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Field Device Integration (FDI®) – Part 4: FDI Packages

IEC 62769-4:2023-04 RLV(en)

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FIELD DEVICE INTEGRATION (FDI®) –

Part 4: FDI® Packages

FOREWORD

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This third edition cancels and replaces the second edition published in 2021. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) added DocumentClass to Package Schema, Description of Feature Table and Documentation Catalog, individual schemas for Feature Table and Package Documentation Catalog, schema for UnitConversion, interactive download to device, and Feature Unit Conversion;

b) moved DocumentClass to Package Documentation Catalog Schema;

c) updated Description of Feature Table updated XML schema for Feature Table.

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

Draft	Report on voting
65E/857/CDV	65E/914/RVC

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.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and 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/standardsdev/publications.

A list of all parts in the IEC 62769 series, published under the general title *Field device integration (FDI®)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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~~INTRODUCTION~~

~~The IEC 62769 series has the general title *Field Device Integration (FDI)* and the following parts:~~

- ~~Part 1: Overview~~
- ~~Part 2: FDI Client~~
- ~~Part 3: FDI Server~~
- ~~Part 4: FDI Packages~~
- ~~Part 5: FDI Information Model~~
- ~~Part 6: FDI Technology Mapping~~
- ~~Part 7: FDI Communication Devices~~
- ~~Part 100: Profiles – Generic Protocol Extensions~~
- ~~Part 101-1: Profiles – Foundation Fieldbus H1~~
- ~~Part 101-2: Profiles – Foundation Fieldbus HSE~~
- ~~Part 103-1: Profiles – PROFIBUS~~
- ~~Part 103-4: Profiles – PROFINET~~
- ~~Part 109-1: Profiles – HART and WirelessHART~~
- ~~Part 115-2: Profiles – Protocol-specific Definitions for Modbus RTU~~
- ~~Part 150-1: Profiles – ISA 100.11a~~

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FIELD DEVICE INTEGRATION (FDI®) –

Part 4: FDI® Packages

1 Scope

This part of IEC 62769 specifies the FDI®[1] Packages. The overall FDI® architecture is illustrated in Figure 1. The architectural components that are within the scope of this document have been highlighted in this figure.

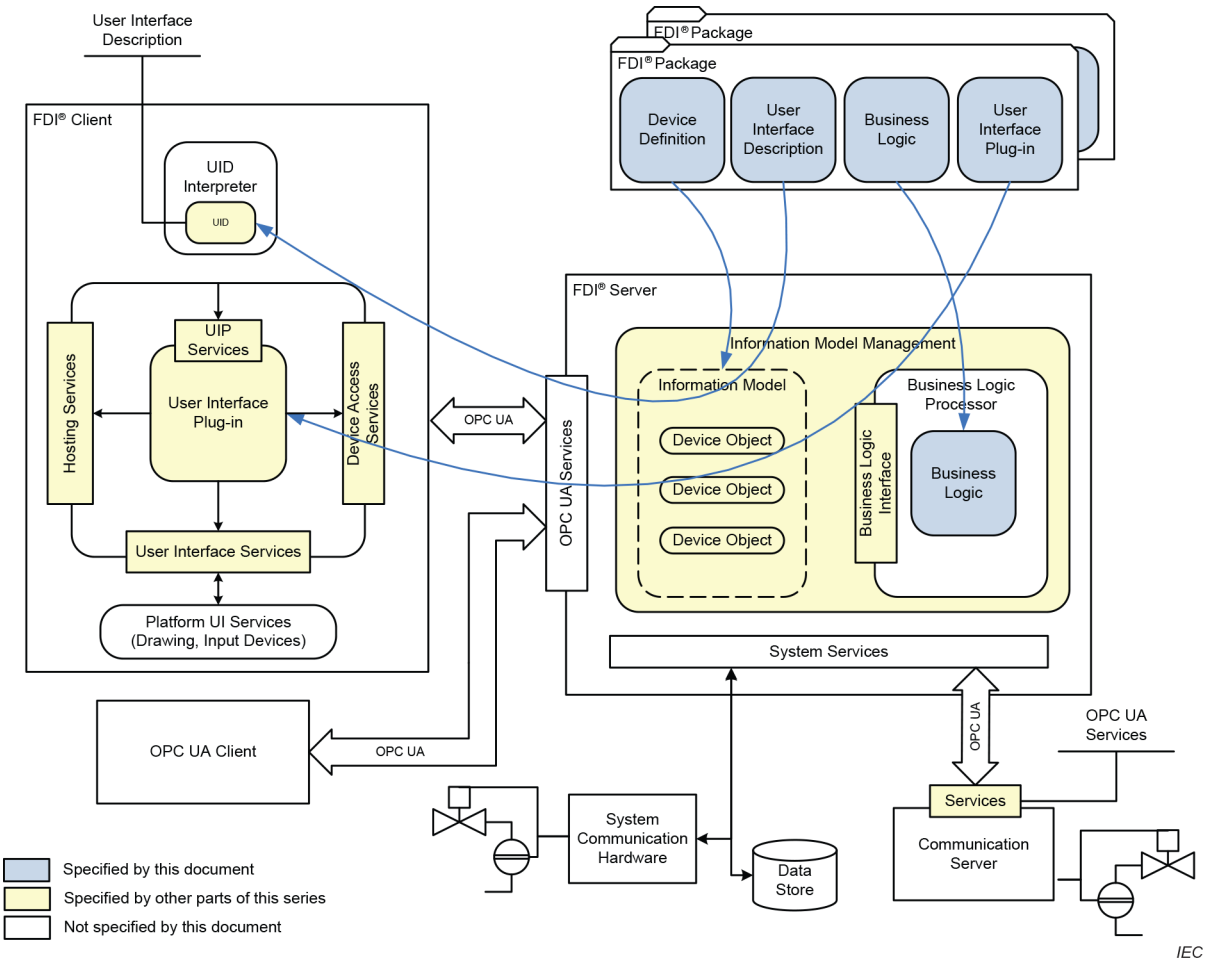

Figure 1 – FDI® architecture diagram

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies.

[1] FDI® is a registered trademark of the non-profit organization Fieldbus Foundation, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance does not require use of the trade name. Use of the trade name requires permission of the trade name holder.

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~~IEC 61804 (all parts), *Function blocks (FB) for process control and electronic device description language (EDDL)*~~

IEC 61804-3, *Devices and integration in enterprise systems − Function blocks (FB) for process control and electronic device description language (EDDL) − Part 3: EDDL syntax and semantics*

IEC 61804-5:~~2015~~2020, *Devices and intergration in enterprise systems − Function blocks (FB) for process control and electronic device description language (EDDL) − Part 5: EDDL Builtin library*

IEC 62769-1, *Field Device Integration (FDI®) – Part 1: Overview*

IEC 62769-2, *Field Device Integration (FDI®) – Part 2: Client*

IEC 62769-5, *Field Device Integration (FDI®) – Part 5: FDI® Information Model*

IEC 62769-6, *Field Device Integration (FDI®) – Part 6: FDI® Technology Mappings*

IEC 62769-7, *Field Device Integration (FDI®) – Part 7: Communication Devices*

IEC 62769-1xx (all parts), *Field Device Integration (FDI®) – Part 1xx-y: Profiles*

ISO/IEC 11578, *Information technology – Open Systems Interconnection – Remote Procedure Call (RPC)*

ISO/IEC 29500-2:~~2016~~2021, ~~*Information technology –*~~ *Document description and processing languages – Office Open XML file formats – Part 2: Open packaging conventions*

ISO 639-1, *Codes for the representation of names of languages – Part 1: Alpha-2 code*

ISO 32000-1, *Document management – Portable document format – Part 1: PDF 1.7*

Dublin Core Metadata Initiative: DCMI Metadata Terms, 2020

FCG TS10099, *Field Device Integration (FDI®) – Technology Management*

FIPS 140-3:2019, *Security Requirements for Cryptographic Modules*

~~*Extensible Markup Language (XML) 1.0, W3C Recommendation, available at <http://www.w3.org/TR/REC-xml/>*~~

~~*XML Schema Definition Language (XSD) 1.1, W3C Recommendation, available at <http://www.w3.org/TR/xmlschema11-1/>*~~

~~*FIPS 140-2, Security Requirements for Cryptographic Modules*~~

ETSI EN 319 132-1, *Electronic Signatures and Infrastructures (ESI); XAdES digital signatures; Part 1: Building blocks and XAdES baseline signatures*

ETSI TS 101 733, *Electronic Signatures and Infrastructures (ESI); CMS Advanced Electronic Signatures (CAdES)*

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3 Terms, definitions, abbreviated terms and ~~conventions~~ acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62769-1, ISO/IEC 29500-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
attachment
device and protocol specific support files that are not directly used to integrate the Device into the system

3.1.2
FDI® Communication Package
FDI® Package that provides information to integrate an FDI® Communication Server to an FDI® Server

3.1.3
FDI® Device Package
FDI® Package that provides one or more device types to an FDI® Server

3.1.4
FDI® Package Model
description of the structure and elements of an FDI® Package

3.1.5
FDI® Profile Package
FDI® Package that provides information for creating a device type node that can be associated with a class of devices

3.1.6
FDI® Registration Authority
entity, which has the right and the ability to perform FDI® conformance tests on FDI® Packages and to issue registration certificate documents

3.1.7
FDI® UIP Package
FDI® Package that provides one or more UIPs to an FDI® Server

3.1.8
Package Catalog
file that describes the contents of an FDI® Package

3.1.9
UIP Catalog
file that describes the properties of a UIP

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3.1.10
UIP Variant
platform specific element of a User Interface Plug-in

Note 1 to entry: A UIP is composed of one or more variants. For example, one variant ~~may~~ can be optimized for portable devices while another variant is optimized for large screen devices.

3.2 Abbreviated terms and acronyms

For the purposes of this document, the abbreviated terms and acronyms given in IEC 62769-1 as well as the following apply.

CFF	Capabilities File for FOUNDATION Fieldbus
ID	Identifier
IDE	Integrated Development Environment
IM	Information Model
PNG	Portable network graphics
ZIP	Zipper (archive file format)

3.3 Conventions

~~For the purposes of this document, the conventions given in IEC 62769-1 apply.~~

Capitalization of the first letter of words is used in the IEC 62769 series to emphasize an FDI® defined term.

4 FDI® Package Model

4.1 Overview

The FDI® Package Model (see Figure 2) provides all of the elements necessary to integrate devices, network components and FDI® Communication Servers into a system. File name conventions are described in Annex A.

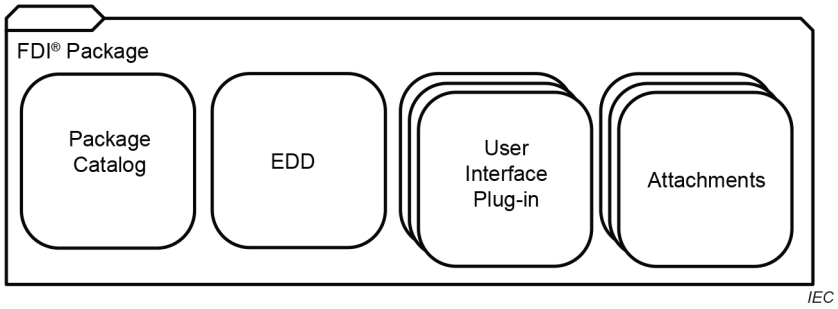

Figure 2 – FDI® Package Model

Figure 3 shows the mapping of the FDI® Package functional elements, as specified in IEC 62769-1, to the physical elements in an actual FDI® Package, as specified in this document.

