

TECHNICAL REPORT



**Field device tool (FDT) interface specification –
Part 51-32: Communication implementation for common object model –
IEC 61784 CP 3/4, CP 3/5 and CP 3/6**



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Part 51-32: Communication implementation for common object model –
IEC 61784 CP 3/4, CP 3/5 and CP 3/6**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 51-32: Communication implementation for common object model – IEC 61784 CP 3/4, CP 3/5 and CP 3/6

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IEC TR 62453-51-32 which is a technical report, has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process management, control and automation.

This document cancels and replaces IEC TR 62453-503-2 published in 2009. This edition constitutes a technical revision. The main change consists of an important correction for the FDTProfinetIOCommunicationSchema.

Each part of the IEC 62453-51-xy series is intended to be read in conjunction with its corresponding part in the IEC 62453-3xy series. This document corresponds to IEC 62453-303-2.

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

Enquiry draft	Report on voting
65E/440/DTR	65E/514/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 document 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 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- withdrawn,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.

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INTRODUCTION

This part of IEC 62453 is an interface specification for developers of Field Device Tool (FDT) 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 fieldbuses 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 Device Type Manager (DTM), 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 fieldbuses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how this part of IEC 62453-51-xy series is aligned in the structure of the IEC 62453 series.

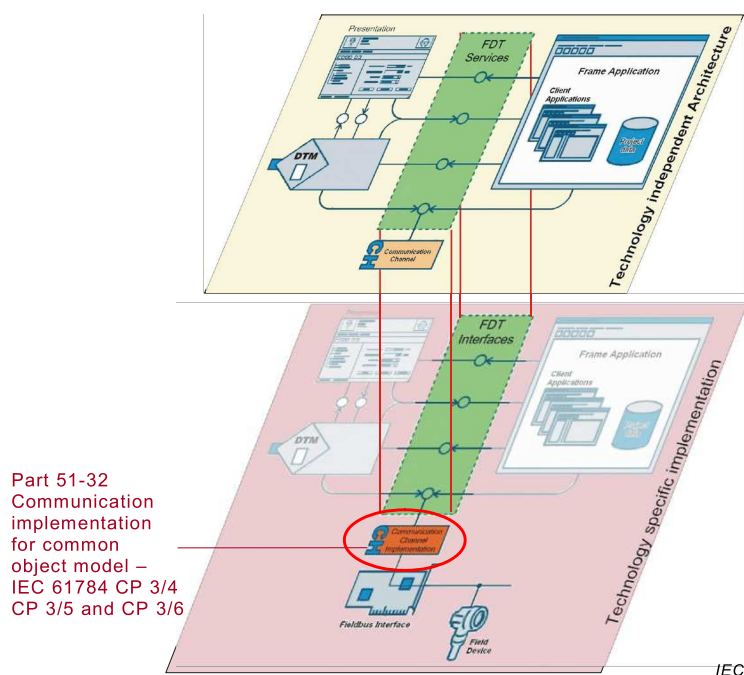


Figure 1 – Part 51-32 of the IEC 62453 series

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 51-32: Communication implementation for common object model – IEC 61784 CP 3/4, CP 3/5 and CP 3/6

1 Scope

This part of the IEC 62453-51-xy series, which is a Technical Report, provides information for integrating the PROFINET®¹ technology into the COM-based implementation of the FDT interface specification (IEC TR 62453-41).

This part of IEC 62453 specifies implementation of communication and other services based on IEC 62453-303-2.

This document neither contains the FDT specification nor modifies it.

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

IEC 61784-1:2014, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 62453-1:2016, *Field device tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:2016, *Field device tool (FDT) interface specification – Part 2: Concepts and detailed description*

IEC TR 62453-41:2016, *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*
IEC 62453-303-2:2009/AMD1:2016

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62453-1, IEC 62453-2, IEC TR 62453-41, and IEC 62453-301 apply.

¹ PROFINET ® is the trademark of PROFIBUS Nutzerorganisation e.V. (PNO). PNO is a non-profit trade organization that supports the fieldbus PROFIBUS. 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 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.

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

3.2 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviations given in IEC 62453-1, IEC 62453-2, IEC 62453-303-2, IEC TR 62453-41 and the following apply.

