

TECHNICAL REPORT



**Field device tool (FDT) interface specification –
Part 503-2: Communication implementation for common object model –
IEC 61784 CP 3/4, CP 3/5 and CP 3/6**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2009 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland
Email: inmail@iec.ch
Web: www.iec.ch

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 corrigenda or an amendment might have been published.

- Catalogue of IEC publications: www.iec.ch/searchpub

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 It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: www.iec.ch/online_news/justpub

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: www.iec.ch/webstore/custserv

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: csc@iec.ch
Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00

TECHNICAL REPORT



**Field device tool (FDT) interface specification –
Part 503-2: Communication implementation for common object model –
IEC 61784 CP 3/4, CP 3/5 and CP 3/6**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE

U

ICS 25.040.40; 35.100.05; 35.110

ISBN 978-2-88910-729-2

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms, definitions, symbols, abbreviated terms and conventions	6
3.1 Terms and definitions	6
3.2 Symbols and abbreviated terms.....	6
3.3 Conventions	7
3.3.1 Data type names and references to data types	7
3.3.2 Vocabulary for requirements	7
4 Bus category	7
5 Access to instance and device data	7
6 Protocol specific usage of general data types	7
7 Network management data types.....	8
7.1 General.....	8
7.2 PNIO device address.....	8
7.3 Bus configuration – FDTProfinetIOParameterSchema	8
8 Communication data types – FDTProfinetIOCommunicationSchema.....	11
9 Channel parameter data types – FDTProfinetIOChannelParameterSchema	13
10 Device identification	14
10.1 Device type identification data types – FDTProfinetIOIdentSchema	14
10.2 Topology scan data types – DTMProfinetIODeviceSchema.....	15
10.3 Scan identification data types – FDTProfinetIOScanIdentSchema	15
10.4 Device type identification data types – FDTProfinetIODeviceIdentSchema	17
10.5 XSLT Transformation	18
Bibliography.....	26
Figure 1 – Part 503-2 of the IEC 62453 series	5
Table 1 – Protocol specific usage of general data types.....	7

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

**Part 503-2: Communication implementation for common object model –
IEC 61784 CP 3/4, CP 3/5 and CP 3/6**

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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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.

The main task of IEC technical committees is to prepare International Standards. However, a technical committee may propose the publication of a technical report when it has collected data of a different kind from that which is normally published as an International Standard, for example "state of the art".

IEC/TR 62453-503-2, which is a technical report, has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation:

This part, in conjunction with the other parts of the first edition of the IEC 62453 series cancels and replaces IEC/PAS 62453-1, IEC/PAS 62453-2, IEC/PAS 62453-3, IEC/PAS 62453-4 and IEC/PAS 62453-5 published in 2006, and constitutes a technical revision.

Each part of the IEC/TR 62453-5xy series is intended to be read in conjunction with its corresponding part in the IEC 62453-3xy series.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
65E/68/DTR	65E/117/RVC

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

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

The list of all parts of the IEC 62453 series, under the general title *Field Device Tool (FDT) interface specification*, can be found on the IEC website.

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.

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

INTRODUCTION

This part of IEC 62453 is an interface specification for developers of FDT (Field Device Tool) components for function control and data access within a client/server architecture. The specification is a result of an analysis and design process to develop standard interfaces to facilitate the development of servers and clients by multiple vendors that need to interoperate seamlessly.

With the integration of fieldbusses into control systems, there are a few other tasks which need to be performed. In addition to fieldbus- and device-specific tools, there is a need to integrate these tools into higher-level system-wide planning- or engineering tools. In particular, for use in extensive and heterogeneous control systems, typically in the area of the process industry, the unambiguous definition of engineering interfaces that are easy to use for all those involved is of great importance.

A device-specific software component, called DTM (Device Type Manager), is supplied by the field device manufacturer with its device. The DTM is integrated into engineering tools via the FDT interfaces defined in this specification. The approach to integration is in general open for all kind of fieldbusses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how IEC/TR 62453-503-2 is aligned in the structure of IEC 62453 series.

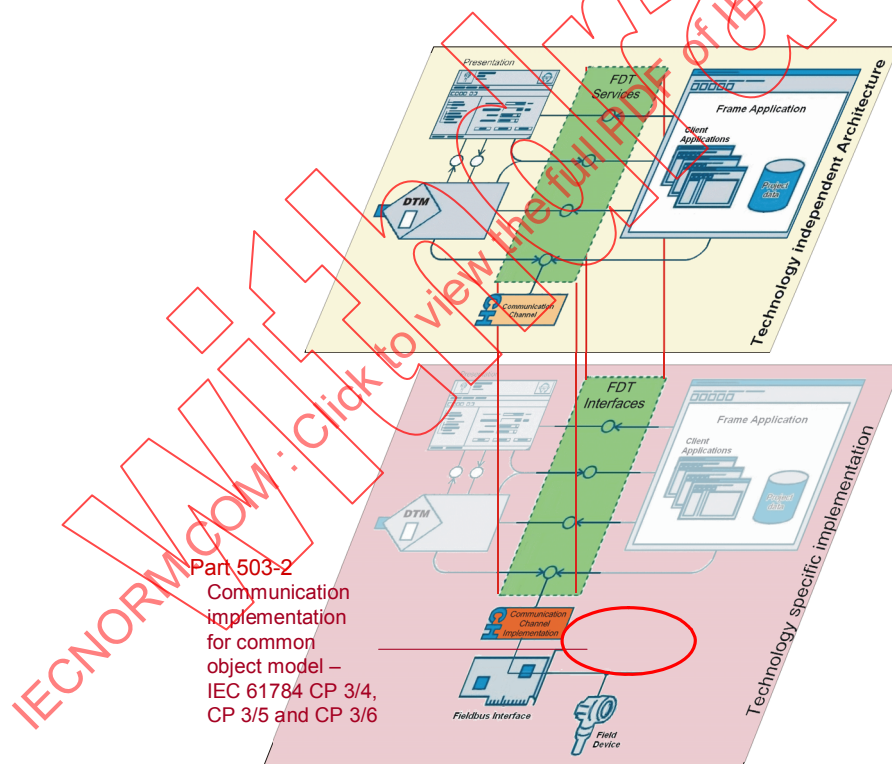


Figure 1 – Part 503-2 of the IEC 62453 series

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 503-2: Communication implementation for common object model – IEC 61784 CP 3/4, CP 3/5 and CP 3/6

1 Scope

IEC/TR 62453-503-2, which is a technical report, provides information for integrating the PROFINET®¹ technology into the implementation of the FDT interface specification (IEC/TR 62453-41).

This part of IEC 62453 specifies communication and other services.

This specification neither contains the FDT specification nor modifies it.

2 Normative references

The following referenced documents are indispensable for the application of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62453-1:2009, *Field Device Tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:2009, *Field Device Tool (FDT) interface specification – Part 2: Concepts and detailed description*

IEC/TR 62453-41:2009, *Field Device Tool (FDT) interface specification – Part 41: Object model integration profile – Common object model*

IEC 62453-303-2:2009, *Field Device Tool (FDT) interface specification – Part 303-2: Communication profile integration – IEC 61784 CP 3/4, CP 3/5 and CP 3/6*

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 62453-1 and IEC 62453-2 apply.