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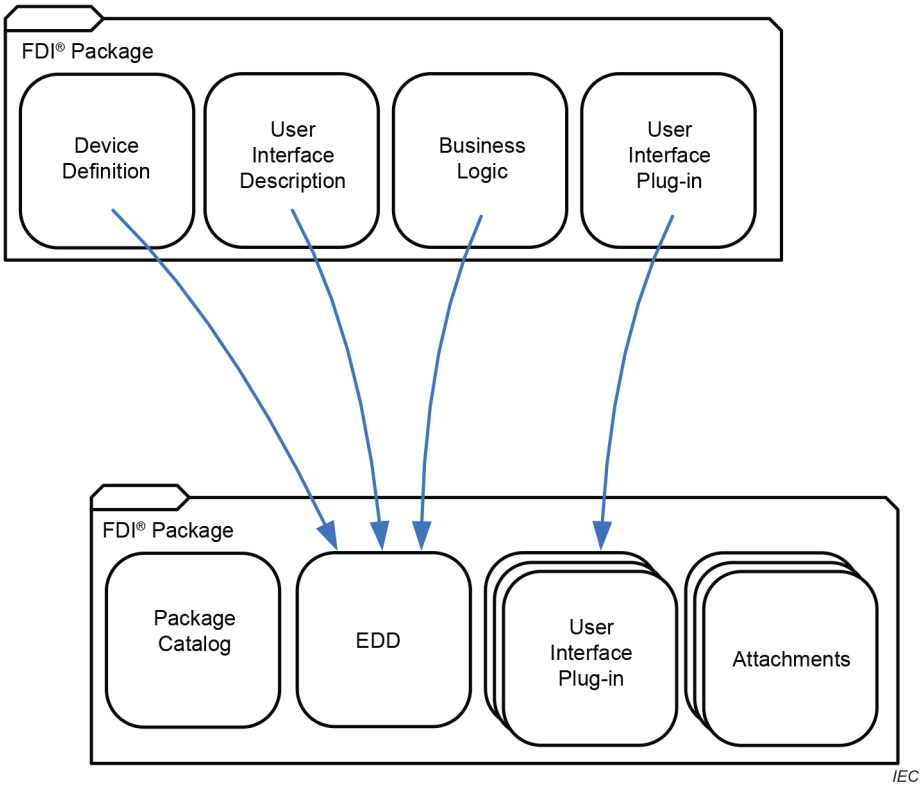

Figure 3 – Architectural mapping

The Electronic Device Description (EDD) corresponds to the Device Definition, the User Interface Description, and the Business Logic functional elements. A set of physical User Interface Plug-ins corresponds to the User Interface Plug-in functional element.

The other physical elements in the FDI® Package, the Package Catalog and Attachments, provide support for basic mechanisms such as identification, versioning and deployment, and distribution of manufacturer and/or protocol specific information about the device and/or the User Interface Plug-ins.

Annex B describes the FDI® Package creation process. Annex C describes sequence examples of how to deploy different FDI® Package types to different system architectures.

4.2 FDI® Package Elements

4.2.1 Package Catalog

The Package Catalog is a required element that provides information about the contents of the FDI® Package including, but not limited to, identification and version information, device type information, hardware and input/output device requirements, FDI® Technology Version, and protocol specific characteristics.

The Package Catalog is used by an FDI® Server to create a catalog of device types and to create DeviceType Nodes in the Information Model.

4.2.2 Package Feature Table

The Package Feature Table is a required element that provides information about the features provided by the FDI® Package and the features requested by the FDI® Package from the FDI® Host. This information is used by the FDI® Server to interpret the contents of the FDI® Package in the correct way, the features and thus the possible entries of the feature table are specified in the following subclauses.

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If an FDI® Package provides a specific feature, the respective feature shall be listed in the feature table. If a feature is not listed in the feature table, it is assumed that the feature is not provided by the FDI® Package.

4.2.3 Feature Unit Conversion

FDI® Packages, which implement the Unit Conversion feature, shall provide unit conversion for all units. The unit conversion shall be implemented as specified in IEC 61804-3.

4.2.4 Electronic Device Description

The EDD is an element that provides Device Definition, User Interface Descriptions, and Business Logic to an FDI® Server.

Subclause 4.3 specifies for which FDI® Package types an EDD is required.

To maximize interoperability, the initial setup of a device shall be achievable solely with the User Interface Descriptions, Device Definition and Business Logic that are part of the EDD in the FDI® Device Package. The use of User Interface Plug-ins is optional and targeted in particular for the complete setup of complex devices.

The device health status model using the GetHealthStatus Method is described in Annex H. Annex K describes rules that shall be applied to an EDD in order to fulfil the conformance to the FDI® profile for EDDs.

4.2.5 User Interface Plug-in

A User Interface Plug-in (UIP) is an element that enables an FDI® Client to present a programmed user interface. The FDI® Server only stores the UIP from a consumed package; it does not execute or interpret the UIP.

A UIP is referenced from a User Interface Description. Those references are reflected in the Information Model through functional groups (see IEC 62769-5). References to UIPs in the Information Model are logical through a unique reference. The physical structure of the UIP is not at the Information Model level. Physically, a single UIP ~~may~~ can consist of one or more UIP Variants, each targeted at a specific platform and run-time environment.

Figure 4 illustrates the logical reference to a UIP in the EDD and the physical structure of that UIP. The EDD of the FDI® Package references a globally unique identifier of the UIP. In addition, the Package Catalog also lists the UIPs required by the device type along with the versions of the UIP supported by the package.

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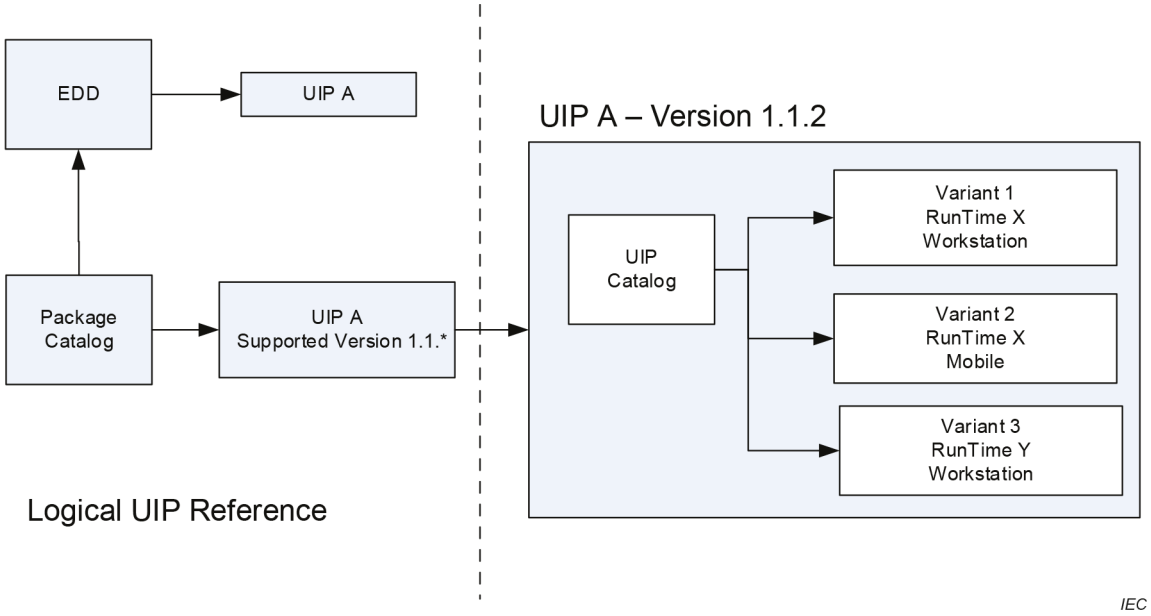

Figure 4 – User Interface Plug-in Reference Model

A UIP can be designed to meet different platform requirements since not all platforms support the same screen sizes and input devices.

When an FDI® Client requests a UIP specifying the platform type, the deployment mechanism in the FDI® Server looks for a UIP Variant that meets the platform type specified and returns it to the FDI® Client.

The target platform defines specific screen resolutions and input devices that shall be supported by the UIP Variant. Available target platforms are described in Table 1.

Table 1 – UIP Platform Capabilities

Platform	Characteristics
Workstation	~~A full client typically with a larger display, full keyboard and mouse input.~~ A client for the Workstation platform is characterized by the following minimum set of supported I/O devices: mouse, keyboard, and color screen resolution of 1024 × 768 pixels.
Mobile	~~A limited client typically with a smaller display and limited input capabilities.~~ A client for the Mobile platform shall feature at minimum a full-graphic screen with a resolution of 480 × 640 pixels. It shall support some way for the input of numbers, characters and ASCII symbols (e.g. a touch screen with an emulated keyboard) as well as some means to scroll, to zoom, to select and to click (single or double click) on text or other elements displayed on the screen.
WorkstationAndMobile	The UIP has the capability to run on the Workstation platform and the Mobile platform.

~~Detailed platform requirements are technology dependent and specified in IEC 62769-6.~~

Technology dependent platform requirements are specified in IEC 62769-6.

A UIP can be delivered internally (self-contained) or the UIP can be delivered through an FDI® UIP Package. An EDD of one package shall not reference any UIP delivered self-contained with another package. Figure 5 illustrates two FDI® Device Packages referencing UIPs from an FDI® UIP Package. In this example, the EDD from Device Package A and Device Package B references UIP B delivered by UIP Package C.

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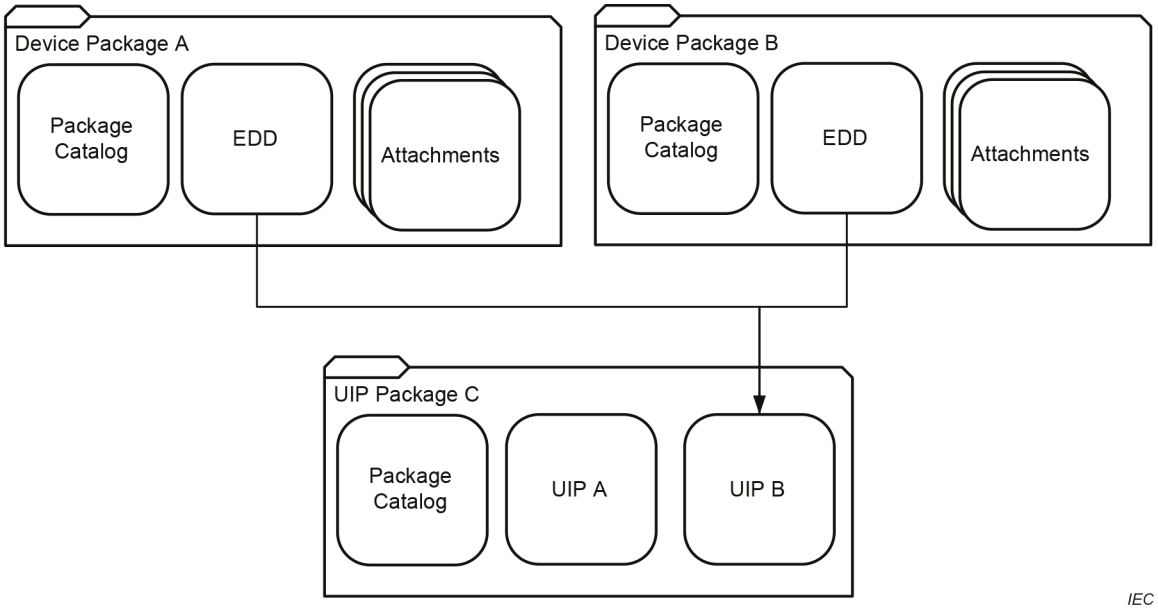

Figure 5 – Multiple FDI® Packages referencing a common UIP

4.2.6 Attachment

Attachments provide device and protocol specific support files, along with other files that are not directly used to integrate the device into the system, for example, product manuals.

