IEC/TR 62453-501

Edition 1.0 2009-08

TECHNICAL REPORT



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Part 501: Communication implementation for common object model – IEC 61784 CPF 1

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IEC/TR 62453-501:2009(E)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE XC

ICS 25.040.40; 35.100.05; 35.110

ISBN 978-2-88910-726-1

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 501: Communication implementation for common object model – IEC 61784 CPF 1

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IEC/TR 62453-501, 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.

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

Enquiry draft	Report on voting
65E/65/DTR	65E/114/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- withdrawn,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.

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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 62453-501 is aligned in the structure of IEC 62453 series.

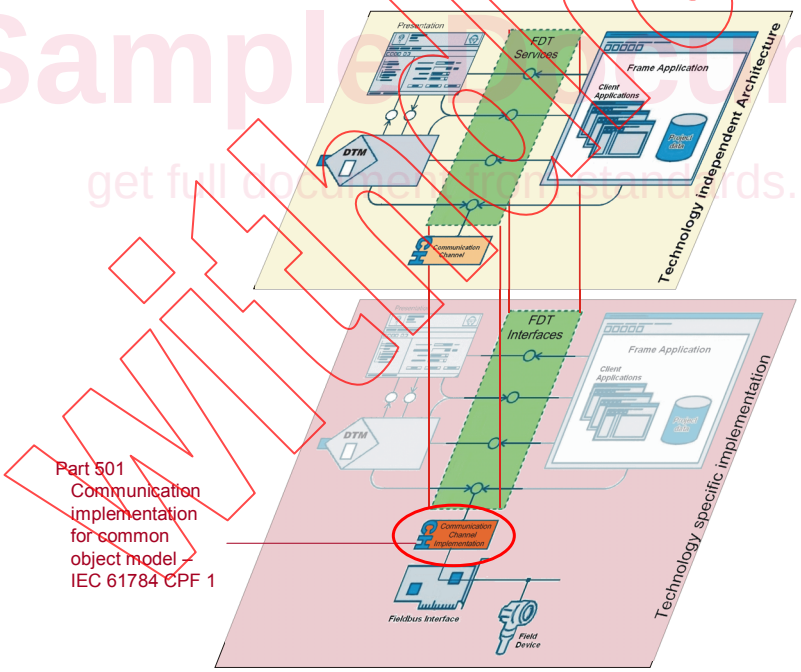


Figure 1 – Part 501 of the IEC 62453 series

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Part 501: Communication implementation for common object model – IEC 61784 CPF 1

1 Scope

IEC/TR 62453-501, which is a technical report, provides additional information for integrating the Foundation Fieldbus (FF) protocol into the COM implementation of the FDT Specification (IEC/TR 62453-41).

The document describes communication definitions, protocol specific extensions and the means for block (e.g. transducer, resource or function blocks) representation.

The new protocol specific definitions are based on FF-Specifications for H1 and HSE protocols. Furthermore, the definitions contain information that is needed by systems to configure FF Devices.

The scope is limited to Foundation Fieldbus device and system specific definitions.

This specification neither contains the FDT specification nor modifies it.

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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 62453-301:2009, *Field Device Tool (FDT) interface specification – Part 301: Communication profile integration – IEC 61784 CPF 1*

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, IEC 62453-2, IEC/TR 62453-41 and the following apply.

3.2 Symbols and abbreviated terms

CP	Communication Profile	[IEC 61784-1]
CPF	Communication Profile Family	[IEC 61784-1]
UML	Unified Modelling Language	[ISO/IEC 19501]

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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 behaviour.
Usage of “can’ or “Optional’	Function or behaviour may be provided, depending on defined conditions.

3.3.3 Use of UML

Figures in this document are using UML notation as defined in Annex A of IEC 62453-1.

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4 Bus category

IEC 61784 CPF 1 protocol is identified by the identifiers, as specified in IEC 62453-301.

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 as defined in IEC 62453-301.