3.2 Symbols and abbreviated terms

For the purpose of this document, the symbols and abbreviations given in IEC 62453-1, IEC 62453-2 and the following apply.

GSDML	Generic Station Description Markup Language
DCP	Discovery and basic Configuration Protocol

¹ PROFINET ® is the trademark of PROFIBUS Nutzerorganisation e.V. (PNO). PNO is a non-profit trade organization to support the fieldbus PROFIBUS. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this profile does not require use of the registered trademark. Use of the trademark PROFIBUS and PROFINET requires permission of the trade name holder.

3.3 Conventions

3.3.1 Data type names and references to data types

The conventions for naming and referencing of data types are explained in IEC 62453-2 Clause A.1

3.3.2 Vocabulary for requirements

The following expressions are used when specifying requirements.

Usage of “shall” or “Mandatory”	No exceptions allowed.
Usage of “should” or “Recommended”	Strong recommendation. It may make sense in special exceptional cases to differ from the described behavior.
Usage of “can” or “Optional”	Function or behavior may be provided, depending on defined conditions.

4 Bus category

IEC 61784 CP 3/3 protocol is identified in the attribute `busCategory` of the `BusCategory` element by the identifiers, as specified in IEC 62453-303-2.

5 Access to instance and device data

Used at methods:

- `IDtmParameter::GetParameters()`
- `IDtmParameter::SetParameters()`

These methods shall provide access to at least to all parameters defined in IEC 62453-303-2.

6 Protocol specific usage of general data types

Table 1 shows how general data types are used with IEC 61784 CP 3/3 devices.

Table 1 – Protocol specific usage of general data types

Attribute	Description for use
<code>fdt:address</code> <code>fdt:protocolId</code>	All these attributes of the <code>FDTDatatype</code> schema are used as defined in IEC 62453-303-2.
<code>fdt:deviceTypeId</code> <code>fdt:deviceTypeInfo</code> <code>fdt:deviceTypeInfoPath</code> <code>fdt:manufacturerId</code> <code>fdt:semanticId</code> <code>fdt:applicationDomain</code>	
<code>fdt:tag</code>	

7 Network management data types

7.1 General

The data types specified in this clause are used at following methods:

- IDtmParameter:GetParameters
- IDtmParameter:SetParameters

7.2 PNIO device address

The address information of a PNIO device is handled in the <BusInformation/UserdefinedBus> element.

7.3 Bus configuration – FDTProfinetIOPParameterSchema

```
<Schema name="FDTProfinetIOPParameterSchema" xmlns="urn:schemas-microsoft-com:xml-data"
xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml">
<!-- Version of the Schema -->
<AttributeType name="schemaVersion" dt:type="number" default="1.00"/>

<!--AR attributes-->
<AttributeType name="arType" dt:type="ui2"/>
<AttributeType name="arProperties" dt:type="ui4"/>
<AttributeType name="arUUID" dt:type="uuid"/>

<!--AlarmCR attributes-->
<AttributeType name="alarmCRTYPE" dt:type="ui2"/>
<AttributeType name="alarmCRProperties" dt:type="ui4"/>
<AttributeType name="rtaTimeoutFactor" dt:type="ui2"/>
<AttributeType name="rtaRetries" dt:type="ui2"/>
<AttributeType name="localAlarmReference" dt:type="ui2"/>
<AttributeType name="maxAlarmDataLength" dt:type="ui2"/>

<!--Identification attributes-->
<AttributeType name="infoText" dt:type="string"/>
<AttributeType name="localIndex" dt:type="ui2"/>

<!--Network attributes-->
<AttributeType name="nameOfStation" dt:type="string"/>
<AttributeType name="dynIpAdress" dt:type="boolean" default="false"/>
<AttributeType name="ipAdress" dt:type="string"/>
<AttributeType name="ipSubnetMask" dt:type="string"/>
<AttributeType name="ipDefaultGateway" dt:type="string"/>
<AttributeType name="macAddress" dt:type="string"/>

<!--Module attributes-->
<AttributeType name="slotNumber" dt:type="ui2"/>
<AttributeType name="moduleIdentNumber" dt:type="ui4"/>
<AttributeType name="moduleProperties" dt:type="ui2"/>

<!--SubModule attributes-->
<AttributeType name="subSlotNumber" dt:type="ui2"/>
<AttributeType name="subModuleIdentNumber" dt:type="ui4"/>
<AttributeType name="api" dt:type="ui4"/>
<!--SubModule attributes / Submodule properties-->
<AttributeType name="ioType" dt:type="enumeration" dt:values="Input Output InputAndOutput"/>
<AttributeType name="sharedInput" dt:type="enumeration" dt:values="IOController IOControllerShare"/>
<AttributeType name="reduceInputSubmoduleDataLength" dt:type="enumeration" dt:values="Expected Zero"/>
<AttributeType name="reduceOutputSubmoduleDataLength" dt:type="enumeration" dt:values="Expected Zero"/>
<AttributeType name="discardIOXS" dt:type="enumeration" dt:values="Expected Zero"/>

<!--RecordParamData attributes-->
<AttributeType name="index" dt:type="ui2"/>
<AttributeType name="recordData" dt:type="bin.hex"/>
```

```

<!--InputDataList attributes-->
<AttributeType name="consistency" dt:type="enumeration" dt:values="itemConsistency allItemsConsistency"/>

<!--DataItem attributes-->
<AttributeType name="sendClockFactor" dt:type="ui2"/>
<AttributeType name="reductionRatio" dt:type="ui2"/>
<AttributeType name="watchdogFactor" dt:type="ui2"/>
<AttributeType name="dataHoldFactor" dt:type="ui2"/>

<!--Definition of Element RecordParamData-->
<ElementType name="RecordParamData" content="empty" model="closed">
  <attribute type="index" required="yes"/>
  <attribute type="recordData" required="yes"/>
  <attribute type="fdt:name" required="no"/>
</ElementType>

<!--Definition of Element RecordParamDataList-->
<ElementType name="RecordParamDataList" content="eltOnly" model="closed">
  <element type="RecordParamData" minOccurs="1" maxOccurs="*/"/>
</ElementType>

<!--Definition of Element OutputDataList-->
<ElementType name="OutputDataList" content="eltOnly" model="closed">
  <attribute type="consistency" required="no" default="itemConsistency"/>
  <element type="fdt:ChannelReferences" minOccurs="1" maxOccurs="1"/>
</ElementType>

<!--Definition of Element InputDataList-->
<ElementType name="InputDataList" content="mixed" model="closed">
  <attribute type="consistency" required="no" default="itemConsistency"/>
  <element type="fdt:ChannelReferences" minOccurs="1" maxOccurs="1"/>
</ElementType>

<!--Definition of Element SubModuleProperties-->
<ElementType name="SubModuleProperties" content="empty" model="closed">
  <attribute type="ioType" required="yes"/>
  <attribute type="sharedInput" required="yes"/>
  <attribute type="reduceInputSubmoduleDataLength" required="yes"/>
  <attribute type="reduceOutputSubmoduleDataLength" required="yes"/>
  <attribute type="discardIOXS" required="yes"/>
</ElementType>

<!--Definition of Element SubModule-->
<!--sendClockfactor, reduction ratio etc. are set by CommDTM, but saved at DeviceDTM-->
<ElementType name="SubModule" content="eltOnly" model="closed">
  <attribute type="subSlotNumber" required="yes"/>
  <attribute type="fdt:name" required="yes"/>
  <attribute type="fdt:descriptor" required="no"/>
  <attribute type="subModuleIdentNumber" required="yes"/>
  <attribute type="api" required="yes"/>
  <attribute type="sendClockFactor" required="yes"/>
  <attribute type="reductionRatio" required="yes"/>
  <attribute type="watchdogFactor" required="yes"/>
  <attribute type="dataHoldFactor" required="yes"/>
  <element type="InputDataList" minOccurs="0" maxOccurs="1"/>
  <element type="OutputDataList" minOccurs="0" maxOccurs="1"/>
  <element type="RecordParamDataList" minOccurs="0" maxOccurs="1"/>
  <element type="SubModuleProperties" minOccurs="0" maxOccurs="1"/>
</ElementType>

<!--Definition of Element SubModuleList-->
<ElementType name="SubModuleList" content="eltOnly" model="closed">
  <element type="SubModule" minOccurs="1" maxOccurs="*/"/>
</ElementType>

<!--Definition of Element Module-->
<ElementType name="Module" content="eltOnly" model="closed">
  <attribute type="slotNumber" required="yes"/>
  <attribute type="moduleIdentNumber" required="yes"/>

