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Entwurf**Feldgeräteintegration (FDI) –
Teil 3: FDI-Server
(IEC 65E/261/CD:2012), Text in Englisch**

Field Device Integration (FDI) –
Part 3: FDI Server
(IEC 65E/261/CD:2012), Text in English

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Dieser Norm-Entwurf mit Erscheinungsdatum 2012-12-17 wird der Öffentlichkeit zur Prüfung und Stellungnahme vorgelegt.

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Gesamtumfang 56 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

Nationales Vorwort

Die englische Originalfassung des internationalen Dokuments IEC 65E/261/CD:2012 „Field Device Integration (FDI) – Part 3: FDI Server“ (CD, en: Committee Draft) ist unverändert in diesen Norm-Entwurf übernommen worden.

Das internationale Dokument wurde vom SC 65E „Devices and integration in enterprise systems“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet und den nationalen Komitees zur Stellungnahme vorgelegt.

Die IEC und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

Da der Abstimmungszeitraum für einen FDIS bzw. Schluss-Entwurf prEN nur 2 Monate beträgt, und dann keine sachlichen Stellungnahmen mehr abgegeben werden können, sondern nur noch eine „JA/NEIN“-Entscheidung möglich ist, wobei eine „NEIN“-Entscheidung fundiert begründet werden muss, wird bereits der CD als DIN-Norm-Entwurf veröffentlicht, um die Stellungnahmen aus der Öffentlichkeit frühzeitig berücksichtigen zu können.

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

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf eine Norm ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils neueste gültige Ausgabe der in Bezug genommenen Norm.

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Da sich die Benutzer des vorliegenden Normentwurfs der englischen Sprache als Fachsprache bedienen, wird die Englische Fassung der IEC 62769-3 veröffentlicht. Zu deren Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA des vorliegenden Normentwurfs hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Dieser Normentwurf steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

Nationaler Anhang NA (informativ)

3 Begriffe und Abkürzungen

3.1 Begriffe

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

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE INTEGRATION (FDI) –

Part 3: FDI Server

FOREWORD

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International Standard 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.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/xxx/FDIS	65C/xxx/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

The National Committees are requested to note that for this publication the stability date is 2017.

THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

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

FIELD DEVICE INTEGRATION (FDI) –

Part 3: FDI Server

1 Scope

This International Standard specifies the FDI 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 illustration.

