PNNL-25140

Pacific Northwest
SMART GRID
DEMONSTRATION PROJECT

PNWSGD Data Collection

Non-Transactive Data

XML Schema and Examples
Release 3.0

Authors:
Olga A. Kuchar, Battelle
Stephen T. Elbert, Battelle
Cristina Marinovici, Battelle

Date: January 17, 2015

LEGAL NOTICE

This report was prepared by Battelle Memorial Institute (Battelle) as an account of sponsored research activities. Neither Client nor Battelle nor any person acting on behalf of either:

MAKES ANY WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, process, or composition disclosed in this report may not infringe privately owned rights; or

Assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, process, or composition disclosed in this report.

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by Battelle. The views and opinions of authors expressed herein do not necessarily state or reflect those of Battelle.

Revision History

Version	Date	Authors	Changes
3.0	January 17, 2015	O. Kuchar	Updated document for public release. Minor: Updated schemata version list and associated appendices
2.9	September 24, 2012	S. Elbert	Minor: Added "Demand Shifter Status Change" to the DeviceEventTypes list and "Manual" and "Auto" to the DeviceStatusTypes list
2.8	September 7, 2012	O. Kuchar	Minor: Appendix B PNWSGDSchema-MeasurementQualifierTypes enumeration updated by deleting the "NULL" enumeration. This causes errors during Netezza data loading.
2.7	August 29, 2012	O. Kuchar	Minor: Appendix B PNWSGDSchema-TestCaseEventTypes enumeration updated with preferred and negotiated lists. Minor: Appendix B PNWSGDSchema-TestCaseStatusTypes enumeration updated with preferred and negotiated lists. Minor: Appendix B PNWSGDSchema-MeasurementUnitTypes enumeration updated to include "unitless"
2.6	July 31, 2012	S. Elbert	Minor: Appendix B PNWSGDSchema-MeasurementUnitTypes enumeration updated to include "#"
2.5	July 3, 2012	S. Elbert	Minor: added values to Appendices B and N: PNWSGDSchema-MeasurementValueTypes
2.4	May 15, 2012	S. Elbert	Minor: added values to Appendix N PNWSGDSchema-MeasurementValueTypes

Version	Date	Authors	Changes
2.3	May 10, 2012	S. Elbert O. Kuchar	Change 8.1.1 MeasurementQualifier text to match schema Minor: PNWSGDSchema-MeasurementUnitTypes The schema was updated to follow standard written measurement units, while still allowing acceptable variations. For example, kW·h is the standard, but kWh is also acceptable. Minor: PNWSGDSchema-DeviceEventTypes Added “Relay meter controller” to the list of enumerations. Minor: Added a table that denotes all the schemata and their associated versions that are bundled with this release.
2.2	March 23, 2012	S. Elbert	Minor: PNWSGDSchema-TestCaseStatusTypes Added new enumerations: “DRUs curtailed (TRUE)”; “DRUs restored (FALSE)”; “CVR engaged level 1”; “CVR engaged level 2”” “CVR engaged level 3”; “CVR engaged (TRUE)”; “Normal operation (TRUE)”; and “Normal operation (FALSE)”. Minor: PNWSGDSchema-TestCaseEventTypes Added new enumerations “DRU change” and “CVR change”.
2.1	March 22, 2012	O. Kuchar	Minor: PNWSGDSchema-MeasurementQualifierTypes In this schema, there was an extra space between the word average and (nominal) in the string "Interval average (nominal)". The extra space was removed.

Version	Date	Authors	Changes
2.0	February 27, 2012	O. Kuchar	Major: MembershipConfigTransaction schema change due to duplicate definition for TestCaseID. The TestCaseID attribute definition and usage has been removed and only the TestCaseID element is used. Updated Section 2.3, Appendix A, B, C Major: MembershipEventTransaction schema change due to a logic error. The structure has now been simplified. Updated Section 2.4, Appendix A, B, D Minor: Added "Temperature" to the MeasurementValueTypes schema and "°C", "°F", and "K" to MeasurementUnitTypes schema. Updated Appendix A, B Minor: Fixed Figure 4-2.
1.1	February 10, 2012	S. Elbert	Default initial time: 1/1/11 Summary Expand Executive Summary Align Summaries with Data Lists actions
1.0 Approved	February 4, 2012	O. Kuchar	Updated sections 1.0, 4.2, 4.5, 5.0 Add new section 6 (location) Updated appendicies A, B, F, G, H Add new appendix I (location)
1.0 Revision1	January 25, 2012	S. Elbert	Add section 1.2
1.0 Revision1	January 24, 2012	S. Elbert	Incorporate L. Connell feedback
1.0 Revision1	January 22, 2012	O. Kuchar, S. Elbert, C. Mariovinci (Battelle)	Add sections 6 - 8
1.0 Revision0	January 19, 2012	S. Elbert	Incorporate Battelle feedback
1.0 Revision0	January 10, 2012	O. Kuchar, S. Elbert	Draft sections 1-5

Schemata List and their Versions that Compose this Release

Schema File	Schema Version (found in <xs:schema … version="x.x")
PNWSGDSchema.xsd	2.3
PNWSGDSchema-DeviceEventTypes.xsd	1.3
PNWSGDSchema-DeviceStatusTypes.xsd	1.3
PNWSGDSchema-DeviceTypes.xsd	1.1
PNWSGDSchema-MeasurementQualifierTypes.xsd	1.4
PNWSGDSchema-MeasurementUnitTypes.xsd	1.7
PNWSGDSchema-MeasurementValueTypes.xsd	1.4
PNWSGDSchema-TestCaseEventTypes.xsd	1.9
PNWSGDSchema-TestCaseStatusTypes.xsd	1.9

Review Documentation Template

Project-Level Infrastructure Participants

[X]	Version Reviewed	Date Review Completed	Company	Reviewer Name(s)
X	1.0R0	1/24/2012	3TIER	Amy Vandervoort
			Alstom Grid	
X	1.0R0		Battelle	D. Hammerstrom, T. Esram, S. Elbert, L. Connell, R. Singh, O. Kuchar, C. Marinovici
X			BPA	
X			IBM	
X			Netezza	
X			QualityLogic	

Subproject Utility Participants

[X]	Version Reviewed	Date Review Completed	Company	Reviewer Name(s)
X			Avista Utilities	
X			Benton PUD	
X			Ellensburg	
X			Flathead	
X			Idaho Falls	
X			Lower Valley	
X			Milton-Freewater	
X			NorthWestern Energy	
X			Peninsula Light	
X	1.0R0		Portland General Electric	Jeff Poppe
X			U. Washington & SCL	

Executive Summary

This document defines the Pacific Northwest Smart Grid Demonstration Data Collection implementation for non-transactive data[1], the XML schemata, and a few data examples (both in XML and CSV). The PNWSGD Transactions Schema is defined in eXtensible Mark-up Language (XML) format.

Section 1.0 describes the top level of the schema and the roles played by each of the components.

Section 2.0 Membership Transactions describes the transactions involving which data streams are members of which test case and the role they play. This role may be as a *Control Member* (baseline data), as an *Experimental Member*, or *Not a Member*. This information is covered by two types of transactions: *MembershipConfigTransaction* and *MembershipEventTransaction*. Configuration transactions determine the current state of membersips of the data streams with respect to the test cases; event transactions allow membership changes to be made and tracked historically.

Section 3.0 Test Case Transactions describes events relevant to the status of test cases. These events, chosen from a pre-determined list, allow the analysts to track elements that may have an impact on the test case results, such as asset engagement and configuration.

Section 4.0 Device Transactions describes how information about devices is collected and how events reported by devices are captured. Only events listed in a predetermined list are reported.

Section 5.0 Customer Transaction describes how to track customers in the context of a device. This will be useful in only limited contexts.

Section 6.0 Location Information Transaction provides a mechanism for connecting data streams to a service location. Not all data streams have a location, but most will be related to a point in the distribution network.

Section 7.0 Data Stream Measurements describes collecting the actual data from the data streams.

Most of the remainder of the document deals with metadata, the data about the data. This is how the data itself is captured.

Section 8.0 Data Stream Information describes how the data streams are defined. Data streams connect locations with time varying data (or even one-time data).

Section 9.0 Summary provides a checklist of what a utility needs to do to report non-transactive data to the Data Collection System.

---

[1] Non-transactive data is defined as information or measurements that are **actual/factual**; transactive data is defined as data that is predictive information. This document does not apply to transactive data.

Contents

Figures

1.0 PNWSGD Transactions Schema

This section describes the PNWSGD Transactions Schema. The full PNWSGD Transactions Schema is in Appendix A.

1.1 Schema

Figure 1-1 depicts the PNWSGD Transactions Schema at its top level.

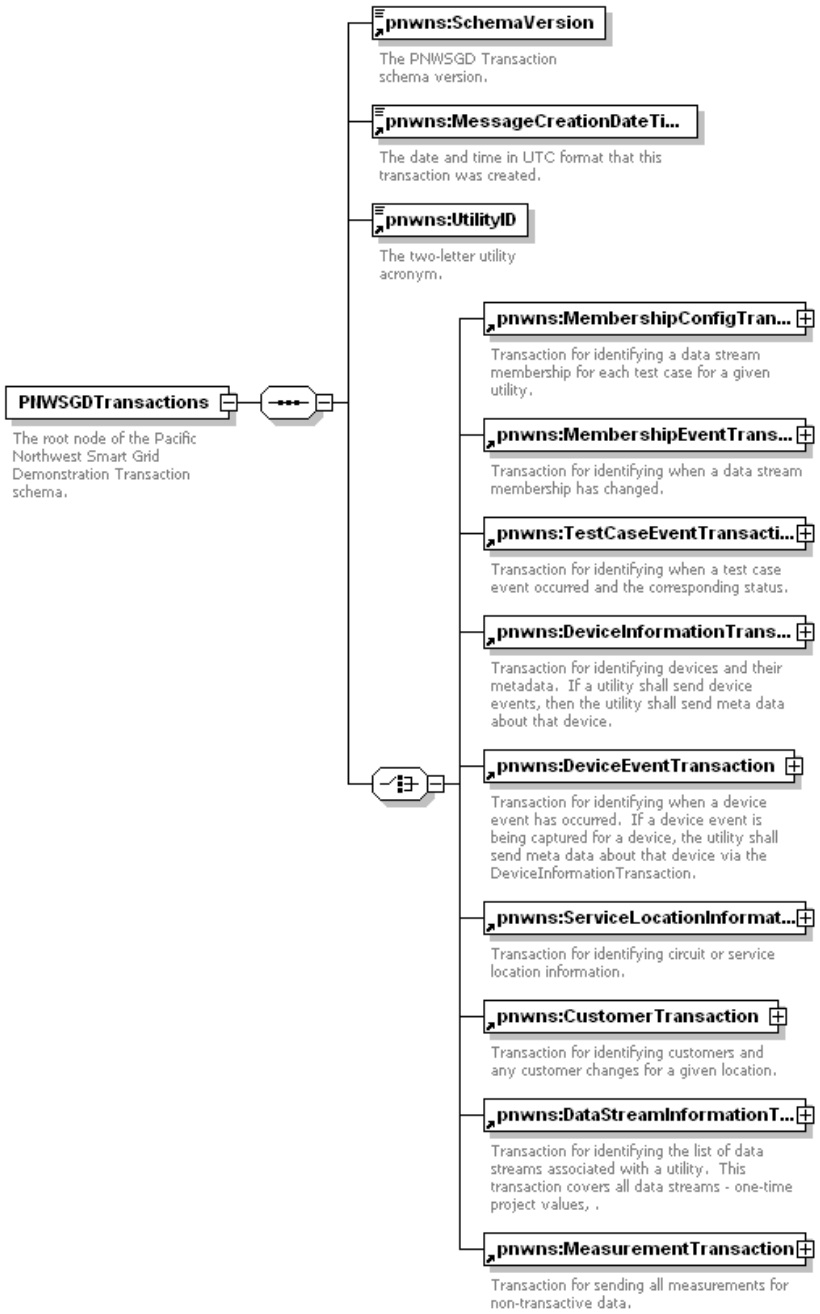


Figure 1-1. Top-level of the PNWSGD Transactions Schema.

Within the schema, the top node is the *PNWSGDTransactions* element that contains four child elements: *SchemaVersion*; *MessageCreationDateTime*; *UtilityID*; and choice of *MembershipConfigTransaction*, *MembershipEventTransaction*; *TestCaseEventTransaction*; *DeviceInformationTransaction*; *DeviceEventTransaction*; *ServiceLocationInformationTransaction*; *CustomerTransaction*; *DataStreamInformationTransaction*; and *MeasurementTransaction*. Each of these is described in the following sections.

1.1.1 XML Instance Information

The schema depicted in Figure 1-1 immediately has three elements that will be required for parsing and business-logic purposes:

- *SchemaVersion* element contains the version number that an XML instance can be validated against. The type is a restricted string of the form **dd.d** where d is an integer between 0-9. We envision the schema evolving over time. We also want to allow an instance to validate using multiple versions of a schema thus not requiring all software to be updated if the schema updates. The schema version in this document is 2.3.

- *MessageCreationDateTime* element contains the date and time that this PNWSGD Transactions instance was created; this date/time is in UTC format. Its purpose is to track when the *message* was *created.*

- *UtilityID* element is of type string and contains a list of the 2-letter utility abbreviations participating in the project.

These three elements are immediately located at the top of the schema so that a parser can quickly extract this information and before reading the rest of the XML instance, can determine how to read the instance and if this instance is needed to be read.

1.1.2 Data Collection Transactions

The remaining elements are the different types of transactions that will be processed by the Data Collection software for collecting non-transactive data in the Netezza database. Each of these elements is described in detail in the remainder of this document. Each section will cover the transaction, the schema, and a few XML and CSV examples.

1.2 Transaction Overview

The bulk of the non-transactive data consists of periodic measurements, discussed in detail in section 7.1. This is represented by a numeric value (the measurement, although it could be from anywhere such as a calculation), the units of the measurement, a time period, a status and a data stream identifier. The time period actually consists of a start time, an end time, and the interval duration. Only two of these may be unique; three are used for the sake of redundancy. Non-periodic data can be collected with this mechanism too; in that case the start time is the same as the end time and the interval is zero. The element that makes the data uniquely identifiable is the data stream identifier. In this context, a data stream is the

set of numeric values over all of the time periods represented. For each data stream, there is a Data ID in the Data List tab of each utilities TestCase_DesignAndData Microsoft™ Excel spreadsheet.

Before the data can be analyzed, however, the analyst needs a way to find the data and what it means, i.e., the data stream needs to be defined—in fact it must be defined before the data can be put in the database. The definition of the data streams is the purpose of the data stream information transaction, discussed in detail in section 8.1. The information represented includes the type of measurement the data stream represents (selected from a predefined list that includes power, voltage, distance, frequency, etc.). It also includes a measurement qualifier that is also selected from a predefined list that includes instantaneous, interval average, interval maximum, interval minimum, etc. Since many measurements come from a device, there is an option to specify a device and service location. A text description may also be provided.

If a data stream is coming from a device, it and its location need to be defined. Collecting this information, or metadata, is the purpose of the device information transaction, discussed in detail in section 4.1. The key information is the list of data streams the device is supplying. This is especially important if a utility is providing device events. Some of the other information that may be collected (many elements are optional) relates to the customer, manufacturer, model, version, when the device was put in service and when it was taken out.

Devices are not static. Things happen, alarms go off, that are relevant to the analysis of the data. This status information is collected through the device event transaction, discussed in detail in section 4.3 and following subsections. For a given device, the elements reported are the time the event occurred, what the event was (again selected from a predetermined list), and what the current status of the device is (again selected from a predetermined list). These predetermined lists for device events and status shall be agreed upon between each utility and Battelle prior to sending any device events.

Devices may have customers associated with them. Customers move and the analysts would like to know if a customer should move from a control group environment to an experimental group environment. Tracking these movements is the purpose of the customer change transaction, discussed in detail in section 5.0, which associates a unique customer identifier with the start and (optional) end time at a particular service location.

In addition, devices and customers have locations associated with them. Utilities can provide metadata about a location, discussed in detail in section 6.0, which provides the opportunity for utilities to describe more information about a particular location identifier.

Data streams and their associated locations, devices, events and customers still need to be connected to the test cases that are the focus of much of the analysis. This is accomplished with the membership configuration transaction, discussed in detail in section 2.3. A data stream is either a control member (CM), an experiment member (EM), or not a member (NM) of a test case. For the analyst to see a data stream in the context of a particular test case, that data stream must be declared as an active member (a control member or experiment member) of that test case. By default, no data stream is a member of any test case until it is declared to be so with a *MembershipConfigTransaction* message.

If for some reason (equipment failure resulting in faulty data) a data stream needs to be removed from active participation in a test case, or its membership changes from control to experiment or back, a

membership event transaction message is sent declaring the new membership of that test case effective at the specified time. These messages are discussed in detail in section 2.4.

There is one final type of non-transactive transaction. That is the test case event transaction, described in detail in Section 3.0. These are events (again selected from a predetermined list) that affect all the devices, locations and data streams associated with a specific test case effective at the specified time. These predetermined lists for test case events and status shall be agreed upon between each utility and Battelle prior to sending any test case events.

2.0 Membership Transactions

One of the key components to the data collection process is the notion of data streams, test cases, and memberships. This section will describe these concepts, how they are recorded, and their format for the PNWSG Data Collection System.