GSDML Generic Station Description Markup Language

DCP Discovery and basic Configuration Protocol

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 62453-2:2016, 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 behaviour.
Usage of “can” or “optional”	Function or behaviour 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` methods
- `IDtmSingleDeviceDataAccess` methods
- `IDtmSingleInstanceDataAccess` methods

These methods (if supported according IEC TR 62453-41) shall provide access to at least 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
fdt:address	All these attributes of the FDTDatatype schema are used as defined in IEC 62453-303-2.
fdt:protocolId	
fdt:deviceTypeId	
fdt:deviceTypeInfo	
fdt:deviceTypeInfoPath	
fdt:manufacturerId	
fdt:semanticId	
fdt:applicationDomain	
fdt:tag	

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="dynIpAddress" dt:type="boolean"/>
  <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="extAddrSupported" dt:type="boolean"/>

  <!--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="1"/>
</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:deviceTypeId" 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="extAddrSupported" required="yes"/>
<attribute type="macAddress" required="no"/>
</ElementType>

<!--Definition of DeviceList Element, needed for multiple PNI/O 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="1"/>
</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="ui1"/>
  <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="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
    <attribute type="addData1" required="no"/>
    <attribute type="addData2" required="no"/>
  </ElementType>

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

  <ElementType name="DisconnectResponse" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="communicationReference" required="yes"/>
    <attribute type="addData1" required="no"/>
  </ElementType>

```

```

    <attribute type="addData2" required="no"/>
  </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="1"/>
    <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"/>
    <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="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:deviceTypeId" 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:FDTProfinetIOIdentSchema.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:pnioident="x-schema:FDTProfinetIODeviceIdentSchema.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="pnioident:busProtocol" required="no"/>
    <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="IdManufacturer" content="eltOnly" model="closed">
    <attribute type="fdt:manufacturerId" required="no"/>
    <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="IdTypeID" content="eltOnly" model="closed">
    <attribute type="fdt:deviceTypeID" required="no"/>
    <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
  </ElementType>
  <ElementType name="IdDeviceRole" content="eltOnly" model="closed">
    <attribute type="pnioident:deviceRole" required="no"/>
    <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
  </ElementType>

```

```

<ElementType name="ManufacturerSpecificExtension" content="empty" model="closed">
  <attribute type="pnioident:manufacturerSpecificExtension" required="yes"/>
</ElementType>

<!-- I&M -->
<ElementType name="IdOrder" content="eltOnly" model="closed">
  <attribute type="pnioident:orderId" required="yes"/>
  <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="IdSoftwareRevision" content="eltOnly" model="closed">
  <attribute type="pnioident:softwareRevision" required="no"/>
  <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="IdHardwareRevision" content="eltOnly" model="closed">
  <attribute type="pnioident:hardwareRevision" required="no"/>
  <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ProfileID" content="eltOnly" model="closed">
  <attribute type="pnioident:profileID" required="no"/>
  <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
</ElementType>
<ElementType name="ProfileSpecificType" content="eltOnly" model="closed">
  <attribute type="pnioident:profileSpecificType" required="no"/>
  <element type="pnioident:RegExpr" minOccurs="0" maxOccurs="1"/>
</ElementType>

<ElementType name="DeviceIdentification_DCP" 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"/>
</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.xml 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: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.xml 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="pnidevice:IdDeviceRole"/>
        <xsl:apply-templates select="pnidevice: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:ipSubnetMask"/>;<xsl:value-of
select="pnioscan:IdAddress/@pnioident:ipDefaultGateway"/>;<xsl:value-of
select="pnioscan:IdAddress/@pnioident:macAddress"/></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="pnidevice: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="pnidevice: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="pnidevice:IdManufacturer"/>
        <xsl:apply-templates select="pnidevice:IdTypeID"/>
        <xsl:apply-templates select="pnidevice:IdSoftwareRevision"/>
        <xsl:apply-templates select="pnidevice:IdHardwareRevision"/>
        <xsl:element name="IdValues">
            <xsl:apply-templates select="pnidevice:IdDeviceRole"/>
            <xsl:apply-templates select="pnidevice:ManufacturerSpecificExtension"/>
            <xsl:apply-templates select="pnidevice:ProfileID"/>
            <xsl:apply-templates select="pnidevice:ProfileSpecificType"/>
            <xsl:apply-templates select="pnidevice:IdOrder"/>
        </xsl:element>
    </xsl:element>
</xsl:template>

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</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:ipSubnetMask"/>;<xsl:value-of
select="@pnioident:ipDefaultGateway"/>;<xsl:value-of select="@pnioident:macAddress"/></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">

