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**Feldgeräteintegration (FDI) –
Teil 5: FDI-Informationsmodell
(IEC 62769-5:2015);
Englische Fassung EN 62769-5:2015**

Field Device Integration (FDI) –
Part 5: FDI Information Model
(IEC 62769-5:2015);
English version EN 62769-5:2015

Intégration des appareils de terrain (FDI) –
Partie 5: Modèle d'Information FDI
(IEC 62769-5:2015);
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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2015-06-24 angenommene Europäische Norm als DIN-Norm ist 2016-03-01.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 62769-5:2013-01.

Für dieses Dokument ist das nationale Arbeitsgremium K 956 „Feldbus“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik in DIN und VDE (www.dke.de) zuständig.

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Nationaler Anhang NA (informativ)

1 Anwendungsbereich^{N1)}

Dieser Teil von IEC 62769 legt das FDI-Informationsmodell fest. Eine der Hauptaufgaben des Informationsmodells ist die Beschreibung der Topologie eines Automatisierungssystems. Daher stellt es sowohl das Automatisierungssystem als auch die verbindenden Kommunikationsnetzwerke mit ihren Eigenschaften, Beziehungen und den Operationen dar, die auf ihnen ausführbar sind. Die Typen innerhalb des Adressraumes des FDI-Servers bilden eine Art von Katalog, der aus FDI-Paketen besteht.

Die grundsätzlichen Typen für das FDI-Informationsmodell sind in der OPC UA für Geräte (IEC 62541-100) klar definiert. Das FDI-Informationsmodell legt für einige Fälle Erweiterungen fest und erklärt, wie diese Typen anzuwenden sind und wie die Inhalte aus Elementen von Gerätepaketen gebildet werden.

Die gesamte FDI-Architektur ist in Bild 1 dargestellt. Die im Anwendungsbereich dieses Dokumentes liegenden Architekturkomponenten sind in dem Bild hervorgehoben.

