1 xTEDS Interface with Satellite Data Model

In the SPA network, the xTEDS are actually used and routed by the Satellite Data Model (SDM). The SDM is the messaging protocol and set of primary managers (software) that enable the SPA network to function and which are detailed in the SPA Satellite Data Model Standard. The xTEDS define the communications interface for each sensor, actuator, processor, hub, router, software application and even each SDM primary manager within the SPA network. Every component of the SPA network that receives or produces data must define how it communicates, using the xTEDS. This document explains how to prepare an xTEDS. For an explanation of how SPA uses the xTEDS to communicate, refer to the SPA Satellite Data Model Standard.

2 xTEDS and the XML Schema Language

The XML standard requires a set of rules to which an XML document must conform in order to be considered valid. This set of rules is called a "schema language." XML schema languages express shared vocabularies and provide a means for defining the structure, content and semantics of XML documents. Of the multiple widely-available XML languages (i.e. Document Type Definition (DTD), RELAX NG, and W3C XML Schema), SPA has chosen to use the World-Wide Web Consortium-recommended XML Schema, abbreviated as W3C XML Schema, version 1.0, published in May 2001.

SPA uses a particular XML Schema instance, called an XML Schema Definition (XSD), to fully describe an xTEDS. An XSD defines a type of XML document in terms of what elements and attributes may appear, their relationship to each other, what types of data may be in them, and other qualifying and constraining information. All xTEDS prepared for SPA implementations must conform to the SPA xTEDS Schema and the XML Schema. Conformance with the SPA xTEDS Schema and the XML Schema must be validated using a "validating XML parser."

The current version of the SPA xTEDS Schema is contained in Annex B and detailed information on accessing a suitable validating XML parser is contained in Annex C. The following section provides a general description of a valid SPA xTEDS.

3 xTEDS Format

The xTEDS is written to define communication interfaces between a software application or a hardware device and the rest of the satellite network. All xTEDS have three basic parts:

1) The header, that names the xTEDS and the schema with which it conforms,

2) The component declaration, that provides information on the supported application or device, and

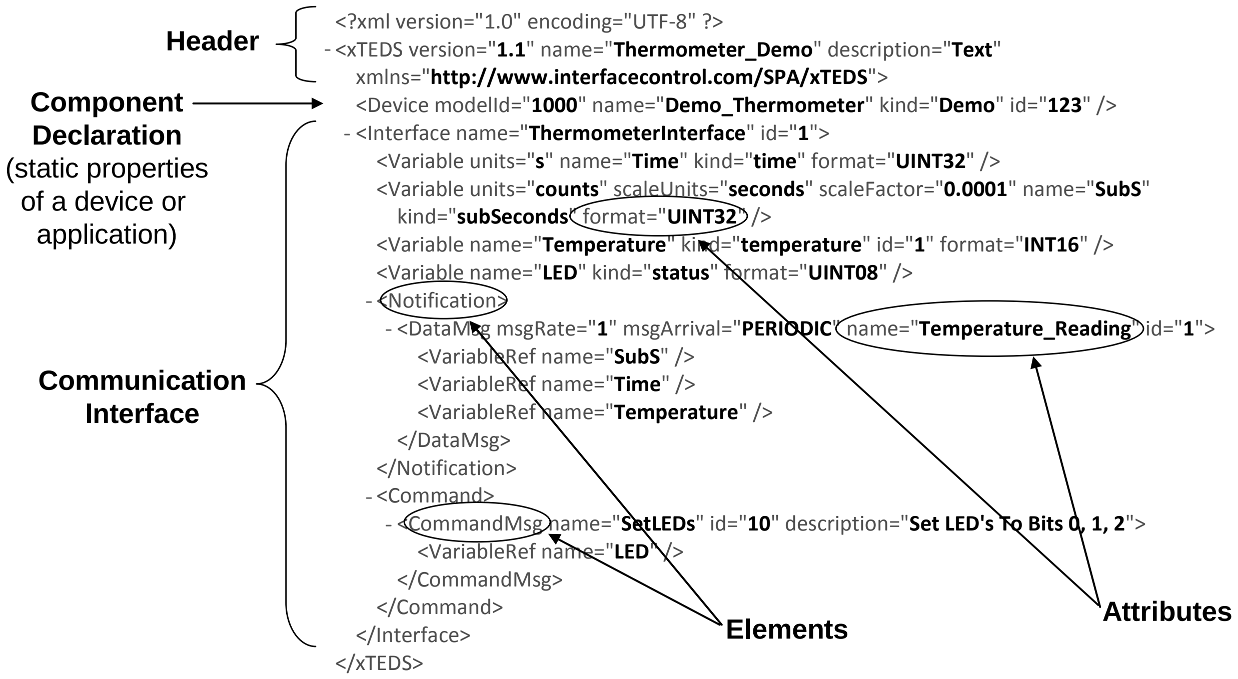
3) All the communication interfaces that the device or application supports.

This information must be presented in the XML format, which says that every piece of information in the xTEDS is either an element or an attribute. An attribute is a single piece of data while an element has one or more attributes or elements under it. Elements can be nested under elements. Using the XML syntax, the code looks like:

```
-<Element1 attribute11=”data11” attribute12=”data12”/>
    <Element2 attribute21=”data21” attribute22=”data22” attribute23=”data23”/>
    <Element3 attribute31=”data31” attribute32=”data32”/>
</Element1>
```

The hyphen indicates the beginning of a nested element, while the slash before the element name shows the end of the nested element. Multiple layers of nesting can be used. All possible xTEDS elements and attributes must be defined in the xTEDS Schema.

All three parts of the xTEDS, listed above, must conform to the XML syntax. Figure 2 provides a sample xTEDS. Note that the top line, part of the header, has a slightly different format to define the XML version and the encoding information.



```
  <?xml version="1.0" encoding="UTF-8" ?>
- <xTEDS version="1.1" name="Thermometer_Demo" description="Text"
    xmlns="http://www.interfacecontrol.com/SPA/xTEDS">
    <Device modelId="1000" name="Demo_Thermometer" kind="Demo" id="123" />
  - <Interface name="ThermometerInterface" id="1">
      <Variable units="s" name="Time" kind="time" format="UINT32" />
      <Variable units="counts" scaleUnits="seconds" scaleFactor="0.0001" name="SubS"
        kind="subSeconds" format="UINT32" />
      <Variable name="Temperature" kind="temperature" id="1" format="INT16" />
      <Variable name="LED" kind="status" format="UINT08" />
    - <Notification>
      - <DataMsg msgRate="1" msgArrival="PERIODIC" name="Temperature_Reading" id="1">
          <VariableRef name="SubS" />
          <VariableRef name="Time" />
          <VariableRef name="Temperature" />
        </DataMsg>
      </Notification>
    - <Command>
      - <CommandMsg name="SetLEDs" id="10" description="Set LED's To Bits 0, 1, 2">
          <VariableRef name="LED" />
        </CommandMsg>
      </Command>
    </Interface>
  </xTEDS>
```

Figure 2 Sample xTEDS shows the three basic parts of an xTEDS, as well as elements and attributes.