6 Protocol specific usage of general data types

Table 1 shows how general data types are used with IEC 61784 CPF 1 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 62453-301.
fdt:protocolId	
fdt:deviceTypeId	
fdt:deviceTypeInformation	
fdt:deviceTypeInformationPath	
fdt:manufacturerId	

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Attribute	Description for use
fdt:semanticId fdt:applicationDomain	
fdt:tag	

7 Protocol specific common data types - FdtFFDataTypesSchema

This clause specifies the protocol specific common data types, which are used in the definition of other data types.

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

    <AttributeType name="schemaVersion" dt:type="string" default="1.21"/>

    <!--
      Common definitions of datatypes for Fieldbus Foundation
      use name space prefix fftypes when referencing
   -->
    <!--Definition of Attributes-->
    <!-- VFD Reference according to FF-880 section 8 -->
    <AttributeType name="vfdRef" dt:type="ui4"/>
    <AttributeType name="vfdTag" dt:type="string"/>
    <AttributeType name="communicationReference" dt:type="uuid"/>
    <AttributeType name="subIndex" dt:type="ui4"/>
    <AttributeType name="versionOd" dt:type="i2"/>
    <AttributeType name="versionNumber" dt:type="bin.hex"/>
    <AttributeType name="devID" dt:type="string"/>
    <AttributeType name="ip" dt:type="string"/>
    <AttributeType name="port" dt:type="ui2"/>
    <AttributeType name="deviceIndex" dt:type="ui4"/>
    <AttributeType name="listCount" dt:type="ui4"/>
    <AttributeType name="smServiceID" dt:type="enumeration" dt:values="SmSetPDTag SmSetAddress
SmClearAddress SmIdentify SmFindTagQuery SmClearAssignmentInfo SmSetAssignmentInfo"/>
    <AttributeType name="deviceType" dt:type="enumeration" dt:values="linkingDevice ioGateway hseFieldDevice
h1Device"/>
    <!--Attributes of element DataLinkAddress - Denotes the Data link (DL) Addresses. see FF-822 Annex A -->
    <!-- Link designator according to FF-822 -->
    <AttributeType name="linkId" dt:type="ui2"/>
    <!-- Node designator according to FF-822 -->
    <AttributeType name="nodeId" dt:type="ui2"/>
    <!-- Selector according to FF-822 -->
    <AttributeType name="selector" dt:type="ui2"/>
    <!-- See FF-870 section 3.3.4 - FMS services and the options supported by the server-->
    <AttributeType name="fmsFeaturesSupported" dt:type="bin.hex"/>
    <!-- Management attributes -->
    <AttributeType name="smSupport" dt:type="bin.hex"/>
    <AttributeType name="macroCycleDuration" dt:type="ui4"/>
    <AttributeType name="operationalPowerup" dt:type="ui4"/>
    <AttributeType name="scheduleActivation" dt:type="ui4"/>
    <AttributeType name="timeValue" dt:type="bin.hex"/>
    <AttributeType name="domain" dt:type="bin.hex"/>
    <!-- represent parameters DEV_REV and DD_REV from the resource block-->
    <AttributeType name="deviceRevision" dt:type="ui1" />
    <AttributeType name="ddRevision" dt:type="ui1" />
    <AttributeType name="devType" dt:type="ui2" />
    <!--Definition of Elements-->
    <!--Element DataLinkAddress - Denotes the Data link (DL) Addresses. see FF-822 Annex A -->
    <ElementType name="DataLinkAddress" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="linkId" required="yes"/>
        <attribute type="nodeId" required="yes"/>
        <attribute type="selector" required="yes"/>
    </ElementType>
    <!--Element index -->
```

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```
<ElementType name="Index" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="fdt:index" required="yes"/>
</ElementType>
<!--Element SubIndex -->
<ElementType name="SubIndex" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="subIndex" required="yes"/>
</ElementType>
<ElementType name="IndexList" content="eltOnly" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="listCount" required="yes"/>
    <element type="Index" minOccurs="1" maxOccurs="*"/>
</ElementType>
<ElementType name="IP" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="ip" required="yes"/>
    <attribute type="port" required="no"/>
</ElementType>
<!-- Management elements -->
<ElementType name="VfdTag" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="vfdTag" required="yes"/>
</ElementType>
<ElementType name="VfdRef" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="vfdRef" required="yes"/>
</ElementType>
<ElementType name="OperationalPowerup" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="operationalPowerup" required="yes"/>
</ElementType>
<ElementType name="PdTag" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="fdt:tag" required="yes"/>
</ElementType>
<ElementType name="DeviceId" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" default="1" required="no"/>
    <attribute type="devID" required="yes"/>
</ElementType>
<ElementType name="MacrocycleDuration" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="macroCycleDuration" required="yes"/>
</ElementType>
<ElementType name="CurrentTime" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="timeValue" required="yes"/>
</ElementType>
<ElementType name="SmSupport" content="empty" model="closed">
    <attribute type="fdt:nodeId" required="no"/>
    <attribute type="fdt:readAccess" required="no"/>
    <attribute type="fdt:writeAccess" required="no"/>
    <attribute type="smSupport" required="yes"/>
</ElementType>
```