```

```

<attribute type="moduleProperties" required="yes"/>
<attribute type="fdt:name" required="yes"/>
<attribute type="fdt:descriptor" required="no"/>
<element type="SubModuleList" minOccurs="1" maxOccurs="1"/>
</ElementType>

<!--Definition of Element ModuleList-->
<ElementType name="ModuleList" content="eltOnly" model="closed">
  <element type="Module" minOccurs="1" maxOccurs="*" />
</ElementType>

<!--Definition of Element AlarmCR-->
<!--only for saving at Device DTM-->
<ElementType name="AlarmCR" content="empty" model="closed">
  <attribute type="alarmCRType" required="yes"/>
  <attribute type="alarmCRProperties" required="yes"/>
  <attribute type="rtaTimeoutFactor" required="yes"/>
  <attribute type="rtaRetries" required="yes"/>
  <attribute type="localAlarmReference" required="yes"/>
  <attribute type="maxAlarmDataLength" required="yes"/>
</ElementType>

<!--Definition of Element AR-->
<!--only for saving at Device DTM-->
<ElementType name="AR" content="eltOnly" model="closed">
  <attribute type="arType" required="yes"/>
  <attribute type="arProperties" required="yes"/>
  <attribute type="arUUID" required="yes"/>
  <element type="AlarmCR" minOccurs="1" maxOccurs="1"/>
  <element type="ModuleList" minOccurs="0" maxOccurs="1"/>
</ElementType>

<!--Definition of Element Identification-->
<ElementType name="Identification" content="eltOnly" model="closed">
  <attribute type="localIndex" required="yes"/>
  <attribute type="fdt:deviceType" required="yes"/>
  <attribute type="fdt:manufacturerId" required="yes"/>
  <attribute type="infoText" required="no"/>
  <element type="fdt:VersionInformation" minOccurs="0" maxOccurs="1"/>
</ElementType>

<!--Definition of Element SendClockFactor-->
<ElementType name="SendClockFactor" content="empty" model="closed">
  <attribute type="sendClockFactor" required="yes"/>
</ElementType>

<!--Definition of Element ReductionRatio-->
<ElementType name="ReductionRatio" content="empty" model="closed">
  <attribute type="reductionRatio" required="yes"/>
</ElementType>

<!--Definition of Element TimingProperties-->
<ElementType name="TimingProperties" content="eltOnly" model="closed">
  <element type="SendClockFactor" minOccurs="1" maxOccurs="*" />
  <element type="ReductionRatio" minOccurs="1" maxOccurs="*" />
</ElementType>

<!--Definition of Element Device-->
<ElementType name="Device" content="eltOnly" model="closed">
  <element type="Identification" minOccurs="1" maxOccurs="1"/>
  <element type="AR" minOccurs="0" maxOccurs="*" />
  <element type="TimingProperties" minOccurs="0" maxOccurs="1"/>
</ElementType>

<!--Definition of Element Network-->
<ElementType name="Network" content="empty" model="closed">
  <attribute type="nameOfStation" required="yes"/>
  <attribute type="dynIpAddress" required="yes"/>
  <attribute type="ipAddress" required="yes"/>
  <attribute type="ipSubnetMask" required="yes"/>

```

```

    <attribute type="ipDefaultGateway" required="yes"/>
    <attribute type="macAddress" required="no"/>
</ElementType>

<!--Definition of DeviceList Element, needed for multiple PNIO Instances on one physical device!-->
<ElementType name="DeviceList" content="eltOnly" model="closed">
    <element type="Network" minOccurs="1" maxOccurs="1"/>
    <element type="Device" minOccurs="1" maxOccurs="*/>
</ElementType>
</Schema>

```

8 Communication data types – FDTProfinetIOCommunicationSchema

The data types specified in this clause are used with the methods of IFdtCommunication.

```

<Schema name="FDTProfinetIOCommunicationSchema"
    xmlns="urn:schemas-microsoft-com:xml-data"
    xmlns:dt="urn:schemas-microsoft-com:datatypes"
    xmlns:fdt="x-schema:FDTDataTypesSchema.xml">
    <!--Definition of Attributes-->
    <AttributeType name="schemaVersion" dt:type="number" default="1.00"/>
    <AttributeType name="api" dt:type="ui4"/>
    <AttributeType name="nameOfStation" dt:type="string"/>
    <AttributeType name="localIndex" dt:type="ui2"/>
    <AttributeType name="errorDecode" dt:type="ui1"/>
    <AttributeType name="errorCode1" dt:type="ui2"/>
    <AttributeType name="errorCode2" dt:type="ui1"/>
    <AttributeType name="index" dt:type="ui2"/>
    <AttributeType name="communicationReference" dt:type="uuid"/>
    <AttributeType name="slot" dt:type="ui2"/>
    <AttributeType name="subSlot" dt:type="ui2"/>
    <AttributeType name="addData1" dt:type="ui2" default="0"/>
    <AttributeType name="addData2" dt:type="ui2" default="0"/>
    <AttributeType name="length" dt:type="ui4" default="0"/>
    <AttributeType name="readOnly" dt:type="boolean" default="0"/>
    <AttributeType name="sequenceTime" dt:type="ui4"/>
    <AttributeType name="delayTime" dt:type="ui4"/>
    <AttributeType name="systemTag" dt:type="string"/>

    <!--Definition of Elements-->
    <ElementType name="ResponseError" content="empty" model="closed">
        <attribute type="errorDecode" required="yes"/>
        <attribute type="errorCode1" required="yes"/>
        <attribute type="errorCode2" required="yes"/>
    </ElementType>

    <ElementType name="ConnectRequest" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="nameOfStation" required="yes"/>
        <attribute type="fdt:manufacturerId" required="yes"/>
        <attribute type="fdt:deviceTypeId" required="yes"/>
        <attribute type="localIndex" required="yes"/>
        <attribute type="systemTag" required="yes"/>
        <attribute type="readOnly" required="no"/>
    </ElementType>

    <ElementType name="ConnectResponse" content="eltOnly" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="communicationReference" required="yes"/>
        <attribute type="addData1" required="no"/>
        <attribute type="addData2" required="no"/>
        <element type="ResponseError" minOccurs="0" maxOccurs="1"/>
    </ElementType>

    <ElementType name="DisconnectRequest" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="communicationReference" required="yes"/>
    </ElementType>

    <ElementType name="DisconnectResponse" content="eltOnly" model="closed">
        <attribute type="fdt:nodeId" required="no"/>