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

<!-- Device role. -->
<xsl:template match="pniodvice: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="pniodvice: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="pniodvice: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="pniodvice: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">
      <xsl:with-param name="value" select="$value"/>
    </xsl:call-template>
  </xsl:element>
</xsl:template>

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</xsl:template>
<xsl:template match="pnioscan:IdHardwareRevision">
  <xsl:element name="IdHardwareRevision">
    <xsl:attribute name="ident:protocolSpecificName">IM_Hardware_Revision</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@fdt:hardwareRevision"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Profile ID. -->
<xsl:template match="pnidevice:ProfileID">
  <xsl:param name="value" select="@pnioident:profileID"/>
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">IM_Profile_ID</xsl:attribute>
    <xsl:attribute name="ident:name">Profile ID</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:ProfileID">
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">IM_Profile_ID</xsl:attribute>
    <xsl:attribute name="ident:name">Profile ID</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@pnioident:profileID"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Profile specific type. -->
<xsl:template match="pnidevice:ProfileSpecificType">
  <xsl:param name="value" select="@pnioident:profileID"/>
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">IM_Profile_Specific_Type</xsl:attribute>
    <xsl:attribute name="ident:name">Profile Specific Type</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:ProfileSpecificType">
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">IM_Profile_Specific_Type</xsl:attribute>
    <xsl:attribute name="ident:name">Profile Specific Type</xsl:attribute>
    <xsl:attribute name="ident:value"><xsl:value-of select="@pnioident:profileSpecificType"/></xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Order ID. -->
<xsl:template match="pnidevice:IdOrder">
  <xsl:param name="value" select="@pnioident:orderId"/>
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">IM_Order_ID</xsl:attribute>
    <xsl:attribute name="ident:name">Order ID</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:IdOrder">
  <xsl:element name="IdValue">
    <xsl:attribute name="ident:protocolSpecificName">IM_Order_ID</xsl:attribute>
    <xsl:attribute name="ident:name">Order ID</xsl:attribute>
    <xsl:attribute name="ident:value">
      <xsl:value-of select="@pnioident:orderId"/>
    </xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Configured attribute. -->
<xsl:template match="@configuredState">
  <xsl:attribute name="configuredState">
    <xsl:value-of select="."/>
  </xsl:attribute>
</xsl:template>

<!-- Communication error. -->
<xsl:template match="fdt:CommunicationError">
  <xsl:element name="fdt:CommunicationError">

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    <xsl:attribute name="communicationError">
      <xsl:value-of select="@communicationError"/>
    </xsl:attribute>
    <xsl:attribute name="tag">
      <xsl:value-of select="@tag"/>
    </xsl:attribute>
  </xsl:element>
</xsl:template>

<!-- Generate matching information. -->
<xsl:template name="genMatch">
  <xsl:param name="value"/>
  <xsl:param name="empty"/>
  <xsl:if test="$value!=$empty">
    <xsl:attribute name="ident:value">
      <xsl:value-of select="$value"/>
    </xsl:attribute>
  </xsl:if>
  <xsl:apply-templates select="pnioident:RegExpr"/>
</xsl:template>

<!-- Generate regular expressions. -->
<xsl:template match="pnioident:RegExpr">
  <!-- Copy pattern info. -->
  <xsl:call-template name="genPattern">
    <xsl:with-param name="match" select="@match"/>
    <xsl:with-param name="nomatch" select="@nomatch"/>
  </xsl:call-template>
</xsl:template>

<!-- Generate pattern information. -->
<xsl:template name="genPattern">
  <xsl:param name="match"/>
  <xsl:param name="nomatch"/>
  <xsl:param name="empty"/>
  <xsl:choose>
    <xsl:when test="$match!=$empty">
      <xsl:element name="ident:RegExpr">
        <xsl:attribute name="match">
          <xsl:value-of select="$match"/>
        </xsl:attribute>
        <xsl:if test="$nomatch!=$empty">
          <xsl:attribute name="nomatch">
            <xsl:value-of select="$nomatch"/>
          </xsl:attribute>
        </xsl:if>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$nomatch!=$empty">
      <xsl:element name="ident:RegExpr">
        <xsl:attribute name="nomatch">
          <xsl:value-of select="$nomatch"/>
        </xsl:attribute>
        <xsl:if test="$match!=$empty">
          <xsl:attribute name="match">
            <xsl:value-of select="$match"/>
          </xsl:attribute>
        </xsl:if>
      </xsl:element>
    </xsl:when>
  </xsl:choose>
</xsl:template>
</xsl:stylesheet>

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