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```
    <ElementType name="VfdIdentification" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="ddRevision" required="yes" />
        <attribute type="deviceRevision" required="yes" />
        <attribute type="devType" required="yes" />
        <attribute type="fdt:manufacturerId" required="no"/>
        <attribute type="vfdTag" required="yes"/>
    </ElementType>
</Schema>
```

8 Network management data types

8.1 General

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

- IDtmParameter:GetParameters
- IDtmParameter:SetParameters

All parameters defined in EDS in ther [Params]-section shall be exposed by these methods.

8.2 H1 Management – FdtFFH1ManagementSchema

```
<Schema name="FdtFFH1ManagementSchema"
      xmlns="urn:schemas-microsoft-com:xml-data"
        xmlns:dt="urn:schemas-microsoft-com:datatypes"
        xmlns:fftypes="x-schema:FdtFFDataTypesSchema.xml"
        xmlns:fdt="x-schema:FDTDataTypesSchema.xml">


<!-- ************************************************************************** -->
<!--                    Definition of Attributes                                -->
<!-- ************************************************************************** -->

    <AttributeType name="schemaVersion" dt:type="string" default="1.21"/>

    <!-- ************************************************************************ -->
    <!-- System management information base (SMIB) attributes as in FF-880 section 8 -->

    <!-- "SmAgent" attributes -->
    <AttributeType name="t1" dt:type="ui4"/>
    <AttributeType name="t2" dt:type="ui4"/>
    <AttributeType name="t3" dt:type="ui4"/>

    <!-- "SyncAndScheduling" attributes -->
    <AttributeType name="localTimeDiff" dt:type="ui4"/>
    <AttributeType name="applicationClockSyncInterval" dt:type="ui1"/>
    <AttributeType name="timeLastReceived" dt:type="bin.hex"/>
    <AttributeType name="primaryApplicationTimePublisher" dt:type="ui1"/>
    <AttributeType name="timePublisherAddress" dt:type="ui1"/>
    <!-- "FbSchedule" attributes -->
    <AttributeType name="startTimeOffset" dt:type="ui4"/>

    <!-- ************************************************************************ -->
    <!-- Network management information base (NMIB) attributes as in FF-801 section 8 -->