2.1 Test Cases and Data Lists

Each utility has been working with the subproject deputies to formulate test case design and data lists to achieve the project's objectives for the Metrics and Benefits Reporting Plan. These test case designs and data lists are captured in Microsoft Excel workbooks on the PNWSG SharePoint site under each subproject's Test Case folder. An example test case from Milton-Freewater City Light and Power is depicted in Figure 2-1.

MF-01-1.4	01. Load Control with Demand Response Units - (DRUs)	1. Transactive control	4. Automated Real Time (ART)	BPA monthly Peak demand management. 800 ACLARA demand response units installed on large resistive loads in residential homes. Controlled by the Milton-Freewater SCADA system to provide load-shedding capabilities on feeders 1 - 13.
MF-02-1.2	02. Conservation Voltage Reduction - (CVR)	1. Transactive control	2. Automated Direct Demand Response (ADDR)	This asset will be controlled locally by the Milton-Freewater utility via SCADA control of the substation voltage regulators. Feeders 5 and 6 from the Milton Substation and 7 through 13 from the Freewater Substation will have decreased voltage by 1 1/2 % per step, up to 3 steps. The ability to change voltage will be used in peak shaving on feeders 5 - 13.
MF-03-1.2	03. DRU voltage threshold controlled water heaters - demand reduction response	1. Transactive control	2. Automated Direct Demand Response (ADDR)	The City of Milton-Freewater will establish an incentive program for 100 DRUs placed on water heaters. These DRUs will be programmed to shed the water heater load when the line voltage drops below the programmed threshold voltage. Freewater # 1, Freewater # 2 and the Milton Substations will lower voltage by three steps during high demand periods to manage peak demands. During this voltage reduction, the voltage sensitive disconnect devices controlling the water heaters will disconnect those units.

Figure 2-1. Test Case excerpt from Milton-Freewater City Light and Power.

Once the test cases were designed, data lists were created to determine what data would be provided by the utilities for the analysis of each test case. Figure 2-2 shows an example of some data list items.

MF-01-1.4	MF-1-1.4-IM-1-(feeders 1 thru 13) customer # 1 thru 800	Hourly Customer Electricity Usage for approximately 800 Milton-Freewater customers who have Demand Response Units (DRU) installed.	kWh/h for 1 hour (i.e., average kW)	Extracted from daily meter reads for all Milton-Freewater customers who have a DRU installed.	D	Approximately 73,000 (# customers having DRU) x (91 days per quarter) = 800 x 91
MF-01-1.4	MF-1-1.4-IM-200-1	Asset System Engagement Time Series - Engagement of DRUs to Transactive Control	0 = Normal 1 = DRUs Curtailed	Status of asset system to be collected via transactive control system (?)	D	TBD

Figure 2-2. Data list excerpt from Milton-Freewater City Light and Power.

Using this information, subproject deputies and utilities will work together to further refine each data list entry into a set of data stream identifications, as described in the next section.

2.2 Data Streams

The concept of a data stream was introduced in the project due to the complexities of gathering and analyzing test case data. An instrument or device (for example, meter) could (potentially) have more than one type of measurement that it records. For example, a meter could potentially record total kilowatts, total kilovolt-ampere reactive (kVar), etc. Even more intriguing is that a data stream could be a control member of one test case for a given utility but an experimental member for another test case for that same utility.

A data stream is any ordered pair (s,Δ) where s is a sequence of values, e.g., measurements, meter readings, etc., and Δ is a sequence of positive, real time intervals. Examples of data streams are kW readings from a meter for some time period, kVar aggregated data from multiple meters, SAIDI calculations, etc. Data streams can be actual measurements from single devices, derived measurements from multiple devices, or calculated values, but all must be associated with a time period.

2.2.1 Data Stream Identification

Each utility will define a set of data streams associated with each data list entry in their respective DesignandData Microsoft Excel workbook on the Data List tab. Once these data streams have been identified by the utility (in collaboration with the subproject deputy), each utility must provide this data stream information in the format specified in the PNWSG Transactions Schema under the *DataStreamInformationTransaction* element (see Section 8.0) and the *MembershipConfigTransaction* element.

2.3 MembershipConfigTransaction

Once a utility has identified all of their data streams, the utility must also describe how each data stream relates to each of its test cases; Figure 2-3 depicts such a matrix.

AV-DS003	AV-01-1.4	AV-01-3.2	AV-02-3.2	AV-03-1.1	AV-04-3.2
Experimental Member	✓				
Control Member				✓	
Not a Member		✓	✓		✓

Figure 2-3. Example of a membership matrix for a unique data stream identified as AV-DS003.

Once such a matrix has been defined by the utility, the information in this matrix is sent to the PNWSG Data Collection System in either XML or CSV formats, described in the next section.

2.3.1 XML Format

The utility shall send the data stream configuration information as defined in the PNWSG Transaction Schema using the *MembershipConfigTransaction* element. Figure 2-4 depicts a visual representation of this element.

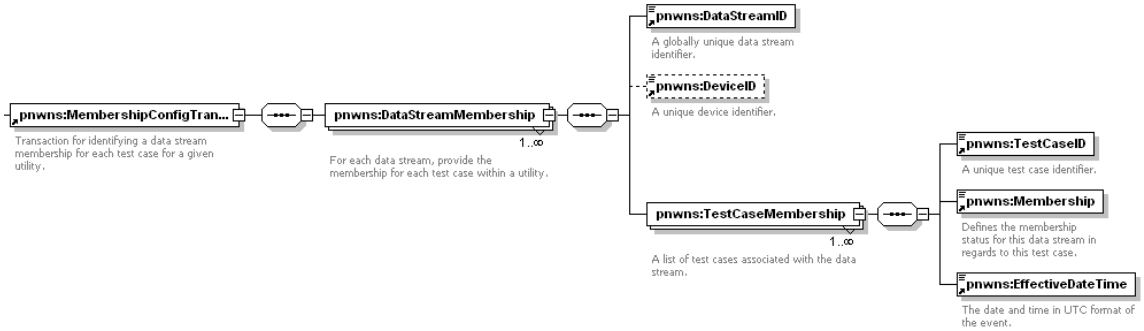


Figure 2-4. Visual representation of the *MembershipConfigTransaction* element in the PNWSG Transaction Schema.

The *MembershipConfigTransaction* element contains the *DataStreamMembership* element. This allows a utility to report as many data streams and their memberships as a utility has defined. For each data stream, the following information is provided:

- *DataStreamID* element contains the unique data stream identifier for a given utility and is a string type. This identifier must be globally unique to a utility.
- *DeviceID* element is an optional element and contains the unique device identifier for a given utility and is a string type.

- *TestCaseMembership* element contains the membership of this data stream to all the test cases for a given utility. For each test case, the following is identified:
    - *TestCaseID* element contains the unique test case identifier found in the DesignandData Microsoft Excel workbook for a given utility. It is a string type.
    - *Membership* element defines the membership status for this data stream in regards to this test case. This is an enumerated type defined as *EM (Experimental Member)*, *CM (Control Member)*, and *NM (Not a Member)*. Upon the creation of a new data stream, through the establishment of a *DataStreamID*, it has no membership in any test case (i.e., the default membership setting is *NM*). The membership element is used to establish a membership. The *NM (Not a Member)* is necessary only to revoke a previously established membership. NOTE: it is good practice to describe each membership upon initial configuration and continue to supply such information at later intervals for completeness.
    - *EffectiveDateTime* element contains the membership effective date and time in UTC format and is of type dateTime.

Please see the following for additional information:

- Appendix A contains the XML Schema.
- Appendix B contains the definitions of the elements.
- Appendix C contains a sample XML instance of a *MembershipConfigTransaction* message.

2.3.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the *MembershipConfigTransaction* message. An example CSV *MembershipConfigTransaction* message is depicted in Figure 2-5.

UtilityID	DataStreamID	DeviceID	TestCaseID	Membership	EffectiveDateTime
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-01-1.4	EM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-01-3.2	NM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-02-3.2	NM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-03-1.1	EM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-04-3.2	NM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-05-1.2	EM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-05-3.1	NM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-05-4.1	EM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-05-4.2	EM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-05-4.3	EM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-06-3.1	NM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-07-2.1	CM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C120	AV_M2567	AV-08-2.2	CM	2011-12-03T12:45:22.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-01-1.4	EM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-01-3.2	NM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-02-3.2	NM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-03-1.1	EM	2011-11-27T15:29:07.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-04-3.2	NM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-05-1.2	EM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-05-3.1	NM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-05-4.1	EM	2011-12-24T18:00:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-05-4.2	EM	2011-12-24T18:00:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-05-4.3	EM	2011-12-24T18:00:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-06-3.1	NM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-07-2.1	CM	2011-11-24T10:25:02.0Z
AV	AV-01-1.4-IM-1-F3-C121		AV-08-2.2	CM	2011-11-24T10:25:02.0Z

Figure 2-5. Example CSV file for a *MembershipConfigTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.
- DataStreamID
- DeviceID
- TestCaseID
- Membership – see TestCaseMembership element definition above, section 2.3.1, and the accompanying note in regards to the NM usage.
- EffectiveDateTime – NOTE: if the EffectiveDateTime column is blank in a CSV file, then during the CSV to XML conversion in the Data Collection System, this date time shall be set to January 1, 2011 (1/1/11). The column header must still exist in the CSV file even though the column may be without any values.

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section, 2.3.1.

2.3.3 File Naming Convention

The XML and CSV file for the *MembershipConfigTransaction* message shall adhere to the following naming convention:

SourceName-`MembershipConfigTransaction`-*MessageCreationDateTime*.{`xml`|`csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

2.3.4 Message Frequency

The *MembershipConfigTransaction* message shall be sent every time a membership event occurs for a data stream at a given utility. Only memberships that have changed *are required* to be included in the transaction, but best practice would include all data stream memberships for a given utility.

2.4 MembershipEventTransaction

During the course of the PNWSG Project, a data stream may change its membership due to new equipment being installed, equipment failure, change in customer participation, etc. Any time that a data stream changes its membership with a test case, a *MembershipEventTransaction* message shall be sent to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the next sections. The time frame within which membership changes must be reported is not specified. It may be part of another regular reporting period as long as the information is captured and reported before analysis of the data takes place.

2.4.1 XML Format

The utility shall send the data stream membership event information as defined in the PNWSG Transaction Schema using the *MembershipEventTransaction* element. Figure 2-6 depicts a visual representation of this element.

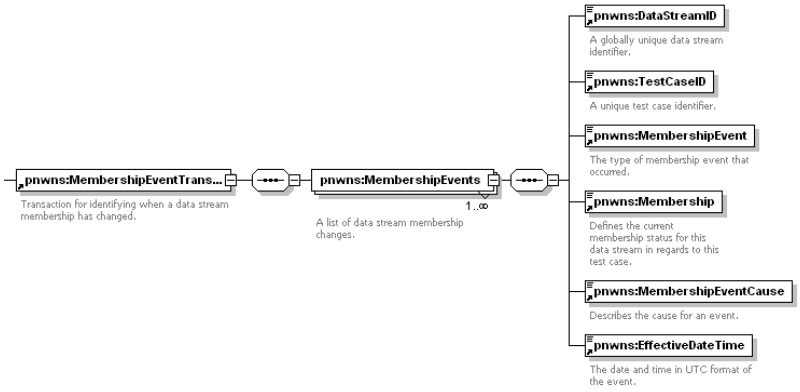


Figure 2-6. Visual representation of the *MembershipEventTransaction* element in the PNWSG Transaction Schema.

The *MembershipEventTransaction* element contains the *MembershipEvents* element. This allows a utility to report as many data stream membership events as may have occurred over a given period. For each data stream, the following information is provided:

- *DataStreamID* element contains the unique data stream identifier for a given utility and is a string type.
- *TestCaseID* element contains the unique test case identifier found in the DesignandData Microsoft Excel workbook for a given utility. It is a string type.
- *MembershipEvent* element contains the type of event and is an enumerated type of either *Enter* or *Leave*.
- *Membership* element contains the membership that this event affects and it is an enumerated type of *EM*, *CM*, and *NM*.
- *MembershipEventCause* element contains the cause of the event and is an enumerated type.
- *EffectiveDateTime* element contains the membership effective date and time in UTC format and is of type dateTime.

Please see the following for additional information:

- Appendix A contains the XML Schema.
- Appendix B contains the definitions of the elements.
- Appendix D contains a sample XML instance of a *MembershipEventTransaction* message.

2.4.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the *MembershipEventTransaction* message. An example CSV *MembershipEventTransaction* message is depicted in Figure 2-7.

UtilityID	DataStreamID	TestCaseID	MembershipEvent	Membership	MembershipEventCause	EffectiveDateTime
FH	FH-01-2.2-IM-60-T1205	FH-01-2.2	Enter	EM	Equipment Installed and commissioned	2011-12-03T18:34:02.0Z
FH	FH-02-1.1-IM-1-D12	FH-02-1.1	Enter	EM	Equipment Installed and commissioned	2011-12-03T10:53:23.0Z
FH	FH-02-1.1-IM-1-D12	FH-02-1.1	Leave	EM	Equipment failed	2011-12-04T01:23:22.0Z
FH	FH-02-1.1-IM-1-D12	FH-02-1.1	Enter	NM	Equipment failed	2011-12-04T01:23:22.0Z
FH	FH-02-1.1-IM-1-D10	FH-02-1.1	Leave	EM	Change in customer participation	2011-12-03T09:00:00.0Z
FH	FH-02-1.1-IM-1-D10	FH-02-1.1	Enter	CM	Change in customer participation	2011-12-03T09:00:00.0Z

Figure 2-7. Example CSV file for a *MembershipEventTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.

- DataStreamID
- TestCaseID
- MembershipEvent – an enumerated type of *Enter* or *Leave*.
- Membership
- MembershipEventCause
- EffectiveDateTime

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

2.4.3 File Naming Convention

The XML and CSV file for the *MembershipEventTransaction* message shall adhere to the following naming convention:

SourceName-`MembershipEventTransaction`-*MessageCreationDateTime*.{`xml`|`csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

2.4.4 Message Frequency

The *MembershipEventTransaction* message shall be created every time a data stream changes its membership. These messages may be queued and reported periodically. Following a *MembershipEventTransaction* message being sent it is recommended that a *MembershipConfigTransaction* message that lists the current data streams and their memberships (i.e. membership snapshot in time) be sent. This provides additional redundancy that reduces the chance of important configuration data getting lost.

2.5 Membership Scenarios

Utility A is a subproject member of the PNWSG Project. Utility A has defined 3 test cases (TC1, TC2, TC3) and 5 data streams (DS1, DS2, DS3, DS4, DS5). Upon project initialization, Utility A sends a *MembershipConfigTransaction* message to the PNWSG Data Collection System identifying each data stream and its membership to each of the 3 test cases. Initially specifying which test cases a data stream is not a member of is not required but is encouraged for completeness. Two days later, DS1 changes its membership due to equipment failure (i.e., DS1 is not an experimental or control member of any test case). This membership change would trigger a *MembershipEventTransaction* message that would

contain at least two events (several events if DS1 is a CM/EM of each applicable test case, the other would be an enter to the NM group). It is encouraged, but not required, that a *MembershipConfigTransaction* message would follow that would list **all** the current data streams and their memberships. A periodic specification of all data stream memberships is a useful guard against the loss or corruption of membership changes that are critical to the analysis process.

One week later, DS2 changes its membership from being a control member to an experimental member in TC3. This change would trigger two events: DS2 leaves the control population; DS2 enters the experimental population. This membership change would trigger a *MembershipEventTransaction* message that would contain the two events. Again, it is encouraged, but not required, that a *MembershipConfigTransaction* message would follow that would list **all** the current data streams and their memberships.

2.6 Summary

Test cases, data streams, and memberships are a key concept to the Data Collection System. Utilities need to:

1. Create data stream identifiers for each data list row in the Data List tab (see Section 8.0).
2. Add data stream identifiers into their test case layout diagrams.
3. Define each data stream's membership (CM, EM, or NM) for each test case for a given utility.
4. Report the membership for each data stream to the Data Collection System via *MembershipConfigTransaction* messages in XML or CSV files.
5. Track data stream membership changes and report any changes to the Data Collection System via *MembershipEventTransaction* messages in XML or CSV files.

Data stream membership is a key component for the analysis that will be conducted on this project.

3.0 Test Case Transactions

In the previous section, we described the concept of data streams, test cases, and their relation via memberships. In this section, we describe test case events that will need to be tracked and reported by each utility to the Data Collection System.

3.1 What are Test Case Events?

Each utility has been working with the subproject deputies to formulate test case designs (refer back to Figure 2-1 for an example). In regards to each of these test cases, there are certain events that will affect how data analysis will be accomplished. For example, a test case can be defined as a load control with demand response units (DRUs). A utility will want to track the engagement of DRUs to transactive control. Thus, test case events could be defined as the test case asset is under normal operation or the DRUs are curtailed.

3.2 Utility Responsibility

Each utility has been working with the subproject deputies in defining the test cases and assets. For Data Collection, each utility needs to define the test case events that are important to track during the project and the related status that they will want to report (for example, normal operation, DRU curtailed, etc.). These events and statuses need to be defined and incorporated into the PNWSG Transactions Schema via the support schemata entitled “TestCaseEventTypes.xsd” and “TestCaseStatusTypes.xsd” *before any data can be collected by the Data Collection System.* Once these have been defined and incorporated into the support schemata, the utility is responsible for reporting the test case events and status as they occur during the project via the *TestCaseEventTransaction* message, which is defined in the remainder of this section.