Several naming conventions shall be followed in building an xTEDS:

1) Self-describing names are preferred over short, bandwidth-conserving ones.

2) Mixed case is used in names, rather than underscores, to combine multiple words (e.g. scaleFactor).

3) Element names begin with an upper case letter (e.g. Variable).

4) Attribute names begin with a lower case letter (e.g. name).

Actual values, called data (bold text in Figure 2), for attributes are entered to the right of the equal signs. Underscores may be used in data names, but the mixed case naming convention is preferred. Other data standardization and conventions are covered in the Common Data Dictionary in Annex B.

The SPA xTEDS Schema defines the root element as "**xTEDS**" and all elements that can be directly nested under it as "child" elements. Figure 3 shows a diagram of all the elements that can be used in an xTEDS and all possible child elements for each element. There are presently 20 distinct elements that have been defined for the xTEDS. The function of each element is explained in Table 1.

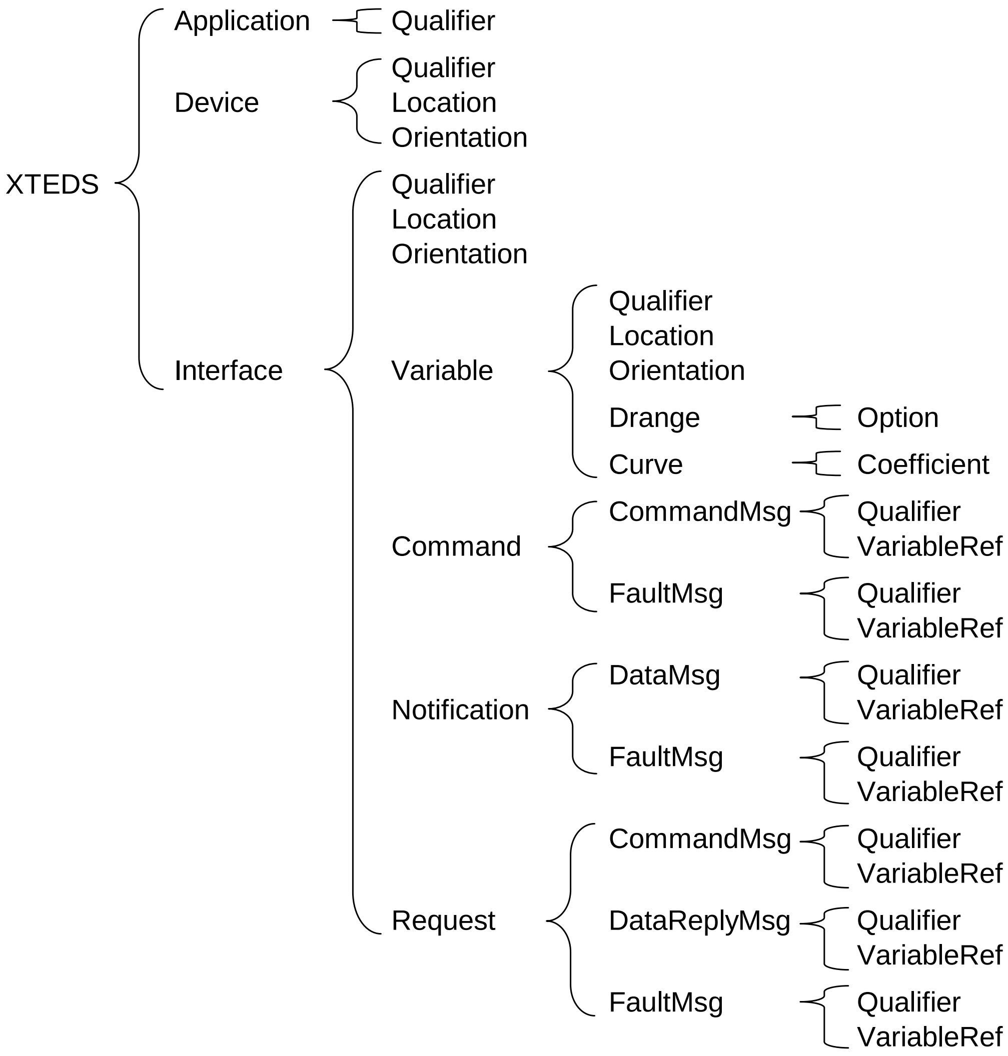


Figure 3 The allowable xTEDS structure shows the complete set of elements and nesting relations.

It is possible for a SPA component to have more than one interface. An interface is defined as a grouping of messages by logical convenience, such as messages related to power or messages related to safety. The groupings are determined by the xTEDS developer, but each interface must be complete and uniquely defined in accordance with the XML and xTEDS Schemas, i.e., messages in one interface cannot reference variables defined in another interface. The same variable can be used in two different interfaces, but it must be completely defined in each interface.

Each element has one or more attributes that describe or define the element. A complete list of the allowable attributes for each element is also provided in Table 1. Annex D provides more detailed descriptions for all the allowable attributes.

Table 1 The complete set of elements and attributes allowed in an xTEDS.

Element	Function	Required Attributes	Optional Attributes
xTEDS	The root element, it defines the static properties and messages interfaces for SPA components.	xlmns (xTEDS namespace) xmlns:xsi (XML namespace) schemaLocation name	description

		version	
Application	Defines the static properties of a SPA software application	componentKey name kind	description version manufacturerId id architecture memoryMinimum operatingSystem pathForAssembly pathOnSpacecraft
Device	Defines the static properties of a SPA hardware device	componentKey name kind	description version manufacturerId modelId versionLetter serialNumber calibrationDate calDueDate powerRequirements sensitivityAtReference referenceFrequency referenceTemperature measurementRange electricalOutput qualityFactor temperatureCoefficient directionXYZ spaUHub spaUPort
Interface	Defines the set of messages and variables implemented by the SPA component	name id	description extends
Qualifier	Provides additional information about the component. It can be used to query for components.	name value	units
Location	Provides device location in Body Coordinates – merged at run-time from an SDMConfig instance document (See the SPA SDM Standard)	x y z units	- none -
Orientation	Provides device orientation – merged at run-time from an SDMConfig instance document (See the SPA SDM Standard)	axis angle units	- none -
Variable	Defines specific information that will be conveyed in a Command, Notification, or Request Message. Variables must be defined at the interface level before they can be used in a specific message.	name kind format	units id description rangeMin rangeMax yLow yHigh rLow rHigh

			length defaultValue invalidValue precision accuracy scaleFactor scaleUnits
Drange	Used to define a range of discrete values that can be assigned to a specific variable	name	description
Option	Used exclusively with Drange Elements to describe a discrete value and a name to be associated with the value.	name value	description alarm
Curve	Defines coefficients for a named polynomial curve for data conversion from raw data counts to engineering units	name	description
Coef (Coefficient)	Used exclusively with Curve Elements to hold the coefficients for a conversion curve. Describes a value and an exponent associated with the value.	exponent value	description
Command	Defines a one-way command operation using an in-only or robust-in-only message exchange pattern with exactly one input command message and an optional fault message.	- none -	- none -
Notification	Defines a one-way data or event notification operation using out-only and robust-out-only message exchange patterns with exactly one output data message and an optional fault message.	- none -	- none -
Request	Defines a two-way request-response operation using in-out and in-optional-out with exactly one input command message followed by one output data reply message and an optional fault message. Using the fault replaces the data reply message and the fault message triggers fault rules.	- none -	- none -
CommandMsg	Defines a command message received by the component	name id	description
DataMsg	Defines a data message sent by the component	name id msgArrival	description msgRate
DataReplyMsg	Defines a data message sent	name	description

	by the component in response to the associated CommandMsg.	id	
FaultMsg	Defines a fault message. Typically, a fault message will contain a reference to a variable that specifies the fault as a Drange	name id	description
VariableRef	Identifies a message parameter previously defined as a variable	name	- none -