    <!-- "DlmeLinkSettings" attributes -->
    <AttributeType name="slotTime" dt:type="ui2"/>
    <AttributeType name="perDlpduPhlOverhead" dt:type="ui1"/>
    <AttributeType name="maxResponseDelay" dt:type="ui1"/>
    <AttributeType name="firstUnpolledNodeId" dt:type="ui1"/>
    <AttributeType name="thisLink" dt:type="ui2"/>
    <AttributeType name="minInterPduDelay" dt:type="ui1"/>
    <AttributeType name="numConsecUnpolledNodeId" dt:type="ui1"/>
    <AttributeType name="preambleExtension" dt:type="ui1"/>
    <AttributeType name="postTransGapExtension" dt:type="ui1"/>
```

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```
<AttributeType name="maxInterChanSignalSkew" dt:type="ui1"/>
<AttributeType name="timeSyncClass" dt:type="ui1"/>

<!-- "ScheduleDescriptor" attributes -->
<AttributeType name="timeResolution" dt:type="ui2"/>

<!-- "StackCapabilities" attributes -->
<AttributeType name="fasArTypesAndRolesSupported" dt:type="ui4"/>
<AttributeType name="maxDlsapAddressesSupported" dt:type="ui2"/>
<AttributeType name="maxDlcepAddressesSupported" dt:type="ui2"/>
<AttributeType name="dlcepDeliveryFeaturesSupported" dt:type="ui1"/>
<AttributeType name="agentFunctionsSupported" dt:type="ui2"/>

<!-- "ListCharacteristics" attributes -->
<AttributeType name="maxEntries" dt:type="ui2"/>
<AttributeType name="numPermanentEntries" dt:type="ui2"/>
<AttributeType name="numCurrentlyConfigured" dt:type="ui2"/>
<AttributeType name="firstUnconfiguredEntry" dt:type="ui2"/>
<AttributeType name="dynamicsSupportedFlag" dt:type="boolean"/>
<AttributeType name="statisticsSupported" dt:type="ui1"/>
<AttributeType name="numOfStatisticsEntries" dt:type="ui2"/>

<!-- "VcrStaticEntry" attributes -->
<AttributeType name="fasArTypeAndRole" dt:type="ui1"/>
<AttributeType name="fasDllLocalAddr" dt:type="ui4"/>
<AttributeType name="fasDllConfiguredRemoteAddr" dt:type="ui4"/>
<AttributeType name="fasDllSDAP" dt:type="ui1"/>
<AttributeType name="fasDllMaxConfirmDelayOnConnect" dt:type="ui2"/>
<AttributeType name="fasDllMaxConfirmDelayOnData" dt:type="ui2"/>
<AttributeType name="fasDllMaxDlsduSize" dt:type="ui2"/>
<AttributeType name="fasDllResidualActivitySupported" dt:type="boolean"/>
<AttributeType name="fasDllTimelinessClass" dt:type="ui1"/>
<AttributeType name="fasDllPublisherTimeWindowSize" dt:type="ui2"/>
<AttributeType name="fasDllPublisherSynchronizingDlcep" dt:type="ui4"/>
<AttributeType name="fasDllSubscriberTimeWindowSize" dt:type="ui2"/>
<AttributeType name="fasDllSubscriberSynchronizingDlcep" dt:type="ui4"/>
<AttributeType name="fmsVfdId" dt:type="ui4"/>
<AttributeType name="fmsMaxOutstandingServicesCalling" dt:type="ui1"/>
<AttributeType name="fmsMaxOutstandingServicesCalled" dt:type="ui1"/>

<!-- "VcrDynamicEntry" attributes -->
<AttributeType name="fmsState" dt:type="ui1"/>
<AttributeType name="fmsActualMaxOutstandingServicesCalling" dt:type="ui1"/>
<AttributeType name="fmsActualMaxOutstandingServicesCalled" dt:type="ui1"/>
<AttributeType name="fmsOutstandingServicesCounterCalling" dt:type="ui1"/>
<AttributeType name="fmsOutstandingServicesCounterCalled" dt:type="ui1"/>
<AttributeType name="fasState" dt:type="ui1"/>
<AttributeType name="fasDllActualRemoteAddress" dt:type="ui4"/>
<AttributeType name="fasDllMaxSendingQueueDepth" dt:type="ui1"/>
<AttributeType name="fasDllMaxReceivingQueueDepth" dt:type="ui1"/>

<!-- "VcrStatisticsEntry" attributes -->
<AttributeType name="clearVcrStatistics" dt:type="boolean"/>
<AttributeType name="fasNumOfAbortsCtr" dt:type="ui2"/>
<AttributeType name="fasLocallyGeneratedLastAborted" dt:type="boolean"/>
<AttributeType name="fasReasonLastAborted" dt:type="ui2"/>
<AttributeType name="dllNumOfDtPdusSent" dt:type="ui2"/>
<AttributeType name="dllNumOfDtPdusReceived" dt:type="ui2"/>
<AttributeType name="dllNumOfDlDataTransferTimeoutFailures" dt:type="ui2"/>
<AttributeType name="dllNumOfRcvrQuFullDlDataFailures" dt:type="ui2"/>

<!-- "DlmeBasicCharacteristics" attributes -->
<AttributeType name="basicStatisticsSupportedFlag" dt:type="boolean"/>
<AttributeType name="dlOperatFunctionalClass" dt:type="ui1"/>
<AttributeType name="dlDeviceConformance" dt:type="ui4"/>

<!-- "DlmeBasicInfo" attributes -->
<!-- AttributeType name="slotTime" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="perDlpduPhlOverhead" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="maxResponseDelay" already defined in DlmeLinkSettings /-->
```