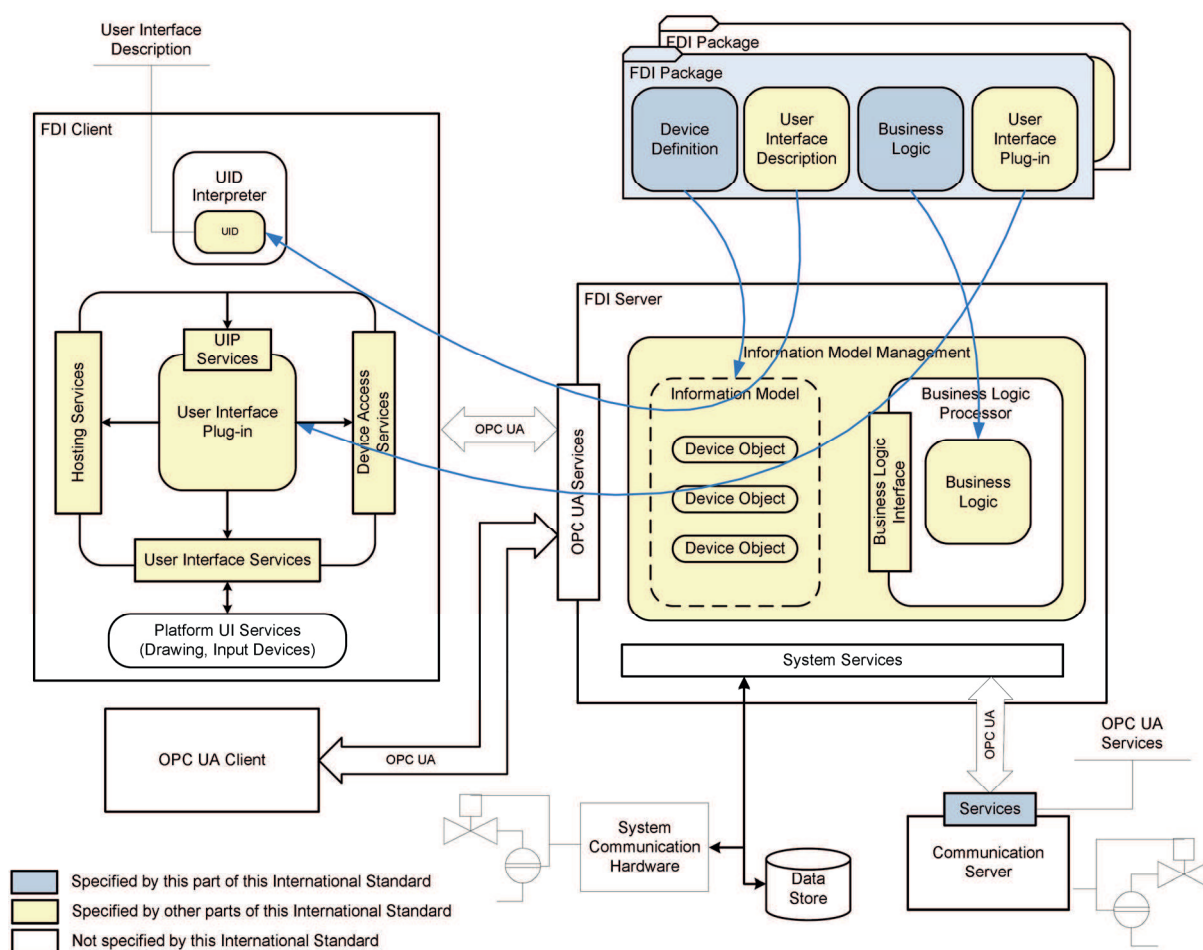


Bild 1 – FDI Architektur

^{N1)} Nationale Fußnote: Die Nummerierung der IEC 62769-5:2015 wurde beibehalten.

3 Begriffe, Abkürzungen und Konventionen^{N2)}

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die Begriffe nach IEC 62769-1.

^{N2)} Nationale Fußnote: Nationale Fußnote: Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

English Version

Field Device Integration (FDI) - Part 5: FDI Information Model
(IEC 62769-5:2015)

Intégration des appareils de terrain (FDI) - Partie 5: Modèle
d'Information FDI
(IEC 62769-5:2015)

Feldgeräteintegration (FDI) - Teil 5: FDI-Informationsmodell
(IEC 62769-5:2015)

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European foreword

The text of document 65E/348/CDV, future edition 1 of IEC 62769-5, prepared by SC 65E "Devices and integration in enterprise systems" of IEC/TC 65 "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62769-5:2015.

The following dates are fixed:

- latest date by which the document has to be (dop) 2016-03-24
implemented at national level by
publication of an identical national
standard or by endorsement
- latest date by which the national (dow) 2018-06-24
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The text of the International Standard IEC 62769-5:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC/TR 62541-1	NOTE	Harmonized as CLC/TR 62541-1.
IEC 62541-7	NOTE	Harmonized as EN 62541-7

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INTRODUCTION

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning

- a) Method for the Supplying and Installation of Device-Specific Functionalities, see Patent Family DE10357276;
- b) Method and device for accessing a functional module of automation system, see Patent Family EP2182418;
- c) Methods and apparatus to reduce memory requirements for process control system software applications, see Patent Family US2013232186;
- d) Extensible Device Object Model, see Patent Family US12/893,680.

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FIELD DEVICE INTEGRATION (FDI) –

Part 5: FDI Information Model

1 Scope

This part of IEC 62769 defines the FDI Information Model. One of the main tasks of the Information Model is to reflect the topology of the automation system. Therefore it represents the devices of the automation system as well as the connecting communication networks including their properties, relationships, and the operations that can be performed on them. The types in the AddressSpace of the FDI Server constitute some kind of catalogue, which is built from FDI Packages.

The fundamental types for the FDI Information Model are well defined in OPC UA for Devices (IEC 62541-100). The FDI Information Model specifies extensions for a few special cases and otherwise explains how these types are used and how the contents are built from elements of DevicePackages.

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 illustration.

