435/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

The structure and editorial rules used in this publication reflect the practice of the organization which submitted it.

This document was developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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- reconfirmed,
- withdrawn, or
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NFC Data Exchange Format

Technical Specification

Version 1.0

2021-08-23

[NDEF]

NFC Forum™

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1 Overview

The NFC Data Exchange Format (NDEF) specification defines a message encapsulation format to exchange information between two NFC Forum Devices.

NDEF is a lightweight, binary message format that can be used to encapsulate one or more application-defined payloads of arbitrary type and size into a single message construct. Each payload is described by a type, a length, and an optional identifier.

Type identifiers can be URIs, MIME media types, or NFC-specific types. This latter format permits compact identification of well known types commonly used in NFC Forum applications, or self-allocation of a name space for organizations that wish to use it for their own NFC-specific purposes.

The NDEF Payload Length is an unsigned integer that indicates the number of octets in the payload. A compact, NDEF short-record layout is provided for very small payloads.

The optional NDEF Payload Identifier enables association of multiple payloads and cross-referencing between them.

NDEF Payloads can include nested NDEF Messages or chains of linked chunks of length unknown at the time the data is generated.

NDEF is strictly a message format, which provides no concept of a connection or of a logical circuit, nor does it address head-of-line problems.

1.1 Objectives

The NFC Data Exchange Format (NDEF) specification is a common data format for NFC Forum Devices.

The NFC Data Exchange Format specification defines the NDEF data structure format as well as rules to construct a valid NDEF Message as an ordered and unbroken collection of NDEF Records. Furthermore, it defines the mechanism for specifying the types of application data encapsulated in NDEF Records.

The NDEF specification defines only the data structure format to exchange application or service specific data in an interoperable way, and it does not define any NDEF Record Types in detail — NDEF Record Types are defined in separate specifications.

This NDEF specification assumes a reliable underlying protocol and therefore this specification does not specify the data exchange between two NFC Forum Devices.

An NFC Forum Device can process the NDEF information independently of the way it has received the NDEF Message.

Because of the large number of existing message encapsulation formats, record marking protocols, and multiplexing protocols, it is best to be explicit about the design goals of NDEF and, in particular, about what is outside the scope of NDEF.

1.1.1 Design Goals

The design goal of NDEF is to provide an efficient and simple message format that can accommodate the following:

1. Encapsulating arbitrary documents and entities, including encrypted data, XML documents, XML fragments, image data like GIF and JPEG files, etc.

2. Encapsulating documents and entities initially of unknown size. This capability can be used to encapsulate dynamically generated content or very large entities as a series of chunks.
3. Aggregating multiple documents and entities that are logically associated in some manner into a single message. For example, NDEF can be used to encapsulate an NFC-specific message and a set of attachments of standardized types referenced from that NFC-specific message.
4. Compact encapsulation of small payloads should be accommodated without introducing unnecessary complexity to parsers.

To achieve efficiency and simplicity, the mechanisms provided by this specification have been deliberately limited to serve these purposes. NDEF has not been designed as a general message description or document format such as MIME or XML. Instead, NFC applications can take advantage of such formats by encapsulating them in NDEF Messages.

1.1.2 Anti-Goals

The following list identifies items outside the scope of NDEF:

1. NDEF does not make any assumptions about the types of payloads that are carried within NDEF Messages or about the message exchange patterns implied by such messages.
2. NDEF does not in any way introduce the notion of a connection or a logical circuit (virtual or otherwise).
3. NDEF does not attempt to deal with head-of-line blocking problems that might occur when stream-oriented protocols like TCP are used.

1.2 Applicable Documents or References

[NFC RTD] NFC Record Type Definition (RTD) Specification, NFC Forum

[RFC 1700] Reynolds, J. and J. Postel, “Assigned Numbers”, STD 2, RFC 1700, October 1994.

[RFC 1900] B. Carpenter, Y. Rekhter, “Renumbering Needs Work”, RFC 1900, IAB, February 1996.

[RFC 2046] N. Freed, N. Borenstein, “Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types” RFC 2046, Innosoft, First Virtual, November 1996.

[RFC 2047] K. Moore, “MIME (Multipurpose Internet Mail Extensions) Part Three: Message Header Extensions for Non-ASCII Text”, RFC 2047, University of Tennessee, November 1996.

[RFC 2048] N. Freed, J. Klensin, J. Postel, “Multipurpose Internet Mail Extensions (MIME) Part Four: Registration Procedures”, RFC 2048, Innosoft, MCI, ISI, November 1996.