```

```

    <attribute type="communicationReference" required="yes"/>
    <attribute type="addData1" required="no"/>
    <attribute type="addData2" required="no"/>
    <element type="ResponseError" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ReadRequest" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
    <attribute type="api" required="yes"/>
    <attribute type="slot" required="yes"/>
    <attribute type="subSlot" required="yes"/>
    <attribute type="index" required="yes"/>
    <attribute type="length" required="no"/> <!-- needed for partial access -->
</ElementType>
<ElementType name="ReadResponse" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
    <attribute type="addData1" required="no"/>
    <attribute type="addData2" required="no"/>
    <element type="ResponseError" minOccurs="0" maxOccurs="1"/>
    <element type="fdt:CommunicationData" minOccurs="1" maxOccurs="1"/>
</ElementType>
<ElementType name="WriteRequest" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
    <attribute type="api" required="yes"/>
    <attribute type="slot" required="yes"/>
    <attribute type="subSlot" required="yes"/>
    <attribute type="index" required="yes"/>
    <element type="fdt:CommunicationData" minOccurs="1" maxOccurs="1"/>
</ElementType>
<ElementType name="WriteResponse" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
    <attribute type="addData1" required="no"/>
    <attribute type="addData2" required="no"/>
    <element type="ResponseError" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="CancelTransaction" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="SequenceBegin" content="empty" model="closed">
    <attribute type="sequenceTime" required="no"/>
    <attribute type="delayTime" required="no"/>
    <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="SequenceEnd" content="empty" model="closed">
    <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="SequenceStart" content="empty" model="closed">
    <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="Abort" content="empty" model="closed">
    <attribute type="communicationReference" required="yes"/>
</ElementType>
<ElementType name="FDT" content="eltOnly" model="closed">
    <attribute type="schemaVersion" required="no"/>
    <attribute type="fdt:nodeId" required="no"/>
    <group order="one">
        <element type="ConnectRequest"/>
        <element type="ConnectResponse"/>
        <element type="DisconnectRequest"/>
        <element type="DisconnectResponse"/>
        <element type="ReadRequest"/>
        <element type="ReadResponse"/>
        <element type="WriteRequest"/>
        <element type="WriteResponse"/>
    
```

```

        <element type="CancelTransaction"/>
        <element type="SequenceBegin"/>
        <element type="SequenceEnd"/>
        <element type="SequenceStart"/>
        <element type="Abort"/>
        <element type="fdt:CommunicationError"/>
    </group>
</ElementType>
</Schema>

```

9 Channel parameter data types – FDTProfinetIOChannelParameterSchema

The data types specified in this clause are used with the following methods:

- IFdtChannel::GetChannelParameters()
- IFdtChannel::SetChannelParameters()

```

<Schema name="FDTProfinetIOChannelParameterSchema" xmlns="urn:schemas-microsoft-com:xml-data"
xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:fdt="x-schema:FDTDataTypesSchema.xml"
xmlns:appld="x-schema:FDTApplicationIdSchema.xml">

```

```

    <!--Definition of Attributes-->

```

```

    <AttributeType name="schemaVersion" dt:type="number" default="1.00"/>
    <AttributeType name="api" dt:type="ui4"/>
    <AttributeType name="bitLength" dt:type="ui4"/>
    <AttributeType name="bitOffset" dt:type="ui4"/>
    <AttributeType name="byteOffset" dt:type="ui4"/>
    <AttributeType name="frameApplicationTag" dt:type="string"/>
    <AttributeType name="gatewayBusCategory" dt:type="uuid"/>
    <AttributeType name="index" dt:type="ui2"/>
    <AttributeType name="number" dt:type="ui4"/>
    <AttributeType name="protectedByChannelAssignment" dt:type="boolean"/>
    <AttributeType name="statusChannelType" dt:type="enumeration" dt:values="IOCS IOPS"/>
    <AttributeType name="slotNumber" dt:type="ui2"/>
    <AttributeType name="subSlotNumber" dt:type="ui2"/>
    <!--Definition of Elements-->

```

```

    <ElementType name="IODataAddress" content="empty" model="closed">

```

```

        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="bitOffset" required="yes"/>
    </ElementType>

```

```

    <ElementType name="RecordDataAddress" content="empty" model="closed">

```

```

        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="index" required="yes"/>
        <attribute type="bitOffset" required="yes"/>
        <attribute type="byteOffset" required="yes"/>
    </ElementType>

```

```

    <ElementType name="FDTChannel" content="eltOnly" model="closed" order="seq">

```

```

        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:tag" required="yes"/>
        <attribute type="fdt:id" required="yes"/>
        <attribute type="fdt:descriptor" required="no"/>
        <attribute type="protectedByChannelAssignment" required="yes"/>
        <attribute type="number" required="yes"/>
        <attribute type="api" required="yes"/>
        <attribute type="slotNumber" required="yes"/>
        <attribute type="subSlotNumber" required="yes"/>
        <attribute type="fdt:dataType" required="yes"/>
        <attribute type="bitLength" required="yes"/>
        <attribute type="fdt:signalType" required="yes"/>
        <attribute type="frameApplicationTag" required="no"/>
        <attribute type="appld:applicationId" required="no"/>
        <element type="fdt:SemanticInformation" minOccurs="0" maxOccurs="*" />
        <element type="fdt:BitEnumeratorEntries" minOccurs="0" maxOccurs="1" />
        <element type="fdt:EnumeratorEntries" minOccurs="0" maxOccurs="1" />
        <element type="fdt:Unit" minOccurs="0" maxOccurs="1" />
        <element type="IODataAddress" minOccurs="0" maxOccurs="1" />
        <element type="RecordDataAddress" minOccurs="0" maxOccurs="1" />
        <element type="fdt:Alarms" minOccurs="0" maxOccurs="1" />
    </ElementType>

```

```

    <element type="fdt:Ranges" minOccurs="0" maxOccurs="1"/>
    <element type="fdt:SubstituteValue" minOccurs="0" maxOccurs="1"/>
    <element type="fdt:Deadband" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="FDTChannelType" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <element type="fdt:VersionInformation" minOccurs="1" maxOccurs="1"/>
    <attribute type="gatewayBusCategory" required="no"/>
    <attribute type="statusChannelType" required="no"/>
  </ElementType>
  <ElementType name="FDT" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <element type="FDTChannelType" minOccurs="1" maxOccurs="1"/>
    <element type="FDTChannel" minOccurs="1" maxOccurs="1"/>
  </ElementType>
</Schema>