3.3 TestCaseEventTransaction

During the course of the PNWSG Project, test case events and status must be tracked and reported via TestCaseEventTransaction message to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

3.3.1 XML Format

The utility shall send the test case event information as defined in the PNWSG Transaction Schema using the *TestCaseEventTransaction* element.

Figure 3-1 depicts a visual representation of this element.

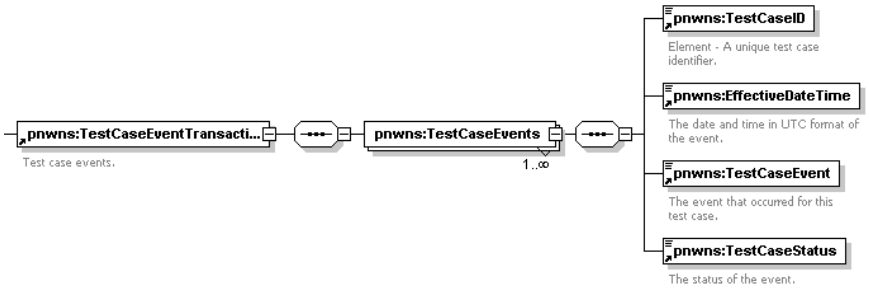


Figure 3-1. Visual representation of the *TestCaseEventTransaction* element in the PNWSG Transaction Schema.

The *TestCaseEventTransaction* element contains the *TestCaseEvents* element. This allows a utility to report as many test case events as may have occurred over a given period. For each test case event, the following information is provided:

- *TestCaseID* element contains the unique test case identifier found in the DesignandData Microsoft Excel workbook for a given utility. It is a string type.
- *EffectiveDateTime* element contains the test case event effective date and time in UTC format and is of type dateTime.
- *TestCaseEvent* element contains the test case event that occurred at the effective date/time and is of type TestCaseEventType. TestCaseEventType is defined in a separate schema (PNWSGSchema-TestCaseEventTypes.xsd). This list is pre-determined by the utilities as noted in section 3.2.
- *TestCaseStatus* element contains the status for that test case event and is of type TestCaseStatusType. TestCaseStatusType is defined in a separate schema (PNWSGSchema-TestCaseStatusTypes.xsd). This list is pre-determined by the utilities as noted in section 3.2.

Please see the following for additional information:

- Appendix A contains the XML Schema.
- Appendix B contains the definitions of the elements.
- Appendix E contains a sample XML instance of a *TestCaseEventTransaction* message.

3.3.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format format is the CSV format (comma separated values) for the *TestCaseEventTransaction* message. An example CSV *TestCaseEventTransaction* message is depicted in

Figure 3-2.

UtilityID	TestCaseID	EffectiveDateTime	TestCaseEvent	TestCaseStatus
FH	FH-02-1.1	2011-12-03T12:45:22.0Z	Changed asset system engagement	Low price signal
FH	FH-03-1.2	2011-12-03T09:12:34.0Z	Changed asset system engagement	Curtailed
FH	FH-03-1.2	2011-12-03T14:02:39.0Z	Device alarms detected - Outage	On
FH	FH-03-1.2	2011-12-03T11:12:34.0Z	Changed asset system engagement	Normal
FH	FH-03-1.2	2011-12-03T14:22:39.0Z	Device alarms detected - Outage	Off

Figure 3-2. Example CSV file for a *TestCaseEventTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.
- TestCaseID
- EffectiveDateTime
- TestCaseEvent
- TestCaseStatus

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

3.3.3 File Naming Convention

The XML and CSV file for the *TestCaseEventTransaction* message shall adhere to the following naming convention:

SourceName-`TestCaseEventTransaction`-*MessageCreationDateTime*.{`xml`|`csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

3.3.4 Message Frequency

The *TestCaseEventTransaction* message shall be created every time a test case event occurs that needs to be reported to the PNWSG Data Collection System. These messages may be queued and reported periodically.

3.4 Summary

To track test case events, the utilities need to:

1. Define and create a list of test case events for each test case.
2. Define and create status enumerations for each test case event.
3. Provide these test case events and status enumerations to the PNWSG Data Collection Working Group (via e-mail) prior to sending any test case data. This information will be used to validate the XML messages and provide a uniform representation of events throughout the Project.
4. Track test case events and report these events and their status to the PNWSG Data Collection System.

Test case events and status are a key component for the analysis that will be conducted on this project.

4.0 Device Transactions

Collecting data from devices (the data streams) will constitute a large portion of the data collection. It is *optional* for a utility to send device information; however, it is *mandatory* if a utility shall send device events. Tracking device events is key to understanding and analyzing the data. This section describes the metadata that shall be collected for devices, including device events that affect the data quality and analysis.

4.1 Device Information

There are many devices that a utility owns, operates, and controls in order to deliver energy to its customers. A variety of devices have been defined by each utility as part of their test case design. Device information (the metadata) needs to be supplied to the PNWSG Data Collection System. Device information constitutes data about the device (for example, device type and manufacturer), its location (i.e., where is it located in the test case design layout diagram), its associated data streams (a device can generate more than one data stream), and unique identifier. No Personally Identifiable Information (PII) is allowed (i.e., customer IDs). In order to supply this information, a *DeviceInformationTransaction* message shall be sent to the PNWSG Data Collection System and is described in the following section.

4.2 DeviceInformationTransaction

During the course of the PNWSG Project, device metadata must be tracked and reported via *DeviceInformationTransaction* message to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

4.2.1 XML Format

The utility shall send device information as defined in the PNWSG Transaction Schema using the *DeviceInformationTransaction* element. Figure 4-1 depicts a visual representation of this element.

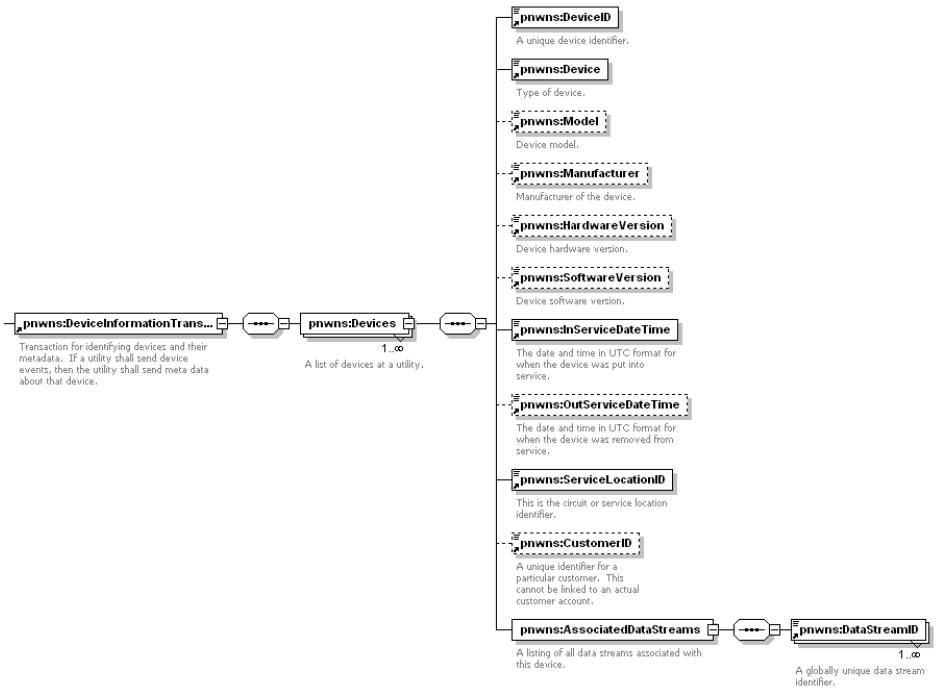


Figure 4-1. Visual representation of the *DeviceInformationTransaction* element in the PNWSG Transaction Schema.

The *DeviceInformationTransaction* element contains the *Devices* element. This allows a utility to report as many devices as they need to describe their test cases. For each device, the following information is provided:

- *DeviceID* element contains a unique device identifier for a given utility and is of type string.
- *Device* element contains the type of device and is an enumerated list. This list contains such values as *Water meter*, *Demand meter*, *Switch*, etc. Note that one of the device types is a transactive node. This is provided for completeness since a utility-owned device may be a transactive node.
- *Model* element is an optional element that contains the device model information and is of type string.
- *Manufacturer* element is an optional element that contains the manufacturer of the device and is of type string.
- *HardwareVersion* element is an optional element that contains the hardware version of the device and is a string.
- *SoftwareVersion* element is an optional element that contains the software version of the device and is a string. This element is not optional if the device is of type “Transactive Node”.
- *InServiceDateTime* element contains the date and time in UTC format that the device went into service.

- *OutServiceDateTime* element is an optional element that contains the date and time in UTC format that the device went out of service. If optional, the default value of 1/5/15 will be used if no value is provided. This element is not optional if a utility is notifying the PNWSG Data Collection System that a device is out of service.

- *ServiceLocationID* element contains a unique service location identifier and can be mapped to the test case layout diagram for a given utility. This element is of type string.

- *CustomerID* element is an optional element and contains a unique customer identification that cannot be mapped to any account information in a given utility's database (i.e., no PII allowed). One of the uses of this information is for tracking membership in control or experimental populations. This element is not optional if a device has an associated customer that the utility shall be providing customer information (see section 5.0). This element is of type string.

- *AssociatedDataStreams* element contains a list of all data stream identifiers associated with this device.

Please see the following for additional information:

- Appendix A contains the XML Schema.

- Appendix B contains the definitions of the elements.

- Appendix F contains a sample XML instance of a *DeviceInformationTransaction* message.

4.2.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format format is the CSV format (comma separated values) for the *DeviceInformationTransaction* message. An example CSV *DeviceInformationTransaction* message is depicted in

Figure 4-2.

UtilityID	DeviceID	Device	Model	Manufacturer	HardwareVersion	SoftwareVersion	InServiceDateTime	OutServiceDateTime	ServiceLocationID	CustomerID	DataStreamID
MF	123456	Electric meter	Centron	Itron			2001-12-15T09:30:47.0Z		123	456	DS004
MF	234567	Demand meter		GE			2001-11-12T10:30:47.0Z	2001-12-17T09:30:47.0Z	234	378	DS034
MF	345678	Electric meter	Centron II	Itron			2001-04-04T13:05:47.0Z		134	234	DS023

Figure 4-2. Example CSV file for a *DeviceInformationTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.

- DeviceID

- Device

- Model

- Manufacturer
- HardwareVersion
- SoftwareVersion
- InServiceDateTime – NOTE: if the InServiceDateTime column is blank in a CSV file, then during the CSV to XML conversion in the Data Collection System, this date time shall be set to January 1, 2011 (1/1/11). The column header must still exist in the CSV file even though the column may be without any values.
- OutServiceDateTime
- ServiceLocationID
- CustomerID
- DataStreamID – NOTE: if there is more than one data stream associated with a device, the utility shall use the *DataStreamInformationTransaction* message described in section 8.1.2 to capture these data stream identifiers and their respective device.

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

4.2.3 File Naming Convention

The XML and CSV file for the *DeviceInformationTransaction* message shall adhere to the following naming convention:

SourceName-`DeviceInformationTransaction`-*MessageCreationDateTime*.{`xml`|`csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

4.2.4 Message Frequency

The *DeviceInformationTransaction* message shall be created every time a new device or updated device needs to be reported to the PNWSG Data Collection System. These messages may be queued and reported periodically based on agreements between a utility and the PNWSGD Project.

4.3 Device Events

As with test cases, there will be device events and a status that need to be tracked in order to aid data analysis. Device events are events that occur at the device level. *Note: test case events are events that occur for an entire test case. Some device events may trigger a test case event.*

4.4 Utility Responsibility

Each utility has been working with the subproject deputies in defining the test cases and devices that shall be used. For Data Collection, each utility needs to define the device events that are important to track during the project and the related status that they will want to report. These events and statuses need to be defined and incorporated into the PNWSG Transactions Schema via the support schemata entitled "DeviceEventTypes.xsd" and "DeviceStatusTypes.xsd" *before any data can be collected by the Data Collection System.* Once these have been defined and incorporated into the support schemata, the utility is responsible for reporting the device events and status as they occur during the project via the *DeviceEventTransaction* message, which is defined in the remainder of this section.

4.5 DeviceEventTransaction

During the course of the PNWSG Project, device events and status must be tracked and reported via *DeviceEventTransaction* message to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

4.5.1 XML Format

A utility shall send the device event information as defined in the PNWSG Transaction Schema using the *DeviceEventTransaction* element. Figure 4-3 depicts a visual representation of this element.

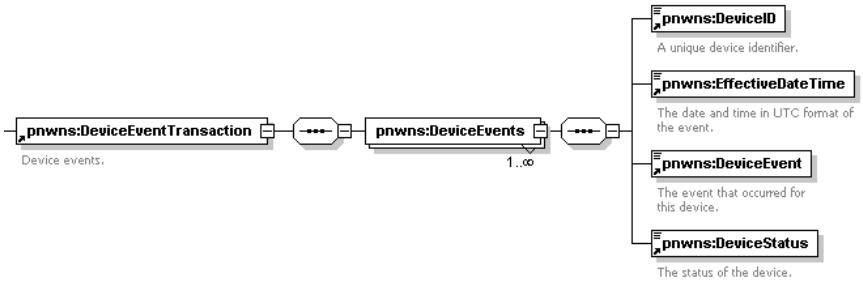


Figure 4-3. Visual representation of the *DeviceEventTransaction* element in the PNWSG Transaction Schema.

The *DeviceEventTransaction* element contains the *DeviceEvents* element. This allows a utility to report as many device events as may have occurred over a given period. For each device event, the following information is provided:

- *DeviceID* element contains the unique device identifier for a given utility. It is a string type.

- *EffectiveDateTime* element contains the device event effective date and time in UTC format and is of type dateTime.

- *DeviceEvent* element contains the device event that occurred at the effective date/time and is of type DeviceEventType. DeviceEventType is defined in a separate schema (PNWSGSchema-DeviceEventTypes.xsd). This list is pre-determined by the utilities as noted in section 4.4.

- *DeviceStatus* element contains the status for that device event and is of type DeviceStatusType. DeviceStatusType is defined in a separate schema (PNWSGSchema-DeviceStatusTypes.xsd). This list is pre-determined by the utilities as noted in section 4.4.

The reader is redirected to the following additional information:

- Appendix A contains the XML Schema.

- Appendix B contains the definitions of the elements.

- Appendix G contains a sample XML instance of a *DeviceEventTransaction* message.

4.5.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the *DeviceEventTransaction* message. An example CSV *DeviceEventTransaction* message is depicted in

Figure 4-4.

UtilityID	DeviceID	EffectiveDateTime	DeviceEvent	DeviceStatus
FH	M-001	2011-12-03T12:45:22.0Z	Device Alarm - High voltage	On
FH	VF-025	2011-12-03T09:12:34.0Z	Equipment failures	Disconnected
FH	TN-01	2011-12-03T14:02:39.0Z	System requests overriden	Device failure

Figure 4-4. Example CSV file for a *DeviceEventTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.

- DeviceID

- EffectiveDateTime

- DeviceEvent

- DeviceStatus

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

4.5.3 File Naming Convention

The XML and CSV file for the *DeviceEventTransaction* message shall adhere to the following naming convention:

SourceName-`DeviceEventTransaction`-*MessageCreationDateTime*.{`xml`|`csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

4.5.4 Message Frequency

The *DeviceEventTransaction* message shall be created every time a device event occurs that needs to be reported to the PNWSG Data Collection System. These messages may be queued and reported periodically based on agreements between a utility and the PNWSGD Project.

4.6 Summary

To track devices, their events, and status, the utilities need to:

1. Track all devices, their metadata information, and data streams.
2. Create enumerations of all possible devices.
3. Create enumerations of possible device events for each device type.
4. Create status enumerations for each device event.
5. Provide the device, device events and status enumerations to the PNWSG Data Collection Working Group (via e-mail to deputy) prior to sending any device data. This information will be used to validate the XML messages and provide a uniform representation of devices, statuses and events throughout the Project.
6. Report devices to the PNWSG Data Collection Service via *DeviceInformationTransaction* messages in XML or CSV files.
7. Track device events and be report these events and their status to the PNWSG Data Collection System via *DeviceEventTransaction* messages in XML or CSV files.

5.0 Customer Transaction

In the previous section, we described device information and events. One aspect of the device metadata is a customer that is associated with a device. There is no need for the project to gather any customer information; the only information we need is a unique customer identifier for a device and knowing when that customer identifier changes. This information is important when during analysis; for example, analyzing customer behavior patterns in DRUs. In this section, we describe customer information and updates (via the *CustomerTransaction* message) that will need to be tracked and reported by each utility to the Data Collection System.

5.1 CustomerTransaction

During the course of the PNWSG Project, customers associated with devices must be tracked and reported via *CustomerTransaction* message to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

5.1.1 XML Format

The utility shall send customer update information as defined in the PNWSG Transaction Schema using the *CustomerTransaction* element.
Figure 5-1 depicts a visual representation of this element.