Annex A Common Data Dictionary Overview (Informative)

A.1 Purpose

Consistent names for component-specific commands, service requests, or data are essential to the successful implementation of SPA. Component-specific names and their meanings are regularly published in the publicly available Common Data Dictionary (CDD), a lexicon for the SPA vocabulary. This is a living document that will evolve as SPA gains wider use. The parser used to validate the SPA xTEDS actually tests the xTEDS against the CDD to ensure only registered terms are used.

A.2 Organization

There are six Microsoft Excel tables in the CDD, as defined in Table 2.

Table 2 The Common Data Dictionary Tables

<table>
<tr><th>Table Title</th><th colspan="6">Contents</th></tr>
<tr><td>Devices</td><td>Device Kind</td><td>Device Description</td><td colspan="3"></td><td></td></tr>
<tr><td>Applications</td><td>Application Kind</td><td>Application Description</td><td colspan="3">Qualifier Name – to more specifically define the application</td><td>Qualifier Values – To more specifically define the purpose of the application</td></tr>
<tr><td>Variables</td><td>Variable Kind</td><td>Variable Description</td><td colspan="3">Variable Qualifier (Specifically: Representation) – to define the expected format of the variable</td><td></td></tr>
<tr><td>Variable Qualifiers</td><td>Variable Qualifier Name</td><td>Variable Qualifier Value</td><td colspan="3">Variable Qualifier Description</td><td></td></tr>
<tr><td>Variable Units</td><td>Variable Unit</td><td>Variable Unit Description</td><td colspan="3"></td><td></td></tr>
<tr><td rowspan="2">Message Qualifiers</td><td rowspan="2">Message Qualifier Name</td><td rowspan="2">Message Qualifier Value</td><td colspan="3">Required Variable</td><td rowspan="2">Description</td></tr>
<tr><td>Name</td><td>Length</td><td>Format</td></tr>
</table>

A.3 Access

The CDD is currently maintained at AFRL/RVSE and the latest version is included in the TacSat 5 data package.

Annex B SPA xTEDS Schema (Normative)

The following is the complete code for the xTEDS Schema, which is included in the TacSat 5 data package.

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

 edited with XMLSpy v2007 sp1 (http://www.altova.com) by Philip L Courtney
  (private)

  -->
   - <!--

    Style Notes, used throughout the schema:
      - Mixed case is used in names rather than underscores to combine
  multiple words (camelCase).
      - Element and Type names begin with a capital letter.
      - Type names end with the word "Type".
      - Attribute names begin with a lowercase letter.
      - In general, attributes are preferred over elements because they're
  easier to deal with in SAX and DOM, but whenever the Element/Attribute may
  one day carry metadata, elements are used.
      - The bias is toward self-describing names over short, bandwidth
  conserving ones.
      - Major elements or any elements used multiple times are defined with a
  complexType definition
      - Simplicity in the XML files is favored over simplicity in the Schema

  -->
- <xs:schema xmlns:xt="http://www.interfacecontrol.com/SPA/xTEDS"
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    targetNamespace="http://www.interfacecontrol.com/SPA/xTEDS"
    elementFormDefault="qualified" attributeFormDefault="unqualified" version="2.5">
- <xs:element name="xTEDS">
- <xs:annotation>
  <xs:documentation>is the XML Transducer Electronic Data Sheet root element. It
    defines the static properties and message interface for devices and
    services.</xs:documentation>
   </xs:annotation>
- <xs:complexType>
- <xs:sequence>
- <xs:choice>
- <xs:element name="Application" type="xt:ApplicationType">
- <xs:annotation>
  <xs:documentation>defines the static properties of a software
    application.</xs:documentation>
   </xs:annotation>
   </xs:element>
- <xs:element name="Device" type="xt:DeviceType">
- <xs:annotation>
  <xs:documentation>defines the static properties of a device. The attributes are based
     upon the IEEE 1451 TEDS standard.</xs:documentation>
    </xs:annotation>
    </xs:element>
    </xs:choice>
- <xs:element name="Interface" type="xt:InterfaceType" maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>Defines the interfaces - i.e. the variables and messages -
     implemented by the component. Note: Interfaces must be self contained. That is,
     messages in one interface cannot reference variables defined in another
     interface.</xs:documentation>
    </xs:annotation>
- <xs:unique name="Names">
- <xs:annotation>
  <xs:documentation>Variable, Drange, Curve, CommandMsg, DataMsg, DataReplyMsg,
     and FaultMsg names must be unique within an Interface.</xs:documentation>
    </xs:annotation>
  <xs:selector
     xpath=".//xt:Variable|.//xt:Drange|.//xt:Curve|.//xt:CommandMsg|.//xt:DataMs
     g|.//xt:DataReplyMsg|.//xt:FaultMsg" />
  <xs:field xpath="@name" />
    </xs:unique>
- <xs:key name="VariableNameKey">
- <xs:annotation>
  <xs:documentation>The Variable name is a unique key within an
     Interface.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath=".//xt:Variable" />
  <xs:field xpath="@name" />
    </xs:key>
- <xs:keyref name="VariableNameRef" refer="xt:VariableNameKey">
- <xs:annotation>
  <xs:documentation>A VariableRef name must correspond to a Variable name within
     the same Interface.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath=".//xt:VariableRef" />
  <xs:field xpath="@name" />
    </xs:keyref>
    </xs:element>
    </xs:sequence>
- <xs:attribute name="name" type="xt:IdentifierType" use="required">
- <xs:annotation>
  <xs:documentation>identifies the xTEDS.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="version" type="xs:decimal" use="optional">
- <xs:annotation>
  <xs:documentation>specifies the version number of the xTEDS.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string" use="optional">
- <xs:annotation>
  <xs:documentation>describes the purpose of the xTEDS. It is intended for human
    understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
- <xs:unique name="Interfaces">
- <xs:annotation>
  <xs:documentation>Interface id's must be unique within the
    xTEDS.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath=".//xt:Interface" />
  <xs:field xpath="@id" />
    </xs:unique>
    </xs:element>
 - <!--