```

10 Device identification

10.1 Device type identification data types – FDTProfinetIOIdentSchema

```

<Schema name="FDTProfinetIOIdentSchema" xmlns="urn:schemas-microsoft-com:xml-data"
xmlns:dt="urn:schemas-microsoft-com:datatypes">
  <!--Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.00"/>
  <AttributeType name="busProtocol" dt:type="enumeration" dt:values="protocol_DCP protocol_IM"/>
  <!--
  <!--          Profinet IO
  <!--          DCP Identify Information
  <!--
  <!--          -->
  <AttributeType name="nameOfStation" dt:type="string"/>
  <AttributeType name="ipAddress" dt:type="string"/>
  <AttributeType name="ipSubnetMask" dt:type="string"/>
  <AttributeType name="ipDefaultGateway" dt:type="string"/>
  <AttributeType name="macAddress" dt:type="string"/>
  <AttributeType name="deviceRole" dt:type="enumeration" dt:values="ProfinetIO_Controller ProfinetIO_Device
ProfinetIO_MultiDevice ProfinetIO_Supervisor"/>
  <!--
  <!--          Profinet IO
  <!--          I&M information
  <!--
  <!--          -->
  <!--          -->
  <!-- I&M 0 Element 1 -->
  <AttributeType name="orderId" dt:type="string" dt:maxLength="20"/>
  <!-- I&M 0 Element 2 -->
  <AttributeType name="serialNumber" dt:type="string" dt:maxLength="16"/>
  <!-- I&M 0 Element 3 unique serial number -->
  <AttributeType name="hardwareRevision" dt:type="string"/>
  <!-- I&M 0 Element 4 HARDWARE_REVISION - 2 Octets transformed to string (to be consistent to PA_I&M) -->
  <AttributeType name="softwareRevision" dt:type="string"/>
  <!-- I&M 0 Element 5 SOFTWARE_REVISION - 4 Octets: 4 Octets - 1 char + 3 unsigned 8 , e.g.: V1.2.3 -->
  <AttributeType name="profileID" dt:type="ui2"/>
  <!--I&M 0 Element 7 PROFILE_ID -->
  <AttributeType name="profileSpecificType" dt:type="ui2"/>
  <!-- I&M 0 Element 8 PROFILE_SPECIFIC_TYPE - MSB = BLOCK_OBJECT, LSB = PARENT_CLASS -->
  <AttributeType name="tagFunction" dt:type="string" dt:maxLength="32"/>
  <!-- I&M1 element 1 TAG_FUNCTION - mapped to semantic of IdTag -->
  <AttributeType name="tagLocation" dt:type="string" dt:maxLength="22"/>
  <!-- I&M1 element 2 TAG_LOCATION -->
  <!--
  <!--
  <!--          general
  <!--
  <!--          -->
  <AttributeType name="idDTMSupportLevel" dt:type="enumeration" dt:values="genericSupport profileSupport
blockspecificProfileSupport specificSupport"/>
  <AttributeType name="manufacturerSpecificExtension" dt:type="string"/>
  <AttributeType name="match" dt:type="string"/>

```

```

<AttributeType name="nomatch" dt:type="string"/>
<ElementType name="RegExpr" content="empty" model="closed">
  <attribute type="match" required="no"/>
  <attribute type="nomatch" required="no"/>
</ElementType>
</Schema>

```

10.2 Topology scan data types – DTMProfinetIODeviceSchema

Used at IDtmEvents::OnScanResponse()

The XML document describes one entry, < ProfinetIODevice >, in the list of scanned devices.

```

<Schema name="DTMProfinetIODeviceSchema" xmlns="urn:schemas-microsoft-com:xml-data" xmlns:fdt="x-
schema:FDTDataTypesSchema.xml" xmlns:dt="urn:schemas-microsoft-com:datatypes">
  <!--Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.00"/>
  <AttributeType name="nameOfStation" dt:type="string"/>
  <AttributeType name="ipAddress" dt:type="string"/>
  <AttributeType name="ipSubnetMask" dt:type="string"/>
  <AttributeType name="ipDefaultGateway" dt:type="string"/>
  <AttributeType name="macAddress" dt:type="string"/>
  <AttributeType name="dynIpAddress" dt:type="string"/>
  <AttributeType name="deviceRole" dt:type="enumeration" dt:values="IO_Controller IO_Device IO_MultiDevice
IO_Supervisor"/>
  <!--Definition of Elements-->
  <ElementType name="ProfinetIODevice" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="schemaVersion" required="no"/>
    <attribute type="nameOfStation" required="yes"/>
    <attribute type="ipAddress" required="yes"/>
    <attribute type="ipSubnetMask" required="yes"/>
    <attribute type="ipDefaultGateway" required="yes"/>
    <attribute type="macAddress" required="yes"/>
    <attribute type="deviceRole" required="yes"/>
    <attribute type="fdt:deviceId" required="yes"/>
    <attribute type="fdt:manufacturerId" required="yes"/>
    <element type="fdt:VersionInformation" minOccurs="0" maxOccurs="1"/>
  </ElementType>
</Schema>

```

10.3 Scan identification data types – FDTProfinetIOScanIdentSchema

This schema defines the XML document provided by a scan response of a network.

```

<Schema name="FDTProfinetIOScanIdentSchema" xmlns="urn:schemas-microsoft-com:xml-data"
xmlns:dt="urn:schemas-microsoft-com:datatypes" xmlns:pnioident="x-schema:FDTProfinetIOScanIdentSchema.xml"
xmlns:fdt="x-schema:FDTDataTypesSchema.xml">

```

```

  <!-- Definition of Attributes-->
  <AttributeType name="schemaVersion" dt:type="number" default="1.00"/>
  <AttributeType name="resultState" dt:type="enumeration" dt:values="provisional final error"/>
  <AttributeType name="configuredState" dt:type="enumeration" dt:values="configuredAndPhysicallyAvailable
configuredAndNotPhysicallyAvailable availableButNotConfigured notApplicable"/>

```

```

  <!-- DCP -->
  <ElementType name="IdBusProtocol" content="empty" model="closed">
    <attribute type="pnioident:busProtocol" required="yes"/>
  </ElementType>
  <ElementType name="IdAddress" content="empty" model="closed">
    <attribute type="pnioident:nameOfStation" required="yes"/>
    <attribute type="pnioident:ipAddress" required="no"/>
    <attribute type="pnioident:macAddress" required="yes"/>
    <attribute type="pnioident:ipSubnetMask" required="no"/>
    <attribute type="pnioident:ipDefaultGateway" required="no"/>
  </ElementType>
  <ElementType name="IdManufacturer" content="empty" model="closed">
    <attribute type="fdt:manufacturerId" required="yes"/>