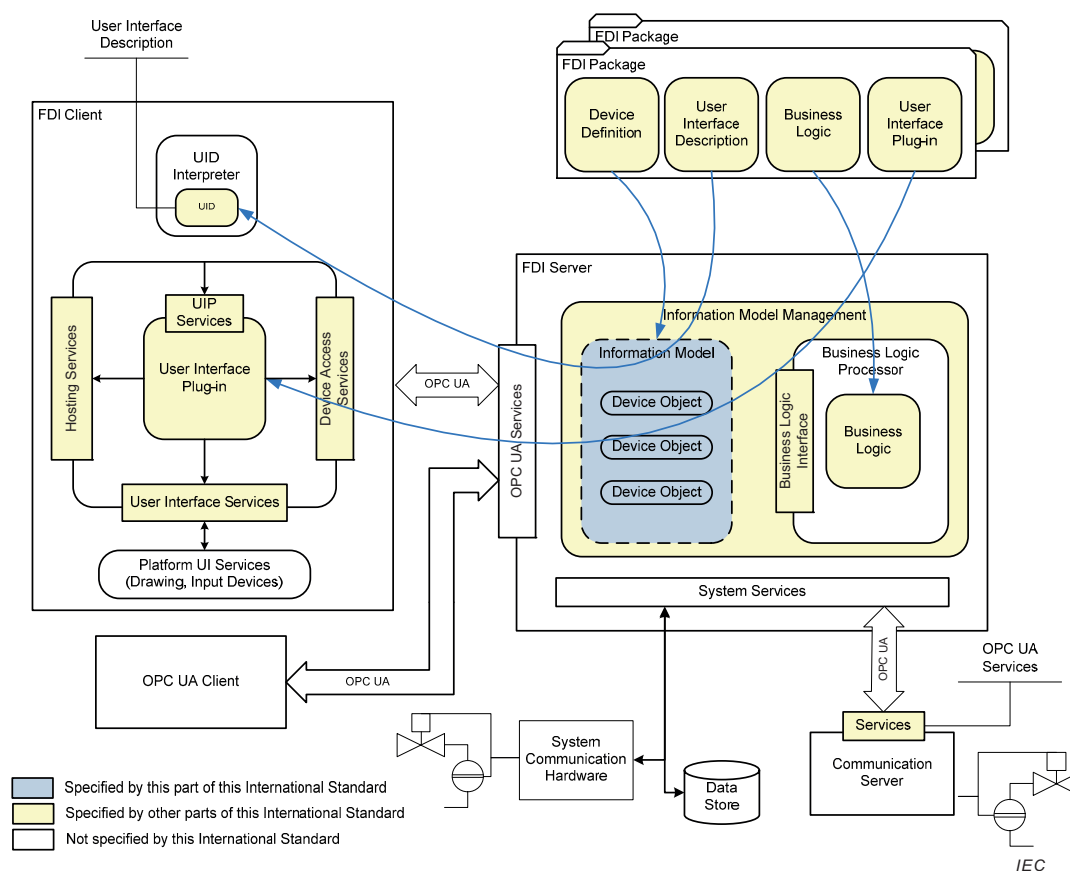


Figure 1 – FDI architecture diagram

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61804-3¹, *Function blocks (FB) for process control and Electronic Device Description Language (EDDL) – Part 3: EDDL syntax and semantics*

IEC 62541-3, *OPC unified architecture – Part 3: Address Space Model*

IEC 62541-4, *OPC unified architecture – Part 4: Services*

IEC 62541-5, *OPC unified architecture – Part 5: Information Model*

IEC 62541-6, *OPC unified architecture – Part 6: Mappings*

IEC 62541-8, *OPC unified architecture – Part 8: Data Access*

IEC 62541-100², *OPC unified architecture – Part 100: OPC UA for Devices*

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

NOTE IEC 62769-1 is technically identical to FDI-2021

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

NOTE IEC 62769-2 is technically identical to FDI-2022

IEC 62769-4, *Field Device Integration (FDI) – Part 4: FDI Packages*

NOTE IEC 62769-4 is technically identical to FDI-2024

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

NOTE IEC 62769-7 is technically identical to FDI-2027

3 Terms, definitions, abbreviated terms, acronyms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62769-1 apply.

¹ To be published.

² Under consideration.