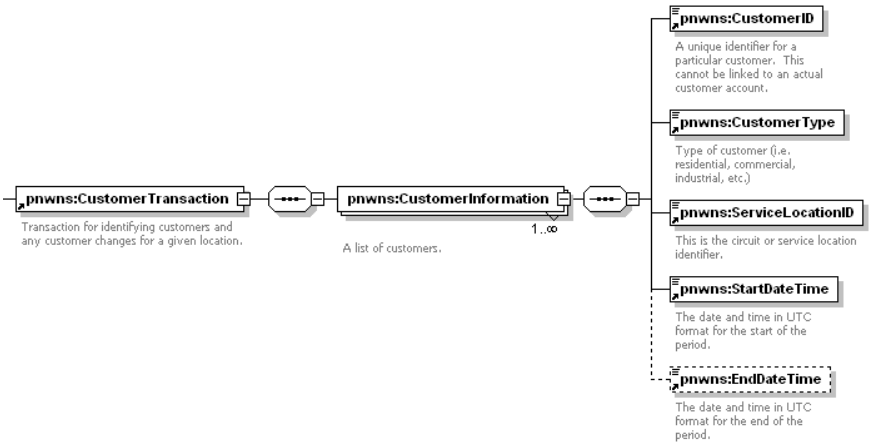


Figure 5-1. Visual representation of the *CustomerTransaction* element in the PNWSG Transaction Schema.

The *CustomerTransaction* element contains the *CustomerInformation* element. This allows a utility to report as many customer changes as may have occurred over a given period. For each customer change, the following information is provided:

- *CustomerID* element contains the unique customer identifier and is a string type.

- *CustomerType* element is an optional element and contains the type of customer. This element is an enumerated list containing *Residential*, *Industrial*, *Commercial*, and *Irrigation*.
- *ServiceLocationID* element contains the service location identifier for this customer and is of type string.
- *StartDateTime* element contains the customer start date and time for a given service location identifier and is of type dateTime.
- *EndDateTime* element is an optional element that contains the customer end date and time for a given service location identifier and is of type dateTime. This is not an optional element if a utility is reporting that a customer has left that service location.

Please see the following for additional information:

- Appendix A contains the XML Schema.
- Appendix B contains the definitions of the elements.
- Appendix H contains a sample XML instance of a *CustomerTransaction* message.

5.1.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the *CustomerTransaction* message. An example CSV *CustomerTransaction* message is depicted in
Figure 5-2.

UtilityID	CustomerID	CustomerType	ServiceLocationID	StartDateTime	EndDateTime
AV	10045	Residential	37568	2011-12-17T09:30:47.0Z	
AV	200	Irrigation	27483	2010-12-17T09:30:47.0Z	2011-12-17T09:30:47.0Z
AV	2517	Industrial	17283	2011-12-17T13:35:00.0Z	

Figure 5-2. Example CSV file for a *CustomerTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.
- CustomerID
- CustomerType
- ServiceLocationID
- StartDateTime – NOTE: if the StartDateTime column is blank in a CSV file, then during the CSV to XML conversion in the Data Collection System, this date time shall be set to January

1, 2011 (1/1/11). The column header must still exist in the CSV file even though the column may be without any values.

- EndDateTime

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

5.1.3 File Naming Convention

The XML and CSV file for the *CustomerTransaction* message shall adhere to the following naming convention:

SourceName-`CustomerTransaction`-*MessageCreationDateTime*.{`xml`|`csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

5.1.4 Message Frequency

The *CustomerTransaction* message shall be created every time a customer change event occurs that needs to be reported to the PNWSG Data Collection System. These messages may be queued and reported periodically.

5.2 Summary

To track customer changes, the utilities need to:

1. Track all customers associated with locations.
2. Provide any customer changes for a location to the PNWSG Data Collection System via *CustomerTransaction* messages in XML or CSV files.

6.0 Location Information Transaction

In the previous sections, we described device information and customer information. One aspect of both the device metadata and customer metadata is a location that is associated with devices and customers. There is no need for the project to gather any location information; the only information we need is a unique location identifier. In this section, we describe location information that can be reported by each utility to the Data Collection System.

6.1 ServiceLocationInformationTransaction

During the course of the PNWSG Project, locations associated with devices and customers may be tracked and reported via *ServiceLocationInformationTransaction* message to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

6.1.1 XML Format

The utility shall send location information as defined in the PNWSG Transaction Schema using the *ServiceLocationInformationTransaction* element.
Figure 6-1 depicts a visual representation of this element.

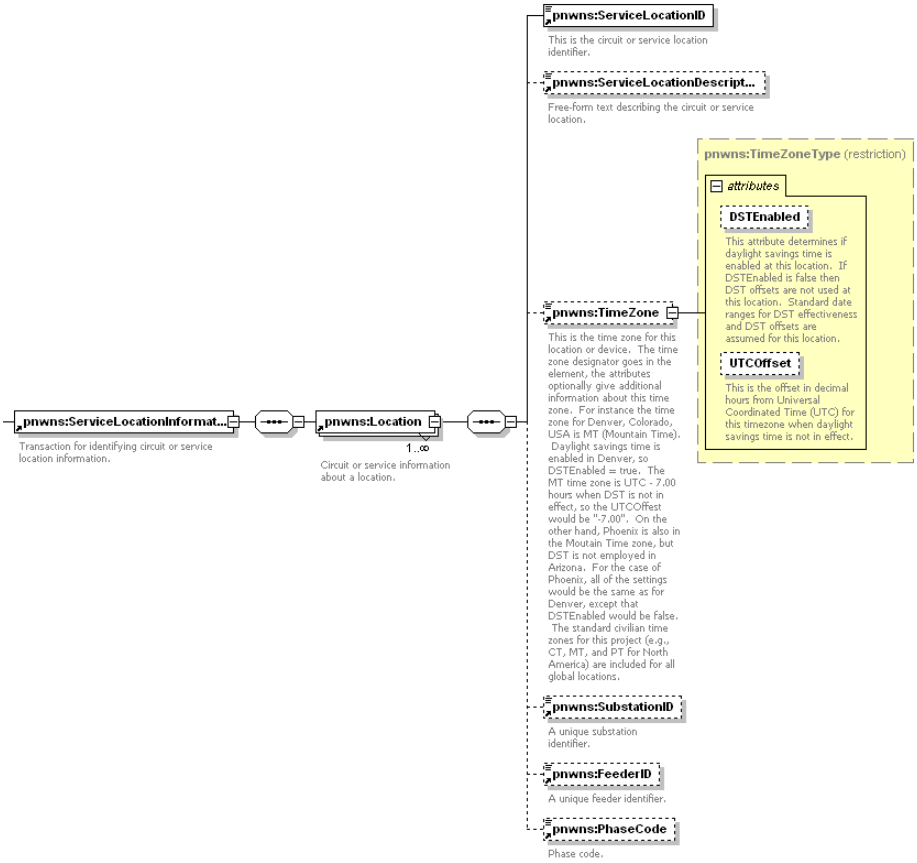


Figure 6-1. Visual representation of the *ServiceLocationInformationTransaction* element in the PNWSG Transaction Schema.

The *ServiceLocationInformationTransaction* element contains the *Location* element. This allows a utility to report as many locations as they want. For each location, the following information is provided:

- *ServiceLocationID* element contains a unique service location identifier and can be mapped to the test case layout diagram for a given utility. This element is of type string.

- *ServiceLocationDescription* element is an optional element containing a description of the location and is of type string.

- *TimeZone* element contains the time zone information for a given location and is optional. The time zone designator goes in the element, the attributes (<DSTEnabled> and <UTCOffset>) give additional information about this time zone. For instance the time zone for Helena, Montana, USA is MT (Mountain Time). Daylight savings time is enabled in Helena, so DSTEnabled = 1 or true. The MT time zone is UTC - 7.00 hours when DST is not in effect, so the UTCOffest would be "-7.00". On the other hand, Phoenix is also in the Moutain Time zone, but DST is not employed in Arizona. For the case of Phoenix, all of the settings would be the same as for Helena, except that DSTEnabled would be false. The standard civilian time zones for this project (e.g., MT and PT) are included for all global locations.

- *SubstationID* element is an optional element and contains a unique identifier for a substation that this device belongs to. This element is of type string.

- *FeederID* element is an optional element and contains a unique identifier for a feeder that this device belongs to. This element is of type string.

- *PhaseCode* element is an optional element that contains the phase of the device. This element is an enumerated type of *A*, *B*, *C*, *AB*, *AC*, *BC*, *ABC*, and *Unknown*.

Please see the following for additional information:

- Appendix A contains the XML Schema.

- Appendix B contains the definitions of the elements.

- Appendix I contains a sample XML instance of a *ServiceLocationInformationTransaction* message.

6.1.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the *ServiceLocationInformationTransaction* message. An example CSV *ServiceLocationInformationTransaction* message is depicted in Figure 6-2.

UtilityID	ServiceLocationID	ServiceLocationDescription	TimeZone	DSTEnabled	UTCOffset	SubstationID	FeederID	PhaseCode
FH	T1205	Transformer				Libby	T1205	
FH	T3667	Transformer				Libby	T3667	
FH	Libby-All	Data computations for the whole utility						

Figure 6-2. Example CSV file for a *ServiceLocationInformationTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.
- ServiceLocationID
- ServiceLocationDescription
- TimeZone
- DSTEnabled – if a utility provides information in this column, you must also provide the TimeZone
- UTCOffset – if a utility provides information in this column, you must also provide the TimeZone
- SustationID
- FeederID
- PhaseCode

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

6.1.3 File Naming Convention

The XML and CSV file for the *ServiceLocationInformationTransaction* message shall adhere to the following naming convention:

SourceName-`ServiceLocationInformationTransaction`-*MessageCreationDateTime*.{`xml` | `csv`}

where:

- *SourceName* is the 2-letter utility abbreviation.
- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

6.1.4 Message Frequency

The *ServiceLocationInformationTransaction* message shall be created every time a location needs to be reported to the PNWSG Data Collection System. These messages may be queued and reported periodically.

6.2 Summary

Providing metadata about a service location is an option for a utility. In order to provide location information, the utilities need to:

1. Track all locations.
2. Provide location information to the PNWSG Data Collection System via *ServiceLocationInformationTransaction* messages in XML or CSV files.
3. Connect location information to data stream information and report to the PNWSG Data Collection System via *DataStreamInformationTransaction* messages in XML or CSV files.
4. Connect location information to device information (if relevant) and report to the PNWSG Data Collection System via *DeviceInformationTransaction* messages in XML or CSV files.
5. Connect location information to customer information (if relevant) and report to the PNWSG Data Collection System via *CustomerTransaction* messages in XML or CSV files.

7.0 Data Stream Measurements

In section 2.2, the concept of data streams was introduced. In section 4.2, device information was introduced and the relationship between devices and data streams. This section describes how the actual values from data streams are collected via the *MeasurementTransaction* message that will need to be reported by each utility to the Data Collection System.

7.1 MeasurementTransaction

During the course of the PNWSG Project, data created by devices must be reported via *MeasurementTransaction* messages to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

7.1.1 XML Format

The utility shall send measurement values as defined in the PNWSG Transaction Schema using the *MeasurementTransaction* element.
Figure 7-1 depicts a visual representation of this element.

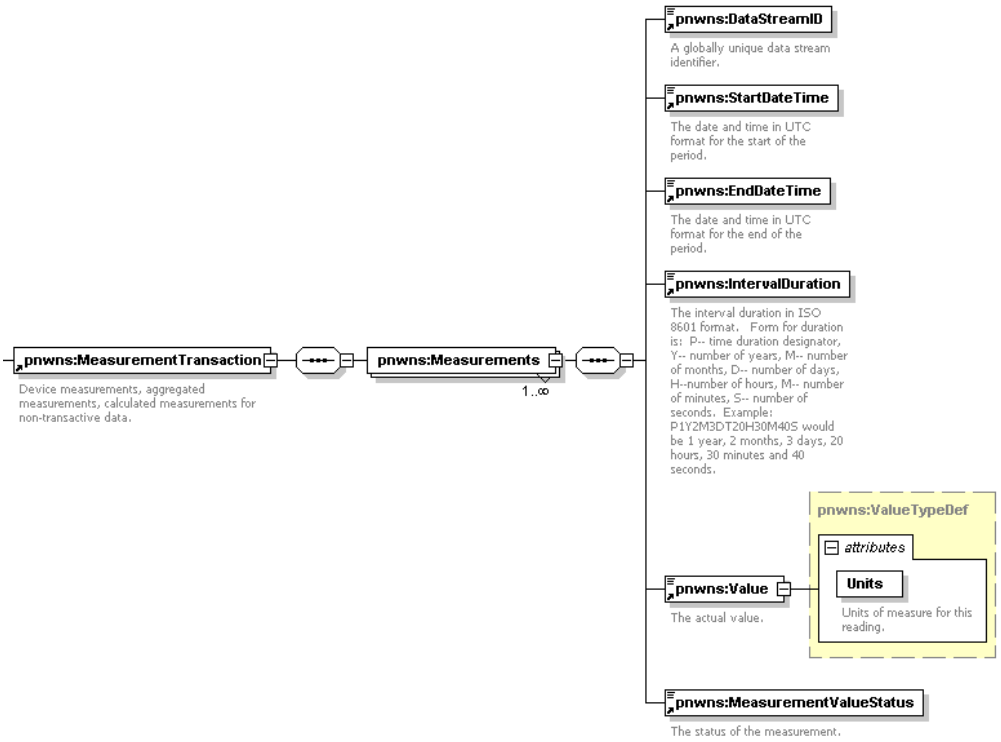


Figure 7-1. Visual representation of the *MeasurementTransaction* element in the PNWSG Transaction Schema.

The *MeasurementTransaction* element contains the *Measurements* element. This allows a utility to report as many data stream measurements as may have occurred over a given period. For each measurement, the following information is provided:

- *DataStreamID* element contains the unique data stream identifier for a given utility and is a string type.
- *StartDateTime* element contains the measurement start date and time in UTC format and is of type dateTime.
- *EndDateTime* element contains the measurement end date and time in UTC format and is of type dateTime.
- *IntervalDuration* element contains the measurement duration in ISO 8601 format and is of type duration. Examples include: PT45.23S; P10M4DT3H; P1Y2M1DT3H30M40S. Format for duration is:
    - P – time duration designator.
    - Y – number of years.
    - M – number of months.
    - D – number of days.
    - T – time duration designator.
    - H – number of hours.
    - M – number of minutes.
    - S – number of seconds.
- *Value* element contains the actual numerical measurement and is of type float. This element has a required attribute entitled <Units> that contains the unit of measure for this value.
- *MeasurementValueStatus* element contains the description of the measurement type. This element is an enumerated type of *Actual Reading*, *Calculated Reading*, *Estimated Reading*, *Edited Reading*, *Missed Reading* (a known missed reading, such as a missed value from a meter), *Unknown* (an unknown description, where it cannot be determined to be of any other description), and *Not Applicable* (when none of these descriptions are applicable to the value).

Please see the following for additional information:

- Appendix A contains the XML Schema.
- Appendix B contains the definitions of the elements.

- Appendicies J through M contain sample XML instances of a *MeasurementTransaction* message.

7.1.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the *MeasurementTransaction* message. An example CSV *MeasurementTransaction* message is depicted in
Figure 7-2.

UtilityID	DataStreamID	StartDateTime	EndDateTime	IntervalDuration	Value	Units	MeasurementValueStatus
AV	AV-06-3.1-IM-41-1211	2011-12-17T09:30:00Z	2011-12-17T09:35:00Z	PT5M	3.86	MW	Actual Reading
AV	AV-06-3.1-IM-41B-1211	2011-12-17T09:30:00Z	2011-12-17T09:35:00Z	PT5M	3.14	MW	Edited Reading
AV	AV-06-3.1-IM-42-3211	2011-12-17T09:30:00Z	2011-12-17T09:35:00Z	PT5M	6.11	MVAR	Estimated Reading
AV	AV-06-3.1-IM-42B-3211	2011-12-17T09:30:00Z	2011-12-17T09:35:00Z	PT5M	6.00	MVAR	Actual Reading

Figure 7-2. Example CSV file for a *MeasurementTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.
- DataStreamID
- StartDateTime
- EndDateTime
- IntervalDuration
- Value
- Units
- MeasurementValueStatus

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

7.1.3 File Naming Convention

The XML and CSV file for the *MeasurementTransaction* message shall adhere to the following naming convention:

SourceName-`MeasurementTransaction`-*MessageCreationDateTime*.{`xml` | csv}

where:

- *SourceName* is the 2-letter utility abbreviation.

- *MessageCreationDateTime* is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

7.1.4 Message Frequency

The *MeasurementTransaction* message shall be sent every time measurements are collected that needs to be reported to the PNWSG Data Collection System.

7.2 Summary

Data stream measurements will constitute a large portion of the data contained in the PNWSGD Database. Utilities shall send all their data list measurements via the *MeasurementTransaction* message. In order to accomplish this task, utilities need to:

1. Keep track of all of their data streams and associated measurements.
2. Provide all data stream measurements to the PNWSG Data Collection System via XML or CSV files. Timely transmission of the data is important to prevent backlogs.

8.0 Data Stream Information

Central to the collection of PNWSGD non-transactive data is the concept of a data stream – a time-varying set of some type of data. The type of the data stream represention is selected from a predefined list that includes power, voltage, distance, frequency, etc. It also includes a measurement qualifier, again selected from a predefined list that includes instantaneous, interval average, interval maximum, interval minimum, etc. Additional information about the data may be necessary in terms of its context with respect to the service location or the device that made the measurements. Other data may come from utility's *calculated values*. Examples of utility calculated values are SAIFI, CAIFI, truck rolls, number of abnormally high AMI meter voltage occurrences, supplier energy cost to utility, total outages, etc. Even though these may be generated a small number of times, or even once, they are still considered data streams and are reported through a *MeasurementTransaction* described in Section 7.1 just as any other data stream is reported.

Note:

- Every data stream must have a unique identifier: the *DataStreamID*.
- Data streams have no relationship with streaming data.