The following types of Attachments are defined and reflected in the Package Catalog:

- protocol specific files (see 5.3.5.3);
- documentation (see 5.3.5.2);
- device pictures (see 5.3.5.1).

Some protocol specific files are mandatory (see Annex F).

4.3 FDI® Package Types

4.3.1 FDI® Device Package

The FDI® Device Package is intended to provide information about a device to a system. An FDI® Device Package describes a single device type. Figure 6 shows the physical structure of an FDI® Device Package describing a single device type. Details about how to create a package for a modular device are described in Annex I.

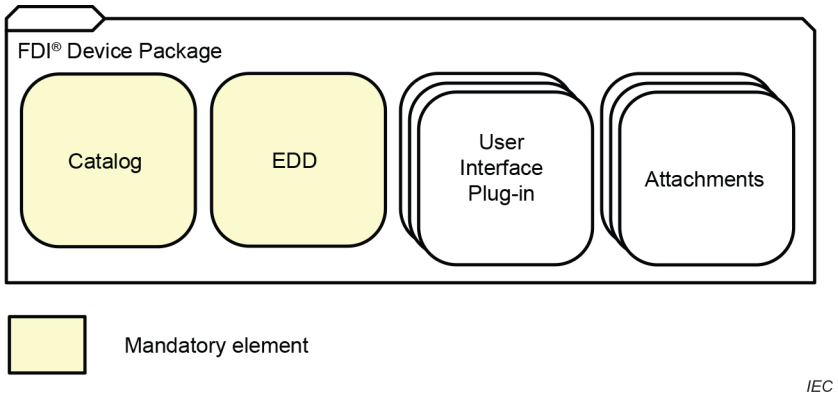

Figure 6 – FDI® Device Package

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The FDI® Device Package shall have a single Package Catalog.

An FDI® Package for simple Devices contains one EDD. For modular Devices, multiple EDDs ~~may~~ can exist (see Annex I).

The FDI® Device Package may include one or more User Interface Plug-ins.

The FDI® Device Package may include Attachments.

4.3.2 FDI® Communication Package

The FDI® Communication Package is intended to provide information about a single FDI® Communication Device. The group of FDI® Communication Devices splits into two sub-groups.

- FDI® Communication Packages for Gateways – Contain everything required to describe all device functions and logic required to bridge between different communication protocol networks, including the bridging algorithms (details are described in IEC 62769-7).
- FDI® Communication Packages for FDI® Communication Servers – Contain basic information to describe the communication device and to integrate it into the FDI® Host but also to create a valid reference to the external FDI® Communication Server application. This application shall not be delivered as part of the FDI® Communication Package. The FDI® Communication Server provides access to single field devices or field device networks (details are described in IEC 62769-7). Requirements to the FDI® Communication Package content that are specific for FDI® Communication Servers are defined in Annex J.

However, representatives of both groups are integrated into FDI® Hosts by using FDI® Communication Packages. Their physical structure is shown in Figure 7. Binary components necessary to communicate to the communication hardware shall be provided outside the scope of this FDI® Communication Package.

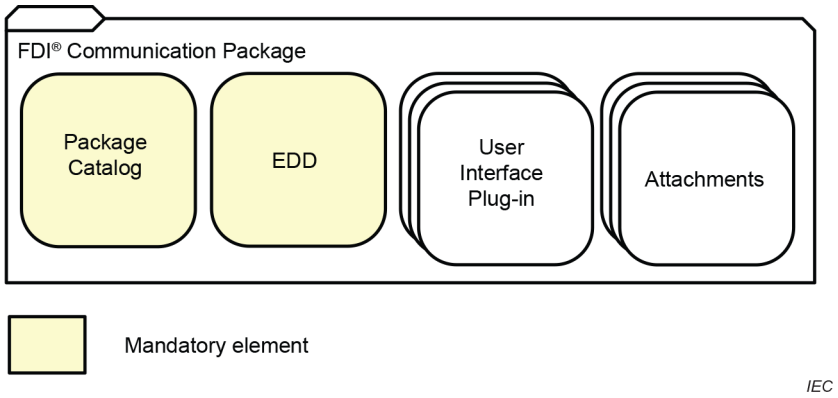

Figure 7 – FDI® Communication Package

4.3.3 FDI® UIP Package

The FDI® UIP Package delivers User Interface Plug-ins to an FDI® Server. It is used to distribute one or more UIPs that are intended to be shared by several device types. Its physical structure is illustrated in Figure 8.

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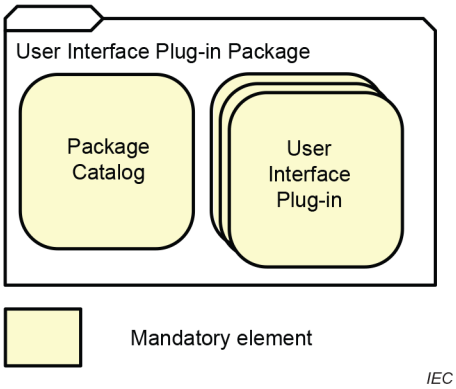

Figure 8 – FDI® UIP Package

The FDI® UIP Package shall have a Package Catalog and one or more User Interface Plug-ins.

4.3.4 FDI® Profile Package

An FDI® Profile Package provides information for creating a device type node that can be associated with a class of devices implementing a common set of parameters and functions (described in profiles or profile like definitions created by, for example, communication foundations or similar interest groups).

Conceptually, an FDI® Profile Package provides information that is a super class of an FDI® Device Package. The FDI® Profile Package is represented in Figure 9.

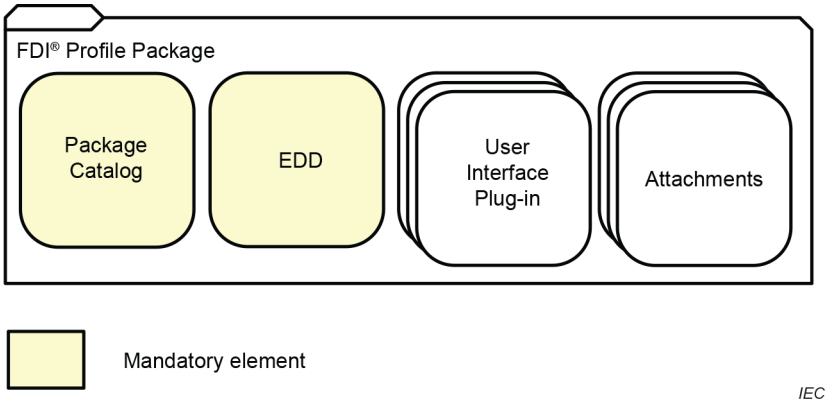

Figure 9 – FDI® Profile Package

These packages enable integration of devices without having a specific FDI® Device Package. FDI® Profile Packages only support standard functionalities as defined by the corresponding communication protocol and application profiles (Annex F).

An FDI® Profile Package shall be self-contained. For example, if a Profile B extends the definition of a Profile A, then the FDI® Profile Package for the Profile B shall include a complete definition of Profile B, including the elements from Profile A.

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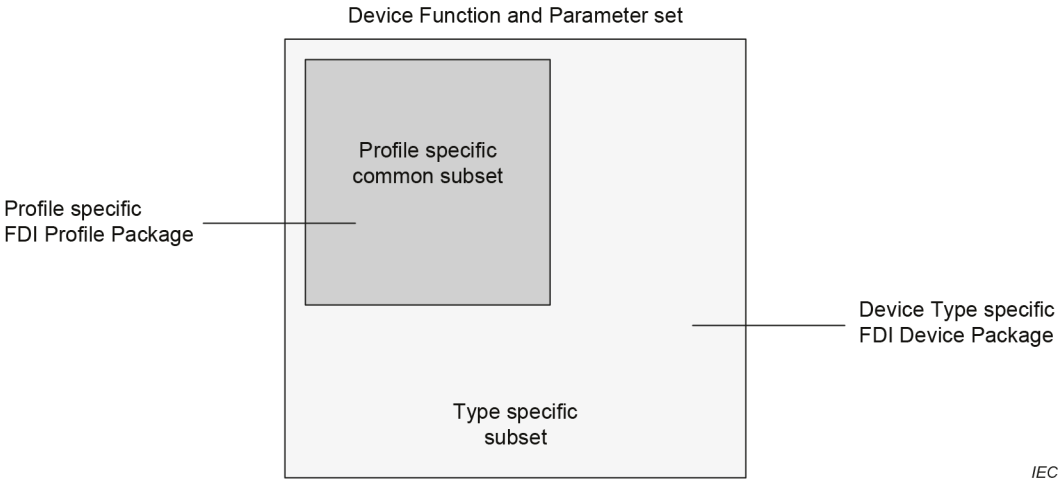

Figure 10 – Device Function and Parameter sets (type and profile specific)

Figure 10 represents the entire functionality of a device. Some of the functionality conforms to a specific communication profile, which ~~may~~ can be accessed by using an FDI® Profile Package. If there is a need to access Device Type specific functionality, in addition to the common functionality, then an FDI® Device Package is required.

~~The detailed description of the communication protocol-specific requirements is not part of this document.~~

An automatic FDI® Package selection implementation (launching FDI® Packages matching a connected physical device) typically would search first for available Device Type specific FDI® Device Packages. If the specific package is not available, the profile specific FDI® Profile Package is loaded (if available). This behaviour, however, is system specific.

5 FDI® Package implementation

5.1 Packaging technology

The FDI® Package's format complies with the Open Packaging Convention as specified by ISO/IEC 29500-2. The Open Packaging Convention specification is designed to represent a broad range of applications. The technology was designed to provide a mechanism for delivering, deploying, and utilizing a set of logically and physically related components in a flexible, extensible, efficient, and open manner.

Subclause 5.2 clarifies the use of specific elements of the Open Packaging Conventions specification.~~The naming conventions for the FDI Package file are described in Annex A. FDI Package creation fundamentals are described in Annex B. an example FDI Device Package implementation is described in Annex D.~~ See Annex D for an example FDI® Device Package implementation based on ISO/IEC 29500-2.

NOTE *FDI-cooperation.com* was used when the FDI Cooperation LLC existed. The URL has not been changed to not endanger consistency. The URL does not indicate the current technology ownership and ~~may not~~ cannot point to a valid address.

5.2 Use of Open Packaging Conventions

5.2.1 Unknown parts

Unknown parts are all parts not defined in this document or ISO/IEC 29500-2. Unknown parts ~~may~~ can exist as the FDI® specification is updated and legacy FDI® Server ~~may not~~ cannot have knowledge of these additional parts. Unknown parts shall be ignored by the FDI® Server to enable forward compatibility.

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5.2.2 Invalid parts

Invalid parts are those parts that do not conform to the naming guidelines or that do not associate with content types specified in this document or ISO/IEC 29500-2. Invalid parts shall not be used in an FDI® Package.

5.2.3 Unknown relationships

Unknown relationships are those relationships that are not defined in this document or ISO/IEC 29500-2. Unknown relationships shall be ignored by an FDI® Package consumer.

5.2.4 Interleaving

All parts of the FDI® Package shall be laid out using simple ordering. The package producer shall not interleave parts.

5.2.5 Core properties

The core properties are not used in the FDI® Package Model and shall be ignored by all FDI® Package consumers.

5.2.6 Thumbnails

The thumbnail is an optional part of an FDI® Package.