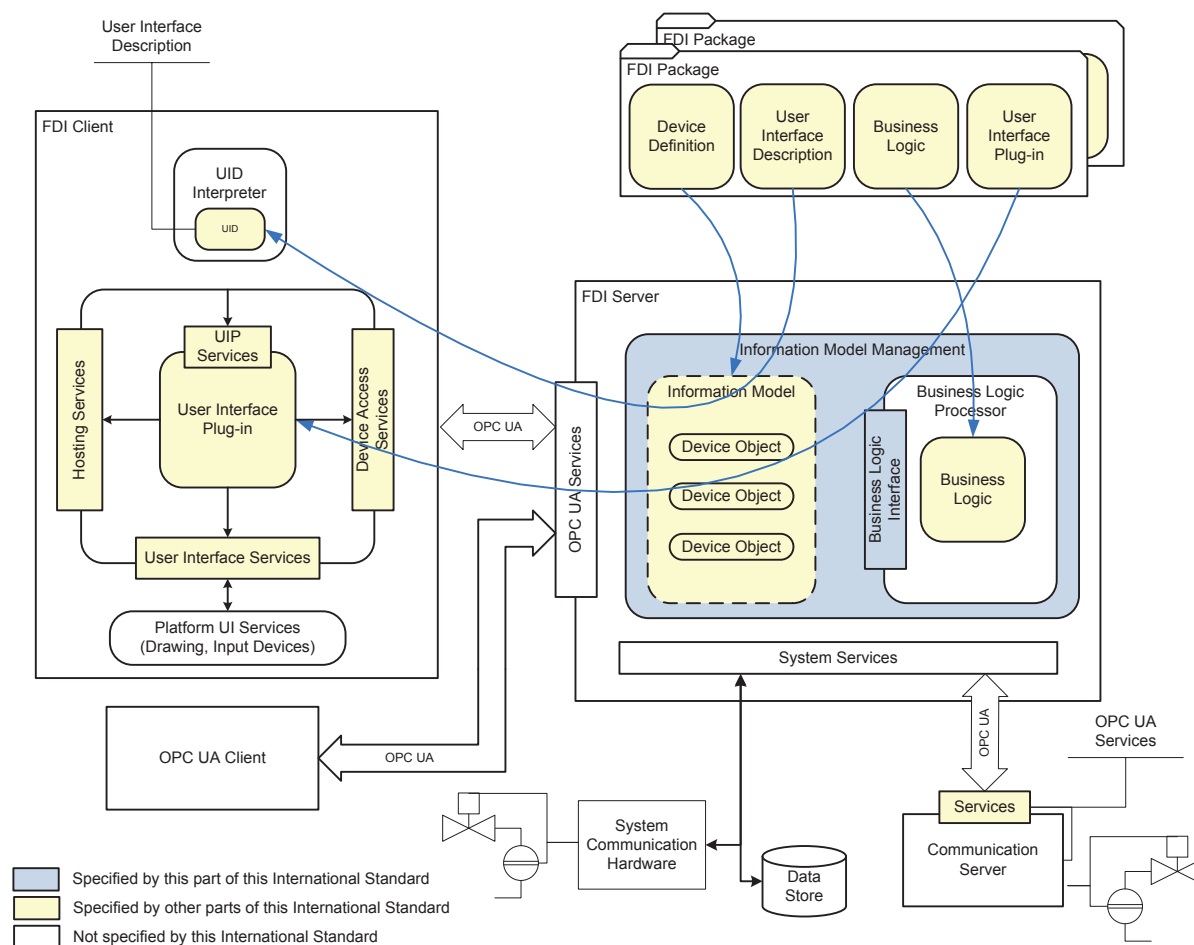


Figure 1 – FDI architecture diagram

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 62541 (all parts), *OPC Unified Architecture*

18 IEC 61804-3:2013², *Function block (FB) for process control and EDDL – Part 3: Electronic*
19 *Device Description Language (EDDL)*

20 IEC 62769-1, *Devices and integration in enterprise systems – Field device integration –*
21 *Part 1: Overview*

22 NOTE IEC 62769-1 is technical identical to FDI-2021

23 IEC 62769-2, *Devices and integration in enterprise systems – Field device integration –*
24 *Part 2: FDI Client*

25 NOTE IEC 62769-2 is technical identical to FDI-2022

26 IEC 62769-4, *Devices and integration in enterprise systems – Field device integration –*
27 *Part 2: FDI Packages*

28 NOTE IEC 62769-4 is technical identical to FDI-2024

29 IEC 62769-5, *Devices and integration in enterprise systems – Field device integration –*
30 *Part 5: FDI Information Model*

31 NOTE IEC 62769-5 is technical identical to FDI-2025

32 IEC 62769-6, *Devices and integration in enterprise systems – Field device integration –*
33 *Part 6: FDI Technology Mapping*

34 NOTE IEC 62769-6 is technical identical to FDI-2026

35 IEC 62769-7, *Devices and integration in enterprise systems – Field device integration –*
36 *Part 7: FDI Communication Devices*

37 NOTE IEC 62769-7 is technical identical to FDI-2027

38 **3 Terms, definitions, abbreviated terms, acronyms**

39 **3.1 Terms and definitions**

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

41 **3.2 Abbreviated terms and acronyms**

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

44 **4 Overview**

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

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

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

² To be published.