8.1 DataStreamInformationTransaction

During the course of the PNWSG Project, a utility shall create data stream identifiers for every data stream; these data stream identifiers must be reported via *DataStreamInformationTransaction* message to the PNWSG Data Collection System, in either XML or CSV formats, which are described in the following subsections.

8.1.1 XML Format

The utility shall send data stream identifier metadata information as defined in the PNWSG Transaction Schema using the *DataStreamInformationTransaction* element.
Figure 8-1 depicts a visual representation of this element.

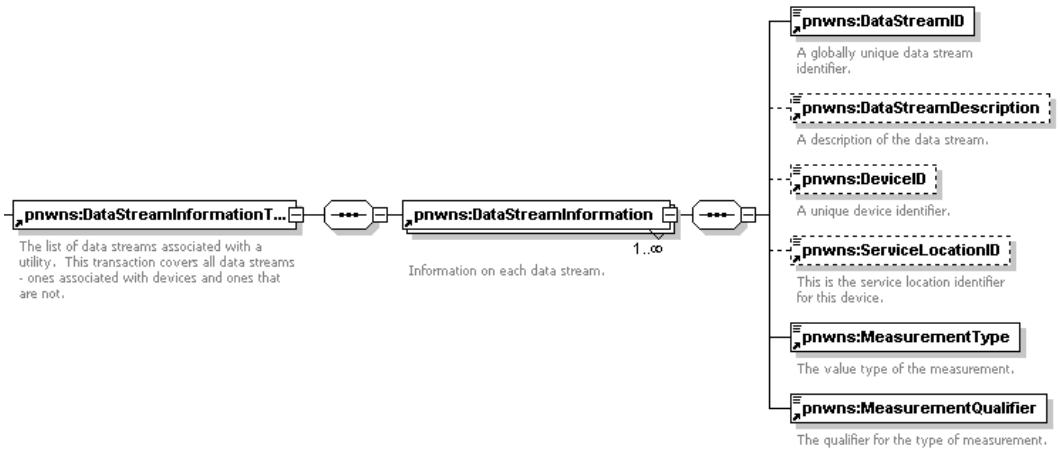


Figure 8-1. Visual representation of the *DataStreamInformationTransaction* element in the PNWSG Transaction Schema.

The *DataStreamInformationTransaction* element contains the *DataStreaIinformation* element. This allows a utility to report as many data stream identifiers as created by a utility. For each data stream, the following information is provided:

- *DataStreamID* element contains the unique data stream identifier for a given utility and is a string type.
- *DataStreamDescription* element is an optional element that contains a free-form description of this data stream.
- *DeviceID* element is an optional element that contains the unique device identifier for a given utility and is a string type. This element is not optional if a device is associated with this data stream identifier.
- *ServiceLocationID* element is an optional element that contains a unique service location identifier and can be mapped to the test case layout diagram for a given utility. This element is of type string. This element is not optional if a location is associated with this data stream identifier.
- *MeasurementType* element contains a description of the measurement and is an enumerated type. The values for this enumerated type are defined in a separate schema entitled PNWSGSchema-MeasurementValueTypes (schema as of this writing) and are depicted in Appendix N.
- *MeasurementQualifier* element contains a qualifier of the measurement type and is an enumerated type of *During peak hour of interval*, *Instantaneous (sampled nominal)*, *Interval (default interpretation)*, *Interval actual*, *Interval average (nominal)*, *Interval estimate*, *Interval maximum (peak)*, *Interval minimum*, *Interval standard deviation*, *Interval total (cumulative)*, *Quantity* and *NULL*.

Please see the following for additional information:

- Appendix A contains the XML Schema.

- Appendix B contains the definitions of the elements.
- Appendicies O and P contain sample XML instances of a *DataStreamInformationTransaction* message.

8.1.2 CSV Format

A less preferable (XML has validity checking capabilities absent in CSV) alternative to the XML format is the CSV format (comma separated values) for the DataStreamInformationTransaction message. An example CSV DataStreamInformationTransaction message is depicted in Figure 8-2.

UtilityID	DataStreamID	DataStreamDescription	DeviceID	ServiceLocationID	MeasurementType	MeasurementQualifier
LV	LV_E Jackson_CustomerInterruptions	Yearly sum of customer interrupted over total customers served		EastJackson123	SAIFI	Interval (default interpretation)
LV	LV-Hoback_PF	LV-05-3.2-IM-51-SVC-A		Hoback45	Power factor	Interval (default interpretation)
LV	LV_Teton_DemandCharges	LV-02-1.3-IM-800-1-		Teton	Demand charges	Interval total (cumulative)
LV	LV-02-2.1-IM-523-1	Meter	LV-M0234	LV-378	Electrical (real) energy	Interval minimum

Figure 8-2. Example CSV file for a *DataStreamInformationTransaction* message.

Each CSV file shall have a header row whose column names are:

- UtilityID – 2-letter utility abbreviation.
- DataStreamID
- DataStreamDescription
- DeviceID
- ServiceLocationID
- MeasurementType
- MeasurementQualifier

For the definitions, the reader is redirected to the XML schema in Appendix A or the previous section.

8.1.3 File Naming Convention

The XML and CSV file for the *DataStreamInformationTransaction* message shall adhere to the following naming convention:

SourceName-`DataStreamInformationTransaction`-*MessageCreationDateTime*.{`xml | csv`}

where:

- SourceName is the 2-letter utility abbreviation.

- MessageCreationDateTime is the date and time that the message was created (see MessageCreationDateTime in the XML format found in section 1.1.1)

8.1.4 Message Frequency

The *DataStreamInformationTransaction* message shall be sent every time new data stream identifiers are created by a utility that need to be reported to the PNWSG Data Collection System.

8.2 Summary

For each utility, all data values that are described on the data list with a DataID shall have data stream identifiers. In order to set-up the data stream identifiers in the Data Collection System for this data, utilities need to:

1. Create data stream identifiers (*DataStreamID*) for each data list row in the Data List tab.
2. Add data stream identifiers into their test case layout diagrams.
3. For each *DataStreamID* select the appropriate *MeasurementType* and *MeasurementType.*
4. Where appropriate, for each *DataStreamID* associate it with a *ServiceLocationID.*
5. Where appropriate, for each *DataStreamID* associate it with a *DeviceID.*
6. Where appropriate, for each *DataStreamID* provide a *DataStreamDescription.*
7. Provide the list of data stream identifiers and associated elements to the Data Collection System via *DataStreamInformationTransaction* messages in XML or CSV files before any data values are sent via *MeasurementTransaction* messages.
8. Keep track of all of their data streams and associated measurements or calculations.
9. Provide all data stream measurements to the PNWSG Data Collection System via *MeasurementTransaction* messages in XML or CSV files. Timely transmission of the data is important to prevent backlogs.

9.0 Summary

This document defines the Pacific Northwest Smart Grid Demonstration Data Collection implementation for non-transacative data, the XML schemata, and a few data examples (both in XML and CSV).

After reading and understanding this document, each utility needs to:

1. Send the list of data stream identifiers DataStreamIDs developed in the Compressed/Condensed Data List and Layout of Test Cases to the Data Collection System via SFTP, collecting all metadata about the data streams (i.e., associated location, device, etc.), via *DataStreamInformationTransaction, ServiceLocationInformationTransaction,* and, *DeviceInformation Transaction* messages.
2. Track all devices, their metadata information, and associated data streams.
3. Track all values associated with the data streams and be able to report these values to the PNWSG Data Collection System via *MeasurementTransaction* messages
4. Define each data stream's membership for each test case for a given utility
5. Report each data stream's test case membership via *MembershipConfigTransaction* messages.
6. Track data stream membership changes and report any changes to the Data Collection System via *MembershipEventTransaction* messages.
7. Create test case events enumerations for each test case.
8. Create status enumerations for each test case event.
9. Provide the test case events and status enumerations to the PNWSG Data Collection System via e-mail to the appropriate deputy, prior to sending any test case data.
10. Track test case events and be able to report these events and their status to the PNWSG Data Collection System via a *TestCaseEventTransaction*.
11. Create device event enumerations for each device in which the device events are relevant to the data analysis or test case analysis.
12. Create device status enumerations for each device event.
13. Provide the device events and status enumerations to PNWSG Data Collection System via e-mail to the appropriate deputy, prior to sending any test case data.
14. Track device events and be able to report these events and their status to the PNWSG Data Collection System via *DeviceEventTransaction* messages.
15. Track customer change events and be able to report these events to the PNWSG Data Collection System via *CustomerTransaction* messages.

Appendix A – PNWSGSchema.xsd

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2015 rel. 4 sp1 (x64) (http://www.altova.com) by Sherry Kowalski
(Pacific Northwest National Laboratory) -->
<!-- updated by Steve Elbert 1/17/2014 AV-05-1.2 to AV-05-1.4 -->
<!-- updated by Steve Elbert 4/1/2013 -->
<!-- Schema Version Information
  Schema Title: PNWSGD Transactions Schema
  Schema Type: Domain, Constrained
  Version Number: 2.3
  Version Date: 01/17/2014
  Contact: Ron Melton, Battelle
  Namespace Prefix: pnwns (Pacific Northwest name space)
  Namespace URI: http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
  Exchange Description: Data format standard for Non-transactive data collection for the Smart
Grid Project.
  Imported Schema Versions:
      W3C XML Schema = version 0.0.0 of xmlschema.xsd
          PNWSGDSchema-TestCaseEventTypes.xsd
          PNWSGDSchema-TestCaseStatusTypes.xsd
      PNWSGDSchema-DeviceEventTypes.xsd
          PNWSGDSchema-DeviceStatusTypes.xsd
          PNWSGDSchema-MeasurementValueTypes.xsd
          PNWSGDSchema-MeasurementQualifierTypes.xsd
          PNWSGDSchema-MeasurementUnitTypes.xsd
  -->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions"
targetNamespace="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions"
elementFormDefault="qualified" attributeFormDefault="unqualified" version="2.3">
       <!-- The enumerated lists for volatile "controlled" vocabularies.  These vocabularies are
expected to change independently of the normal release cycle of schema versions. -->
       <xs:include schemaLocation="PNWSGDSchema-TestCaseEventTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-TestCaseStatusTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-DeviceEventTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-DeviceStatusTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-DeviceTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-MeasurementValueTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-MeasurementQualifierTypes.xsd"/>
       <xs:include schemaLocation="PNWSGDSchema-MeasurementUnitTypes.xsd"/>
       <xs:element name="PNWSGDTransactions">
              <xs:annotation>
                     <xs:documentation>The root node of the Pacific Northwest Smart Grid
Demonstration Transaction schema.</xs:documentation>
              </xs:annotation>
              <xs:complexType>
                     <xs:sequence>
                            <xs:element ref="pnwns:SchemaVersion"/>
                            <xs:element ref="pnwns:MessageCreationDateTime"/>
                            <xs:element ref="pnwns:UtilityID"/>
                            <xs:choice>
                                   <xs:element ref="pnwns:MembershipConfigTransaction">
                                          <xs:annotation>
                                                 <xs:documentation>Transaction for
identifying a data stream membership for each test case for a given utility.</xs:documentation>
                                          </xs:annotation>
                                   </xs:element>
                                   <xs:element ref="pnwns:MembershipEventTransaction">
                                          <xs:annotation>
                                                 <xs:documentation>Transaction for
identifying when a data stream membership has changed.</xs:documentation>
                                          </xs:annotation>
                                   </xs:element>
                                   <xs:element ref="pnwns:TestCaseEventTransaction">
                                          <xs:annotation>
                                                 <xs:documentation>Transaction for
identifying when a test case event occurred and the corresponding status.</xs:documentation>
                                          </xs:annotation>
```

```
                                        </xs:element>
                                        <xs:element ref="pnwns:DeviceInformationTransaction">
                                                <xs:annotation>
                                                        <xs:documentation>Transaction for
identifying devices and their metadata.  If a utility shall send device events, then the utility
shall send meta data about that device.</xs:documentation>
                                                </xs:annotation>
                                        </xs:element>
                                        <xs:element ref="pnwns:DeviceEventTransaction">
                                                <xs:annotation>
                                                        <xs:documentation>Transaction for
identifying when a device event has occurred.  If a device event is being captured for a device,
the utility shall send meta data about that device via the
DeviceInformationTransaction.</xs:documentation>
                                                </xs:annotation>
                                        </xs:element>
                                        <xs:element
ref="pnwns:ServiceLocationInformationTransaction">
                                                <xs:annotation>
                                                        <xs:documentation>Transaction for
identifying circuit or service location information.</xs:documentation>
                                                </xs:annotation>
                                        </xs:element>
                                        <xs:element ref="pnwns:CustomerTransaction">
                                                <xs:annotation>
                                                        <xs:documentation>Transaction for
identifying customers and any customer changes for a given location. </xs:documentation>
                                                </xs:annotation>
                                        </xs:element>
                                        <xs:element ref="pnwns:DataStreamInformationTransaction">
                                                <xs:annotation>
                                                        <xs:documentation>Transaction for
identifying the list of data streams associated with a utility.  This transaction covers all data
streams - one-time project values, .</xs:documentation>
                                                </xs:annotation>
                                        </xs:element>
                                        <xs:element ref="pnwns:MeasurementTransaction">
                                                <xs:annotation>
                                                        <xs:documentation>Transaction for sending
all measurements for non-transactive data.</xs:documentation>
                                                </xs:annotation>
                                        </xs:element>
                                </xs:choice>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="SchemaVersion">
                <xs:annotation>
                        <xs:documentation>The PNWSGD Transaction schema
version.</xs:documentation>
                </xs:annotation>
                <xs:simpleType>
                        <xs:restriction base="xs:string">
                                <xs:pattern value="[1-9]+[0-9]*\.[0-9]+"/>
                        </xs:restriction>
                </xs:simpleType>
        </xs:element>
        <xs:element name="MessageCreationDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format that this transaction
was created.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:simpleType name="UtilityNameAbbrType">
                <xs:annotation>
                        <xs:documentation>The two-letter abbreviation of a
utility.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="AV"/>
                        <xs:enumeration value="BP"/>
```

```
                        <xs:enumeration value="EB"/>
                        <xs:enumeration value="FH"/>
                        <xs:enumeration value="IF"/>
                        <xs:enumeration value="LV"/>
                        <xs:enumeration value="MF"/>
                        <xs:enumeration value="NW"/>
                        <xs:enumeration value="PL"/>
                        <xs:enumeration value="PG"/>
                        <xs:enumeration value="UW"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:simpleType name="UtilityNameLongFormType">
                <xs:annotation>
                        <xs:documentation>The long-form name of a utility.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="Avista Utilities"/>
                        <xs:enumeration value="Benton PUD"/>
                        <xs:enumeration value="City of Ellensburg"/>
                        <xs:enumeration value="Flathead Electric Cooperative"/>
                        <xs:enumeration value="Idaho Falls Power"/>
                        <xs:enumeration value="Lower Valley Energy"/>
                        <xs:enumeration value="Milton-Freewater City Light and Power"/>
                        <xs:enumeration value="Northwestern Energy"/>
                        <xs:enumeration value="Peninsula Light"/>
                        <xs:enumeration value="Portland General Electric"/>
                        <xs:enumeration value="Seattle City Light - University of Washington"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:simpleType name="MembershipLongFormType">
                <xs:annotation>
                        <xs:documentation>The long-form description of membership
categories.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="Experimental Member"/>
                        <xs:enumeration value="Control Member"/>
                        <xs:enumeration value="Not a Member"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:simpleType name="MembershipAbbrType">
                <xs:annotation>
                        <xs:documentation>The abbreviation of membership
categories.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="EM"/>
                        <xs:enumeration value="CM"/>
                        <xs:enumeration value="NM"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:simpleType name="TestCaseIDType">
                <xs:annotation>
                        <xs:documentation>An enumerated list of test cases.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="AV-01-1.4"/>
                        <xs:enumeration value="AV-01-3.2"/>
                        <xs:enumeration value="AV-02-3.2"/>
                        <xs:enumeration value="AV-03-1.1"/>
                        <xs:enumeration value="AV-04-3.2"/>
                        <xs:enumeration value="AV-05-1.4"/>
                        <xs:enumeration value="AV-05-3.1"/>
                        <xs:enumeration value="AV-05-4.1"/>
                        <xs:enumeration value="AV-05-4.2"/>
                        <xs:enumeration value="AV-05-4.3"/>
                        <xs:enumeration value="AV-06-3.1"/>
                        <xs:enumeration value="AV-07-2.1"/>
                        <xs:enumeration value="AV-08-2.2"/>
                        <xs:enumeration value="AV-09-1.1"/>
                        <xs:enumeration value="AV-10-1.1"/>
```