  Attribute Groups used in xTEDS and SDMConfig Schema

    -->
- <xs:attributeGroup name="commonComponentGroup">
- <xs:annotation>
  <xs:documentation>defines the attributes of xTEDS and SDMConfig Applications and
    Devices.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="componentKey" type="xt:NameType">
- <xs:annotation>
  <xs:documentation>specifies a system unique name for the component. This attribute
    is inserted at run-time from an SDMConfig instance document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:attributeGroup>
- <xs:attributeGroup name="commonApplicationGroup">
- <xs:annotation>
  <xs:documentation>defines the attributes of xTEDS and SDMConfig
    Applications.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="architecture" type="xt:ArchitectureType">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
    document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="memoryMinimum" type="xs:nonNegativeInteger">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
    document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="operatingSystem" type="xt:OperatingSystemType">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="pathForAssembly" type="xs:string">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="pathOnSpacecraft" type="xs:string">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:attributeGroup>
- <xs:attributeGroup name="commonDeviceGroup">
- <xs:annotation>
  <xs:documentation>defines the attributes of xTEDS and SDMConfig
     Devices.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="spaUHub" type="xs:string">
- <xs:annotation>
  <xs:documentation>is the SPA_U_hub identifier. This attribute is inserted at run-time
     from an SDMConfig instance document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="spaUPort" type="xs:nonNegativeInteger">
- <xs:annotation>
  <xs:documentation>is the SPA_U_port address. This attribute is inserted at run-time
     from an SDMConfig instance document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:attributeGroup>
  - <!--

  Attributes Groups used in xTEDS schema

    -->
- <xs:attributeGroup name="xTEDSComponentGroup">
- <xs:annotation>
  <xs:documentation>defines the attributes of xTEDS Applications and
     Devices.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="name" type="xt:IdentifierType" use="required">
- <xs:annotation>
```

```
  <xs:documentation>specifies the component name.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="kind" type="xt:KindType" use="required">
- <xs:annotation>
  <xs:documentation>specifies the class of the component. It must be one of the values
     specified in the Common Data Dictionary.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string">
- <xs:annotation>
  <xs:documentation>describes the component. It is intended for human
     understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="id" type="xt:IdType">
- <xs:annotation>
  <xs:documentation>specifies a numeric id for the component. The value must be
     unique within the xTEDS instance.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="manufacturerId" type="xs:NMTOKEN">
- <xs:annotation>
  <xs:documentation>identifies the manufacturer of the component.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="qualifier" type="xs:token">
- <xs:annotation>
  <xs:documentation>provides additional information about the component. Note: The
     qualifier attribute is deprecated, and will be removed from the next major version
     of the schema. New or revised xTEDS should use the Qualifier element instead of
     this attribute.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:attributeGroup>
- <xs:attributeGroup name="xTEDSApplicationGroup">
- <xs:annotation>
  <xs:documentation>defines the attributes of xTEDS Applications.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="version" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the application's version number.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:attributeGroup>
- <xs:attributeGroup name="xTEDSDeviceGroup">
- <xs:annotation>
  <xs:documentation>defines the attributes of xTEDS Devices.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="modelId" type="xs:NMTOKEN">
- <xs:annotation>
  <xs:documentation>specifies the Model number of the Device.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="versionLetter" type="xs:NMTOKEN">
- <xs:annotation>
  <xs:documentation>specifies the model's version letter.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="serialNumber" type="xs:NMTOKEN">
- <xs:annotation>
  <xs:documentation>is the manufacturer's serial number.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="calibrationDate" type="xs:date">
- <xs:annotation>
  <xs:documentation>specifies the latest date the Device was
    calibrated.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="sensitivityAtReference" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the sensitivity at the reference frequency and
    temperature.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="referenceFrequency" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the frequency at which the sensitivity was
    measured.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="referenceTemperature" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the temperature at which the sensitivity was
    measured.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="measurementRange" type="xs:token">
- <xs:annotation>
  <xs:documentation>is the dynamic range of the Device in engineering
    units.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="electricalOutput" type="xs:token">
- <xs:annotation>
  <xs:documentation>is the dynamic range of the Device in electrical
    units.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
```

```
- <xs:attribute name="qualityFactor" type="xs:token">
- <xs:annotation>
  <xs:documentation>TBD</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="temperatureCoefficient" type="xs:token">
- <xs:annotation>
  <xs:documentation>TBD</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="directionXYZ" type="xs:token">
- <xs:annotation>
  <xs:documentation>is the alignment axis of the Device.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="calDueDate" type="xs:date">
- <xs:annotation>
  <xs:documentation>specifies the next date the Device must be re-
    calibrated.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="powerRequirements" type="xs:token">
- <xs:annotation>
  <xs:documentation>is the power consumed by the Device.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:attributeGroup>
  - <!--

  Global Common Types

    -->
- <xs:simpleType name="FormatType">
- <xs:annotation>
  <xs:documentation>is a restricted type to enumerate the valid format
    values.</xs:documentation>
    </xs:annotation>
- <xs:restriction base="xs:string">
- <xs:enumeration value="INT08">
- <xs:annotation>
  <xs:documentation>Signed Byte (8 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="INT16">
- <xs:annotation>
  <xs:documentation>Signed Short Integer (16 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="INT32">
- <xs:annotation>
  <xs:documentation>Signed Long Integer (32 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="UINT08">
- <xs:annotation>
  <xs:documentation>Unsigned Byte (8 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="UINT16">
- <xs:annotation>
  <xs:documentation>Unsigned Short Integer (16 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="UINT32">
- <xs:annotation>
  <xs:documentation>Unsigned Long Integer (32 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="FLOAT32">
- <xs:annotation>
  <xs:documentation>Single Precision Floating Point (32 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
- <xs:enumeration value="FLOAT64">
- <xs:annotation>
  <xs:documentation>Double Precision Floating Point (64 bits)</xs:documentation>
    </xs:annotation>
    </xs:enumeration>
    </xs:restriction>
    </xs:simpleType>
- <xs:simpleType name="IdType">
- <xs:annotation>
  <xs:documentation>is a restricted integer type to limit IDs from 1 to 255
    inclusive.</xs:documentation>
    </xs:annotation>
- <xs:restriction base="xs:integer">
  <xs:minInclusive value="1" />
  <xs:maxInclusive value="255" />
    </xs:restriction>
    </xs:simpleType>
- <xs:simpleType name="IdentifierType">
- <xs:annotation>
  <xs:documentation>is a restricted type for unique identifiers to specify the pattern
    and limit the maximum length. The pattern is consistent with the syntax for
    identifiers in common languages such as C++.</xs:documentation>
    </xs:annotation>
- <xs:restriction base="xs:ID">
  <xs:maxLength value="32" />
  <xs:pattern value="[a-zA-Z][a-zA-Z0-9_]*" />
    </xs:restriction>
    </xs:simpleType>
- <xs:simpleType name="KindType">
- <xs:annotation>
  <xs:documentation>is a restricted type for class names to specify the pattern and limit
    the maximum length. Enumerations may be added in the
    future.</xs:documentation>
    </xs:annotation>
- <xs:restriction base="xs:NCName">
  <xs:maxLength value="128" />
  <xs:pattern value="[a-zA-Z][a-zA-Z0-9_]*" />
    </xs:restriction>
    </xs:simpleType>
- <xs:simpleType name="NameType">
- <xs:annotation>
  <xs:documentation>is a restricted type for identifiers to specify the pattern and limit
    the maximum length. The pattern is consistent with the syntax for identifiers in
    common languages such as C++.</xs:documentation>
    </xs:annotation>
- <xs:restriction base="xs:NCName">
  <xs:maxLength value="32" />
  <xs:pattern value="[a-zA-Z][a-zA-Z0-9_]*" />
    </xs:restriction>
    </xs:simpleType>
- <xs:complexType name="QualifierType">
- <xs:annotation>
  <xs:documentation>defines the complex type for specifying a
    qualifier.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>specifies the name of the qualifier. It must be one of the qualifier
    names specified in the Common Data Dictionary.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="value" type="xs:NMTOKEN" use="required">
- <xs:annotation>
  <xs:documentation>specifies the value of the qualifier. It must be a valid value as
    specified in the Common Data Dictionary for the qualifier
    name.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="units" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the engineering units of the value.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
  - <!--
  Global Component Types