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

- 53 • The Information Model includes information about Device Types and Device Instances.
54 The information for a Device Instance includes offline data (engineering data), as well as
55 online data (values from the physical device).
- 56 • The Information Model is created using information from FDI Packages. However, not all
57 of the information in an FDI Package is reflected in the Information Model.
- 58 • Referential integrity of the Information Model is maintained using information from FDI
59 Packages.
- 60 • FDI Packages can contain Attachments that contain device manuals and protocol specific
61 information (see IEC 62769-4:2013, 4.2.4). Device manuals are exposed via the
62 Information Model. Protocol specific support files are not exposed via the Information
63 Model.
- 64 • FDI Packages may contain information about one or more device types (see
65 IEC 62769-4:2013, 4.3.1). Distinct DeviceType nodes appear in the Information Model for
66 each device type specified in an FDI Package.
- 67 • FDI Profile Packages are used to provide interaction with devices for which an FDI Device
68 Package does not exist (see IEC 62769-4:2013, 4.3.4).
- 69 • Multiple revisions of an FDI Package generate distinct DeviceType nodes in the
70 Information Model (see IEC 62769-4:2013, 6.2.2).

71 FDI Packages contain digital signatures that allow an FDI Server to authenticate their
72 contents (see IEC 62769-4:2013, 5.2.7). An FDI Server shall not use an FDI Package if the
73 digital signature provided by the FDI Package is invalid.

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

76 **5 Information Model**

77 **5.1 General**

78 The FDI Server shall use the Device Definition of an FDI Package to maintain the Information
79 Model.

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

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

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

91 The FDI Server shall generate DataChange Notifications to any FDI Clients that are
92 subscribing to Information Model elements that have changed.

93 FDI Packages provide Business Logic that is used by the FDI Server to maintain the integrity
94 of the Information Model. The Business Logic specified in an FDI Package can invoke built-in

95 functions that shall be implemented by the FDI Server. The built-in functions that shall be
96 implemented by the FDI Server are specified in IEC 61804-3.

97 **5.2 Online / Offline**

98 **5.2.1 Overview**

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

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

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

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

113 The transfer of information between the offline values and the physical device is supported
114 through the TransferToDevice and TransferFromDevice methods in the Information Model.
115 These methods transfer the offline values in the correct order; they do not detect or report on
116 differences.

117 **5.2.2 Transfer to Device**

118 The TransferToDevice method shall be implemented using the EDD menu named
119 download_to_device_root_menu as specified in IEC 61804-4.

120 As a general rule, the FDI Server should not change the Online variable node when writing a
121 value to the device. The Online variable node should be updated only in the process of read
122 operations or subscriptions.

123 All write operations shall follow the behavior specified in 5.7. However, unlike normal online
124 write service requests, the offline values are written to the device instead of the values
125 specified in the write service request. This transfers the offline values to the physical device.

126 The TransferToDevice method does not return errors. Clients shall therefore perform a Read
127 or Subscribe to the transferred variables to verify success after execution of this operation.

128 **5.2.3 Transfer from Device**

129 The TransferFromDevice method shall be implemented using the EDD menu named
130 upload_from_device_root_menu as specified in IEC 61804-4.

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

133 All read operations shall follow the behavior specified in 5.6. However, unlike normal online
134 read service requests, the offline values are updated with the values read from the device.
135 This transfers the values from the physical device values to the offline values.

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.

The usage attributes are defined in Table 1.

Table 1 – Usage Attributes

Usage attribute	Description
DEVICE_STATUS_VIEW	Allows read-only to all users. These parameters reflect status and process information for the device or sub-elements of the device. Parameters may be either static or dynamic depending on the CLASS attributes of the variable
SYSTEM_ENGINEERING	Allows read and write access to users authorized to perform system engineering activities. System engineering activities involve the configuration of IO Channels, as well as alarms, which are directly used within system control operations. These parameters are configuration parameters.
DEVICE_ENGINEERING	Allows read and write access to users authorized to perform device engineering functions. These parameters are configuration parameters.
DEVICE_COMMISSIONING	Allows read and write access to users authorized to perform device commissioning functions. These parameters are configuration parameters.
DEVICE_MAINTENANCE	Allows read and write access to users authorized to perform device maintenance functions. These parameters are maintenance parameters.
CONDITION_MONITORING	Allows read access to users authorized to perform condition monitoring activities. These activities are part of predictive maintenance processes. These parameters are maintenance and status parameters.