```

```

</ElementType>
<ElementType name="IdTypeID" content="empty" model="closed">
  <attribute type="fdt:deviceTypeId" required="yes"/>
</ElementType>
<ElementType name="IdDeviceRole" content="empty" model="closed">
  <attribute type="pnioident:deviceRole" required="yes"/>
</ElementType>
<ElementType name="ManufacturerSpecificExtension" content="empty" model="closed">
  <attribute type="pnioident:manufacturerSpecificExtension" required="yes"/>
</ElementType>

<!-- I&M -->
<ElementType name="IdOrder" content="empty" model="closed">
  <attribute type="pnioident:orderId" required="yes"/>
</ElementType>
<ElementType name="IdSerialNumber" content="empty" model="closed">
  <attribute type="pnioident:serialNumber" required="yes"/>
</ElementType>
<ElementType name="IdSoftwareRevision" content="empty" model="closed">
  <attribute type="pnioident:softwareRevision" required="yes"/>
</ElementType>
<ElementType name="IdHardwareRevision" content="empty" model="closed">
  <attribute type="pnioident:hardwareRevision" required="yes"/>
</ElementType>
<ElementType name="ProfileID" content="empty" model="closed">
  <attribute type="pnioident:profileID" required="yes"/>
</ElementType>
<ElementType name="ProfileSpecificType" content="empty" model="closed">
  <attribute type="pnioident:profileSpecificType" required="yes"/>
</ElementType>

<ElementType name="ScanIdentification_DCP" content="eltOnly" model="closed">
  <attribute type="configuredState" required="no"/>
  <element type="fdt:CommunicationError" minOccurs="0" maxOccurs="1"/>

  <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
  <element type="IdAddress" minOccurs="1" maxOccurs="1"/>
  <element type="IdManufacturer" minOccurs="1" maxOccurs="1"/>
  <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
  <element type="IdDeviceRole" minOccurs="1" maxOccurs="1"/>
  <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ScanIdentification_IM" content="eltOnly" model="closed">
  <attribute type="configuredState" required="no"/>
  <element type="fdt:CommunicationError" minOccurs="0" maxOccurs="1"/>

  <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
  <element type="IdAddress" minOccurs="1" maxOccurs="1"/>
  <element type="IdManufacturer" minOccurs="1" maxOccurs="1"/>
  <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
  <element type="IdDeviceRole" minOccurs="1" maxOccurs="1"/>
  <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>

  <element type="IdOrder" minOccurs="1" maxOccurs="1"/>
  <element type="IdSerialNumber" minOccurs="1" maxOccurs="1"/>
  <element type="IdSoftwareRevision" minOccurs="1" maxOccurs="1"/>
  <element type="IdHardwareRevision" minOccurs="1" maxOccurs="1"/>
  <element type="ProfileID" minOccurs="1" maxOccurs="1"/>
  <element type="ProfileSpecificType" minOccurs="1" maxOccurs="1"/>
</ElementType>

<ElementType name="ScanIdentifications" content="eltOnly" model="closed">
  <attribute type="fdt:busCategory" required="yes"/>
  <attribute type="resultState" required="yes"/>
  <group order="one" minOccurs="1" maxOccurs="1">
    <element type="ScanIdentification_DCP" minOccurs="0" maxOccurs="1"/>
    <element type="ScanIdentification_IM" minOccurs="0" maxOccurs="1"/>
  </group>
</ElementType>
<ElementType name="FDT" content="eltOnly" model="closed">

```

```

    <element type="ScanIdentifications" minOccurs="1" maxOccurs="1"/>
  </ElementType>
</Schema>

```

10.4 Device type identification data types – FDTProfinetIODeviceIdentSchema

This subclause defines data types that are used to protocol specific information for device types.

```

<Schema name="FDTProfinetIODeviceIdentSchema"
  xmlns="urn:schemas-microsoft-com:xml-data"
  xmlns:dt="urn:schemas-microsoft-com:datatypes"
  xmlns:pnoident="x-schema:FDTProfinetIOIdentSchema.xml"
  xmlns:fdt="x-schema:FDTDataTypesSchema.xml">

  <!-- Definition of Attributes -->
  <AttributeType name="schemaVersion" dt:type="number" default="1.00"/>

  <!-- DCP -->
  <ElementType name="IdBusProtocol" content="eltOnly" model="closed">
    <attribute type="pnoident:busProtocol" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="IdManufacturer" content="eltOnly" model="closed">
    <attribute type="fdt:manufacturerId" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="IdTypeID" content="eltOnly" model="closed">
    <attribute type="fdt:deviceTypeID" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="IdDeviceRole" content="eltOnly" model="closed">
    <attribute type="pnoident:deviceRole" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="ManufacturerSpecificExtension" content="empty" model="closed">
    <attribute type="pnoident:manufacturerSpecificExtension" required="yes"/>
  </ElementType>

  <!-- I&M -->
  <ElementType name="IdOrder" content="eltOnly" model="closed">
    <attribute type="pnoident:orderId" required="yes"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="IdSoftwareRevision" content="eltOnly" model="closed">
    <attribute type="pnoident:softwareRevision" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="IdHardwareRevision" content="eltOnly" model="closed">
    <attribute type="pnoident:hardwareRevision" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="ProfileID" content="eltOnly" model="closed">
    <attribute type="pnoident:profileID" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>
  <ElementType name="ProfileSpecificType" content="eltOnly" model="closed">
    <attribute type="pnoident:profileSpecificType" required="no"/>
    <element type="pnoident:RegExpr" minOccurs="0" maxOccurs="*/"/>
  </ElementType>

  <ElementType name="DeviceIdentification_DCP" content="eltOnly" model="closed">
    <attribute type="pnoident:idDTMSupportLevel" required="yes"/>

    <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
    <element type="IdManufacturer" minOccurs="1" maxOccurs="1"/>
    <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
    <element type="IdDeviceRole" minOccurs="1" maxOccurs="1"/>
    <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>

```

```

</ElementType>
<ElementType name="DeviceIdentification_IM" content="eltOnly" model="closed">
  <attribute type="pnioident:idDTMSupportLevel" required="yes"/>

  <element type="IdBusProtocol" minOccurs="1" maxOccurs="1"/>
  <element type="IdManufacturer" minOccurs="1" maxOccurs="1"/>
  <element type="IdTypeID" minOccurs="1" maxOccurs="1"/>
  <element type="IdDeviceRole" minOccurs="1" maxOccurs="1"/>
  <element type="ManufacturerSpecificExtension" minOccurs="0" maxOccurs="1"/>

  <element type="IdOrder" minOccurs="1" maxOccurs="1"/>
  <element type="IdSoftwareRevision" minOccurs="1" maxOccurs="1"/>
  <element type="IdHardwareRevision" minOccurs="1" maxOccurs="1"/>
  <element type="ProfileID" minOccurs="1" maxOccurs="1"/>
  <element type="ProfileSpecificType" minOccurs="1" maxOccurs="1"/>
</ElementType>

<ElementType name="DeviceIdentifications" content="eltOnly" model="closed">
  <attribute type="fdt:busCategory" required="yes"/>
  <group order="one" minOccurs="1" maxOccurs="1">
    <element type="DeviceIdentification_DCP" minOccurs="0" maxOccurs="1"/>
    <element type="DeviceIdentification_IM" minOccurs="0" maxOccurs="1"/>
  </group>
</ElementType>
<ElementType name="FDT" content="eltOnly" model="closed">
  <element type="DeviceIdentifications" minOccurs="1" maxOccurs="1"/>
</ElementType>
</Schema>