    -->
- <xs:complexType name="BaseComponentType" abstract="true">
- <xs:annotation>
  <xs:documentation>defines the abstract type used as the base for all component
     types.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="Qualifier" type="xt:QualifierType" minOccurs="0"
     maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>provides additional information about the component. It can be
     used to query for components.</xs:documentation>
    </xs:annotation>
    </xs:element>
    </xs:sequence>
  <xs:attributeGroup ref="xt:commonComponentGroup" />
- <xs:attributeGroup ref="xt:xTEDSComponentGroup">
- <xs:annotation>
  <xs:documentation>defines the common attributes of all
     components.</xs:documentation>
    </xs:annotation>
    </xs:attributeGroup>
    </xs:complexType>
- <xs:complexType name="ApplicationType">
- <xs:annotation>
  <xs:documentation>defines the complex type for specifying an
     application.</xs:documentation>
    </xs:annotation>
- <xs:complexContent>
- <xs:extension base="xt:BaseComponentType">
  <xs:attributeGroup ref="xt:commonApplicationGroup" />
  <xs:attributeGroup ref="xt:xTEDSApplicationGroup" />
    </xs:extension>
    </xs:complexContent>
    </xs:complexType>
- <xs:complexType name="DeviceType">
- <xs:annotation>
  <xs:documentation>defines the complex type for specifying a
     device.</xs:documentation>
    </xs:annotation>
- <xs:complexContent>
- <xs:extension base="xt:BaseComponentType">
- <xs:sequence>
- <xs:element name="Location" type="xt:LocationType" minOccurs="0">
- <xs:annotation>
  <xs:documentation>Device location in Body coordinates. Merged at run-time from an
     SDMConfig instance document.</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:element name="Orientation" type="xt:OrientationType" minOccurs="0"
    maxOccurs="3">
- <xs:annotation>
  <xs:documentation>Device orientation. Merged at run-time from an SDMConfig
    instance document.</xs:documentation>
    </xs:annotation>
    </xs:element>
    </xs:sequence>
  <xs:attributeGroup ref="xt:commonDeviceGroup" />
  <xs:attributeGroup ref="xt:xTEDSDeviceGroup" />
    </xs:extension>
    </xs:complexContent>
    </xs:complexType>
  - <!--

  Global Variable Types

    -->
- <xs:complexType name="CurveType">
- <xs:annotation>
  <xs:documentation>is used to create named polynomial curve elements for data
    conversion from raw data counts to engineering units.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="Coef" maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>is used exclusively with Curve elements to hold the coefficients
    for a conversion curve. Each Coef Element describes a value and a exponent to be
    associated with the value.</xs:documentation>
    </xs:annotation>
- <xs:complexType>
- <xs:attribute name="exponent" type="xs:nonNegativeInteger" use="required">
- <xs:annotation>
  <xs:documentation>specifies the polynomial exponent. The exponent must be unique
    within a Curve.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="value" type="xs:decimal" use="required">
- <xs:annotation>
  <xs:documentation>specifies the coefficient value for this exponent term in the
    polynominal curve.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string">
- <xs:annotation>
  <xs:documentation>describes the coefficient. It is intended for human
    understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
    </xs:element>
    </xs:sequence>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>identifies the polynomial Curve. The name must be unique within
     an Interface.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string">
- <xs:annotation>
  <xs:documentation>describes the Curve. It is intended for human
     understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
- <xs:complexType name="DrangeType">
- <xs:annotation>
  <xs:documentation>is used to create elements that associate static names to discrete
     values. The DrangeType (Discrete Range type) is a container for Option
     elements.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="Option" maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>is used exclusively with DrangeType elements. Each Option
     element describes a discrete value and a name to be associated with the
     value.</xs:documentation>
    </xs:annotation>
- <xs:complexType>
- <xs:attribute name="name" type="xs:Name" use="required">
- <xs:annotation>
  <xs:documentation>specifies the name to be associated with the discrete value. The
     name must be unique within a Drange.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="value" type="xs:nonNegativeInteger" use="required">
- <xs:annotation>
  <xs:documentation>is the discrete value for this name.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string" use="optional">
- <xs:annotation>
  <xs:documentation>describes the Option. It is intended for human
     understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="alarm" type="xs:Name">
- <xs:annotation>
```