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<AttributeType name="thisNode" dt:type="ui1"/>
<!-- AttributeType name="thisLink" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="minInterPduDelay" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="timeSyncClass" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="preambleExtension" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="postTransGapExtension" already defined in DlmeLinkSettings /-->
<!-- AttributeType name="maxInterChanSignalSkew" already defined in DlmeLinkSettings /-->

<!-- "DlmeBasicStatistics" attributes -->
<AttributeType name="numOfDlpduTransmitted" dt:type="ui4"/>
<AttributeType name="numOfGoodDlpduReceived" dt:type="ui4"/>
<AttributeType name="numOfPartialReceivedDlpdu" dt:type="ui4"/>
<AttributeType name="numOfFcsFailures" dt:type="ui4"/>
<AttributeType name="numOfNodeTimeOffsetDiscontinuousChanges" dt:type="ui4"/>

<!-- "DlmeLinkMasterInfo" attributes -->
<AttributeType name="maxSchedulingOverhead" dt:type="ui1"/>
<AttributeType name="defMinTokenDelegTime" dt:type="ui2"/>
<AttributeType name="defTokenHoldTime" dt:type="ui2"/>
<AttributeType name="targetTokenRotTime" dt:type="ui2"/>
<AttributeType name="linkMaintTokHoldTime" dt:type="ui2"/>
<AttributeType name="timeDistributionPeriod" dt:type="ui4"/>
<AttributeType name="maximumInactivityToClaimLasDelay" dt:type="ui2"/>
<AttributeType name="lasDatabaseStatusSpduDistributionPeriod" dt:type="ui2"/>

<!-- "DlmeLinkMasterStatistics" attributes -->
<AttributeType name="numLasRoleDelegOrClaimOrDelegTokenHoldTimeout" dt:type="ui2"/>

<!-- "LastValues" attributes -->
<AttributeType name="frameControlOctetN" dt:type="ui1"/>
<AttributeType name="addressSubfieldsN" dt:type="bin.hex"/>
<AttributeType name="frameControlOctetNminus1" dt:type="ui1"/>
<AttributeType name="addressSubfieldsNminus1" dt:type="bin.hex"/>
<AttributeType name="frameControlOctetNminus2" dt:type="ui1"/>
<AttributeType name="addressSubfieldsNminus2" dt:type="bin.hex"/>
<AttributeType name="frameControlOctetNminus3" dt:type="ui1"/>
<AttributeType name="addressSubfieldsNminus3" dt:type="bin.hex"/>