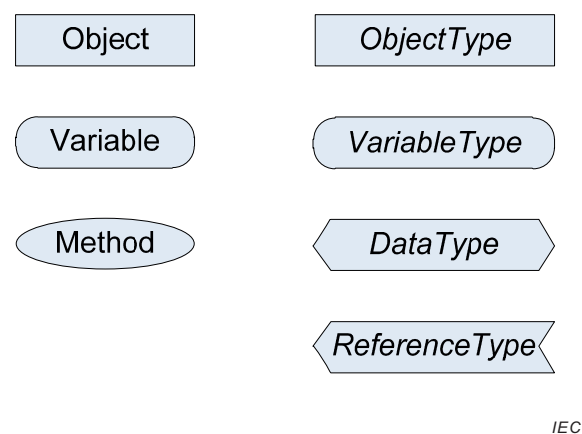
3.2 Abbreviated terms and acronyms

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

HMI	Human Machine Interface
SCADA	Supervisory Control and Data Acquisition
TCP	Transmission Control Protocol

3.3 Conventions for graphical notation

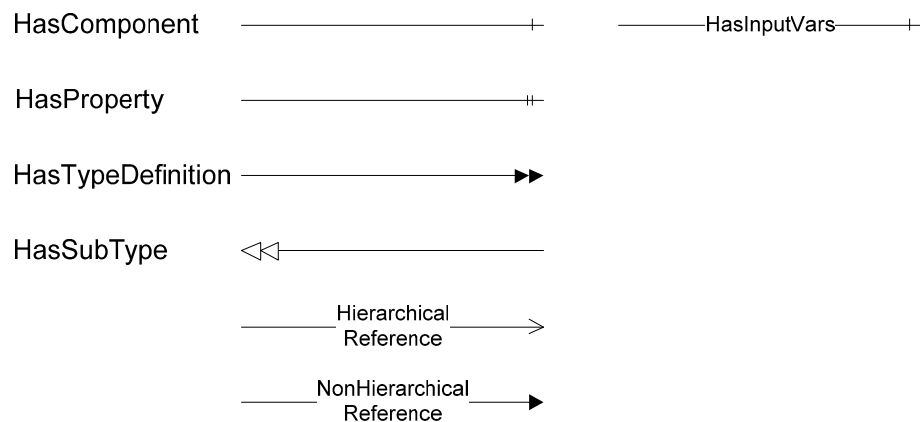
OPC UA defines a graphical notation for an OPC UA AddressSpace. It defines graphical symbols for all NodeClasses and how different types of References between Nodes can be visualized. Figure 2 shows the symbols for the NodeClasses used in this standard. NodeClasses representing types always have a shadow.



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Figure 2 – OPC UA Graphical Notation for NodeClasses

Figure 3 shows the symbols for the ReferenceTypes used in this standard. The Reference symbol is normally pointing from the source Node to the target Node. The only exception is the HasSubType Reference. The most important References such as HasComponent, HasProperty, HasTypeDefinition and HasSubType have special symbols avoiding the name of the Reference. For other ReferenceTypes or derived ReferenceTypes the name of the ReferenceType is used together with the symbol.



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Figure 3 – OPC UA Graphical Notation for References

Figure 4 shows a typical example for the use of the graphical notation. Object_A and Object_B are instances of the ObjectType_Y indicated by the HasTypeDefinition References. The ObjectType_Y is derived from ObjectType_X indicated by the HasSubType Reference. The Object_A has the components Variable_1, Variable_2 and Method_1.

To describe the components of an Object on the ObjectType the same NodeClasses and References are used on the Object and on the ObjectType such as for ObjectType_Y in the example. The Nodes used to describe an ObjectType are instance declaration Nodes.

To provide more detailed information for a Node, a subset or all Attributes and their values can be added to a graphical symbol (see for example Variable_1, the component of Object_A in Figure 4).