5.2.7 Digital Signatures

The use of Digital Signatures as specified in ISO/IEC 29500-2 is a mandatory part of an FDI® Package. For more details, see Clause 7.

5.3 FDI® Package parts

5.3.1 Package Catalog

5.3.1.1 Format

The Package Catalog part is an XML file whose schema is defined in Annex E. An FDI® Package shall have only one Package Catalog. The Package Catalog shall be identified by a single package relationship. The root element of the file is Catalog. The structure of a Catalog element is illustrated in Figure 11.

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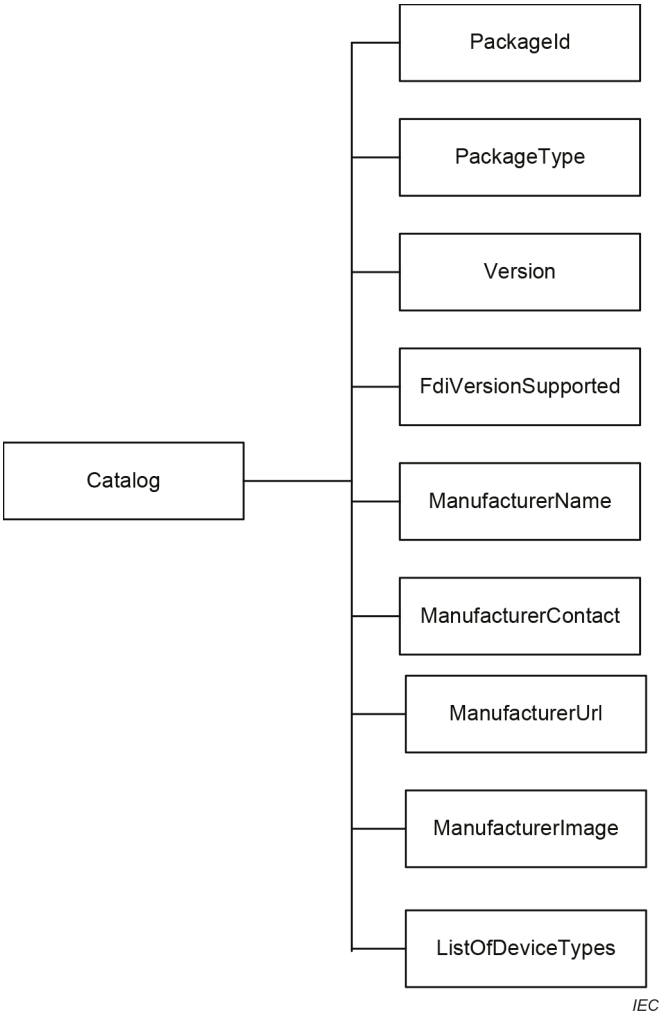

Figure 11 – Catalog Element

The Package Catalog part is described in Table 2.

Table 2 – Package Catalog part

Part	Content
Content Type	application/vnd.FDI.package.catalog+xml
Root Namespace	http://FDI-cooperation.com/2010/package-catalog
Source Relationship	http://FDI-cooperation.com/2010/relationships/package-catalog
Filename	catalog.xml

5.3.1.2 Content

The schema for the Package Catalog is described in Annex E.

5.3.2 Package Feature Table

5.3.2.1 Format

The Package Feature Table is an XML file whose schema is defined in Annex M. An FDI® Package shall have only one Package Feature Table. The Package Feature Table shall be identified by a single package relationship.

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The Package Feature Table part is described in Table 3.

Table 3 – Package Feature Table part

Part	Content
Content Type	application/vnd.FDI.package.feature-table+xml
Root Namespace	http://FDI-cooperation.com/2010/package-feature-table
Source Relationship	http://FDI-cooperation.com/2010/relationships/package-feature-table
Filename	feature-table.xml

5.3.2.2 Content

The schema for the Feature Table is described in Annex M.

5.3.3 Electronic Device Description

5.3.3.1 Format

The EDD is an encoded file using the Electronic Device Description Language (EDDL) according to 5.3.3.2.

The format of the EDD part is described in Table 4.

Table 4 – EDD part

Part	Content
Content Type	application/vnd.FDI.package.edd
Root Namespace	Not applicable
Source Relationship	http://FDI-cooperation.com/2010/relationships/edd
Filename	Not specified

5.3.3.2 Content

The EDDL is specified in IEC 61804-3. ~~FDI specific rules for EDDs are described in Annex K.~~

5.3.4 User Interface Plug-in

5.3.4.1 Format

An FDI® Package may contain one or more User Interface Plug-in parts. All User Interface Plug-in parts shall be identified by a package relationship.

The User Interface Plug-In represents a container element for UIP Variants (see 5.3.4.2.2.2), which contain the physical representation of a UIP (different variants for different platforms) that is consumed and executed by an FDI® Client. A User Interface Plug-in shall at least provide one UIP Variant.

The variants are packaged into a single User Interface Plug-in using Open Packaging Convention as specified in 5.3.4.2. The User Interface Plug-in is not directly consumed by an FDI® Server. The User Interface Plug-in is an optional part of different FDI® Package types as specified in 4.3. The User Interface Plug-in is illustrated in Figure 12.

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The UIP version information as well as the update and upgrade behaviour shall follow the rules and concepts described in ~~IEC 61804-1~~ IEC 62769-2.

The default locale for UIPs and all contained variants is English/(US). Optional language support is allowed according to market needs.

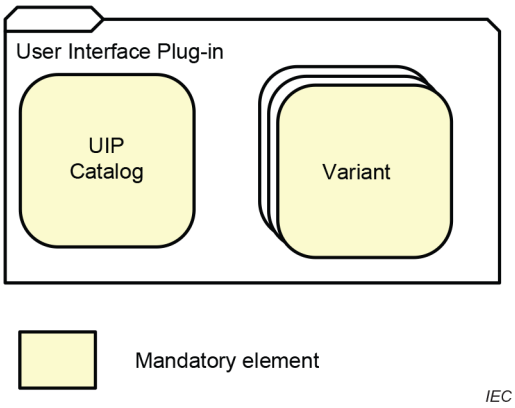

Figure 12 – User Interface Plug-in

The format for the User Interface Plug-in part is described in Table 5.

Table 5 – User Interface Plug-in part

Part	Content
Content Type	application/vnd.FDI.package.uip
Root Namespace	Not applicable
Source Relationship	http://FDI-cooperation.com/2010/relationships/uip
Filename	extension shall be .uip

5.3.4.2 Content

5.3.4.2.1 Use of Open Packaging Convention

5.3.4.2.1.1 Core

Core Properties are not used and shall be ignored by all FDI® UIP Package consumers.

5.3.4.2.1.2 Thumbnails

Thumbnails are not used and shall be ignored by all FDI® UIP Package consumers.

5.3.4.2.1.3 Digital Signatures

Digital Signatures might be necessary for UIP Variants (see 5.3.4.2.2.2) depending on the implementation technology. Implementation technology details and necessary mechanisms to be implemented are described in IEC 62769-6.

The User Interface Plug-in as such however shall not be signed or applied signatures shall be ignored by the consuming FDI® component.

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5.3.4.2.2 User Interface Plug-in parts

5.3.4.2.2.1 UIP Catalog

5.3.4.2.2.1.1 Format

The UIP Catalog is an XML file describing the properties of a UIP that are necessary to create the Information Model nodes in the FDI® Server side and for deployment (FDI® Server to FDI® Client).

The UIP Catalog also hosts information about the physical starting element that has to be called/executed from a UIP Variant on the FDI® Client. The format and type of this starting element are technology specific and therefore defined in IEC 62769-6.

The UIP Catalog shall be identified by a single package relationship.

The UIP Catalog part is an XML file whose schema is defined in Annex E. A User Interface Plug-in shall have only one UIP Catalog. The root element of the file is UipCatalog. The structure of the UipCatalog element is illustrated in Figure 13.

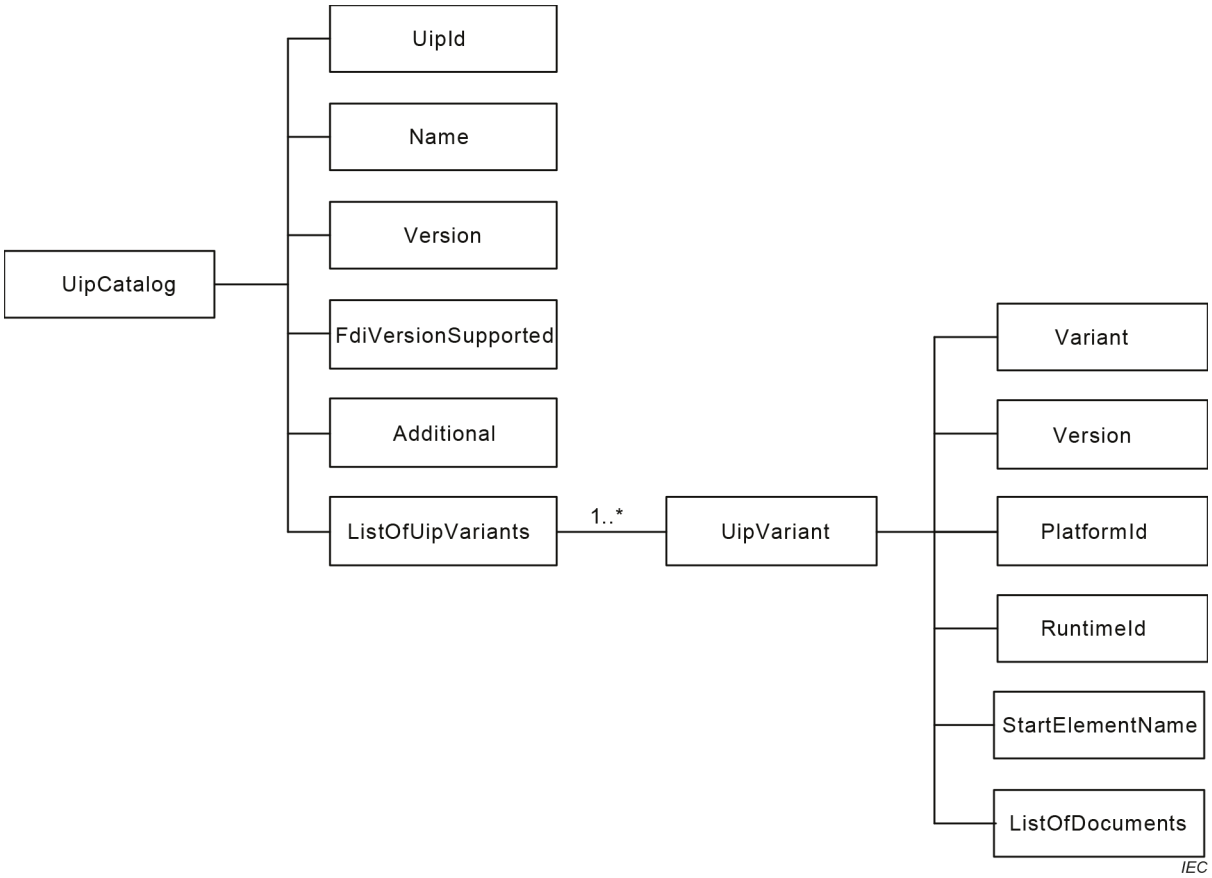

Figure 13 – UIP Catalog

The UIP Catalog part is described in Table 6.

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Table 6 – UIP Catalog part

Part	Content
Content Type	application/vnd.FDI.package.uip.catalog+xml
Root Namespace	http://FDI-cooperation.com/2010/uip-catalog
Source Relationship	http://FDI-cooperation.com/2010/relationships/uip-catalog
Filename	uipcatalog.xml

5.3.4.2.2.1.2 Content

The schema for the UIP Catalog is described in Annex E.