```

10.5 XSLT Transformation

```

<?xml version="1.0" encoding="UTF-8"?>

<!-- Device identification transformation for ProfinetIO identification files. -->
<xsl:stylesheet
  xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
  xmlns:str="http://xslt.org/string"
  xmlns:ident="x-schema:DTMIdentSchema.xml"
  xmlns:fdt="x-schema:FDTDataTypesSchema.xml"
  xmlns:scanident="x-schema:DTMScanIdentSchema.xml"
  xmlns:devident="x-schema:DTMDeviceTypeIdentSchema.xml"
  xmlns:pnioident="x-schema:FDTProfinetIOIdentSchema.xml"
  xmlns:pniodevice="x-schema:FDTProfinetIODeviceTypeIdentSchema.xml"
  xmlns:pnioscan="x-schema:FDTProfinetIOScanIdentSchema.xml" version="2.0">

  <!-- Version of this file. -->
  <xsl:variable name="FileVersion">
    <xsl:number value="1.00"/>
  </xsl:variable>
  <xsl:output method="xml" omit-xml-declaration="yes" indent="yes"/>

  <!-- Transform device root or scan identification. -->
  <xsl:template match="/">
    <xsl:apply-templates select="//pnioscan:ScanIdentifications"/>
    <xsl:apply-templates select="//pniodevice:DeviceIdentifications"/>
  </xsl:template>

  <!-- ProfinetIO catalog identification list. -->
  <xsl:template match="pniodevice:DeviceIdentifications">
    <xsl:text disable-output-escaping="yes">&lt;?xml version="1.0"?&gt;
      &lt;!-- This file is created by FDTProfinetIOIdentTransformation.xsl after transformation of
      ProfinetIODeviceIdentInstance.xml. --&gt;
      &lt;FDT xmlns="x-schema:DTMDeviceTypeIdentSchema.xml"
        xmlns:ident="x-schema:DTMIdentSchema.xml"
        xmlns:fdt="x-schema:FDTDataTypesSchema.xml" &gt;</xsl:text>
    <xsl:element name="DeviceIdentifications">
      <xsl:apply-templates select="pniodevice:DeviceIdentification_DCP"/>
      <xsl:apply-templates select="pniodevice:DeviceIdentification_IM"/>
    </xsl:element>
  </xsl:template>

```

```

</xsl:element>
<xsl:text disable-output-escaping="yes">&lt;/FDT&gt;</xsl:text>
</xsl:template>

<!-- ProfinetIO scan identification list. -->
<xsl:template match="pnioscan:ScanIdentifications">
  <xsl:text disable-output-escaping="yes">&lt;?xml version="1.0"?&gt;
    &lt;!-- This file is created by FDTProfinetIOIdentTransformation.xsl after transformation of
ProfinetIOScanIdentInstance.xml --&gt;
    &lt;FDT xmlns="x-schema:DTMScanIdentSchema.xml"
      xmlns:ident="x-schema:DTMIdentSchema.xml"
      xmlns:fdt="x-schema:FDTDataTypesSchema.xml" &gt;</xsl:text>
  <xsl:element name="ScanIdentifications">
    <xsl:attribute name="fdt:busCategory">
      <xsl:value-of select="@fdt:busCategory"/>
    </xsl:attribute>
    <xsl:attribute name="resultState">
      <xsl:value-of select="@resultState"/>
    </xsl:attribute>
    <xsl:apply-templates select="pnioscan:ScanIdentification_DCP"/>
    <xsl:apply-templates select="pnioscan:ScanIdentification_IM"/>
  </xsl:element>
  <xsl:text disable-output-escaping="yes">&lt;/FDT&gt;</xsl:text>
</xsl:template>

<!-- ProfinetIO DCP catalog identification. -->
<xsl:template match="pniodevice:DeviceIdentification_DCP">
  <xsl:element name="DeviceIdentification">
    <xsl:attribute name="ident:idDTMSupportLevel">
      <xsl:value-of select="@pnioident:idDTMSupportLevel"/>
    </xsl:attribute>

    <xsl:element name="IdBusProtocol">
      <xsl:attribute name="ident:protocolSpecificName">ProfinetIO DCP</xsl:attribute>
      <xsl:attribute name="ident:value">
        <xsl:value-of select="pniodevice:IdBusProtocol/@pnioident:busProtocol"/>
      </xsl:attribute>
    </xsl:element>
    <xsl:element name="IdBusProtocolVersion">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
    </xsl:element>
    <xsl:apply-templates select="pniodevice:IdManufacturer"/>
    <xsl:apply-templates select="pniodevice:IdTypeID"/>
    <xsl:element name="IdSoftwareRevision">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
    </xsl:element>
    <xsl:element name="IdHardwareRevision">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
    </xsl:element>
    <xsl:element name="IdValues">
      <xsl:apply-templates select="pniodevice:IdDeviceRole"/>
      <xsl:apply-templates select="pniodevice:ManufacturerSpecificExtension"/>
    </xsl:element>
  </xsl:element>
</xsl:template>

<!-- ProfinetIO DCP scan identification. -->
<xsl:template match="pnioscan:ScanIdentification_DCP">
  <xsl:element name="ScanIdentification">
    <xsl:apply-templates select="@configuredState"/>
    <xsl:apply-templates select="fdt:CommunicationError"/>

    <xsl:element name="IdBusProtocol">
      <xsl:attribute name="ident:protocolSpecificName">ProfinetIO DCP</xsl:attribute>
      <xsl:attribute name="ident:value">
        <xsl:value-of select="pnioscan:IdBusProtocol/@pnioident:busProtocol"/>
      </xsl:attribute>
    </xsl:element>
    <xsl:element name="IdBusProtocolVersion">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>

```

```

</xsl:element>
<xsl:element name="IdAddress">
  <xsl:attribute name="ident:protocolSpecificName">Address</xsl:attribute>
  <xsl:attribute name="ident:value"><xsl:value-of
select="pnioscan:IdAddress/@pnioident:nameOfStation"/>;<xsl:value-of
select="pnioscan:IdAddress/@pnioident:ipAddress"/>;<xsl:value-of
select="pnioscan:IdAddress/@pnioident:macAddress"/>;<xsl:value-of
select="pnioscan:IdAddress/@pnioident:ipSubnetMask"/>;<xsl:value-of
select="pnioscan:IdAddress/@pnioident:ipDefaultGateway"/></xsl:attribute>
  </xsl:element>
  <xsl:apply-templates select="pnioscan:IdManufacturer"/>
  <xsl:apply-templates select="pnioscan:IdTypeID"/>
  <xsl:element name="IdSoftwareRevision">
    <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
  </xsl:element>
  <xsl:element name="IdHardwareRevision">
    <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
  </xsl:element>
  <xsl:element name="IdDeviceTag">
    <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
  </xsl:element>
  <xsl:element name="IdSerialNumber">
    <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
  </xsl:element>
  <xsl:element name="IdValues">
    <xsl:apply-templates select="pnioscan:IdDeviceRole"/>
    <xsl:apply-templates select="pnioscan:ManufacturerSpecificExtension"/>
  </xsl:element>
</xsl:element>
</xsl:template>

<!-- ProfinetIO IM catalog identification. -->
<xsl:template match="pniodevice:DeviceIdentification_IM">
  <xsl:element name="DeviceIdentification">
    <xsl:attribute name="ident:idDTMSupportLevel">
      <xsl:value-of select="@pnioident:idDTMSupportLevel"/>
    </xsl:attribute>

    <xsl:element name="IdBusProtocol">
      <xsl:attribute name="ident:protocolSpecificName">ProfinetIO IM</xsl:attribute>
      <xsl:attribute name="ident:value">
        <xsl:value-of select="pniodevice:IdBusProtocol/@pnioident:busProtocol"/>
      </xsl:attribute>
    </xsl:element>
    <xsl:element name="IdBusProtocolVersion">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
    </xsl:element>
    <xsl:apply-templates select="pniodevice:IdManufacturer"/>
    <xsl:apply-templates select="pniodevice:IdTypeID"/>
    <xsl:apply-templates select="pniodevice:IdSoftwareRevision"/>
    <xsl:apply-templates select="pniodevice:IdHardwareRevision"/>
    <xsl:element name="IdValues">
      <xsl:apply-templates select="pniodevice:IdDeviceRole"/>
      <xsl:apply-templates select="pniodevice:ManufacturerSpecificExtension"/>
      <xsl:apply-templates select="pniodevice:ProfileID"/>
      <xsl:apply-templates select="pniodevice:ProfileSpecificType"/>
      <xsl:apply-templates select="pniodevice:IdOrder"/>
    </xsl:element>
  </xsl:element>
</xsl:template>

<!-- ProfinetIO IM scan identification. -->
<xsl:template match="pnioscan:ScanIdentification_IM">
  <xsl:element name="ScanIdentification">
    <xsl:apply-templates select="@configuredState"/>
    <xsl:apply-templates select="fdt:CommunicationError"/>

    <xsl:element name="IdBusProtocol">
      <xsl:attribute name="ident:protocolSpecificName">ProfinetIO IM</xsl:attribute>
      <xsl:attribute name="ident:value">