[RFC 2119] S. Bradner, “Key words for use in RFCs to Indicate Requirement Levels”, RFC 2119, Harvard University, March 1997.

[RFC 2616] R. Fielding, J. Gettys, J. C. Mogul, H. F. Nielsen, T. Berners-Lee, “Hypertext Transfer Protocol -- HTTP/1.1”, RFC 2616, U.C. Irvine, DEC W3C/MIT, DEC, W3C/MIT, W3C/MIT, January 1997.

[RFC 2717] R. Petke, I. King, “Registration Procedures for URL Scheme Names”, BCP: 35, RFC 2717, UUNET Technologies, Microsoft Corporation, November 1999.

[RFC 2718] L. Masinter, H. Alvestrand, D. Zigmond, R. Petke, “Guidelines for new URL Schemes”, RFC 2718, Xerox Corporation, Maxware, Pirsenteret, WebTV Networks, Inc., UUNET Technologies, November 1999.

[RFC 2732] R. Hinden, B. Carpenter, L. Masinter, “Format for Literal IPv6 Addresses in URL's”, RFC 2732, Nokia, IBM, AT&T, December 1999.

[RFC 3023] M. Murata, S. St. Laurent, D. Kohn, “XML Media Types” RFC 3023, IBM Tokyo Research Laboratory, simonstl.com, Skymoon Ventures, January 2001.

[RFC 3986] T. Berners-Lee, R. Fielding, L. Masinter, “Uniform Resource Identifiers (URI): Generic Syntax”, RFC 3986, MIT/LCS, U.C. Irvine, Xerox Corporation, January 2005.

[URI SCHEME] List of Uniform Resource Identifier (URI) schemes registered by IANA is available at: http://www.iana.org/assignments/uri-schemes.

1.3 Administration

The NFC Forum NFC Data Exchange Format specification is an open specification supported by the Near Field Communication Forum, Inc., located at:

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The Near Field Communication Forum’s policy regarding the use of trademarks and logos is described in the NFC Forum Brand Identity Guidelines and N-Mark Usage Guidelines, which can be found on the NFC Forum website.

1.5 Intellectual Property

This document conforms to the Intellectual Property guidelines specified in the NFC Forum *Intellectual Property Rights Policy*, as outlined in the NFC Forum *Rules of Procedure*. These documents are available on the NFC Forum website.

1.6 Special Word Usage

The key words “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT” and “MAY” in this document are to be interpreted as described in [RFC 2119].

1.7 Abbreviations

Table 1 contains the definitions of the abbreviations and acronyms used in this document.

Table 1: Abbreviations

Abbreviation	Description
CF	Chunk Flag
NDEF	NFC Data Exchange Format
QoS	Quality of Service
RFU	Reserved for Future Use
URI	Uniform Resource Identifier

1.8 Glossary

Big Endian

A method of recording or transmitting numerical data of more than one byte, with the most significant byte placed at the beginning.

Chunked Payload

Application data that has been partitioned into multiple chunks, each carried in a separate NDEF Record.

NDEF Application

The logical, higher-layer application on an NFC Forum Device using NDEF to format information for exchange with other NFC Forum Devices.

NDEF Generator

An entity or module that encapsulates application-defined payloads within NDEF Messages.

NDEF Message

The basic message construct defined by this specification. An NDEF Message contains one or more NDEF Records.

NDEF Parser

An entity or module that parses NDEF Messages and hands off the payloads to an NDEF Application.

NDEF Payload

The application data carried within an NDEF Record.

NDEF Payload Identifier

An optional Uniform Resource Identifier (URI) that can be used to identify a payload.

NDEF Payload Length

An unsigned integer that indicates the number of octets in the payload of a single NDEF Record.

NDEF Payload Type

An identifier that indicates the type of the payload.

NDEF Record

An NDEF Record contains a payload described by a type, a length, and an optional identifier.

NDEF Record Chunk

An NDEF Record that contains a chunk of a payload rather than a full payload.

NDEF Short Record

An NDEF Record that allows payloads or chunks of up to 255 bytes to be carried.

NFC Forum Device

A device that supports at least one communication protocol for at least one communication mode defined by the NFC Forum specifications. Currently the following NFC Forum Devices are defined:
NFC Universal Device, NFC Tag Device and NFC Reader Device.

NFC Reader Device

An NFC Forum Device that supports the following Modus Operandi: Reader/Writer. It can also support Initiator.

NFC Tag Device

An NFC Forum Device that supports at least one communication protocol for Card Emulator and NDEF.

NFC Universal Device

An NFC Forum Device that supports the following Modus Operandi: Initiator, Target, and Reader/Writer. It can also support Card Emulator.