5.3.4.2.2.2 UIP Variant

5.3.4.2.2.2.1 Format

A UIP Variant can be provided to support different versions of the base technology. It is a container for all physical files that represent the UIP Variant, independently of their type and number. The UIP Variant shall use the ZIP file format (compressed archive, application/zip media type) as bundling technology.

Use of the ZIP specification for bundling variants shall be constrained to the requirements in ISO/IEC 29500-2:~~2016~~2021, Annex B.

The UIP Variant part is described in Table 7.

Table 7 – UIP Variant part

Part	Content
Content Type	application/zip
Root Namespace	Not applicable
Source Relationship	http://FDI-cooperation.com/2010/relationships/uip-variant
Filename	Not specified

5.3.4.2.2.2.2 Content

The content of the UIP Variant is specified in IEC 62769-6.

5.3.5 Attachments

5.3.5.1 Image

An FDI® Package image attachment is a computer icon that represents the device type. Multiple images and resolutions of the device type are supported. Each image shall be PNG format and restricted to the following pixel resolutions: 256 × 256, 64 × 64, 32 × 32 or 16 × 16. The image part is described in Table 8.

If the Device Package is supposed to support handheld devices, the provided image shall be available in a resolution of 16 pixels × 16 pixels.

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Table 8 – Image part

Part	Content
Content Type	image/png
Root Namespace	Not applicable
Source Relationship	http://FDI-cooperation.com/2010/relationships/attachment-image
Filename	Not specified

5.3.5.2 Documentation

Documentation parts include documentation such as product manuals and data sheets and shall be encoded in PDF or plain text format. The documentation Attachment is described in Table 9.

Table 9 – Documentation part

Part	Content
Content Type	Application/pdf (specified in ISO 32000-1) Text/plain
Root Namespace	Not applicable
Source Relationship	http://FDI-cooperation.com/2010/relationships/attachment-documentation
Filename	Not specified

Metainformation on the documentation parts shall be provided in the Documentation Catalog. The Documentation Catalog is an XML file, whose schema is defined in Annex L. The metadata elements, which can be used to describe a documentation attachment, are specified in DCMI. The Documentation Catalog shall be identified by a single relationship from within catalog.xml.rels.

The Documentation Catalog part is specified in Table 10.

Table 10 – Documentation Catalog part

Part	Content
Content Type	application/vnd.FDI.package.documentation.catalog+xml
Root Namespace	http://FDI-cooperation.com/2020/package-documentation
Source Relationship	http://FDI-cooperation.com/2020/relationships/attachment-documentation-catalog
Filename	documentation-catalog.xml

5.3.5.3 Protocol Support File

The Protocol Support File part is a file not defined by this document but necessary to integrate the product into a system. Those files usually extend the integration mechanism provided in the basic part of the FDI® Device Package (EDD, UIPs) by protocol specific means.

Those files shall be neither executables nor binary files of any kind. In addition, those files shall not replace any mandatory elements of an FDI® Device Package.

A list of Protocol Support Files for the different communication protocols are defined in Annex F. The protocol specific support file part is described in Table 11.

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Table 11 – Protocol Support File part

Part	Content
Content Type	Not specified here
Root Namespace	Not specified here
Source Relationship	http://FDI-cooperation.com/2010/relationships/attachment-protocol
Filename	Not specified here

5.3.5.4 FDI® Registration Certificate

5.3.5.4.1 Format

The FDI® Registration Certificate is a single XML document per FDI® Package which can be present (optional FDI® Package Element). In the scope of an FDI® Package, it is a Package Element of the type Attachment. The FDI® Registration Certificate part is described in Table 12.

Table 12 – FDI® Registration Certificate part

Part	Content
Content Type	application/vnd.FDI.package.registrationCert+xml
Root Namespace	Not specified here
Source Relationship	http://FDI-cooperation.com/2010/relationships/attachment-registrationCert
Filename	RegistrationCert.xml

5.3.5.4.2 Content

The FDI® Registration Certificate is machine readable and is represented in XML format and has the content and structure according to Figure 14. The FDI® Registration Certificate may be signed with a detached signature within the same document.

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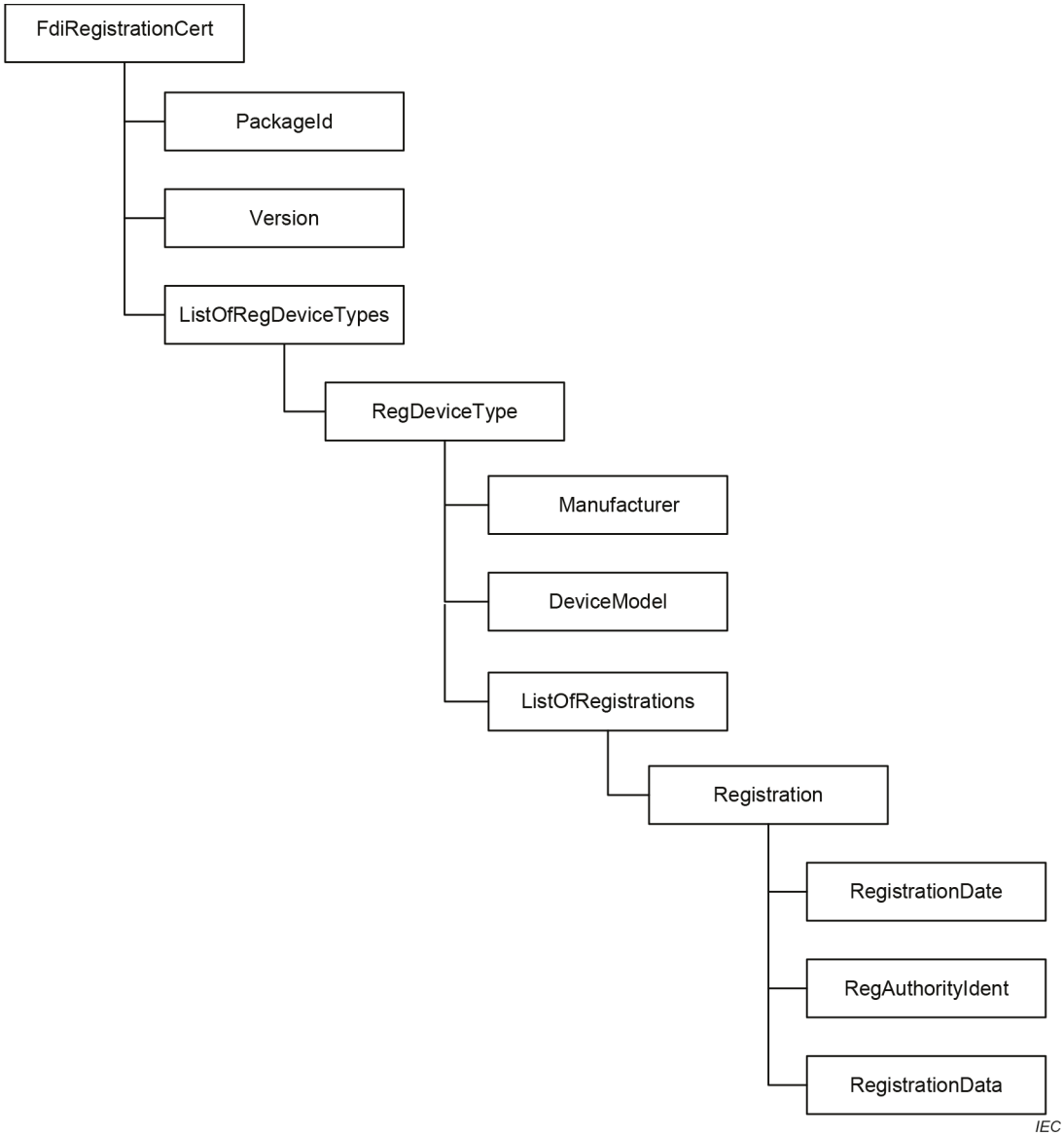

Figure 14 – FDI® Registration Certificate

The schema for the FDI® Registration Certificate is described in Annex E.

6 FDI® Package versioning

6.1 Version scheme

FDI® elements use a major.minor.revision numeric versioning scheme for package and package elements. The initial version shall be ~~1.0.0.~~ 01.00.00.

Incompatible changes are indicated by incrementing the major number. Functional changes that still maintain compatibility to the major version are indicated by incrementing the minor number. Non-functional changes, such as editorial changes are indicated by incrementing the revision number. Rules for incrementing the version number are described in 6.3.

~~Examples of how to deploy different FDI Package types are described in Annex C.~~

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6.2 Versioned elements

An FDI® Package contains the version information that is described in Table 13.

Table 13 – Versioned elements

Scope	Version location	Schema reference
FDI® Package (see 5.3)	Package Catalog (see 5.3.1)	See Annex E, Version element of the Package complex type
UIP (see 5.3.4)	UIP Catalog (see 5.3.4.2.2.1)	See Annex E, Version element of the Uip complex type
UIP Variant (See 5.3.4.2.2.2)	UIP Catalog (see 5.3.4.2.2.1)	See Annex E, Version element of the UipVariant complex type

The following parts of the FDI® Package have version mechanisms that are outside the scope of the FDI®.

- EDD (see 5.3.2)
  - DD_REVISION and DEVICE_REVISION according to IEC 61804-3;
- Attachments (see 5.3.5)
  - Image (see 5.3.5.1),
  - Documentation (see 5.3.5.2),
  - Protocol Support File (see 5.3.5.3 and Annex F).

6.3 Version hierarchy

The version change of FDI® Package elements can influence the version of overlaying elements. Figure 15 illustrates those influences. The orange boxes show elements that are versioned using the FDI® specific version mechanisms described in IEC 62769-1. The green boxes indicate elements that have version mechanisms that are not described by FDI®. The white boxes describe elements that are not explicitly versioned.

All elements in the tree structure shown below influence the version of the parent elements according to Table 14. Their version change causes a version change of the overlaying element.

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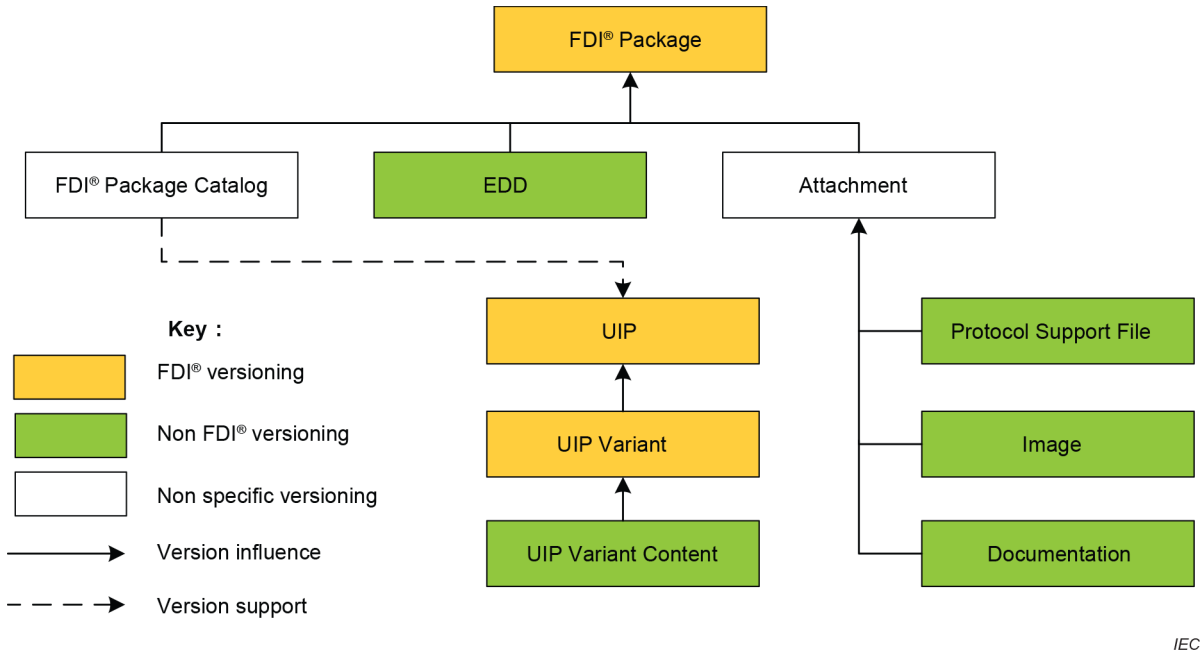

Figure 15 – Version hierarchy

Table 14 describes a selection of possible changes to the different FDI® Package elements and their direct influence on the FDI® Package version. At a minimum, successive FDI® Package versions shall increment the revision number.