All usage attribute definitions in Table 1 are at the same logical level and they are not mutually exclusive. Thus the usage attributes can be combined when the parameter allow access privileges that match more than one of those definitions.

5.4 Browsing

The Parameters and Actions specified in an FDI Package may be declared private. Private Parameters and Actions shall not be browsable; they shall only be accessible through references from other elements of an FDI Package.

More specifically, the FDI Server shall support private Parameters and Actions as follows.

- The FDI Server shall create nodes in the Information Model for the private Parameters and Actions.
- The FDI Server shall not include information about private Parameters and Actions in a response to a Browse, BrowseNext, QueryFirst, or QueryNext service request.
- The FDI Server shall return the NodeIds of private Parameters and Actions when the name of a private Parameter or Action is passed to TranslateBrowsePathsToNodeIds.
- The FDI Server shall process a read/write service requests for a private Parameters in the same way as it does for public (browsable) Parameters (see 5.6 and 5.7).
- The FDI Server shall execute private Actions in the same way as it does public (browsable) Actions (see 5.11).

NOTE An example of private parameters is parameters that should only be modified through an Action. These parameters should not be visible to FDI Clients to prevent direct access. FDI Clients invoke Actions to access these private parameters.

5.5 Locking

The FDI Server provides locking services to grant FDI Clients exclusive access to Device and Network elements in the Information Model. The locking services consist of a set of Methods and status information. The methods, and their behavior, are specified in IEC 62769-5.

The following behavior shall be implemented by the FDI Server to support locks.

- Locking applies to both online and offline nodes.
- Once locked by one FDI Client, any attempt to write to a Parameter or to execute an Action by another FDI Client shall be rejected.
- Locking is not required for read services.
- Parameters that are locked by one FDI Client can still be read by other FDI Clients, i.e., read requests on a Parameter that is locked are not rejected.

Internal use of the locking mechanism for maintaining the Information Model integrity is FDI Server vendor specific.

Figure 2 illustrates a locking sequence with multiple service invocations during the locked state.

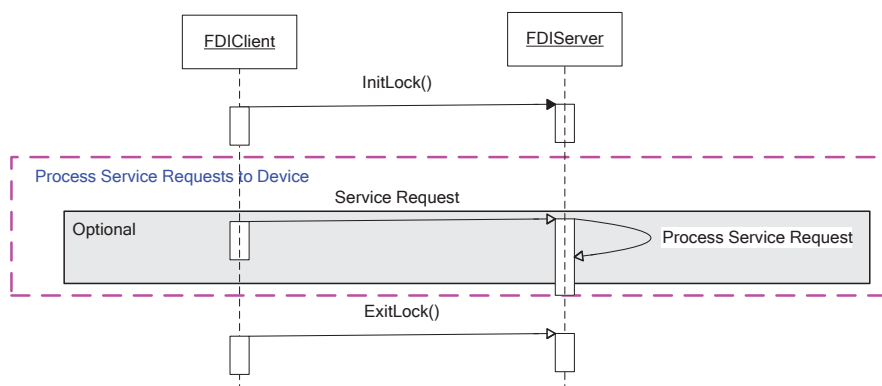


Figure 2 – Locking Services

The FDI Server implicitly locks the device if a write operation to the device is required to fulfil a service request and the Lock method has not been invoked by the FDI Client. The implicit lock is removed by the FDI Server on completion of the service request.

FDI Servers may queue `InitLock` requests until a service for which an implicit lock has been created completes. However, such an optimization is not part of the standard behavior required of an FDI Server.

5.6 Reading

5.6.1 General

The Read service specified in IEC 62541-4 can be used to read a single value or multiple values from a single device or multiple devices. If a Read service request specifies multiple values are to be read, the values are read in the order they appear in the service request.

196 A failure encountered while reading a single value shall not abort the read process; all values
 197 shall be read. Each value returned contains a status indicating success or failure. Standard
 198 OPC UA service status information is returned by the FDI Server as a result of the service
 199 calls as specified in 6.2.

