

INTERNATIONAL STANDARD



Field device integration (FDI®) –
Part 3: Server

ITh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62769-3:2023](#)

<https://standards.iteh.ai/catalog/standards/iec/6793b9e0-483c-46d1-8980-976abf0028b7/iec-62769-3-2023>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2023 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

International Standards
Document Preview
standards.iteh.ai

[IEC 62769-3:2023](https://standards.iteh.ai/catalog/standards/iec/62769-3-2023)

<https://standards.iteh.ai/catalog/standards/iec/6793b9e0-483c-46d1-8980-976abf0028b7/iec-62769-3-2023>



IEC 62769-3

Edition 3.0 2023-04
REDLINE VERSION

INTERNATIONAL STANDARD



Field device integration (FDI®) –
Part 3: Server

iteh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62769-3:2023](#)

<https://standards.iteh.ai/catalog/standards/iec/6793b9e0-483c-46d1-8980-976abf0028b7/iec-62769-3-2023>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.100.05

ISBN 978-2-8322-6805-6

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	5
INTRODUCTION.....	8
1 Scope.....	8
2 Normative references	8
3 Terms, definitions, abbreviated terms and conventions acronyms.....	9
3.1 Terms and definitions.....	9
3.2 Abbreviated terms and acronyms	10
3.3 Conventions.....	10
4 Overview	10
5 Information Model.....	11
5.1 General.....	11
5.2 Online/Offline.....	11
5.2.1 Overview	11
5.2.2 Transfer to device.....	12
5.2.3 Transfer from device.....	12
5.2.4 Interactive Transfer to device	12
5.3 Access privileges	12
5.4 Private Parameters	13
5.5 Locking.....	13
5.6 EditContext.....	14
5.6.1 Concept and usage model	14
5.6.2 Services	15
5.6.3 NodeIds.....	16
5.6.4 Reading.....	16
5.6.5 Writing.....	16
5.6.6 Writing dominant and dependent Variables.....	16
5.6.7 Actions (EDD METHODS).....	18
5.6.8 UIDs	18
5.6.9 Synchronization.....	19
5.7 Reading	19
5.7.1 General	19
5.7.2 Reading offline variables	20
5.7.3 Reading online variables	20
5.8 Writing	21
5.8.1 General	21
5.8.2 Write offline variables	22
5.8.3 Writing online variables	23
5.8.4 Writing to an EditContext.....	24
5.9 Subscription.....	25
5.9.1 General	25
5.9.2 Subscription of offline variables	26
5.9.3 Subscription of online variables	27
5.10 Device topology	28
5.10.1 General	28
5.10.2 Connection Points	28
5.10.3 Topology management	29

5.10.4	Topology scanning.....	32
5.10.5	Use of SCAN function.....	33
5.10.6	Validation of defined topology.....	33
5.11	User Interface Elements.....	34
5.11.1	User Interface Descriptions.....	34
5.11.2	User Interface Plug-ins.....	35
5.12	Actions.....	35
5.12.1	FDI® Server – FDI® Client interaction.....	35
5.12.2	Action state machine.....	38
5.12.3	Actions Proxies.....	39
5.12.4	INTERACTIVE_TRANSFER_TO_DEVICE Action.....	40
5.12.5	Actions, EDD Actions and Actions Proxies.....	41
6	OPC UA services.....	42
6.1	OPC UA profiles.....	42
6.2	Service error information.....	42
6.2.1	Overview.....	42
6.2.2	OPC UA services and their response.....	42
6.2.3	Mappings of EDDL response codes to OPC UA service response.....	43
6.3	Parameter value update during write service request.....	44
6.4	Localization.....	44
6.5	Audit events.....	44
7	Communication.....	44
7.1	Notation.....	44
7.2	General.....	45
7.2.1	Concepts.....	45
7.2.2	Terms.....	47
7.3	Communication Service processing.....	48
7.3.1	Communication Service invocation.....	48
7.3.2	Analyze communication path.....	48
7.3.3	Manage communication relations.....	49
7.3.4	Communication service request mapping.....	49
7.3.5	Communication service request propagation.....	50
7.3.6	Communication error handling.....	51
7.4	FDI® Communication Server specific handling.....	51
7.4.1	Discovery.....	51
7.4.2	Information Model synchronization.....	52
8	Parallel Execution within the FDI® Server.....	52
8.1	Motivation.....	52
8.2	Internal structure of the EDD interpreter.....	53
8.3	Rules for running an EDD entity.....	53
Annex A (informative)	FDI® Server functional structure.....	55
A.1	FDI® functional elements.....	55
A.2	FDI® Server extension.....	56
Annex B (informative)	Access privileges and user roles.....	58
B.1	User roles and usage case.....	58
B.2	Private data usage.....	59
Annex C (informative)	Parallel execution within the FDI® Server – Examples.....	60
C.1	Simple example for a synchronous execution.....	60