Table 14 – Influence on FDI® Package version

Element	Version Level			FDI® Package Type	
	Major	Minor	Revision	Device/ Profile/ Comm Package	UIP Package
Package Catalog	n/a	Modifying existing compatibility references. Change to ListOfSupportedUips (see Annex E). Only addition of wildcards is allowed for modifications to existing VersionSupported (see Annex E)	Editorial	x	x
EDD	Increment Device Revision	Increment DD_REVISION with same DEVICE_REVISION	n/a	x	
Attachments	Changes to Protocol Support Files	Changes to Protocol Support Files	Changes to Documentation, Images, Protocol Support Files	x	
UIP	Incompatible changes Technology driven	Functional enhancement Technology driven	Bug fix Technology driven	x	x

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Annex G describes typical FDI® Package life-cycle use cases for a better understanding of the version hierarchy and the versioning concept.

6.4 UIP compatibility

UIPs are delivered in an FDI® Device Package, FDI® Communication Package, FDI® Profile Package or an FDI® UIP Package. A UIP delivered in an FDI® UIP Package shall not be delivered in any other package type. Therefore, an FDI® Package ~~may not~~ cannot be self-contained.

FDI® Device Packages, FDI® Communication Packages and FDI® Profile Packages do not directly reference UIPs. Instead, the Package Catalog defines the SupportedUip (see Annex E) to define compatible UIPs. More than one installed UIP ~~may~~ can be compatible with a given FDI® Package version. This permits the FDI® Package creators to provide bug fixes and functional enhancements to the FDI® Package without ~~the need~~ having to provide a major release of an FDI® Package.

The version support described in the Package Catalog is defined as follows:

- The major release number shall be specified explicitly as a single, two digit number.
- The minor release number and revision number shall be specified explicitly as a single number or as a wildcard ('*'). If the minor release number is specified as a wildcard, then the revision number shall also be specified as a wildcard.

NOTE Examples of valid compatible version numbers are ~~1.3.1, 1.3.*, 1.*.*.~~ 01.03.01, 01.03.*, 01.*.*.

The use of a wildcard indicates that all minor numbers and/or revision numbers are compatible with the FDI® Package. If the SupportedUip has been defined by using wildcards and there is more than one version of the UIP available, the FDI® Server shall transfer the latest version to the FDI® Client. System specific implementations that allow coexistence of minor release or revisions releases regardless of version support wildcards are outside the scope of this document.

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Figure 16 illustrates an example of selecting the most recent compatible UIP.

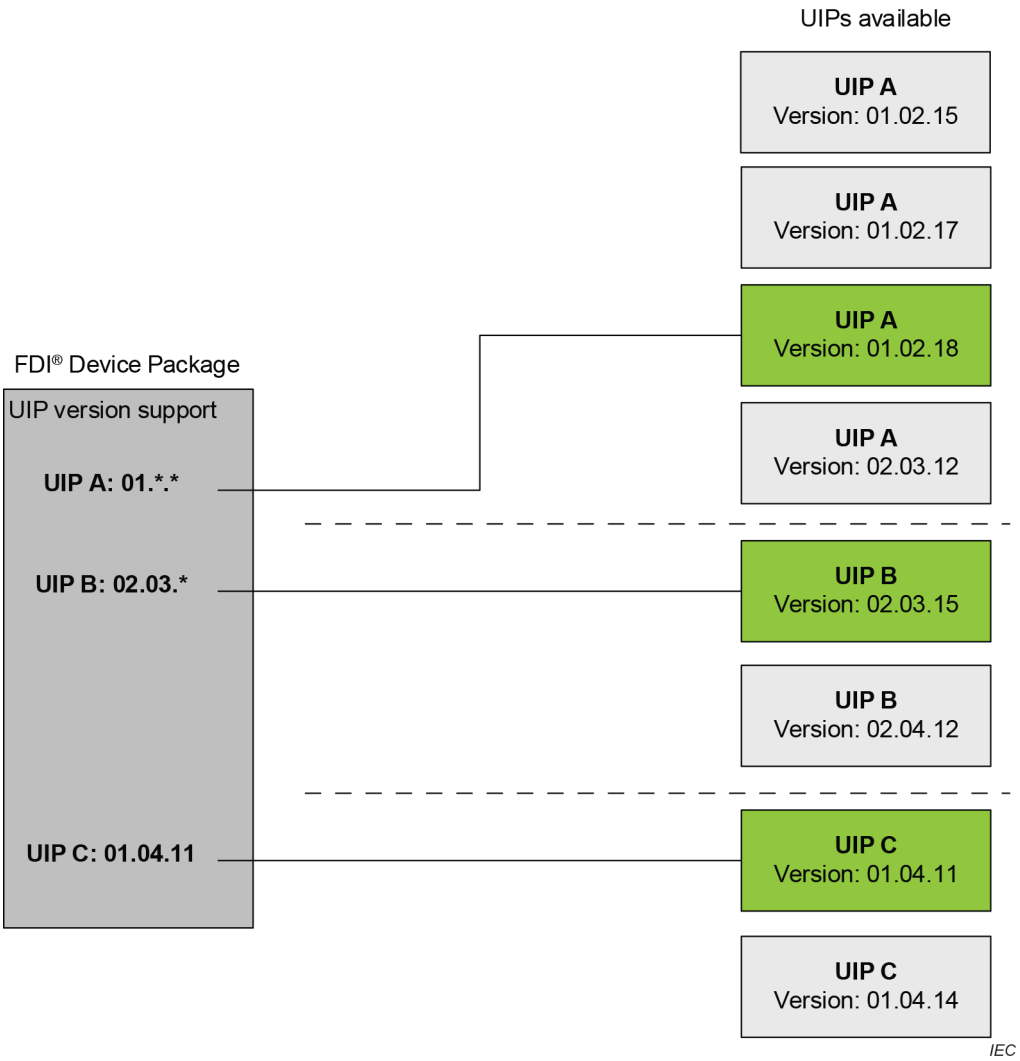

Figure 16 – UIP version support concept

7 Digital Signatures and FDI® Registration Certificates

7.1 Signed elements and certification documents

The FDI® Package signing policy defines that the entire FDI® Package shall be signed by the FDI® Package originator (see 7.3). FDI® Packages which have been registered by an FDI® Registration Authority should contain an FDI® Registration Certificate (special attachment, see 5.3.5.4) which shall be signed by an FDI® Registration Authority (see 7.3). FDI® Packages are registered if they are successfully conformance tested (see B.2.4).

Figure 17 shows an illustration of a signed FDI® Package.

Registered FDI® Packages should carry one or more digitally signed FDI® Registration Certificates to

– indicate that the FDI® Packages have been registered by an official FDI® registration authority;

– indicate that the files in the package, which had been central for registration of the package, have not been altered after submission for registration.

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FDI® Packages as a whole (the surrounding entity covering all elements) shall be signed to

- identify the originator (the signer) of the FDI® Package;
- verify that the signed FDI® Package hasn't been altered after the signature was applied.

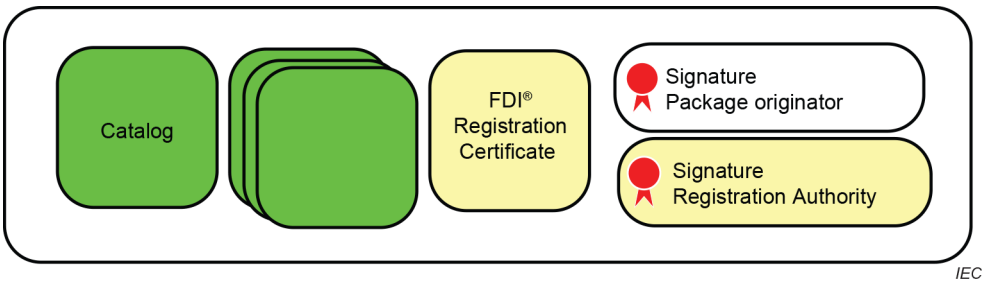

Figure 17 – FDI® Package signing

The FDI® Package originator first sends a package to the FDI® Registration Authority. They perform defined conformance tests and additional tests according to their specific rules and test descriptions or agreements.

After successful test, those Registration Authorities might issue an FDI® Registration Certificate which shall be signed by the individual FDI® Registration Authority. The FDI® Registration Certificate ~~may~~ can contain more information about the registration as for example a hash on the parts of the FDI® Package which had been covered by the conformance tests. The FDI® Registration Certificate is incorporated into the FDI® Package for release. After adding the FDI® Registration Certificate to the FDI® Package content, the package is again signed and afterwards released / published by the originator.

The FDI® Package originator therefore takes over the responsibility that the FDI® Registration Certificate is trustable by signing the entire FDI® Package he releases.

7.2 Signing mechanism

All signatures within the FDI® Package shall be made according to the mechanism defined in ISO/IEC 29500-2. In addition to ISO/IEC 29500-2, the signature shall fulfill the following requirements:

- The information needed to validate the signature shall be part of the Digital Signature, i.e. the KeyInfo element specified in XML Signature Syntax and Processing is mandatory.
- Certificates used for signing shall be rooted in a Certificate Authority which is included in the trusted CAs of the Microsoft®[2] Windows Certificate Store.
- The algorithms used in creation of the signature (for hashing and encryption/decryption) shall be from the list of NIST recommended algorithms in FIPS ~~140-2~~ 140-3:2019, Annex A (NIST).
- The signature shall include a trusted timestamp in compliance with XAdES (XML Advanced Electronic Signatures – ETSI EN 319 132-1).
- Any signature shall include a CommitmentTypeIndication according to ETSI TS 101 733. The used commitment types are specified in Subclause 7.3.

[2] Microsoft ~~Windows Certificate Store®~~ is ~~the trade name~~ a registered trademark of ~~a product supplied by~~ Microsoft~~®~~ Corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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7.3 FDI® Package Originator, FDI® Registration Authority

The FDI® Package Originator and the FDI® Registration Authority have the following responsibilities:

– An FDI® Package originator officially publishes an FDI® Package and signs it to ensure the integrity of the FDI® Package. The FDI® Package can be created by a device vendor or a software solution provider. The publisher of an FDI® Package may be a different person. The commitment type is ProofOfOrigin.

– An FDI® Registration Authority has the right and the ability to perform FDI® conformance tests on FDI® Packages and to issue FDI® Registration Certificates, typically interest groups representing an FDI® supported communication protocol or their authorized partners. The commitment type is ProofOfApproval.