200 An FDI Package can define read actions that are executed by the FDI Server during read
 201 service requests. These actions shall not require user interaction; they are strictly intended to
 202 be used for Business Logic processing. The following read actions may be defined in an FDI
 203 Package:

- 204 • Pre-read Actions
- 205 • Post-read Actions

206 The FDI Server invokes pre-read and post-read actions during the processing of read service
 207 requests of online values only; they are not invoked when reading offline values.

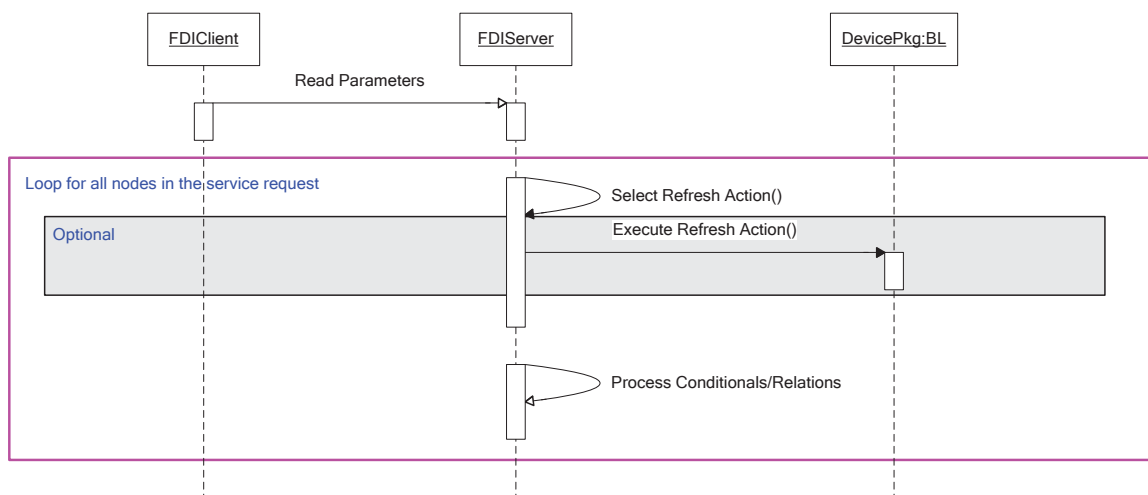
208 In addition to read actions, an FDI Package can define refresh actions that are executed by
 209 the FDI Server during read service requests. These actions shall not require user interaction;
 210 they are strictly intended to be used for Business Logic processing.

211 The FDI Server invokes refresh actions during the processing of read service requests of both
 212 offline and online values.

213 NOTE The refresh actions mentioned in 5.6.1 are not to be mixed up with refresh relations. Refresh actions are
 214 defined by means of the EDDL REFRESH_ACTIONS construct inside an EDDL VARIABLE construct. On the other
 215 hand, refresh relations are defined by means of the EDDL REFRESH construct. The handling of refresh relations is
 216 included in the generic event "Process Conditionals/Relations" that appear in the sequence diagrams for read,
 217 write and subscription services. The explanations that follow the diagrams include refresh relations in the general
 218 term "EDDL relations". See IEC 61804-3 for more details on both refresh actions and refresh relations.

219 5.6.2 Reading offline variables

220 The sequence diagram in Figure 3 shows the behavior of the FDI Server when an offline value
 221 is read.



222

223

Figure 3 – Offline Variable Read

224 If a variable has refresh actions associated with it and the difference between the timestamp
 225 and the current time exceeds the MaxAge argument, the FDI server executes those actions
 226 and updates the timestamp. Otherwise, the current value of the variable can be returned.