```
  <xs:documentation>is the alarm color associated with this state. (RED, YELLOW,
     GREEN). If no alarm is specified, it is assumed to be GREEN.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
    </xs:element>
    </xs:sequence>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>identifies the Drange. The name must be unique within an
     Interface.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string" use="optional">
- <xs:annotation>
  <xs:documentation>describes the Drange. It is intended for human
     understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
- <xs:complexType name="VariableRefType">
- <xs:annotation>
  <xs:documentation>is used to reference a Variable element
     instance.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>specifies the name of a Variable instance. The name must be
     unique within the message and must correspond to a Variable name within the
     same Interface.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
- <xs:complexType name="VariableType">
- <xs:annotation>
  <xs:documentation>defines the complex type for input, output, and state
     variables.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="Qualifier" type="xt:QualifierType" minOccurs="0"
     maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>provides additional information about the Variable. It can be used
     to query for Variables.</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:element name="Location" type="xt:LocationType" minOccurs="0">
- <xs:annotation>
  <xs:documentation>Variable location in Component coordinates.</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:element name="Orientation" type="xt:OrientationType" minOccurs="0"
     maxOccurs="3">
- <xs:annotation>
  <xs:documentation>Variable orientation.</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:choice minOccurs="0">
- <xs:element name="Drange" type="xt:DrangeType">
- <xs:annotation>
  <xs:documentation>associates static names to discrete values.</xs:documentation>
    </xs:annotation>
- <xs:unique name="OptionNames">
- <xs:annotation>
  <xs:documentation>Option names must be unique within a
     Drange.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath="xt:Option" />
  <xs:field xpath="@name" />
    </xs:unique>
    </xs:element>
- <xs:element name="Curve" type="xt:CurveType">
- <xs:annotation>
  <xs:documentation>defines coefficients for a named polynomial curve for data
     conversion from raw data counts to engineering units.</xs:documentation>
    </xs:annotation>
- <xs:unique name="CoefExponents">
- <xs:annotation>
  <xs:documentation>Coef exponents must be unique within a
     Curve.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath="xt:Coef" />
  <xs:field xpath="@exponent" />
    </xs:unique>
    </xs:element>
    </xs:choice>
    </xs:sequence>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>identifies the Variable. The name must be unique within an
     Interface.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="kind" type="xt:KindType" use="required">
- <xs:annotation>
  <xs:documentation>specifies the category (or class) of the Variable. It must be one of
     the values specified in the Common Data Dictionary.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="format" type="xt:FormatType" use="required">
- <xs:annotation>
  <xs:documentation>specifies the representation of the Variable. It must be one of the
     values specified in the Common Data Dictionary.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="qualifier" type="xs:token">
- <xs:annotation>
  <xs:documentation>provides additional information about the Variable. It must be one
     of the values specified in the Common Data Dictionary. It is used with kind to
     search for a particular Variable. Note: The qualifier attribute is deprecated, and
     will be removed from the next major version of the schema. New or revised xTEDS
     should use the Qualifier element instead of this attribute.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="id" type="xs:positiveInteger">
- <xs:annotation>
  <xs:documentation>specifies a numeric id for the variable. Note: id is deprecated and
     will be removed from the next major release of this schema. The id is used to
     specify the memory location accessed by the ASIM code and HWIL (i.e. test by-
     pass). The value must be greater than zero and must be unique within the xTEDS
     instance. Note: the Time and SubSeconds variables do not have an id since the
     timestamp cannot be written by HWIL.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string">
- <xs:annotation>
  <xs:documentation>describes the Variable. It is intended for human
     understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="rangeMin" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the inclusive minimum value of the Variable in the units
     specified in units.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="rangeMax" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the inclusive maximum value of the Variable in the units
     specified in units.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="yLow" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the low warning limit value of the Variable in the units
     specified in units.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="yHigh" type="xs:decimal">
- <xs:annotation>
```

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  <xs:documentation>specifies the high warning limit value of the Variable in the units
     specified in units.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="rLow" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the low alarm limit value of the Variable in the units
     specified in units.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="rHigh" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the high alarm limit value of the Variable in the units
     specified in units.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="length" type="xs:positiveInteger">
- <xs:annotation>
  <xs:documentation>specifies the number of format items in an
     array.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="defaultValue" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the default value of the Variable in the units specified in
     units. Note this is currently defined as a xs:token type to allow aggregate
     assignment of default values to an array. This should be re-
     visited.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="invalidValue" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the value that signifies the Variable value is invalid. The
     value is defined in the units specified by the units attribute. Note this is currently
     defined as a xs:token type to allow aggregate assignment of invalid values to an
     array. This should be re-visited.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="precision" type="xs:nonNegativeInteger">
- <xs:annotation>
  <xs:documentation>specifies the number of digits to the right of the decimal point.
     Valid only for floating point representations.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="units" type="xs:token">
- <xs:annotation>
  <xs:documentation>specifies the units of measure. It must be one of the values
     specified in the Common Data Dictionary.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
```

```
- <xs:attribute name="accuracy" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the accuracy range in the units specified in units. The
     range is defined as plus/minus the value specified, e.g +/- x.xx
     units.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="scaleFactor" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies a scale factor that can be applied to the Variable
     value.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="scaleUnits" type="xs:NMTOKEN">
- <xs:annotation>
  <xs:documentation>specifies the units that result from applying the scaleFactor. The
     units must be defined in the Common Data Dictionary.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
  - <!--

   Global Message Types

    -->
- <xs:complexType name="BaseMsgType" abstract="true">
- <xs:annotation>
  <xs:documentation>defines the abstract type used as the base for all message
     types.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="Qualifier" type="xt:QualifierType" minOccurs="0"
     maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>provides additional information about the message. It can be used
     to query for messages.</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:element name="VariableRef" type="xt:VariableRefType" minOccurs="0"
     maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>identifies a message parameter.</xs:documentation>
    </xs:annotation>
    </xs:element>
    </xs:sequence>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>identifies the message. The name must be unique within an
     Interface.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="id" type="xt:IdType" use="required">
- <xs:annotation>
  <xs:documentation>specifies a numeric id for the message. The value must be unique
    within an Interface.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="description" type="xs:string">
- <xs:annotation>
  <xs:documentation>describes the message. It is intended for human
    understanding.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
- <xs:complexType name="CommandMsgType">
- <xs:annotation>
  <xs:documentation>defines the complex type for command
    messages.</xs:documentation>
    </xs:annotation>
- <xs:complexContent>
  <xs:extension base="xt:BaseMsgType" />
    </xs:complexContent>
    </xs:complexType>
- <xs:complexType name="DataMsgType">
- <xs:annotation>
  <xs:documentation>defines the complex type for data messages.</xs:documentation>
    </xs:annotation>
- <xs:complexContent>
- <xs:extension base="xt:BaseMsgType">
- <xs:attribute name="msgArrival" use="required">
- <xs:annotation>
  <xs:documentation>specifies whether the message arrival is EVENT or PERIODIC.
    EVENT messages are sent aperiodically by the component in response to an
    episode or event. PERIODIC messages are sent by the component at a predictable
    rate specified by the msgRate attribute or by a Variable that can be set by a
    CommandMsg.</xs:documentation>
    </xs:annotation>
- <xs:simpleType>
- <xs:restriction base="xs:NCName">
  <xs:enumeration value="EVENT" />
  <xs:enumeration value="PERIODIC" />
    </xs:restriction>
    </xs:simpleType>
    </xs:attribute>
- <xs:attribute name="msgRate" type="xs:decimal">
- <xs:annotation>
  <xs:documentation>specifies the default message rate in Hz. This attribute does not
    apply if the message arrival is EVENT.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:extension>
    </xs:complexContent>
    </xs:complexType>
- <xs:complexType name="DataReplyMsgType">
- <xs:annotation>
  <xs:documentation>defines the complex type for data reply
    messages.</xs:documentation>
    </xs:annotation>
- <xs:complexContent>
  <xs:extension base="xt:BaseMsgType" />
    </xs:complexContent>
    </xs:complexType>
- <xs:complexType name="FaultMsgType">
- <xs:annotation>
  <xs:documentation>defines the complex type for fault messages. Typically, a fault