C.2	Example for a concurrent execution	60
C.3	Deadlock detection in concurrent execution	62
Annex D (informative)	Read-Only mode for UID Views	63
D.1	Definition	63
Figure 1	– FDI® architecture diagram	8
Figure 2	– Locking services	14
Figure 3	– EditContext models	15
Figure 4	– Online EditContext state diagram for dominant and dependent Variables	17
Figure 5	– Offline EditContext state diagram for dominant and dependent Variables	18
Figure 6	– EditContext for EDD Methods	18
Figure 7	– Offline variable read	20
Figure 8	– Online variable read	21
Figure 9	– Offline variable write immediate	22
Figure 10	– Online variable write immediate	23
Figure 11	– Write with EditContext	25
Figure 12	– Offline variable subscription	26
Figure 13	– Online variable subscription	27
Figure 14	– Topology with Network objects (non-normative)	28
Figure 15	– Add Device to topology	30
Figure 16	– Remove Device from topology	31
Figure 17	– Scan topology	32
Figure 18	– Action execution	37
Figure 19	– Action state machine	38
Figure 20	– System communication integration example	45
Figure 21	– FDI® Communication Server integration example	46
Figure 22	– Gateway integration example	47
Figure 23	– Message propagation example scenario	50
Figure A.1	– Functional components of an FDI® Server	55
Figure A.2	– FDI® Server extensions	57
Figure B.1	– User roles and access privileges	58
Figure C.1	– Synchronous execution of two triggers	60
Figure C.2	– Concurrent execution of two triggers (step 1)	60
Figure C.3	– Concurrent execution of two triggers (step 2)	61
Figure C.4	– Concurrent execution of two triggers (step 3)	61
Figure C.5	– Concurrent execution of two triggers (step 4)	61
Figure C.6	– Concurrent execution of two triggers	62
Table 1	– Action states	38
Table 2	– Action state transitions	39
Table 3	– EDD Action types and the EDD constructs that use them	41
Table 4	– OPC UA severity bits and EDDL response codes TYPE	43

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE INTEGRATION (FDI®) –

Part 3: Server

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62769-3:2021. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62769-3 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

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 interactive transfer to device.

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

Draft	Report on voting
65E/856/CDV	65E/913/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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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

iteh Standards
(<https://standards.iteh.ai>)
Document Preview

[IEC 62769-3:2023](https://standards.iteh.ai/catalog/standards/iec/6793b9e0-483c-46d1-8980-976abf0028b7/iec-62769-3-2023)

<https://standards.iteh.ai/catalog/standards/iec/6793b9e0-483c-46d1-8980-976abf0028b7/iec-62769-3-2023>

FIELD DEVICE INTEGRATION (FDI®) –

Part 3: Server

1 Scope

This part of IEC 62769 specifies the FDI®¹ Server. 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. Annex A provides a functional description of the FDI® Server.