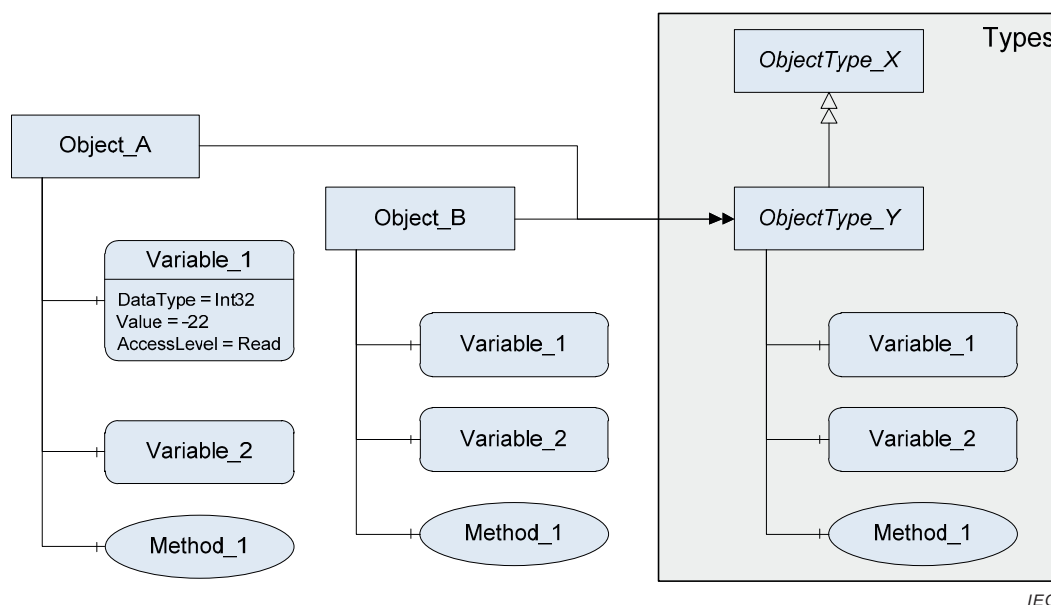


Figure 4 – OPC UA Graphical Notation Example

To improve readability, this document frequently includes the type name inside the instance box rather than displaying both boxes and a reference between them. This optimization is shown in Figure 5.

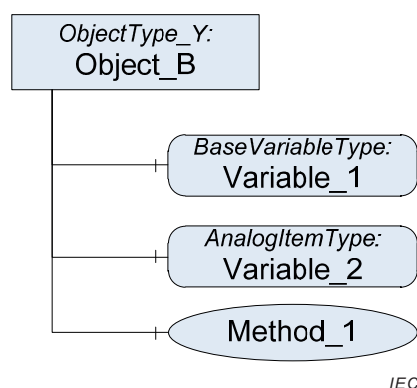


Figure 5 – Optimized Type Reference

4 Overview of OPC Unified Architecture

4.1 General

The main use case for OPC standards is the online data exchange between devices and HMI or SCADA systems. In this use case the device data is provided by an OPC server and is consumed by an OPC client integrated into the HMI or SCADA system. OPC provides functionality to browse through a hierarchical namespace containing data items and to read, write and monitor these items for data changes.

OPC UA incorporates features like Data Access, Alarms and Historical Data via platform independent communication mechanisms and generic, extensible and object-oriented modelling capabilities for the information a system wants to expose.

The current version of OPC UA defines an optimized binary TCP protocol for high performance intranet communication as well as a mapping to Web Services. The abstract service model does not depend on a specific protocol mapping and allows adding new protocols in the future. Features like security, access control and reliability are directly built into the transport mechanisms. Based on the platform independence of the protocols, OPC UA servers and clients can be directly integrated into devices and controllers.

The OPC UA information model provides a standard way for Servers to expose Objects to Clients. Objects in OPC UA terms are composed of other Objects, Variables and Methods. OPC UA also allows relationships to other Objects to be expressed.

The set of Objects and related information that an OPC UA Server makes available to Clients is referred to as its AddressSpace. The elements of the OPC UA Object Model are represented in the AddressSpace as a set of Nodes described by Attributes and interconnected by References. OPC UA defines various classes of Nodes to represent AddressSpace components most importantly Objects, Variables, Methods, ObjectTypes, DataTypes and ReferenceTypes. Each NodeClass has a defined set of Attributes.

Objects are used to represent components like folders, Devices or Networks. An Object is associated to a corresponding ObjectType that provides definitions for that Object.

Variables are used to represent values. Two categories of Variables are defined, Properties and DataVariables.

Properties are Server-defined characteristics of Objects, DataVariables and other Nodes. Properties are not allowed to have Properties defined for them. An example for Properties of Objects is the Manufacturer Property of a Device.