    message will contain a reference to a variable that specifies the faults as a
    Drange.</xs:documentation>
    </xs:annotation>
- <xs:complexContent>
  <xs:extension base="xt:BaseMsgType" />
    </xs:complexContent>
    </xs:complexType>
 - <!--

  Global Interface Types

    -->
- <xs:complexType name="InterfaceType" mixed="false">
- <xs:annotation>
  <xs:documentation>defines the complex type for an interface. Note: Interfaces must
    be self contained. That is, messages in one interface cannot reference variables
    defined in another interface.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="Qualifier" type="xt:QualifierType" minOccurs="0"
    maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>provides additional information about the Interface. It can be
    used to query for Interfaces</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:element name="Location" type="xt:LocationType" minOccurs="0">
- <xs:annotation>
  <xs:documentation>Interface location in Component coordinates.</xs:documentation>
    </xs:annotation>
    </xs:element>
- <xs:element name="Orientation" type="xt:OrientationType" minOccurs="0"
    maxOccurs="3">
- <xs:annotation>
  <xs:documentation>Interface orientation.</xs:documentation>
```

```
     </xs:annotation>
     </xs:element>
- <xs:element name="Variable" type="xt:VariableType" minOccurs="0"
     maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>defines the data that can be output via data messages, or input
     via command messages.</xs:documentation>
     </xs:annotation>
     </xs:element>
- <xs:choice minOccurs="0" maxOccurs="unbounded">
- <xs:annotation>
  <xs:documentation>Allows message exchange elements to appear in any
     order.</xs:documentation>
     </xs:annotation>
- <xs:element name="Command" type="xt:CommandMessageExchangeType">
- <xs:annotation>
  <xs:documentation>Defines a One-Way Command Operation using an In-Only or
     Robust In-Only Message Exchange Pattern with exactly one input command
     message and an optional fault message.</xs:documentation>
     </xs:annotation>
     </xs:element>
- <xs:element name="Notification" type="xt:NotificationMessageExchangeType">
- <xs:annotation>
  <xs:documentation>Defines a One-Way Data or Event Notification Operation using
     Out-Only and Robust Out-Only Message Exchange Patterns with exactly one
     output data message and an optional fault message.</xs:documentation>
     </xs:annotation>
     </xs:element>
- <xs:element name="Request" type="xt:RequestMessageExchangeType">
- <xs:annotation>
  <xs:documentation>Defines a Two-Way Request-Response Operation using In-Out and
     In-Optional-Out with exactly one input command message followed by one output
     data reply message and an optional fault message. using the Fault Replaces
     Message and the Message Triggers Fault rules respectively.</xs:documentation>
     </xs:annotation>
     </xs:element>
     </xs:choice>
     </xs:sequence>
- <xs:attribute name="name" type="xt:NameType" use="required">
- <xs:annotation>
  <xs:documentation>identifies the Interface.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="id" type="xt:IdType" use="required">
- <xs:annotation>
  <xs:documentation>specifies a numeric id for the Interface. The value must be unique
     within the xTEDS element.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="description" type="xs:string">
- <xs:annotation>
  <xs:documentation>describes the Interface. It is intended for human
     understanding.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
- <xs:attribute name="extends" type="xt:NameType" use="optional">
- <xs:annotation>
  <xs:documentation>lists the interfaces from which this interface is derived. To avoid
     circular definitions, an interface MUST NOT appear as an element of the set of
     interfaces it extends, either directly or indirectly. Note this is just a placeholder.
     The interface inheritance approach is TBD.</xs:documentation>
     </xs:annotation>
     </xs:attribute>
     </xs:complexType>
- <xs:complexType name="CommandMessageExchangeType">
- <xs:annotation>
  <xs:documentation>defines the message exchange pattern for command
     messages.</xs:documentation>
     </xs:annotation>
- <xs:sequence>
- <xs:element name="CommandMsg" type="xt:CommandMsgType">
- <xs:annotation>
  <xs:documentation>defines a command message received by the
     component.</xs:documentation>
     </xs:annotation>
- <xs:unique name="CommandCommandMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     CommandMsg.</xs:documentation>
     </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
     </xs:unique>
     </xs:element>
- <xs:element name="FaultMsg" type="xt:FaultMsgType" minOccurs="0">
- <xs:annotation>
  <xs:documentation>defines an optional fault message sent by the component. If
     specified, the Message Triggers Fault propagation rule applies. If not specified, No
     Faults are propagated.</xs:documentation>
     </xs:annotation>
- <xs:unique name="CommandFaultMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     FaultMsg.</xs:documentation>
     </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
     </xs:unique>
     </xs:element>
     </xs:sequence>
    </xs:complexType>
- <xs:complexType name="NotificationMessageExchangeType">
- <xs:annotation>
  <xs:documentation>defines the message exchange pattern for notification
     messages.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="DataMsg" type="xt:DataMsgType">
- <xs:annotation>
  <xs:documentation>defines a data message sent by the
     component.</xs:documentation>
    </xs:annotation>
- <xs:unique name="NotificationDataMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     DataMsg.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
    </xs:unique>
    </xs:element>
- <xs:element name="FaultMsg" type="xt:FaultMsgType" minOccurs="0">
- <xs:annotation>
  <xs:documentation>defines an optional fault message. If specified, the Fault Replaces
     Message propagation rule applies. If not specified, No Faults are
     propagated.</xs:documentation>
    </xs:annotation>
- <xs:unique name="NotificationFaultMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     FaultMsg.</xs:documentation>
    </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
    </xs:unique>
    </xs:element>
    </xs:sequence>
    </xs:complexType>
- <xs:complexType name="RequestMessageExchangeType">
- <xs:annotation>
  <xs:documentation>defines the message exchange pattern for request/reply
     messages.</xs:documentation>
    </xs:annotation>
- <xs:sequence>
- <xs:element name="CommandMsg" type="xt:CommandMsgType">
- <xs:annotation>
  <xs:documentation>defines a command message received by the
     component.</xs:documentation>
    </xs:annotation>
- <xs:unique name="RequestCommandMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     CommandMsg.</xs:documentation>
     </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
     </xs:unique>
     </xs:element>
- <xs:element name="DataReplyMsg" type="xt:DataReplyMsgType">
- <xs:annotation>
  <xs:documentation>defines a data message sent by the component in response to the
     associated CommandMsg.</xs:documentation>
     </xs:annotation>
- <xs:unique name="RequestDataReplyMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     DataReplyMsg.</xs:documentation>
     </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
     </xs:unique>
     </xs:element>
- <xs:element name="FaultMsg" type="xt:FaultMsgType" minOccurs="0">
- <xs:annotation>
  <xs:documentation>defines an optional fault message. If specified, the Fault Replaces
     Message propagation rule applies. If not specified, No Faults are
     propagated.</xs:documentation>
     </xs:annotation>
- <xs:unique name="RequestFaultMsgRefs">
- <xs:annotation>
  <xs:documentation>VariableRef names must be unique within a
     FaultMsg.</xs:documentation>
     </xs:annotation>
  <xs:selector xpath="xt:VariableRef" />
  <xs:field xpath="@name" />
     </xs:unique>
     </xs:element>
     </xs:sequence>
     </xs:complexType>
   - <!--

  Common Simple Types used in xTEDS and SDMConfig Schema

     -->
- <xs:simpleType name="AngleUnitsType">
- <xs:annotation>
  <xs:documentation>Simple type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
     </xs:annotation>
- <xs:restriction base="xs:string">
```

```
   <xs:enumeration value="radians" />
   <xs:enumeration value="degrees" />
     </xs:restriction>
     </xs:simpleType>
 - <xs:simpleType name="ArchitectureType">
 - <xs:annotation>
   <xs:documentation>Simple type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
     </xs:annotation>
 - <xs:restriction base="xs:string">
   <xs:enumeration value="SPAU" />
   <xs:enumeration value="Intel" />
   <xs:enumeration value="PPC7404" />
   <xs:enumeration value="PPC755" />
   <xs:enumeration value="PPC405" />
     </xs:restriction>
     </xs:simpleType>
 - <xs:simpleType name="AxisType">
 - <xs:annotation>
   <xs:documentation>Simple type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
     </xs:annotation>
 - <xs:restriction base="xs:string">
   <xs:enumeration value="X" />
   <xs:enumeration value="Y" />
   <xs:enumeration value="Z" />
     </xs:restriction>
     </xs:simpleType>
 - <xs:simpleType name="LengthUnitsType">
 - <xs:annotation>
   <xs:documentation>Simple type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
     </xs:annotation>
 - <xs:restriction base="xs:string">
   <xs:enumeration value="m" />
   <xs:enumeration value="cm" />
   <xs:enumeration value="in" />
     </xs:restriction>
     </xs:simpleType>
 - <xs:simpleType name="OperatingSystemType">
 - <xs:annotation>
   <xs:documentation>Simple type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
     </xs:annotation>
 - <xs:restriction base="xs:string">
   <xs:enumeration value="Linux24" />
   <xs:enumeration value="Linux26" />
   <xs:enumeration value="Win32" />
   <xs:enumeration value="VXWorks" />
```

```
    </xs:restriction>
    </xs:simpleType>
  - <!--

  Common Complex Types used in xTEDS and SDMConfig Schema

    -->
- <xs:complexType name="LocationType">
- <xs:annotation>
  <xs:documentation>Complex type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="x" type="xs:double" use="required">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="y" type="xs:double" use="required">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="z" type="xs:double" use="required">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="units" type="xt:LengthUnitsType" use="required">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
- <xs:complexType name="OrientationType">
- <xs:annotation>
  <xs:documentation>Complex type definition used in xTEDS and SDMConfig
     schema.</xs:documentation>
    </xs:annotation>
- <xs:attribute name="axis" type="xt:AxisType" use="required">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="angle" type="xs:double" use="required">
- <xs:annotation>
```

```
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
- <xs:attribute name="units" type="xt:AngleUnitsType" use="required">
- <xs:annotation>
  <xs:documentation>merged at run-time from an SDMConfig instance
     document.</xs:documentation>
    </xs:annotation>
    </xs:attribute>
    </xs:complexType>
    </xs:schema>
```