7.4 FDI® Host behaviour

An FDI® Host system shall display a warning message when the FDI® Package import procedure recognizes that

– a Digital Signature on the package is not present or does not include all entities (files) inside the package;

– the Digital Signature as such is not trustable;

– the signature is broken, which indicates that the package has been modified after signing.

Additional security measures to be taken, if the warning message has been displayed, are in the responsibility of the FDI® Host system.

An FDI® Host system should display an information message showing which parts of the ones having gone into the registration have been changed when the FDI® Package import procedure recognizes that

– the unique identifier (PackageID) and the version (as defined in Annex E) of the FDI® Package does not match the same information given as a part of the FDI® Registration Certificate file;

– there is no FDI® Registration Certificate present in the FDI® Package;

– the included FDI® Registration Certificate is not signed, the signature is not trustable, or the signature is broken.

An FDI® Host system can check the signature and certification status by reading the FDI® Registration Certificate. A host shall provide a configuration, which allows to import a FDI® Package, which does not include a FDI® Registration Certificate. The functionality of this FDI® Package shall not be limited.

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Annex A
(normative)

File name conventions

A.1 Identification

Identification naming conventions shall be utilized to provide a unique way of identifying complete FDI® Packages as well as elements of FDI® Packages. Adherence to the identification rules will promote interoperability across systems. However, the names themselves shall not be the only mechanism for deployment.

Traditionally, machine-readable naming conventions have been utilized to uniquely link a file to a specific device and facilitate the import and use of device interface files, such as an EDD, making it difficult for users to determine if the required file was available in the file system. Because an FDI® Package is the visible element to the user, a human readable format is preferred over that of a machine-readable version.

A.2 FDI® Package filename convention

Individual FDI® Packages shall be identified by unique file names, which shall consist of the manufacture, the model or type, the revision and the protocol supported. Due to filename persistence problems, the file name shall not be the only means to identify an FDI® Package. Secure means of identifying an FDI® Package shall be utilized to prevent inappropriate mixing of device to FDI® Packages.

The FDI® Package shall use the following naming convention:

<manufacturer>.<description>.<major>.<minor>.<revision>.<protocol>.FDI®x

Each element of the filename is described in Table A.1.

The following rules for naming an FDI® Package shall apply:

- All FDI® Packages shall use the .FDIx extension.
- Maximum name length including .FDIx extension: 128 characters.
- The file name shall not include a space.

NOTE The maximum file name length is limited to 128 characters to reduce the probability of a path exceeding the maximum value.

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Table A.1 – FDI® Package Naming Convention

Filename component	Description
Manufacturer	String representation of the manufacturer name of the device. The manufacturer shall not include a period.
Description	A brief description of the package. The description shall not include a period. For an FDI® Device Package, a string representation of the device type name.
Major	Two-character numerical representation of the major release of the FDI® Package.
Minor	Two-character numerical representation of the minor release of the FDI® Package.
Revision	Two-character numerical representation of the revision of the FDI® Package.
Protocol	The communication profile family names are defined in the communication profiles (IEC 62769-1xx series).

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Annex B
(informative)

FDI® Package creation

B.1 General

Annex B describes the fundamentals of a possible FDI® Package creation process by using standardized development tools and components available.

B.2 Tools and components

B.2.1 Overview

FDI® Packages consist of several different components – which also might have relationships and dependencies to each other – that are developed by using different implementation technologies and that follow different standards. This complex structure of FDI® Packages requires a tool support to make an easy and economic development and maintenance possible.

B.2.2 FDI® Reference Implementation/Common EDD Engine

The FDI® Reference Implementation, including a common EDD Engine, ensures that a common implementation is used for an FDI® Package implementation and test that has a defined behaviour. The FDI® Reference Implementation is part of both tools mentioned below.

B.2.3 FDI® Package IDE

The FDI® Package IDE provides everything that is necessary to manage development projects for the different kind of FDI® Packages, the development of the descriptive parts, the linking of all remaining package parts but also to do the actual packaging of the package.

B.2.4 FDI® Device Package Conformance Test Tool

A developed FDI® Package and especially FDI® Device Packages are tested to prove the conformance of the implementation to the FDI® Specification. This ensures interoperability. The conformance test is done by using the FDI® Device Package Conformance Test Tool that executes defined test cases with the FDI® Reference Implementation and the developed FDI® Package.

B.3 Development

B.3.1 FDI® Package core development

The FDI® Package IDE allows the creation of a development project for the FDI® Package including the project type and version information. This development project can be used during the complete life-cycle of the FDI® Package. A development project wizard might be available to speed up the project creation process.

An editor component coming with the FDI® Package IDE is available to implement the descriptive part (EDD) of the FDI® Package. Features such as syntax checks, code folding, auto complete and wizards for complex constructs are available to support an efficient and safe development.

The FDI® Package (depending on the FDI® Package type) consists of several FDI® Package parts. A project management component is also part of the FDI® Package IDE, which allows the linkage of external FDI® Package parts to a specific FDI® Package development project. As

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soon as the developer has linked all FDI® Package parts to the development project (and has also implemented EDD relationships if necessary), the FDI® Package can be bound and packaged.

The FDI® Package IDE generates parts of the Package Catalog depending on linked FDI® Package parts, development project information and EDD source code. Some parts of the FDI® Package, however, cannot be developed by using the FDI® Package IDE. Examples are given below and shown in Figure B.1.

B.3.2 User Interface Plug-in development

User Interface Plug-ins are developed using well known implementation technologies (for example, Microsoft.NET™[3]). There are several powerful development tools available to use those implementation technologies (for example, Microsoft Visual Studio®[4]). Those tools should be used to implement the User Interface-Plug-ins needed. The ready implemented Plug-ins can then be imported into the FDI® Package IDE development project to be referenced in the EDD and to be packaged into the FDI® Package for release but also to be tested under runtime conditions in conjunction with the descriptive part of the FDI® Package. See also Figure B.1.

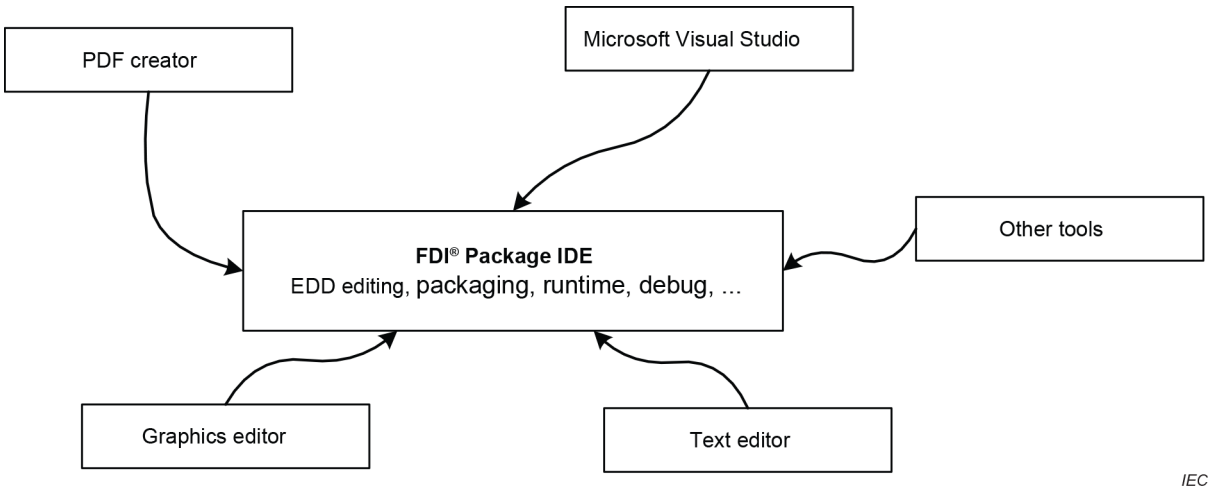

Figure B.1 – Tools used for FDI® Package development

B.3.3 FDI® Package Attachment development

There are different kinds of Attachments that can be incorporated into FDI® Packages. Due to the variety of possible and necessary Attachments, appropriate development tools depending on the type of Attachment shall be used to implement/create those. The Attachments can then be imported into the FDI® Package IDE development project to be packaged into the FDI® Package for release. See also Figure B.1.

B.3.4 FDI® Package binding and packaging

The last step of the FDI® Package development is the packaging as such. In this development step, all developed and related parts of the FDI® Package are packed according to this specification. Checks are performed to ensure consistency. The output can then be used for conformance testing and in systems.

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3 Microsoft.NET™ is the ~~trade name~~ trademark of a product supplied by Microsoft Corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4 ~~Microsoft~~ Visual Studio® is the ~~trade name~~ registered trademark of a product supplied by Microsoft Corporation. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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B.3.5 Conformance Test

The use of the FDI® Package Conformance Test Tool which is also part of the FDI® Package IDE to ensure the conformance of the FDI® Package with the FDI® specification marks the last step before releasing the product. The conformance test tool uses specified test cases with an FDI® runtime engine to check the single features of the FDI® that have or ~~may~~ can be implemented into an FDI® product (an FDI® Package in this case).

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Annex C
(informative)

FDI® Package deployment

C.1 General

Annex C describes sequence examples of how to deploy different FDI® Package types to different system architectures. The sequence and detailed features are system specific.

For FDI® Servers, no conditional deployment of UIP Variants is defined because package content can be consumed by different kinds of FDI® Clients.

For standalone FDI® Host systems, FDI® Server and FDI® Client application are a single integrated entity. A standalone FDI® Host system can perform conditional deployment of the UIP Variants according to the integrated FDI® Client capabilities.

C.2 Scenarios

C.2.1 FDI® Package deployment to PC based client/server systems

C.2.1.1 FDI® Device Packages/FDI® Profile Packages/FDI® Communication Packages

The following steps apply for the deployment of FDI® Device Packages, FDI® Profile Packages and FDI® Communication Packages to an FDI® Server.

a) The user chooses an FDI® Package from the file system.

b) The system validates the FDI® Package signature and integrity.

c) The system reads the FDI® Package Catalog root element as defined in 4.2.1 and verifies

- that the PackageType shall be “Device”, "Profile", or "Communication";
- that the FDIVersionSupported shall be equal to the Major version (depending on the use of wildcards instead of actual version numbers, the Minor and the Revision part of the version information shall also be interpreted) of the FDI® Server;
- the version and PackageId against already installed versions of this device type and handles the update and upgrade accordingly. The deployment is aborted if there is a higher version installed since downgrades are not supported by the FDI®.

d) The system adds the FDI® Package information to the system specific device catalog.

e) The system reads all UIPs stored in the FDI® Package and adds all UIPs and all available variants to the system specific UIP catalog.

f) The system reads the ListOfSupportedUips for each device type and notifies the user if a required UIP is not installed.

g) The system stores the entire FDI® Device Package content.

h) The system reads the EDD for each device type and creates Information Model (IM) type nodes.

C.2.1.2 FDI® UIP Packages

The following steps apply for the deployment of UIP Packages to an FDI® Server.

a) The user chooses an FDI® Package from the file system.

b) The system validates the FDI® Package signature and integrity.

c) The system reads the FDI® Package Catalog root element as defined in 4.2.1 and verifies

- that the PackageType is "Uip";

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- that the FDIVersionSupported is equal to the Major version (depending on the use of wildcards instead of actual version numbers, the Minor and the Revision part of the version information shall also be interpreted) of the FDI® Server; and
- the version and PackageId against already installed versions of this device type and handles the update and upgrade accordingly. The deployment is aborted if there is a higher version installed since downgrades are not supported by the FDI®.

d) The system reads the ListOfSupportedUips for each device type and notifies the user if a required UIP is not installed.

e) The system stores the entire FDI® Device Package content.

f) The system reads all UIPs stored in the FDI® Package and adds all UIPs and all available variants to the system specific UIP catalog.