```

```

        <xsl:value-of select="pnioscan:IdBusProtocol/@pnioident:busProtocol"/>
      </xsl:attribute>
    </xsl:element>
    <xsl:element name="IdBusProtocolVersion">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
    </xsl:element>
    <xsl:apply-templates select="pnioscan:IdAddress"/>
    <xsl:apply-templates select="pnioscan:IdManufacturer"/>
    <xsl:apply-templates select="pnioscan:IdTypeID"/>
    <xsl:apply-templates select="pnioscan:IdSoftwareRevision"/>
    <xsl:apply-templates select="pnioscan:IdHardwareRevision"/>
    <xsl:element name="IdDeviceTag">
      <xsl:attribute name="ident:protocolSpecificName">not applicable</xsl:attribute>
    </xsl:element>
    <xsl:apply-templates select="pnioscan:IdSerialNumber"/>
    <xsl:element name="IdValues">
      <xsl:apply-templates select="pnioscan:IdDeviceRole"/>
      <xsl:apply-templates select="pnioscan:ManufacturerSpecificExtension"/>
      <xsl:apply-templates select="pnioscan:ProfileID"/>
      <xsl:apply-templates select="pnioscan:ProfileSpecificType"/>
      <xsl:apply-templates select="pnioscan:IdOrder"/>
    </xsl:element>
  </xsl:element>
</xsl:template>

<!-- Device address. -->
<xsl:template match="pnioscan:IdAddress">
  <xsl:element name="IdAddress">
    <xsl:attribute name="ident:protocolSpecificName">Address</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@pnioident:nameOfStation"/>;<xsl:value-of
select="@pnioident:ipAddress"/>;<xsl:value-of select="@pnioident:macAddress"/>;<xsl:value-of
select="@pnioident:ipSubnetMask"/>;<xsl:value-of select="@pnioident:ipDefaultGateway"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Serial number. -->
<xsl:template match="pnioscan:IdSerialNumber">
  <xsl:element name="IdSerialNumber">
    <xsl:attribute name="ident:protocolSpecificName">IM_Serial_Number</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of
select="pnioscan:IdSerialNumber/@pnioident:serialNumber"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Manufacturer ID. -->
<xsl:template match="pniodevice:IdManufacturer">
  <xsl:param name="value" select="@fdt:manufacturerId"/>
  <xsl:element name="IdManufacturer">
    <xsl:attribute name="ident:protocolSpecificName">DeviceVendorValue</xsl:attribute>
    <xsl:call-template name="genMatch">
      <xsl:with-param name="value" select="$value"/>
    </xsl:call-template>
  </xsl:element>
</xsl:template>
<xsl:template match="pnioscan:IdManufacturer">
  <xsl:element name="IdManufacturer">
    <xsl:attribute name="ident:protocolSpecificName">DeviceVendorValue</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@fdt:manufacturerId"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Device type ID. -->
<xsl:template match="pniodevice:IdTypeID">
  <xsl:param name="value" select="@fdt:deviceTypeId"/>
  <xsl:element name="IdTypeID">
    <xsl:attribute name="ident:protocolSpecificName">DeviceIdentNumber</xsl:attribute>
    <xsl:call-template name="genMatch">
      <xsl:with-param name="value" select="$value"/>
    </xsl:call-template>
  </xsl:element>
</xsl:template>

```

```

</xsl:template>
<xsl:template match="pnioscan:IdTypeID">
  <xsl:element name="IdTypeID">
    <xsl:attribute name="ident:protocolSpecificName">DeviceIdNumber</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@fdt:deviceTypeId"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Device role. -->
<xsl:template match="pniodevice:IdDeviceRole">
  <xsl:param name="value" select="@pnioident:deviceRole"/>
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">DeviceRoleDetails</xsl:attribute>
    <xsl:attribute name="ident:name">Device Role</xsl:attribute>
    <xsl:call-template name="genMatch">
      <xsl:with-param name="value" select="$value"/>
    </xsl:call-template>
  </xsl:element>
</xsl:template>
<xsl:template match="pnioscan:IdDeviceRole">
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">DeviceRoleDetails</xsl:attribute>
    <xsl:attribute name="ident:name">Device Role</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@pnioident:deviceRole"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Manufacturer specific extension. -->
<xsl:template match="pniodevice:ManufacturerSpecificExtension">
  <xsl:param name="value" select="@pnioident:manufacturerSpecificExtension"/>
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">ManufacturerSpecificString</xsl:attribute>
    <xsl:attribute name="ident:name">Manufacturer Specific Extension</xsl:attribute>
    <xsl:call-template name="genMatch">
      <xsl:with-param name="value" select="$value"/>
    </xsl:call-template>
  </xsl:element>
</xsl:template>
<xsl:template match="pnioscan:ManufacturerSpecificExtension">
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">ManufacturerSpecificString</xsl:attribute>
    <xsl:attribute name="ident:name">Manufacturer Specific Extension</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of
select="@pnioident:manufacturerSpecificExtension"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Software revision. -->
<xsl:template match="pniodevice:IdSoftwareRevision">
  <xsl:param name="value" select="@fdt:firmwareRevision"/>
  <xsl:element name="IdSoftwareRevision">
    <xsl:attribute name="ident:protocolSpecificName">IM_Software_Revision</xsl:attribute>
    <xsl:call-template name="genMatch">
      <xsl:with-param name="value" select="$value"/>
    </xsl:call-template>
  </xsl:element>
</xsl:template>
<xsl:template match="pnioscan:IdSoftwareRevision">
  <xsl:element name="IdSoftwareRevision">
    <xsl:attribute name="ident:protocolSpecificName">IM_Software_Revision</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@fdt:firmwareRevision"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Hardware revision. -->
<xsl:template match="pniodevice:IdHardwareRevision">
  <xsl:param name="value" select="@fdt:hardwareRevision"/>
  <xsl:element name="IdHardwareRevision">
    <xsl:attribute name="ident:protocolSpecificName">IM_Hardware_Revision</xsl:attribute>
    <xsl:call-template name="genMatch">

```