<!-- "LinkScheduleListCharacteristics" attributes -->
<AttributeType name="numOfSchedules" dt:type="ui1"/>
<AttributeType name="numOfSubSchedulesPerSchedule" dt:type="ui1"/>
<AttributeType name="activeScheduleStartingTime" dt:type="bin.hex"/>

<!-- "PlmeBasicCharacteristics" attributes -->
<AttributeType name="channelStatisticsSupported" dt:type="ui1"/>
<AttributeType name="mediumAndDataRatesSupported" dt:type="bin.hex"/>
<AttributeType name="numOfChannels" dt:type="ui1"/>
<AttributeType name="powerMode" dt:type="ui1"/>

<!-- "PlmeBasicInfo" attributes -->
<AttributeType name="interfaceMode" dt:type="ui1"/>
<AttributeType name="loopBackMode" dt:type="ui1"/>
<AttributeType name="xmitEnabled" dt:type="ui1"/>
<AttributeType name="rcvEnabled" dt:type="ui1"/>
<AttributeType name="preferredReceiveChannel" dt:type="ui1"/>
<AttributeType name="mediaTypeSelected" dt:type="ui1"/>
<AttributeType name="receiveSelect" dt:type="ui1"/>

<!-- "MmeWireStatistics" attributes -->
<AttributeType name="channelNumber" dt:type="ui1"/>
<AttributeType name="totalGoodMsgsSent" dt:type="ui4"/>
<AttributeType name="totalGoodMsgsRcvd" dt:type="ui4"/>
<AttributeType name="numOfJabberFaults" dt:type="ui2"/>
<AttributeType name="numOfInternAndJabberFaults" dt:type="ui2"/>
<AttributeType name="numEndActivityBeforeEndData" dt:type="ui2"/>

<!-- "VcrList" attributes -->
<AttributeType name="listControl" dt:type="ui1"/>

<!-- "DlmeLinkMaster" attributes -->
```

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    <AttributeType name="dlmeLinkMasterCapabilities" dt:type="ui1"/>
    <AttributeType name="primaryLinkMasterFlag" dt:type="boolean"/>
    <AttributeType name="liveListStatusArray" dt:type="bin.hex"/>
    <AttributeType name="maxTokenHoldTime" dt:type="bin.hex"/>
    <AttributeType name="bootOperatFunctionalClass" dt:type="ui1"/>

    <!-- "PlmeBasic" attributes -->
    <AttributeType name="channelStates" dt:type="bin.hex"/>

<!-- ************************************************************************** -->
<!--                      Definition of Elements                                -->
<!-- ************************************************************************** -->

    <!-- ********************************************************************** -->
    <!-- SMIB elements for basic variables as in FF-880 section 8 -->
    <!-- ********************************************************************** -->

    <!-- "SmAgent" elements -->
    <ElementType name="T1" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="t1" required="yes"/>
    </ElementType>
    <ElementType name="T2" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="t2" required="yes"/>
    </ElementType>
    <ElementType name="T3" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="t3" required="yes"/>
    </ElementType>

    <!-- "SyncAndScheduling" elements -->
    <ElementType name="LocalTimeDiff" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="localTimeDiff" required="yes"/>
    </ElementType>
    <ElementType name="ApplicationClockSyncInterval" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="applicationClockSyncInterval" required="yes"/>
    </ElementType>
    <ElementType name="TimeLastReceived" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="timeLastReceived" required="yes"/>
    </ElementType>
    <ElementType name="PrimaryApplicationTimePublisher" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="primaryApplicationTimePublisher" required="yes"/>
    </ElementType>
    <ElementType name="TimePublisherAddress" content="empty" model="closed">
        <attribute type="fdt:nodeId" required="no"/>
        <attribute type="fdt:readAccess" required="no"/>
        <attribute type="fdt:writeAccess" required="no"/>
        <attribute type="timePublisherAddress" required="yes"/>
    </ElementType>

    <!-- "FbSchedule" elements -->
```

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