```
<xs:enumeration value="AV-11-1.1"/>
<xs:enumeration value="AV-12-1.1"/>
<xs:enumeration value="AV-13-1.1"/>
<xs:enumeration value="BP-01-2.1"/>
<xs:enumeration value="BP-01-2.2"/>
<xs:enumeration value="BP-01-2.3"/>
<xs:enumeration value="BP-01-3.2"/>
<xs:enumeration value="BP-02-1.4"/>
<xs:enumeration value="EB-01-2.1"/>
<xs:enumeration value="EB-02-3.2"/>
<xs:enumeration value="EB-03-3.2"/>
<xs:enumeration value="EB-04-3.2"/>
<xs:enumeration value="EB-05-3.2"/>
<xs:enumeration value="EB-06-3.2"/>
<xs:enumeration value="EB-07-3.2"/>
<xs:enumeration value="EB-08-3.2"/>
<xs:enumeration value="EB-09-3.2"/>
<xs:enumeration value="EB-10-3.2"/>
<xs:enumeration value="EB-11-3.2"/>
<xs:enumeration value="EB-12-3.2"/>
<xs:enumeration value="EB-13-3.2"/>
<xs:enumeration value="FH-01-2.2"/>
<xs:enumeration value="FH-02-1.1"/>
<xs:enumeration value="FH-03-1.2"/>
<xs:enumeration value="FH-04-1.2"/>
<xs:enumeration value="FH-05-2.2"/>
<xs:enumeration value="FH-06-1.1"/>
<xs:enumeration value="FH-07-1.2"/>
<xs:enumeration value="FH-08-1.2"/>
<xs:enumeration value="FH-09-4.3"/>
<xs:enumeration value="IF-01-1.4"/>
<xs:enumeration value="IF-01-3.2"/>
<xs:enumeration value="IF-02-3.2"/>
<xs:enumeration value="IF-03-2.2"/>
<xs:enumeration value="IF-04-1.3"/>
<xs:enumeration value="IF-04-3.2"/>
<xs:enumeration value="IF-04-4.1"/>
<xs:enumeration value="IF-04-4.2"/>
<xs:enumeration value="IF-04-4.3"/>
<xs:enumeration value="IF-05-1.3"/>
<xs:enumeration value="IF-07-1.3"/>
<xs:enumeration value="IF-07-2.2"/>
<xs:enumeration value="IF-08-1.3"/>
<xs:enumeration value="IF-08-3.2"/>
<xs:enumeration value="IF-09-3.1"/>
<xs:enumeration value="IF-10-1.2"/>
<xs:enumeration value="IF-10-3.2"/>
<xs:enumeration value="LV-01-3.1"/>
<xs:enumeration value="LV-02-1.3"/>
<xs:enumeration value="LV-02-2.1"/>
<xs:enumeration value="LV-03-3.2"/>
<xs:enumeration value="LV-04-3.2"/>
<xs:enumeration value="LV-05-3.2"/>
<xs:enumeration value="LV-06-1.4"/>
<xs:enumeration value="LV-07-3.2"/>
<xs:enumeration value="LV-08-1.1"/>
<xs:enumeration value="LV-09-4.1"/>
<xs:enumeration value="LV-09-4.2"/>
<xs:enumeration value="LV-09-4.3"/>
<xs:enumeration value="LV-10-3.2"/>
<xs:enumeration value="MF-01-1.4"/>
<xs:enumeration value="MF-02-1.2"/>
<xs:enumeration value="MF-03-1.2"/>
<xs:enumeration value="MF-04-3.2"/>
<xs:enumeration value="NW-01-1.2"/>
<xs:enumeration value="NW-01-3.2"/>
<xs:enumeration value="NW-02-2.2"/>
<xs:enumeration value="NW-03-1.3"/>
<xs:enumeration value="NW-03-4.1"/>
<xs:enumeration value="NW-04-1.2"/>
<xs:enumeration value="NW-04-3.2"/>
```

```
                        <xs:enumeration value="PG-01-1.2"/>
                        <xs:enumeration value="PG-01-4.1"/>
                        <xs:enumeration value="PG-01-4.2"/>
                        <xs:enumeration value="PG-02-1.2"/>
                        <xs:enumeration value="PG-03-1.2"/>
                        <xs:enumeration value="PG-04-1.4"/>
                        <xs:enumeration value="PG-04-3.2"/>
                        <xs:enumeration value="PG-05-2.1"/>
                        <xs:enumeration value="PL-01-1.4"/>
                        <xs:enumeration value="PL-02-1.4"/>
                        <xs:enumeration value="PL-02-3.2"/>
                        <xs:enumeration value="PL-03-2.2"/>
                        <xs:enumeration value="UW-01-1.1"/>
                        <xs:enumeration value="UW-02-1.1"/>
                        <xs:enumeration value="UW-03-3.2"/>
                        <xs:enumeration value="UW-04-1.1"/>
                        <xs:enumeration value="UW-04-3.2"/>
                        <xs:enumeration value="UW-04-3.2/1.1"/>
                        <xs:enumeration value="UW-05-3.1"/>
                        <xs:enumeration value="UW-06-3.2"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:element name="UtilityID" type="pnwns:UtilityNameAbbrType">
                <xs:annotation>
                        <xs:documentation>The two-letter utility acronym.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="DataStreamID">
                <xs:annotation>
                        <xs:documentation>A globally unique data stream
identifier.</xs:documentation>
                </xs:annotation>
                <xs:simpleType>
                        <xs:restriction base="xs:string">
                                <xs:minLength value="3"/>
                        </xs:restriction>
                </xs:simpleType>
        </xs:element>
        <xs:element name="DataStreamDescription" type="xs:string">
                <xs:annotation>
                        <xs:documentation>A description of the data stream.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="DeviceID">
                <xs:annotation>
                        <xs:documentation>A unique device identifier.</xs:documentation>
                </xs:annotation>
                <xs:simpleType>
                        <xs:restriction base="xs:string">
                                <xs:minLength value="3"/>
                        </xs:restriction>
                </xs:simpleType>
        </xs:element>
        <xs:element name="Membership" type="pnwns:MembershipAbbrType">
                <xs:annotation>
                        <xs:documentation>Defines the current membership status for this data
stream in regards to this test case.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="EffectiveDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format of the
event.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="DeactiveDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format of the deactive
event.</xs:documentation>
                </xs:annotation>
        </xs:element>
```

```
        <xs:element name="StartDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format for the start of the
period.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="EndDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format for the end of the
period.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="TestCaseID" type="pnwns:TestCaseIDType">
                <xs:annotation>
                        <xs:documentation>A unique test case identifier.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:simpleType name="MembershipEventType">
                <xs:annotation>
                        <xs:documentation>Enumerated list of membership events.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="Enter"/>
                        <xs:enumeration value="Leave"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:element name="MembershipEvent" type="pnwns:MembershipEventType">
                <xs:annotation>
                        <xs:documentation>The type of membership event that
occurred.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:simpleType name="MembershipEventCauseType">
                <xs:annotation>
                        <xs:documentation>Enumerated list of causes for membership
changes.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="Equipment installed and commissioned"/>
                        <xs:enumeration value="Equipment removed or decommissioned"/>
                        <xs:enumeration value="Equipment failed"/>
                        <xs:enumeration value="Change in customer participation"/>
                        <xs:enumeration value="Test period begins"/>
                        <xs:enumeration value="Test period ends"/>
                        <xs:enumeration value="Change in test case"/>
                        <xs:enumeration value="Change in test case topology"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:element name="MembershipEventCause" type="pnwns:MembershipEventCauseType">
                <xs:annotation>
                        <xs:documentation>Describes the cause for an event.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="TestCaseEvent" type="pnwns:TestCaseEventType">
                <xs:annotation>
                        <xs:documentation>The event that occurred for this test
case.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="TestCaseStatus" type="pnwns:TestCaseStatusType">
                <xs:annotation>
                        <xs:documentation>The status of the event.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="DeviceEvent" type="pnwns:DeviceEventType">
                <xs:annotation>
                        <xs:documentation>The event that occurred for this
device.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="DeviceStatus" type="pnwns:DeviceStatusType">
```

```
                <xs:annotation>
                        <xs:documentation>The status of the device.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="Device" type="pnwns:DeviceType">
                <xs:annotation>
                        <xs:documentation>Type of device.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="Model" type="xs:string">
                <xs:annotation>
                        <xs:documentation>Device model.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="Manufacturer" type="xs:string">
                <xs:annotation>
                        <xs:documentation>Manufacturer of the device.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="HardwareVersion" type="xs:string">
                <xs:annotation>
                        <xs:documentation>Device hardware version.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="SoftwareVersion" type="xs:string">
                <xs:annotation>
                        <xs:documentation>Device software version.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="InServiceDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format for when the device was
put into service.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="OutServiceDateTime" type="xs:dateTime">
                <xs:annotation>
                        <xs:documentation>The date and time in UTC format for when the device was
removed from service.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="PhaseCode">
                <xs:annotation>
                        <xs:documentation>Phase code.</xs:documentation>
                </xs:annotation>
                <xs:simpleType>
                        <xs:restriction base="xs:string">
                                <xs:enumeration value="A">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
                                </xs:enumeration>
                                <xs:enumeration value="B">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
                                </xs:enumeration>
                                <xs:enumeration value="C">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
                                </xs:enumeration>
                                <xs:enumeration value="AB">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
                                </xs:enumeration>
                                <xs:enumeration value="AC">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
```

```
                                </xs:enumeration>
                                <xs:enumeration value="BC">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
                                </xs:enumeration>
                                <xs:enumeration value="ABC">
                                        <xs:annotation>
                                                <xs:documentation/>
                                        </xs:annotation>
                                </xs:enumeration>
                                <xs:enumeration value="Unknown"/>
                        </xs:restriction>
                </xs:simpleType>
        </xs:element>
        <xs:complexType name="TimeZoneType">
                <xs:annotation>
                        <xs:documentation>This is the time zone for this location.  The time zone
designator goes in the element, the attributes optioanlly give additional information about this
time zone.  For instance the time zine for Denver, Colorado, USA is MT (Mountain Time).  Daylight
savings time is enabled in Denver, so DSTEnabled = 1 or true.  The MT time zone is UTC - 7.00
hours when DST is not in effect, so the UTCOffest would be "-7.00".  On the other hand, Phoenix
is also in the Moutain Time zone, but DST is not employed in Arizona.  For the case of Phoenix,
all of the settings would be the same as for Denver, except that DSTEnabled would be false.  The
standard civilian time zones (e.g., AT,ET,CT, MT, PT, and AKT for North America) are included for
all global locations</xs:documentation>
                </xs:annotation>
                <xs:simpleContent>
                        <xs:extension base="xs:string">
                                <xs:attribute name="DSTEnabled" type="xs:boolean">
                                        <xs:annotation>
                                                <xs:documentation>This attribute determines if
daylight savings time is enabled at this location.  If DSTEnabled is false then DST offsets are
not used at this location.  Standard date ranges for DST effectiveness and DST offsets are
assumed for this location.</xs:documentation>
                                        </xs:annotation>
                                </xs:attribute>
                                <xs:attribute name="UTCOffset" type="xs:decimal" use="optional">
                                        <xs:annotation>
                                                <xs:documentation>This is the offset in decimal
hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not
in effect.</xs:documentation>
                                        </xs:annotation>
                                </xs:attribute>
                        </xs:extension>
                </xs:simpleContent>
        </xs:complexType>
        <xs:element name="TimeZone">
                <xs:annotation>
                        <xs:documentation>This is the time zone for this location or device.  The
time zone designator goes in the element, the attributes optionally give additional information
about this time zone.  For instance the time zone for Denver, Colorado, USA is MT (Mountain
Time).  Daylight savings time is enabled in Denver, so DSTEnabled = true.  The MT time zone is
UTC - 7.00 hours when DST is not in effect, so the UTCOffest would be "-7.00".  On the other
hand, Phoenix is also in the Moutain Time zone, but DST is not employed in Arizona.  For the case
of Phoenix, all of the settings would be the same as for Denver, except that DSTEnabled would be
false.  The standard civilian time zones for this project (e.g., CT, MT, and PT for North
America) are included for all global locations.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:simpleContent>
                                <xs:restriction base="pnwns:TimeZoneType">
                                        <xs:enumeration value="PT"/>
                                        <xs:enumeration value="MT"/>
                                        <xs:enumeration value="CT"/>
                                        <xs:attribute name="DSTEnabled" type="xs:boolean">
                                                <xs:annotation>
                                                        <xs:documentation>This attribute determines
if daylight savings time is enabled at this location.  If DSTEnabled is false then DST offsets
are not used at this location.  Standard date ranges for DST effectiveness and DST offsets are
assumed for this location.</xs:documentation>
```

```
                                        </xs:annotation>
                                    </xs:attribute>
                                    <xs:attribute name="UTCOffset" type="xs:decimal"
use="optional">
                                        <xs:annotation>
                                            <xs:documentation>This is the offset in
decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time
is not in effect.</xs:documentation>
                                        </xs:annotation>
                                    </xs:attribute>
                                </xs:restriction>
                            </xs:simpleContent>
                        </xs:complexType>
                </xs:element>
                <xs:element name="FeederID" type="xs:string">
                        <xs:annotation>
                                <xs:documentation>A unique feeder identifier.</xs:documentation>
                        </xs:annotation>
                </xs:element>
                <xs:element name="SubstationID" type="xs:string">
                        <xs:annotation>
                                <xs:documentation>A unique substation identifier.</xs:documentation>
                        </xs:annotation>
                </xs:element>
                <xs:element name="CustomerType">
                        <xs:annotation>
                                <xs:documentation>Type of customer (i.e. residential, commercial,
industrial, etc.)</xs:documentation>
                        </xs:annotation>
                        <xs:simpleType>
                                <xs:restriction base="xs:string">
                                        <xs:enumeration value="Residential"/>
                                        <xs:enumeration value="Commercial"/>
                                        <xs:enumeration value="Industrial"/>
                                        <xs:enumeration value="Irrigation"/>
                                </xs:restriction>
                        </xs:simpleType>
                </xs:element>
                <xs:element name="CustomerID" type="xs:string">
                        <xs:annotation>
                                <xs:documentation>A unique identifier for a particular customer.  This
cannot be linked to an actual customer account.</xs:documentation>
                        </xs:annotation>
                </xs:element>
                <xs:element name="ServiceLocationID" type="xs:string">
                        <xs:annotation>
                                <xs:documentation>This is the circuit or service location
identifier.</xs:documentation>
                        </xs:annotation>
                </xs:element>
                <xs:element name="ServiceLocationDescription" type="xs:string">
                        <xs:annotation>
                                <xs:documentation>Free-form text describing the circuit or service
location.</xs:documentation>
                        </xs:annotation>
                </xs:element>
                <xs:element name="Location">
                        <xs:annotation>
                                <xs:documentation>Circuit or service information about a
location.</xs:documentation>
                        </xs:annotation>
                        <xs:complexType>
                                <xs:sequence>
                                        <xs:element ref="pnwns:ServiceLocationID"/>
                                        <xs:element ref="pnwns:ServiceLocationDescription" minOccurs="0"/>
                                        <xs:element ref="pnwns:TimeZone" minOccurs="0"/>
                                        <xs:element ref="pnwns:SubstationID" minOccurs="0"/>
                                        <xs:element ref="pnwns:FeederID" minOccurs="0"/>
                                        <xs:element ref="pnwns:PhaseCode" minOccurs="0"/>
                                </xs:sequence>
                        </xs:complexType>
```

```
        </xs:element>
        <xs:element name="DataStreamInformation">
                <xs:annotation>
                        <xs:documentation>The list of data streams associated with this
device.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element ref="pnwns:DataStreamID"/>
                                <xs:element ref="pnwns:DataStreamDescription" minOccurs="0"/>
                                <xs:element ref="pnwns:DeviceID" minOccurs="0"/>
                                <xs:element ref="pnwns:ServiceLocationID" minOccurs="0"/>
                                <xs:element ref="pnwns:MeasurementType"/>
                                <xs:element ref="pnwns:MeasurementQualifier"/>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="MeasurementType" type="pnwns:MeasurementValueType">
                <xs:annotation>
                        <xs:documentation>The value type of the measurement.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="MeasurementQualifier" type="pnwns:MeasurementQualifierType">
                <xs:annotation>
                        <xs:documentation>The qualifier for the type of
measurement.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:element name="IntervalDuration" type="xs:duration">
                <xs:annotation>
                        <xs:documentation>The interval duration in ISO 8601 format.   Form for
duration is:  P-- time duration designator, Y-- number of years, M-- number of months, D-- number
of days, H--number of hours, M-- number of minutes, S-- number of seconds.  Example:
P1Y2M3DT20H30M40S would be 1 year, 2 months, 3 days, 20 hours, 30 minutes and 40
seconds.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:complexType name="ValueTypeDef">
                <xs:annotation>
                        <xs:documentation>Actual measurement value.</xs:documentation>
                </xs:annotation>
                <xs:simpleContent>
                        <xs:extension base="xs:float">
                                <xs:attribute name="Units" type="pnwns:UnitType" use="required">
                                        <xs:annotation>
                                                <xs:documentation>Units of measure for this
reading.</xs:documentation>
                                        </xs:annotation>
                                </xs:attribute>
                        </xs:extension>
                </xs:simpleContent>
        </xs:complexType>
        <xs:element name="Value" type="pnwns:ValueTypeDef" nillable="true">
                <xs:annotation>
                        <xs:documentation>The actual value.</xs:documentation>
                </xs:annotation>
        </xs:element>
        <xs:simpleType name="MeasurementStatusType">
                <xs:annotation>
                        <xs:documentation>Enumerated list of measurement
status.</xs:documentation>
                </xs:annotation>
                <xs:restriction base="xs:string">
                        <xs:enumeration value="Actual Reading"/>
                        <xs:enumeration value="Calculated Reading"/>
                        <xs:enumeration value="Estimated Reading"/>
                        <xs:enumeration value="Edited Reading"/>
                        <xs:enumeration value="Missed Reading"/>
                        <xs:enumeration value="Missed and Interpolated Reading"/>
                        <xs:enumeration value="Missed and Edited Reading"/>
                        <xs:enumeration value="Unknown"/>
```