DataVariables represent the contents of an Object. DataVariables may have component DataVariables. This is typically used by Servers to expose individual elements of arrays and structures. This standard uses DataVariables mainly to represent the Parameters of Devices.

4.2 Overview of OPC UA Devices

The OPC Unified Architecture for Devices (DI) (IEC 62541-100) standard is an extension of the overall OPC Unified Architecture standard series and defines information models associated with Devices. IEC 62541-100 describes three models which build upon each other as follows:

- The (base) Device Model is intended to provide a unified view of devices irrespective of the underlying device protocols.
- The Device Communication Model adds Network and Connection information elements so that communication topologies can be created.

- The Device Integration Host Model finally adds additional elements and rules required for host systems to manage integration for a complete system. It allows reflecting the topology of the automation system with the devices as well as the connecting communication networks.

The Devices information model specifies different ObjectTypes and other AddressSpace elements used to represent Devices and related components such as the communication infrastructure in an OPC UA AddressSpace. The main use cases are Device configuration and diagnostic but it allows a general and standardized way for any kind of application to access Device related information.

Figure 6 shows an example for a temperature controller represented as Device Object. The component ParameterSet contains all Variables describing the Device. The component MethodSet contains all Methods provided by the Device. Both components are inherited from the TopologyElementType, which is the root Object type of the Device Object type hierarchy. Objects of the FunctionalGroupType are used to group the Parameters and Methods of the Device into logical groups. The FunctionalGroupType and the grouping concept are defined in IEC 62541-100 but the groups are DeviceType specific, i.e., the groups ProcessData and Configuration are defined by the TemperatureControllerType in this example.

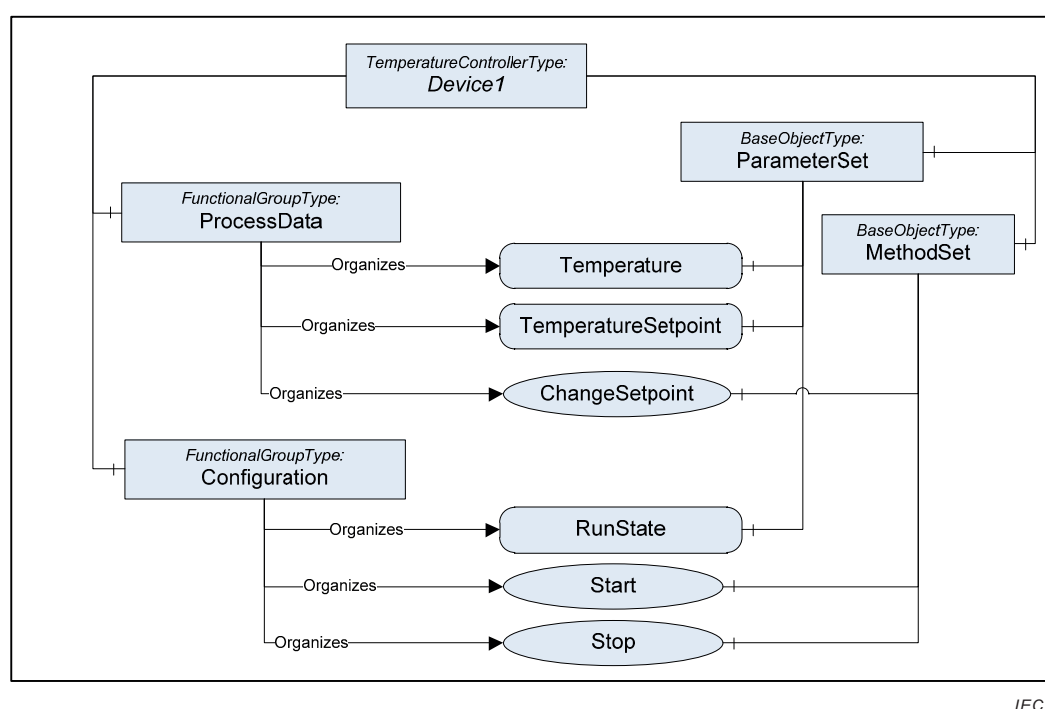


Figure 6 – OPC UA Devices Example: Functional Groups

Another IEC 62541-100 concept is illustrated in Figure 7. The ConfigurableObjectType is used to provide a way to group sub components of a Device and to indicate which types of sub components can be instantiated. The allowed types are referenced from the SupportedTypes folder. This information can be used by configuration clients to allow a user to select the type to instantiate as sub component of the Device.