Annex C SPA xTEDS Validating Parsers (Informative)

C.1 General

The W3C XML Schema was designed with the intent that determination of a document's validity would produce a collection of information adhering to specific data types. It can be used with validation software in order to ascertain whether a particular XML document is of that type, and to produce a Post Schema Validation Infoset (PSVI). In the PSVI for an xTEDS, each element, attribute, and in general, any node of the xTEDS XML document is assigned the data type from the xTEDS schema.

Version Number Conventions:

- Advances in minor versions must be a compatible superset of earlier minor versions of the same major version, i.e., backward compatibility is guaranteed.
- Advances in major version are not required to be supersets of earlier versions and are not guaranteed to be backward compatible.
- The xTEDS schema filename includes the major version number and is referenced in the xTEDS element's xsi:schemaLocation attribute.

xTEDS are validated against the latest xTEDS schema version using a validating parser. A suitable validating XML parser for developing and validating the xTEDS file is included in the TacSat 5 data package.

Annex D SPA xTEDS Allowable Attributes (Normative)

Table 3 The complete set of attribute descriptions for an xTEDS. Definitions may vary slightly in usage based on context sensitivity.

Attribute	Description
accuracy	Specifies the accuracy range in the specified unit. Range is defined as plus or minus the value specified, e.g. +/- x.xx units.
alarm	The alarm color associated with a state (red, yellow, green). Default is green.
angle	Merged at run-time from an SDMConfig instance document
architecture	Merged at run-time from an SDMConfig instance document
axis	Merged at run-time from an SDMConfig instance document
calDueDate	Specifies the next date the device must be recalibrated
calibrationDate	Specifies the latest date the device was calibrated
componentKey	Specifies a system-unique name for the component. Merged at run-time from an SDMConfig instance document.
defaultValue	Specifies the default value of a variable in the specified unit
description	Describes the named element; intended for human understanding
directionXYZ	Alignment axis of the device
electricalOutput	Dynamic range of the device in electrical units
exponent	Specifies the polynomial exponent. Must be unique within a curve.
extends	Lists the interfaces from which this interface is derived. To avoid circular definitions, an interface must not appear as an element of the set of interfaces it extends, either directly or indirectly. Note this is just a placeholder? The interface inheritance approach is TBD.
format	Specifies the representation of the variable. Format must be one of the values specified in the CDD.
id	Specifies a numeric id for the interface. Value must be unique within the xTEDS. Deprecated.
invalidValue	Specifies the value for the variable is invalid.
kind	Specifies the category or class of the variable. Kind must be one of the values specified in the CDD.
length	Specifies the number of format items in an array for a vector
manufacturerId	Identifies the manufacturer of the component
measurementRange	Dynamic range of the device in engineering units
memoryMinimum	Merged at run-time from an SDMConfig instance document

modelId	Specifies the model number of the device
msgArrival	Specifies whether the message arrival is EVENT or PERIODIC. EVENT messages are sent aperiodically by the component in response to an episode or event. PERIODIC messages are sent by the component at a predictable rate specified by the msgRate attribute or by a variable that can be set by a CommandMsg.
msgRate	Specifies the default message rate in Hz. Does not apply if the message arrival is EVENT.
name	Identifies the name of the element. Must be unique within an interface.
operatingSystem	Merged at run-time from an SDMConfig instance document
pathForAssembly	Merged at run-time from an SDMConfig instance document
pathOnSpacecraft	Merged at run-time from an SDMConfig instance document
powerRequirements	Power consumed by the device
precision	Specifies the number of digits to the right of the decimal point. Valid only for floating point representations.
qualifier	Deprecated
qualityFactor	TBD
rangeMax	Specifies the inclusive maximum value of a variable in the specified unit
rangeMin	Specifies the inclusive minimum value of a variable in the specified unit
referenceFrequency	Specifies the frequency at which the sensitivity was measured
referenceTemperature	Specifies the temperature at which the sensitivity was measured
rHigh	Specifies the high alarm limit value of the variable in the specified unit
rLow	Specifies the low alarm limit value of the variable in the specified unit
scaleFactor	Specifies a scale factor that can be applied to a variable value
scaleUnits	Specifies the unit that results from applying the scaleFactor. Unit must be defined in the CDD.
schemaLocation	Used in the header to specify the electronic location of the xTEDS schema
sensitivityAtReference	Specifies the sensitivity of the device at the reference frequency and temperature
serialNumber	Specifies the manufacturer’s serial number for the device
spaUHub	The SPA-U hub identifier. Merged at run-time from an SDMConfig instance document
spaUPort	The Spa-U port address. Merged at run-time from an SDMConfig instance document
temperatureCoefficient	TBD

units	Specifies the unit of measure. Unit must be one of the values specified in the CDD.
value	Discrete value corresponding to a specific element name
version	Specifies the version number of the element
versionLetter	Specifies the version letter of the device model
x	Merged at run-time from an SDMConfig instance document
xlmns	xTEDS namespace
xmlns:xsi	XML namespace
y	Merged at run-time from an SDMConfig instance document
yHigh	Specifies the high warning limit value of the variable in the specified unit
yLow	Specifies the low warning limit value of the variable in the specified unit
z	Merged at run-time from an SDMConfig instance document