C.2.2 FDI® Package deployment to an FDI® standalone system

C.2.2.1 FDI® Device Packages/FDI® Profile Packages/FDI® Communication Packages

The following steps apply for the deployment of FDI® Device Packages, FDI® Profile Packages and FDI® Communication Packages to an FDI® standalone system.

a) The user chooses an FDI® Package from the file system.

b) The system validates the FDI® Package signature and integrity.

c) The system reads the FDI® Package Catalog root element as defined in 4.2.1 and verifies

- that the PackageType is "Device", "Profile", or "Communication";
- that the FDIVersionSupported is equal to the Major version (depending on the use of wildcards instead of actual version numbers, the Minor and the Revision part of the version information shall also be interpreted) of the FDI® Server; and
- the version and PackageId against already installed versions of this device type and handles the update and upgrade accordingly. The deployment is aborted if there is a higher version installed since downgrades are not supported by FDI®.

d) The system reads all UIP Variants for all UIPs in the FDI® Package and verifies

- that the PlatformId and RuntimeId is supported by the integrated FDI® Client; and
- the version and UipId against already imported UIP Variants and handles the update and upgrade accordingly. If there is already a higher version installed, the import is aborted since downgrades are not supported by the FDI®.

e) The system adds the UIP information of matching and imported UIPs to the system specific UIP catalog.

f) The system reads the ListOfSupportedUips for each device type and notifies the user if a required UIP is not installed.

g) The system stores the relevant FDI® Device Package content.

h) The system reads the EDD for each device type and creates Information Model (IM) type nodes.

C.2.2.2 FDI® UIP Packages

The following steps apply for the deployment of UIP Packages to an FDI® standalone system.

a) The user chooses an FDI® Package from file system.

b) The system validates the FDI® Package signature and integrity.

c) The system reads the FDI® Package Catalog information as defined in 4.2.1:

- the PackageType attribute is being checked (see Annex E) for "Uip"
- the FDIVersionSupported shall be equal to the Major version (depending on the use of wildcards instead of actual version numbers, the Minor and the Revision part of the version information shall also be interpreted) of the FDI® Server; and

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- the system imports UIPs including UIP Variants and checks for already imported versions of the particular UIP and handles the update and upgrade accordingly. If there is already a higher version installed, the import is aborted since downgrades are not supported by the FDI®.

d) The system reads all UIP Variants for all UIPs in the FDI® Package and verifies:

- that the PlatformId and RuntimeId is supported by the integrated FDI® Client; and
- the version and UipId against already imported UIP Variants and handles the update and upgrade accordingly. If there is already a higher version installed, the import is aborted since downgrades are not supported by FDI®.

e) The system stores the relevant FDI® Device Package content.

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Annex D
(informative)

Example

D.1 General

The purpose of Annex D is to provide an overview of ISO/IEC 29500-2 and an example FDI® Device Package implementation. It is not intended to provide all the details that might be necessary for the implementation of an FDI® Package.

Unless otherwise stated in Annex D, the ~~initialism~~ acronym OPC refers to Open Packaging Conventions.

D.2 Open Packaging Conventions

D.2.1 Overview

The Open Packaging Conventions (OPC) are a container-file technology specified in ISO/IEC 29500-2. OPC-based documents are ZIP archives that contain XML, binary and other types of files. They combine the advantages of maintaining the independence and the integrity of the files embedded in the document while having a single integrated package.

An OPC package consists of parts and relationships as shown in Figure D.1. Parts refer to the content being packaged such as binary and text files. Relationships define associations between the package, parts and external resources.

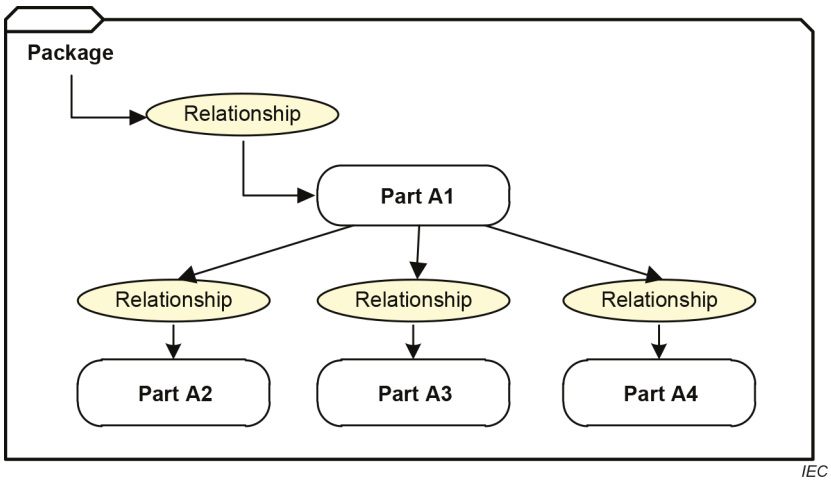

Figure D.1 – Parts and relationships in a package

D.2.2 Parts

OPC packages can store parts that contain any type of data (text, images, XML, binary, whatever). Parts can be organized as a hierarchy of folders that is similar to a file system. The OPC specification allows any folder organization that is convenient for the application.

Every part in a package has a unique URI-compliant part name along with a specified content-type expressed in the form of a MIME media type. The MIME media types for all the parts stored in the package are defined in an XML file named "/[Content_Types].xml".

In an FDI® Package, the parts include the Package Catalog, EDD, UIPs and Attachments.

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D.2.3 Relationships

In addition to a hierarchy of folders and parts, OPC allows the definition of relationships among parts. Relationships provide a layer of indirection so dependencies are not hardcoded into the content.

Relationships allow problem domain and application specific relationships to be defined and enforced by systems and tools. By navigating through the network of associations one can have random access to related content.

Relationships are composed of four elements:

- an identifier (ID);
- an optional source (the package or a part within the package);
- a relationship type (a URI-style expression that defines the type of the relationship);
- a target (a URI to another part within the package or to an external resource).

The relationships are stored in XML files with the extension ".rels" within subfolders named "/_rels".

In an FDI® Package, the relationships are used to express the association of the Package to the Package Catalog, the EDD, the UIP and the Attachments.

The following clause, for instance, defines the relationship identified as "rIdUip1", which establishes the association between the Package and the Package Catalog.

```
  <Relationship Id="rIdUip1"
    Type="http://FDI-cooperation.com/2010/relationships/package-
catalog"
    Target="FDIpackage/catalog.xml"/>
```

D.2.4 OPC Core features

D.2.4.1 Overview

The content types file /[Content_Types].xml, the package relationships file /_rels/.rels, and the part relationships files in the subfolders _rels are the core parts of an OPC package.

The filename [Content_Types].xml in any folder, the subfolder name _rels, and the file extension .rels within such directory are the only three reserved names for files stored in an OPC package.

D.2.4.2 Content types

The file /[Content_Types].xml defines the MIME media types for all the parts stored in the package. It defines default mappings based on file extensions, along with overrides for specific parts with content-types that are different from the file extension defaults.

Table D.1 and Table D.2 show examples of standard MIME media types and examples of FDI®-custom MIME media types that can be used in FDI® Packages.

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Table D.1 – Examples of standard MIME media types that can be used in FDI® Packages

Type of content	Standard MIME media type
XML file	application/xml
PNG image	image/png
PDF document	application/pdf
OPC relationships	application/vnd.openxmlformats-package.relationships+xml

Table D.2 – Examples of FDI®-custom MIME media types that can be used in FDI® Packages

Type of content	FDI®-custom MIME media type
Package catalog	application/vnd.FDI.package.catalog+xml
EDD	application/vnd.FDI.package.edd
UIP	application/vnd.FDI.package.uip

The following clause in the /[Content_Types].xml file defines the default MIME media type for any XML files in the package.

```
<Default Extension="xml" ContentType="application/xml"/>
```

The following clause in the same file will override the definition above for the package catalog part only:

```
<Override PartName="/FDIpackage/catalog.xml"
    ContentType="application/vnd.FDI.package.catalog+xml"/>
```

D.2.4.3 Package relationships

The root level /_rels folder stores the relationships for the package as a whole. The /_rels folder normally contains a file named .rels, an XML file where the starting package-level relationships are stored.

D.2.4.4 Part relationships

Each part may have its own relationships. If the part has relationships, they will be stored in an XML file within the _rels folder that is a sibling of that part. That file takes the part name with a .rels appended to it.

Because the Package Catalog part has relationships to other package parts, there is a file named catalog.xml.rels inside the /_rels folder that defines those relationships.

D.2.5 OPC additional features

D.2.5.1 Core properties

Core properties consist of package metadata. They enable users to get and set well-known and common sets of property metadata within packages, such as categorization of the content, status of package (e.g., draft, reviewed, final), date of creation, identification of the creator, keywords, and language. The core properties are not used in FDI® Packages (see 5.2).

D.2.5.2 Thumbnails

Thumbnails are images that are used as graphical representation of parts of a package or a package as a whole. The use of thumbnails in an FDI® Package is optional (see 5.2).

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D.2.5.3 Digital Signatures

Digital Signatures can be used to enable consumers to validate the integrity of the contents. The use of Digital Signatures is mandatory in FDI® Packages (see 5.2).

D.3 Creation and handling of FDI® Packages

As long as the conventions are followed, OPC files can be created, opened and modified just as any ordinary ZIP file by using standard ZIP file tools. However, there exists higher level support to handle them so that developers do not have to cope with all the peculiarities of OPC. OPC is natively supported in Microsoft .NET Framework 3.0. Open source libraries also exist for other languages. Ultimately, FDI® specific tools are expected to provide automated support for the creation and handling of FDI® Packages.

Given the catalog information, the EDD, the UIPs and Attachments for a specific device type, a hypothetical FDI® packaging tool is capable of creating the FDI® Package for that device type, as depicted in Figure D.2.

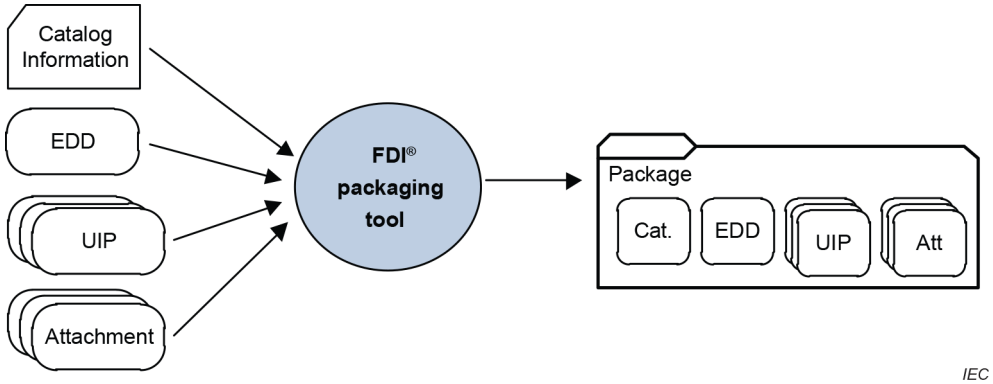

Figure D.2 – Creating an FDI® Package with the content files

D.4 FDI® Device Package example

D.4.1 Overview

Figure D.3 represents an example FDI® Device Package. The root directory of the FDI® Device Package contains three directories and one file. The directory names FDI®package and uip are examples and are not defined by this document. The _rels directory is used to store the package relationships and is defined by ISO/IEC 29500-2.

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