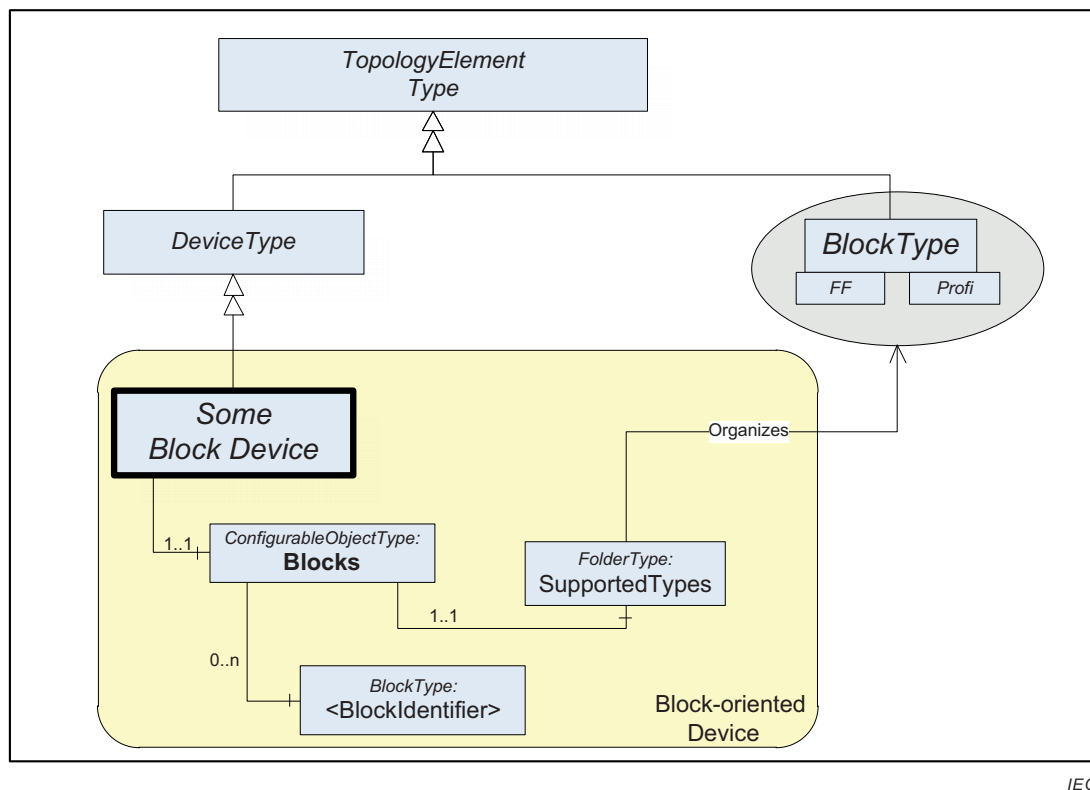


Figure 7 – OPC UA Devices example: Configurable components

The SupportedTypes folder can contain different subsets of ObjectTypes for different instances of the Block-oriented Device depending on their current configuration since the list contains only types that can be instantiated for the current configuration.

5 Concepts

5.1 General

The FDI Server provides FDI Clients access to information about Device instances and Device types regardless of where the information is stored, for example, in the Device itself or in a data store. This information is provided via OPC UA Services and is called the FDI Information Model.

The FDI Information Model specifies the entities that may be accessed in the FDI Server, including their properties, relationships, and the operations that can be performed on them. Which types of Devices or other topological elements are available in a given FDI Server is driven largely by the information in the FDI Packages.

5.2 Device topology

One of the main tasks of the Information Model is to reflect the topology of the automation system. Therefore the Information Model represents the devices of the automation system as well as the connecting communication networks. The entry point Device Topology is the starting point within the Information Model for the topology of the automation system. The entry point Communication Devices contains the communication devices that are used by the FDI Server to access the elements of the topology. Figure 8 and Figure 9 illustrate an example configuration and the configured topology as it will appear in the FDI Server AddressSpace (details left out).