```
                        <xs:enumeration value="Not Applicable"/>
                </xs:restriction>
        </xs:simpleType>
        <xs:element name="MeasurementValueStatus">
                <xs:annotation>
                        <xs:documentation>The status of the measurement.</xs:documentation>
                </xs:annotation>
                <xs:simpleType>
                        <xs:restriction base="pnwns:MeasurementStatusType"/>
                </xs:simpleType>
        </xs:element>
        <xs:element name="MembershipConfigTransaction">
                <xs:annotation>
                        <xs:documentation>Transaction for identifying a data stream membership for
each test case for a given utility.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element name="DataStreamMembership" maxOccurs="unbounded">
                                        <xs:annotation>
                                                <xs:documentation>For each data stream, provide the
membership for each test case within a utility.</xs:documentation>
                                        </xs:annotation>
                                        <xs:complexType>
                                                <xs:sequence>
                                                        <xs:element ref="pnwns:DataStreamID"/>
                                                        <xs:element ref="pnwns:DeviceID"
minOccurs="0"/>
                                                        <xs:element name="TestCaseMembership"
maxOccurs="unbounded">
                                                                <xs:annotation>
                                                                        <xs:documentation>A list of
test cases associated with the data stream.</xs:documentation>
                                                                </xs:annotation>
                                                                <xs:complexType>
                                                                        <xs:sequence>
                                                                                <xs:element
ref="pnwns:TestCaseID"/>
                                                                                <xs:element
ref="pnwns:Membership"/>
                                                                                <xs:element
ref="pnwns:EffectiveDateTime"/>
                                                                        </xs:sequence>
                                                                </xs:complexType>
                                                        </xs:element>
                                                </xs:sequence>
                                        </xs:complexType>
                                </xs:element>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="MembershipEventTransaction">
                <xs:annotation>
                        <xs:documentation>Transaction for identifying when a data stream
membership has changed.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element name="MembershipEvents" maxOccurs="unbounded">
                                        <xs:annotation>
                                                <xs:documentation>A list of data stream membership
changes.</xs:documentation>
                                        </xs:annotation>
                                        <xs:complexType>
                                                <xs:sequence>
                                                        <xs:element ref="pnwns:DataStreamID"/>
                                                        <xs:element ref="pnwns:TestCaseID"/>
                                                        <xs:element ref="pnwns:MembershipEvent"/>
                                                        <xs:element ref="pnwns:Membership"/>
                                                        <xs:element
ref="pnwns:MembershipEventCause"/>
```

```
                                                <xs:element ref="pnwns:EffectiveDateTime"/>
                                        </xs:sequence>
                                </xs:complexType>
                        </xs:element>
                </xs:sequence>
        </xs:complexType>
</xs:element>
<xs:element name="TestCaseEventTransaction">
        <xs:annotation>
                <xs:documentation>Transaction for identifying when a test case event
occurred and the corresponding status.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
                <xs:sequence>
                        <xs:element name="TestCaseEvents" maxOccurs="unbounded">
                                <xs:annotation>
                                        <xs:documentation>A listing of all test case events
and their status.</xs:documentation>
                                </xs:annotation>
                                <xs:complexType>
                                        <xs:sequence>
                                                <xs:element ref="pnwns:TestCaseID"/>
                                                <xs:element ref="pnwns:EffectiveDateTime"/>
                                                <xs:element ref="pnwns:TestCaseEvent"/>
                                                <xs:element ref="pnwns:TestCaseStatus"/>
                                        </xs:sequence>
                                </xs:complexType>
                        </xs:element>
                </xs:sequence>
        </xs:complexType>
</xs:element>
<xs:element name="DeviceEventTransaction">
        <xs:annotation>
                <xs:documentation>Transaction for identifying when a device event has
occurred.  If a device event is being captured for a device, the utility shall send meta data
about that device via the DeviceInformationTransaction.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
                <xs:sequence>
                        <xs:element name="DeviceEvents" maxOccurs="unbounded">
                                <xs:annotation>
                                        <xs:documentation>A listing of device events and
their status.</xs:documentation>
                                </xs:annotation>
                                <xs:complexType>
                                        <xs:sequence>
                                                <xs:element ref="pnwns:DeviceID"/>
                                                <xs:element ref="pnwns:EffectiveDateTime"/>
                                                <xs:element ref="pnwns:DeviceEvent"/>
                                                <xs:element ref="pnwns:DeviceStatus"/>
                                        </xs:sequence>
                                </xs:complexType>
                        </xs:element>
                </xs:sequence>
        </xs:complexType>
</xs:element>
<xs:element name="DeviceInformationTransaction">
        <xs:annotation>
                <xs:documentation>Transaction for identifying devices and their metadata.
If a utility shall send device events, then the utility shall send meta data about that
device.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
                <xs:sequence>
                        <xs:element name="Devices" maxOccurs="unbounded">
                                <xs:annotation>
                                        <xs:documentation>A list of devices at a
utility.</xs:documentation>
                                </xs:annotation>
                                <xs:complexType>
                                        <xs:sequence>
```

```
                                                        <xs:element ref="pnwns:DeviceID"/>
                                                        <xs:element ref="pnwns:Device"/>
                                                        <xs:element ref="pnwns:Model"
minOccurs="0"/>
                                                        <xs:element ref="pnwns:Manufacturer"
minOccurs="0"/>
                                                        <xs:element ref="pnwns:HardwareVersion"
minOccurs="0"/>
                                                        <xs:element ref="pnwns:SoftwareVersion"
minOccurs="0"/>
                                                        <xs:element ref="pnwns:InServiceDateTime"/>
                                                        <xs:element ref="pnwns:OutServiceDateTime"
minOccurs="0"/>
                                                        <xs:element ref="pnwns:ServiceLocationID"/>
                                                        <xs:element ref="pnwns:CustomerID"
minOccurs="0"/>
                                                        <xs:element name="AssociatedDataStreams">
                                                                <xs:annotation>
                                                                        <xs:documentation>A listing
of all data streams associated with this device.</xs:documentation>
                                                                </xs:annotation>
                                                                <xs:complexType>
                                                                        <xs:sequence>
                                                                                <xs:element
ref="pnwns:DataStreamID" maxOccurs="unbounded"/>
                                                                        </xs:sequence>
                                                                </xs:complexType>
                                                        </xs:element>
                                                </xs:sequence>
                                        </xs:complexType>
                                </xs:element>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="CustomerTransaction">
                <xs:annotation>
                        <xs:documentation>Transaction for identifying customers and any customer
changes for a given location.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element name="CustomerInformation" maxOccurs="unbounded">
                                        <xs:annotation>
                                                <xs:documentation>A list of
customers.</xs:documentation>
                                        </xs:annotation>
                                        <xs:complexType>
                                                <xs:sequence>
                                                        <xs:element ref="pnwns:CustomerID"/>
                                                        <xs:element ref="pnwns:CustomerType"/>
                                                        <xs:element ref="pnwns:ServiceLocationID"/>
                                                        <xs:element ref="pnwns:StartDateTime"/>
                                                        <xs:element ref="pnwns:EndDateTime"
minOccurs="0"/>
                                                </xs:sequence>
                                        </xs:complexType>
                                </xs:element>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="DataStreamInformationTransaction">
                <xs:annotation>
                        <xs:documentation>Transaction for identifying the list of data streams
associated with a utility.  This transaction covers all data streams - ones associated with
devices and ones that are not.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element ref="pnwns:DataStreamInformation"
maxOccurs="unbounded">
                                        <xs:annotation>
```

```
                                        <xs:documentation>Information on each data
stream.</xs:documentation>
                                    </xs:annotation>
                                </xs:element>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="MeasurementTransaction">
                <xs:annotation>
                        <xs:documentation>Transaction for sending all measurements for non-
transactive data.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element name="Measurements" maxOccurs="unbounded">
                                        <xs:annotation>
                                                <xs:documentation>A list of
measurements.</xs:documentation>
                                        </xs:annotation>
                                        <xs:complexType>
                                                <xs:sequence>
                                                        <xs:element ref="pnwns:DataStreamID"/>
                                                        <xs:element ref="pnwns:StartDateTime"/>
                                                        <xs:element ref="pnwns:EndDateTime"/>
                                                        <xs:element ref="pnwns:IntervalDuration"/>
                                                        <xs:element ref="pnwns:Value"/>
                                                        <xs:element
ref="pnwns:MeasurementValueStatus"/>
                                                </xs:sequence>
                                        </xs:complexType>
                                </xs:element>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
        <xs:element name="ServiceLocationInformationTransaction">
                <xs:annotation>
                        <xs:documentation>Transaction for identifying circuit or service location
information.</xs:documentation>
                </xs:annotation>
                <xs:complexType>
                        <xs:sequence>
                                <xs:element ref="pnwns:Location" maxOccurs="unbounded"/>
                        </xs:sequence>
                </xs:complexType>
        </xs:element>
</xs:schema>
```

Appendix B – PNWSG Schema Documentation

Schema **PNWSGDSchema.xsd**

schema location:	C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema.xsd
attributeFormDefault:	**unqualified**
elementFormDefault:	**qualified**
targetNamespace:	**http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Elements

Complex types

Simple types

PhaseCode
PNWSGDTransactions
SchemaVersion
ServiceLocationDescription
ServiceLocationID
ServiceLocationInformationTransaction
SoftwareVersion
StartDateTime
SubstationID
TestCaseEvent
TestCaseEventTransaction
TestCaseID
TestCaseStatus
TimeZone
UtilityID
Value

schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-TestCaseEventTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
TestCaseEventType

schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-TestCaseStatusTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
TestCaseStatusType

schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-DeviceEventTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
DeviceEventType

schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-DeviceStatusTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
DeviceStatusType

schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-DeviceTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
DeviceType

schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-MeasurementValueTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
MeasurementValueType

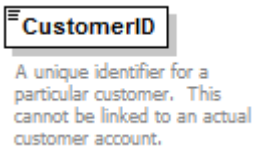
schema location: **C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-MeasurementQualifierTypes.xsd**
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
MeasurementQualifierType

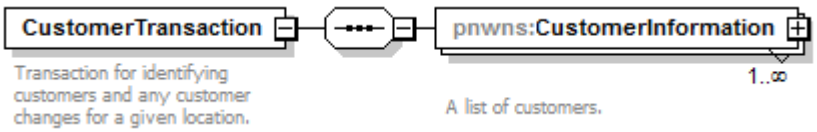
schema location: C:\Users\d3k508\Desktop\Work\SmartGrid\XMLSchemas\NonTransactiveSchemata\PNWSGDSchema-MeasurementUnitTypes.xsd
attributeFormDefault: **unqualified**
elementFormDefault: **qualified**
targetNamespace: **http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions**

Simple types
UnitType

element **CustomerID**

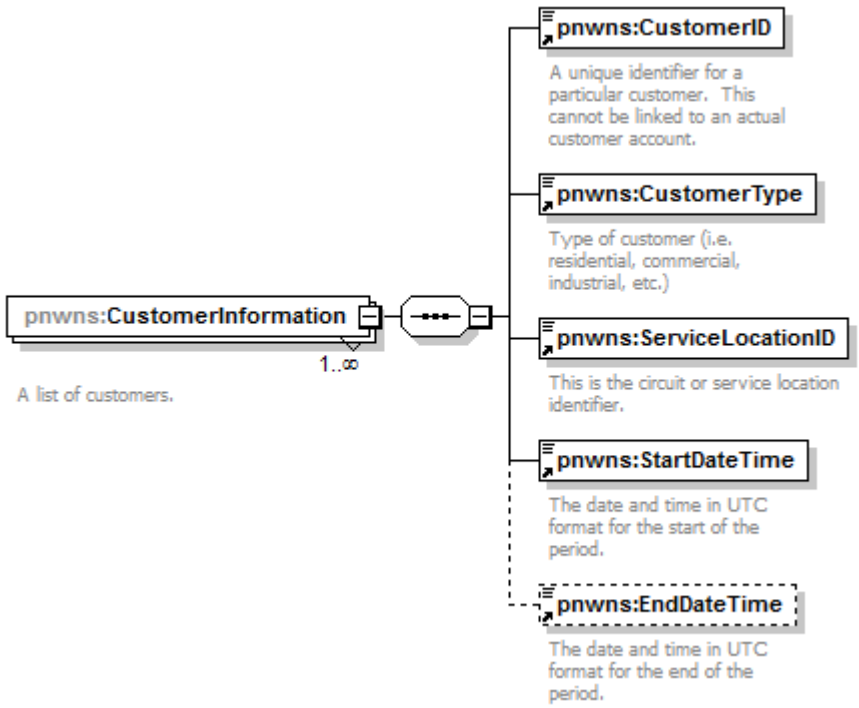
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	elements **CustomerTransaction/CustomerInformation** **DeviceInformationTransaction/Devices**
annotation	documentation A unique identifier for a particular customer. This cannot be linked to an actual customer account.
source	<xs:element name="CustomerID" type="xs:string"> <xs:annotation> <xs:documentation>A unique identifier for a particular customer. This cannot be linked to an actual customer account.</xs:documentation> </xs:annotation> </xs:element>

element **CustomerTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:CustomerInformation**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying customers and any customer changes for a given location.
source	<xs:element name="CustomerTransaction">

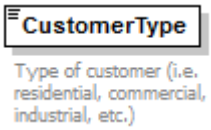
```
  <xs:annotation>
    <xs:documentation>Transaction for identifying customers and any customer changes for a
given location.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="CustomerInformation" maxOccurs="unbounded">
        <xs:annotation>
          <xs:documentation>A list of customers.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element ref="pnwns:CustomerID"/>
            <xs:element ref="pnwns:CustomerType"/>
            <xs:element ref="pnwns:ServiceLocationID"/>
            <xs:element ref="pnwns:StartDateTime"/>
            <xs:element ref="pnwns:EndDateTime" minOccurs="0"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **CustomerTransaction/CustomerInformation**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	**pnwns:CustomerID pnwns:CustomerType pnwns:ServiceLocationID pnwns:StartDateTime**

	pnwns:EndDateTime
annotation	documentation A list of customers.
source	<xs:element name="CustomerInformation" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A list of customers.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:CustomerID"/> <xs:element ref="pnwns:CustomerType"/> <xs:element ref="pnwns:ServiceLocationID"/> <xs:element ref="pnwns:StartDateTime"/> <xs:element ref="pnwns:EndDateTime" minOccurs="0"/> </xs:sequence> </xs:complexType> </xs:element>

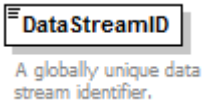
element **CustomerType**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	content simple
used by	element **CustomerTransaction/CustomerInformation**
facets	Kind / Value / Annotation enumeration Residential enumeration Commercial enumeration Industrial enumeration Irrigation
annotation	documentation Type of customer (i.e. residential, commercial, industrial, etc.)
source	<xs:element name="CustomerType"> <xs:annotation> <xs:documentation>Type of customer (i.e. residential, commercial, industrial, etc.)</xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:string"> <xs:enumeration value="Residential"/> <xs:enumeration value="Commercial"/> <xs:enumeration value="Industrial"/> <xs:enumeration value="Irrigation"/> </xs:restriction> </xs:simpleType> </xs:element>

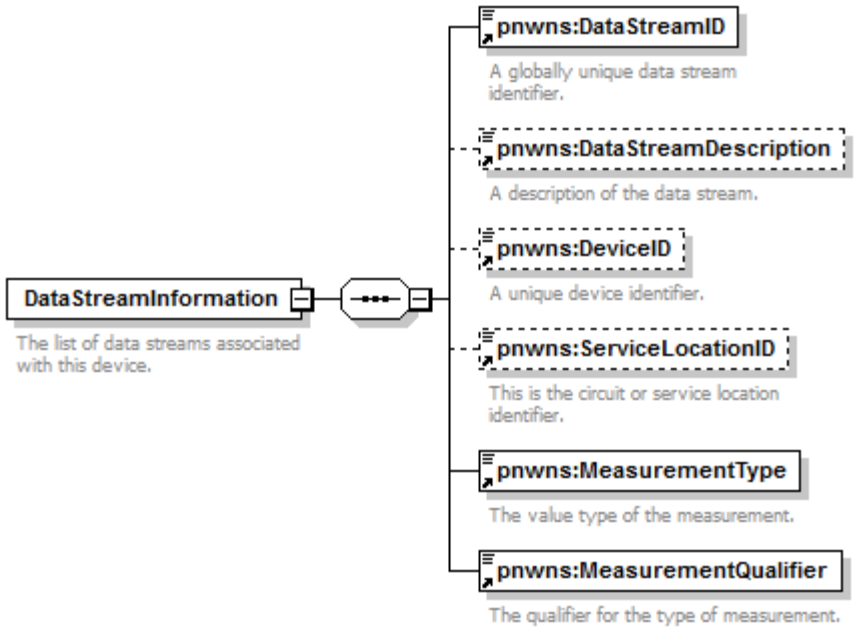
element **DataStreamDescription**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **DataStreamInformation**
annotation	documentation A description of the data stream.
source	<xs:element name="DataStreamDescription" type="xs:string"> <xs:annotation> <xs:documentation>A description of the data stream.</xs:documentation> </xs:annotation> </xs:element>