227 If the refresh actions fail, the status returned for that variable shall indicate the read failed.

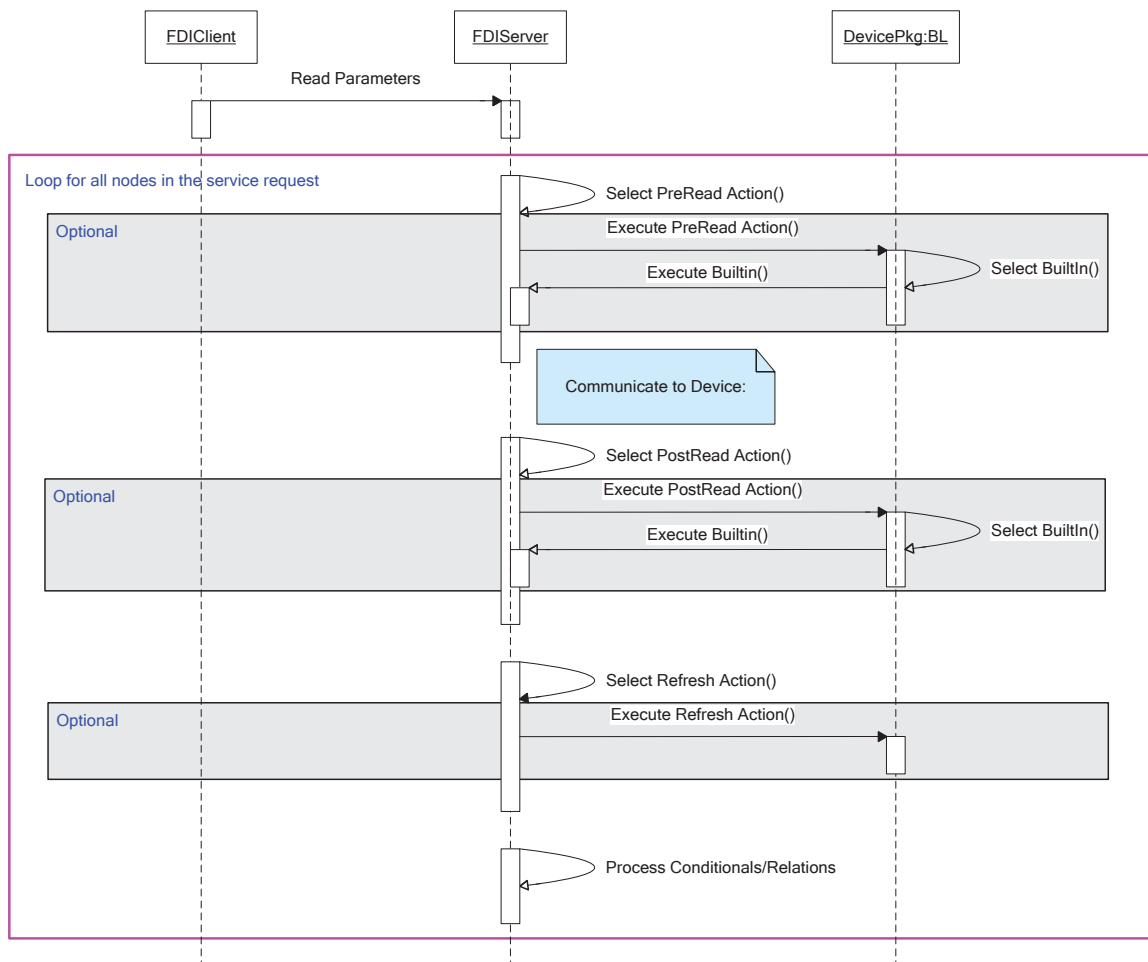
228 The FDI Server evaluates conditionals and relations after the refresh actions are executed.
 229 This provides an opportunity for the revaluation of conditional expressions in EDDL Business
 230 Logic and the processing of EDDL relations.

231 5.6.3 Reading online variables

232 The FDI Server can cache online values read from a device. The FDI Server maintains a
 233 timestamp for each online value that indicates when the value was read from the device. FDI
 234 Servers uses the MaxAge argument of a Read service request to determine whether the
 235 cached value can be returned. If the difference between the timestamp and the current time
 236 exceeds the MaxAge argument the FDI Server shall read the value from the device.
 237 Otherwise, the cached value can be returned.

238 Read actions are only executed when the variable is read from the device. Read actions are
 239 not executed when cached values are returned.

240 The sequence diagram in Figure 4 shows the behavior of the FDI Server when an online value
 241 is read.



242

243

Figure 4 – Online Variable Read