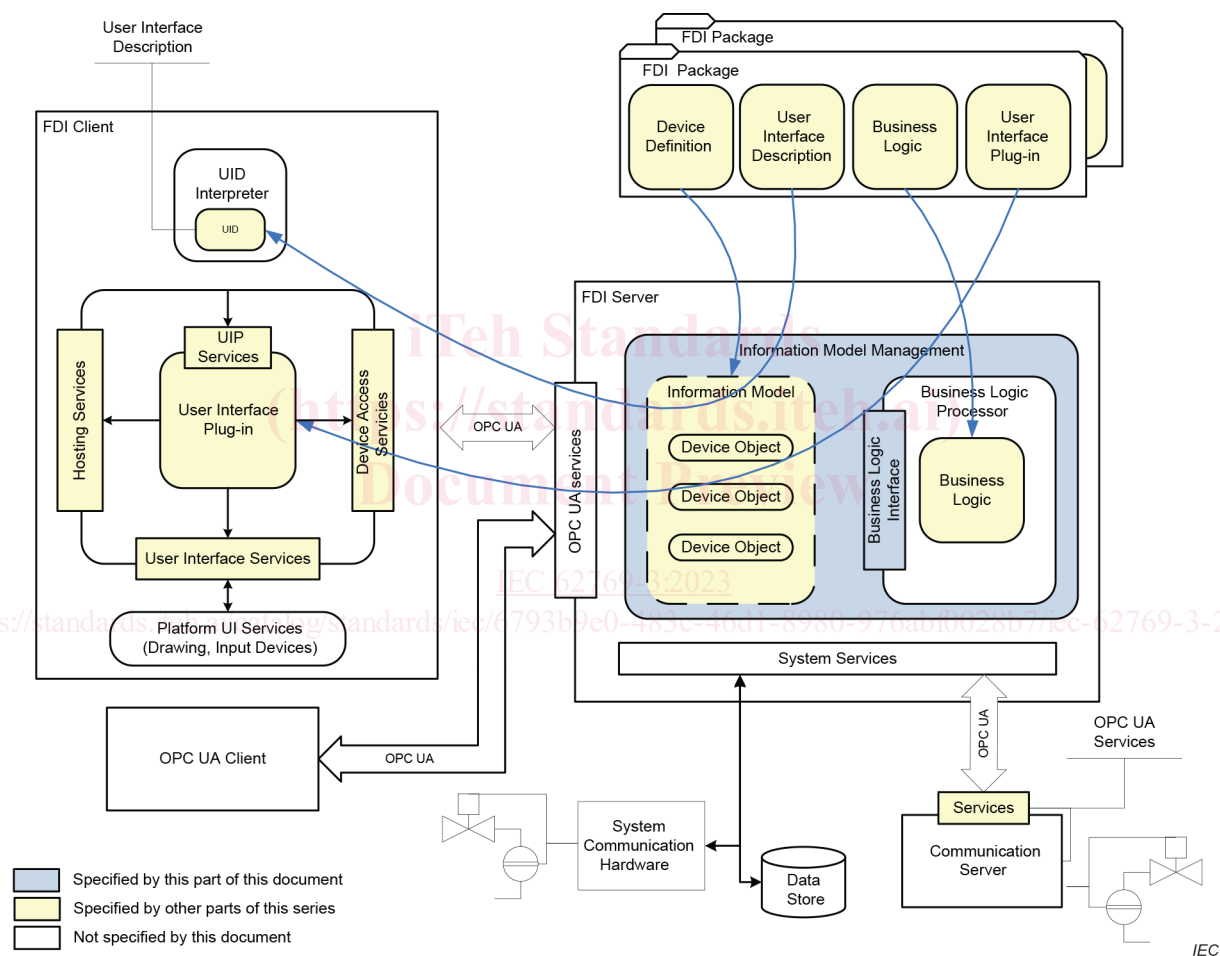


Figure 1 – FDI® architecture diagram

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.

For undated references, the latest edition of the referenced document (including any amendments) applies.

~~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 61804-4:2020, Function blocks (FB) for process control and electronic device description language (EDDL) – Part 4: EDD interpretation~~

IEC 61804-4, *Devices and integration in enterprise systems – Function blocks (FB) for process control and electronic device description language (EDDL) – Part 4: EDD interpretation*

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

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

IEC 62541-7, *OPC unified architecture – Part 7: Profiles*

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

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

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

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

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

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 as well as 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

Actions Proxy

internal FDI® Server entity that encapsulates all the EDD Methods specified in an EDD Action definition

3.1.2

Connection Point

logical representation of a connection of a communication end point to a communication network

3.2 Abbreviated terms and acronyms

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

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 Overview

The structure for an FDI® Server is shown in Figure 1.

FDI® Servers that support connectivity with third-party FDI® Clients shall support OPC UA. A vendor can provide both an FDI® Server and one or more FDI® Clients. In this case, the FDI® Clients can communicate with the FDI® Server through proprietary protocols.

An FDI® Server communicates with devices via Native Communication (see 7.2.1) and/or Communication Devices (see IEC 62769-7).

An FDI® Server provides information to FDI® Clients through an Information Model (see IEC 62769-5) as follows.

- The Information Model includes information about Device Types and Device Instances. The information for a Device Instance includes offline data (engineering data), as well as online data (values from the physical device).
- The Information Model is created using information from FDI® Packages. However, not all of the information in an FDI® Package is reflected in the Information Model.
- Referential integrity of the Information Model is maintained using information from FDI® Packages.
- FDI® Packages can contain Attachments that contain device manuals and protocol specific information (see IEC 62769-4). Those Attachments, including device manuals and protocol specific support files, are exposed via the Information Model.
- FDI® Device Packages contain information about device types (see IEC 62769-4). Each device type defined in a package is mapped to a distinct DeviceType node in the Information Model.
- FDI® Profile Packages are used to provide interaction with devices for which an FDI® Device Package does not exist (see IEC 62769-4).
- Multiple revisions of an FDI® Package generate distinct DeviceType nodes in the Information Model (see IEC 62769-4).

FDI® Packages contain digital signatures that allow an FDI® Server to authenticate their contents (see IEC 62769-4).

~~An FDI Server shall not use an FDI Package if the digital signature provided by the FDI Package is invalid.~~

An FDI® Server shall verify the FDI® Technology Version (see IEC 62769-1) of any FDI® Package it uses to ensure the FDI® Package is compatible with the FDI® Server.

~~The resulting functional structure of an FDI server is described in Annex A.~~

5 Information Model

5.1 General

The FDI[®] Server shall use the Device Definition of an FDI[®] Package to maintain the Information Model.

The Device Definition can contain conditional expressions. Conditional expressions are used when a certain aspect of the Device Definition is not static but rather is dependent on the state of the device. Whenever the online or offline values of a Device Instance are modified, the FDI[®] Server shall re-evaluate the relevant conditional expressions and modify the Information Model accordingly.

The evaluation of conditional expressions can invalidate variables in the Information Model. The FDI[®] Server shall change the AccessLevel attribute of invalidated variables such that they are neither readable nor writable and the status of these variables shall be set to bad. Read and write service requests for invalidated variables shall return a failure.

The Device Definition can specify relationships between variables in a device. These relationships can impact the value of variables in the Information Model.

The FDI[®] Server shall generate DataChange Notifications to any FDI[®] Clients that are subscribing to Information Model elements that have changed.

FDI[®] Packages provide Business Logic that is used by the FDI[®] Server to maintain the integrity of the Information Model. The Business Logic specified in an FDI[®] Package can invoke built-in functions that shall be implemented by the FDI[®] Server. The built-in functions that shall be implemented by the FDI[®] Server are specified in IEC 61804-5.

5.2 Online/Offline

5.2.1 Overview

The Information Model maintained by the FDI[®] Server contains online and offline values. The online values reflect values in a physical component/device. The offline values reflect values stored in a configuration database.

The offline values are updated through write service requests from an FDI[®] Client or Business Logic executed by the FDI[®] Server. The offline values are not updated when the FDI[®] Server reads data from the device or writes data to the device.

The online values in the Information Model are not updated through write service requests. Successful write service requests through the Information Model result in value changes in the physical devices. The online values in the Information Model will then be updated as a result of read service requests or subscriptions.

FDI[®] Servers can provide a server-specific mechanism for creating Device Instances without the presence of physical hardware. The FDI[®] Server creates these instances using information in FDI[®] Packages. All read/write requests for online values for Device Instances with no physical device shall return an error.

The transfer of information between the offline values and the physical device is supported through the TransferToDevice, TransferFromDevice ~~methods~~ in the Information Model, and the INTERACTIVE_TRANSFER_TO_DEVICE_ACTION implementing the transfer including user interaction. These Methods shall implement the download and upload procedures, respectively, as specified in IEC 61804-4. When no implementation is provided based on IEC 61804-4, then these Methods shall return Bad_NotSupported, as per IEC 62541-4.

The Device shall have been locked prior to invoking these methods, as specified in IEC 62769-5.

5.2.2 Transfer to device

The TransferToDevice method shall implement the download procedure as specified in IEC 61804-4. This transfers the offline values to the physical device.

As a general rule, the FDI® Server should not change the Online variable node when writing a value to the device. The Online variable node should be updated only in the process of read operations or subscriptions. Notwithstanding, as specified in IEC 62769-5, the FDI® Server will reset any cached Value for the target Nodes in the Information Model so that they will be re-read next time they are requested.

The status information returned for each variable included in the write service request is used to compose the TransferResult, as specified in IEC 62769-5.

5.2.3 Transfer from device

The TransferFromDevice method shall implement the upload procedure as specified in IEC 61804-4. This transfers the values from the physical device to the offline values.

If any read operations from the device fail during upload, the corresponding offline value shall not be modified.

The status information returned for each variable included in the read service request is used to compose the TransferResult, as specified in IEC 62769-5.

5.2.4 Interactive Transfer to device

The FDI® Server implements the Interactive Transfer to Device as specified in IEC 61804-4. This transfers the offline values to the physical device. In contrast to the non-interactive download performed with the TransferToDevice method, the interactive download may invoke user interaction just before the download starts and after the download has been performed. The Interactive Transfer to device is started by an invocation of the INTERACTIVE_TRANSFER_TO_DEVICE_ACTION by the FDI® Client using the InvokeAction service.

As a general rule, the FDI® Server should not change the Online variable node when writing a value to the device. The Online variable node should be updated only in the process of read operations or subscriptions. Notwithstanding, as specified in IEC 62769-5, the FDI® Server will reset any cached Value for the target Nodes in the Information Model so that they will be re-read next time they are requested.

5.3 Access privileges

Systems implement security and access policies based on a number of characteristics such as user role and plant area. FDI® Servers use these policies, along with information in FDI® Packages, to determine the access privileges granted to the user.

The elements of an FDI® Package can be associated with one or more usage attributes. The FDI® Server uses these attributes to set the UserAccessLevel attribute of Variables and the UserExecutable attribute of Methods. The usage attributes in an FDI® Package are simply hints to be used by the FDI® Server, i.e., they may be disregarded or overridden by the FDI® Server. See also Annex B.