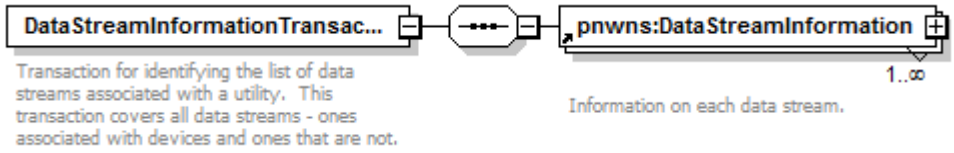
element **DataStreamID**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	content simple
used by	elements **DataStreamInformation DeviceInformationTransaction/Devices/AssociatedDataStreams MembershipConfigTransaction/DataStreamMembership MeasurementTransaction/Measurements MembershipEventTransaction/MembershipEvents**
facets	Kind Value Annotation minLength 3
annotation	documentation A globally unique data stream identifier.
source	<xs:element name="DataStreamID"> <xs:annotation> <xs:documentation>A globally unique data stream identifier.</xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:string"> <xs:minLength value="3"/> </xs:restriction> </xs:simpleType> </xs:element>

element **DataStreamInformation**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:DataStreamID** **pnwns:DataStreamDescription** **pnwns:DeviceID** **pnwns:ServiceLocationID** **pnwns:MeasurementType** **pnwns:MeasurementQualifier**
used by	element **DataStreamInformationTransaction**
annotation	documentation The list of data streams associated with this device.
source	<xs:element name="DataStreamInformation"> <xs:annotation> <xs:documentation>The list of data streams associated with this device.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DataStreamID"/> <xs:element ref="pnwns:DataStreamDescription" minOccurs="0"/> <xs:element ref="pnwns:DeviceID" minOccurs="0"/> <xs:element ref="pnwns:ServiceLocationID" minOccurs="0"/> <xs:element ref="pnwns:MeasurementType"/> <xs:element ref="pnwns:MeasurementQualifier"/> </xs:sequence> </xs:complexType> </xs:element>

element **DataStreamInformationTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:DataStreamInformation**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying the list of data streams associated with a utility. This transaction covers all data streams - ones associated with devices and ones that are not.
source	<xs:element name="DataStreamInformationTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying the list of data streams associated with a utility. This transaction covers all data streams - ones associated with devices and ones that are not.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DataStreamInformation" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>Information on each data stream.</xs:documentation> </xs:annotation> </xs:element> </xs:sequence> </xs:complexType> </xs:element>

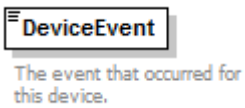
element **DeactiveDateTime**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
annotation	documentation The date and time in UTC format of the deactive event.
source	<xs:element name="DeactiveDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format of the deactive event.</xs:documentation> </xs:annotation> </xs:element>

element **Device**

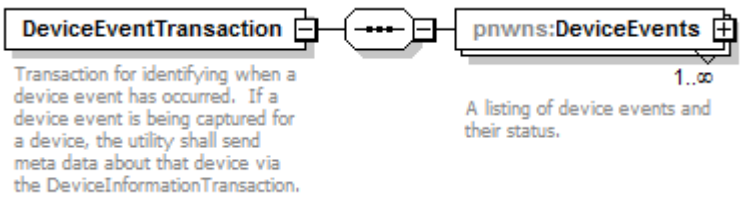
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**DeviceType**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**
facets	Kind Value Annotation enumeration Electric meter enumeration Gas meter enumeration Water meter enumeration Demand meter enumeration Harmonic meter enumeration Phase angle meter enumeration Line potential meter enumeration Line current meter enumeration Recloser enumeration Substation bus potential meter enumeration Substation bus current meter enumeration Substation breaker potential meter enumeration Substation breaker current meter enumeration Switch enumeration Thermometer enumeration Transactive Node enumeration Virtual Meter enumeration EMS Control Add-on enumeration Head Line Sensor enumeration Middle Line Sensor enumeration End Line Sensor enumeration Synchrophasor enumeration Relay meter controller
annotation	documentation Type of device.
source	<xs:element name="Device" type="pnwns:DeviceType"> <xs:annotation> <xs:documentation>Type of device.</xs:documentation> </xs:annotation> </xs:element>

element **DeviceEvent**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions

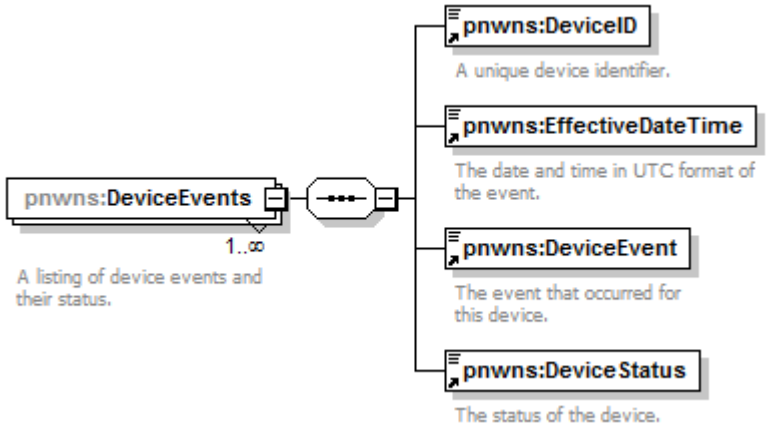
type	**DeviceEventType**
properties	content simple
used by	element **DeviceEventTransaction/DeviceEvents**
facets	Kind / Value / Annotation enumeration Device Alarm enumeration Device Alarm - High voltage enumeration Device Alarm - Hot socket enumeration Device Alarm - Low voltage enumeration Device Alarm - Outage enumeration Device Alarm - Tamper detected enumeration Device Alarm - High temperature enumeration Device Alarm - Fault enumeration Device/Appliance opt out enumeration Device coniditon has changed enumeration Device Engagement enumeration Equipment failures enumeration Equipment failures - Device enumeration Demand Shifter Status Change enumeration Demand Shifter Charging Status enumeration Switch setting enumeration System requests overridden
annotation	documentation The event that occurred for this device.
source	<xs:element name="DeviceEvent" type="pnwns:DeviceEventType"> <xs:annotation> <xs:documentation>The event that occurred for this device.</xs:documentation> </xs:annotation> </xs:element>

element **DeviceEventTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:DeviceEvents**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying when a device event has occurred. If a device event is being captured for a device, the utility shall send meta data about that device via the DeviceInformationTransaction.
source	<xs:element name="DeviceEventTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying when a device event has occurred. If a

	device event is being captured for a device, the utility shall send meta data about that device via the DeviceInformationTransaction.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element name="DeviceEvents" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A listing of device events and their status.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DeviceID"/> <xs:element ref="pnwns:EffectiveDateTime"/> <xs:element ref="pnwns:DeviceEvent"/> <xs:element ref="pnwns:DeviceStatus"/> </xs:sequence> </xs:complexType> </xs:element> </xs:sequence> </xs:complexType> </xs:element>

element **DeviceEventTransaction/DeviceEvents**

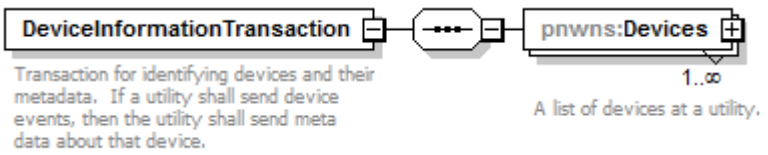
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	**pnwns:DeviceID pnwns:EffectiveDateTime pnwns:DeviceEvent pnwns:DeviceStatus**
annotation	documentation A listing of device events and their status.
source	<xs:element name="DeviceEvents" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A listing of device events and their status.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DeviceID"/> <xs:element ref="pnwns:EffectiveDateTime"/> <xs:element ref="pnwns:DeviceEvent"/>

```
    <xs:element ref="pnwns:DeviceStatus"/>
   </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **DeviceID**

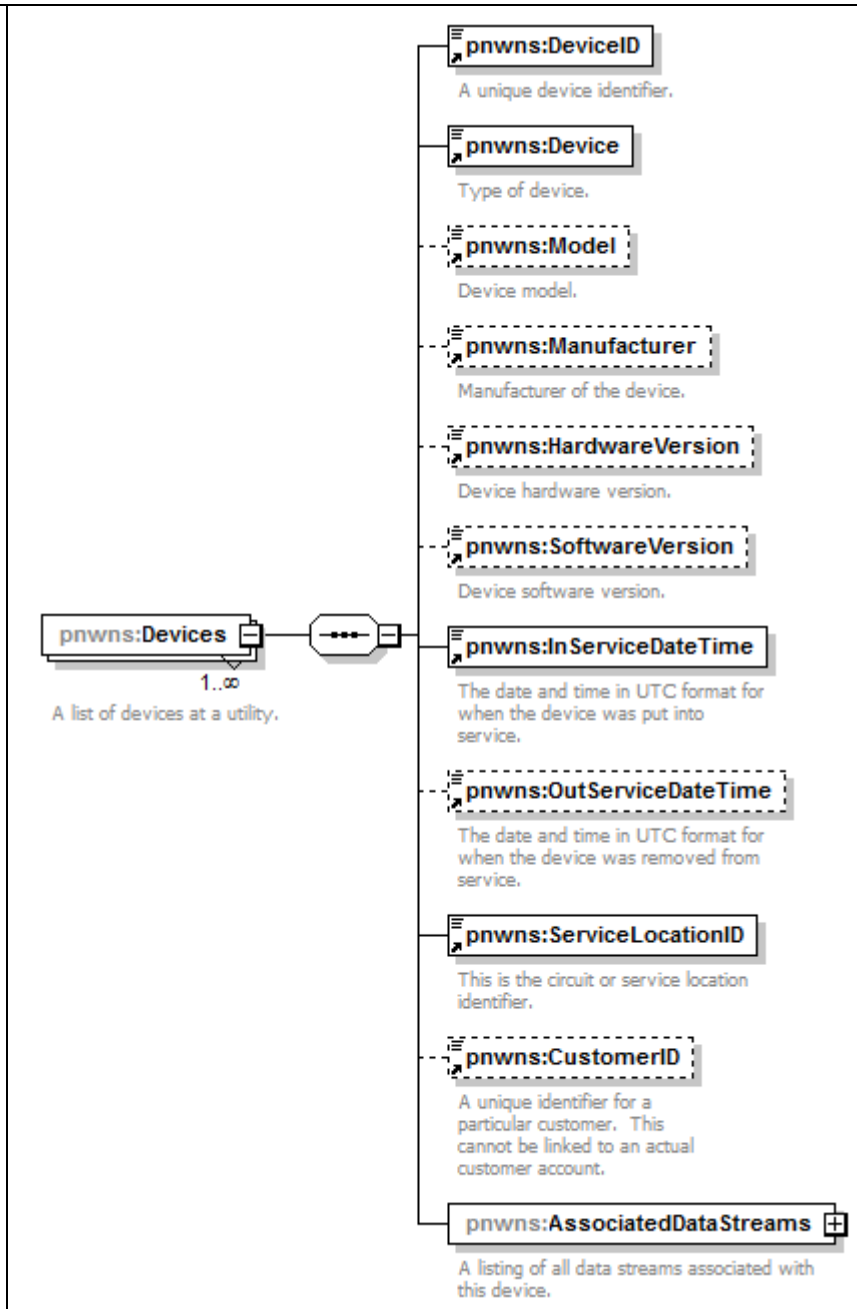
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	content simple
used by	elements **DataStreamInformation** **MembershipConfigTransaction/DataStreamMembership** **DeviceEventTransaction/DeviceEvents** **DeviceInformationTransaction/Devices**
facets	Kind Value Annotation minLength 3
annotation	documentation A unique device identifier.
source	<xs:element name="DeviceID"> <xs:annotation> <xs:documentation>A unique device identifier.</xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:string"> <xs:minLength value="3"/> </xs:restriction> </xs:simpleType> </xs:element>

element **DeviceInformationTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:Devices**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying devices and their metadata. If a utility shall send device events, then the utility shall send meta data about that device.
source	<xs:element name="DeviceInformationTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying devices and their metadata. If a utility shall send device events, then the utility shall send meta data about that device.</xs:documentation>

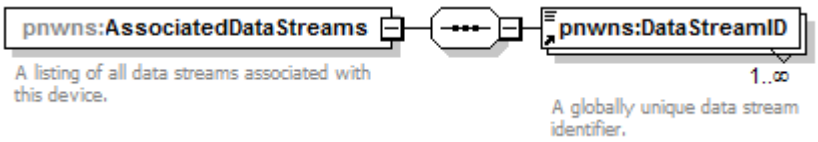
```
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element name="Devices" maxOccurs="unbounded">
        <xs:annotation>
          <xs:documentation>A list of devices at a utility.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element ref="pnwns:DeviceID"/>
            <xs:element ref="pnwns:Device"/>
            <xs:element ref="pnwns:Model" minOccurs="0"/>
            <xs:element ref="pnwns:Manufacturer" minOccurs="0"/>
            <xs:element ref="pnwns:HardwareVersion" minOccurs="0"/>
            <xs:element ref="pnwns:SoftwareVersion" minOccurs="0"/>
            <xs:element ref="pnwns:InServiceDateTime"/>
            <xs:element ref="pnwns:OutServiceDateTime" minOccurs="0"/>
            <xs:element ref="pnwns:ServiceLocationID"/>
            <xs:element ref="pnwns:CustomerID" minOccurs="0"/>
            <xs:element name="AssociatedDataStreams">
              <xs:annotation>
                <xs:documentation>A listing of all data streams associated with this
device.</xs:documentation>
              </xs:annotation>
              <xs:complexType>
                <xs:sequence>
                  <xs:element ref="pnwns:DataStreamID" maxOccurs="unbounded"/>
                </xs:sequence>
              </xs:complexType>
            </xs:element>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **DeviceInformationTransaction/Devices**

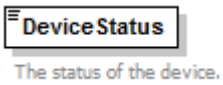
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	pnwns:DeviceID pnwns:Device pnwns:Model pnwns:Manufacturer pnwns:HardwareVersion pnwns:SoftwareVersion pnwns:InServiceDateTime pnwns:OutServiceDateTime pnwns:ServiceLocationID pnwns:CustomerID pnwns:AssociatedDataStreams
annotation	documentation A list of devices at a utility.
source	<xs:element name="Devices" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A list of devices at a utility.</xs:documentation>

```
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="pnwns:DeviceID"/>
      <xs:element ref="pnwns:Device"/>
      <xs:element ref="pnwns:Model" minOccurs="0"/>
      <xs:element ref="pnwns:Manufacturer" minOccurs="0"/>
      <xs:element ref="pnwns:HardwareVersion" minOccurs="0"/>
      <xs:element ref="pnwns:SoftwareVersion" minOccurs="0"/>
      <xs:element ref="pnwns:InServiceDateTime"/>
      <xs:element ref="pnwns:OutServiceDateTime" minOccurs="0"/>
      <xs:element ref="pnwns:ServiceLocationID"/>
      <xs:element ref="pnwns:CustomerID" minOccurs="0"/>
      <xs:element name="AssociatedDataStreams">
        <xs:annotation>
          <xs:documentation>A listing of all data streams associated with this
device.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element ref="pnwns:DataStreamID" maxOccurs="unbounded"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **DeviceInformationTransaction/Devices/AssociatedDataStreams**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:DataStreamID**
annotation	documentation A listing of all data streams associated with this device.
source	<xs:element name="AssociatedDataStreams"> <xs:annotation> <xs:documentation>A listing of all data streams associated with this device.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DataStreamID" maxOccurs="unbounded"/> </xs:sequence> </xs:complexType> </xs:element>

element **DeviceStatus**

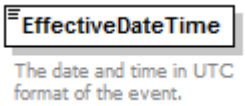
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**DeviceStatusType**
properties	content simple
used by	element **DeviceEventTransaction/DeviceEvents**

facets

Kind	Value	Annotation
enumeration	Bit set 1 for high voltage	
enumeration	Bit set 0 for normal voltage	
enumeration	Bit set 1 for hot socket	
enumeration	Bit set 0 for normal temperature	
enumeration	Bit set 1 for low voltage	
enumeration	Bit set 0 for normal voltage	
enumeration	Bit set to 1 for outage	
enumeration	Bit set to 0 for outage restored	
enumeration	Bit set to 1 for tampering	
enumeration	Bit set to 0 for no tampering	
enumeration	Bit set to 1 for high temperature	
enumeration	Bit set to 0 for normal temperature	
enumeration	Fault indicator tripped	
enumeration	Fault indicator reset	
enumeration	Override	
enumeration	Opt out	
enumeration	Normal	
enumeration	Change in appurtenance group	
enumeration	Charging	
enumeration	Charging begin	
enumeration	Discharging	
enumeration	Discharging begin	
enumeration	Standby begin	
enumeration	Discharging while driving	
enumeration	Faulty PHEV	
enumeration	PHEV sitting idle at charger	
enumeration	DG failure	
enumeration	DER failure	
enumeration	Customer opted out	
enumeration	Level 1	
enumeration	Configuration 1	
enumeration	Tap 1	
enumeration	Equipment failure	
enumeration	Outage	
enumeration	Tampering	
enumeration	Communication failure	

	enumeration Transmission failure enumeration Stuck meter enumeration Slow meter enumeration Device failure enumeration On enumeration Off enumeration Disconnected enumeration Open enumeration Closed enumeration Pt Created enumeration Reconnected enumeration Maintenance enumeration Retired enumeration Engagement on enumeration Engagement off enumeration Curtailing enumeration Non-curtailing enumeration Demand response participation on enumeration Demand response participation off enumeration Manual enumeration Auto
annotation	documentation The status of the device.
source	<xs:element name="DeviceStatus" type="pnwns:DeviceStatusType"> <xs:annotation> <xs:documentation>The status of the device.</xs:documentation> </xs:annotation> </xs:element>

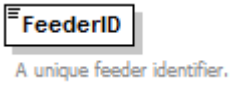
element **EffectiveDateTime**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
used by	elements DeviceEventTransaction/DeviceEvents MembershipEventTransaction/MembershipEvents TestCaseEventTransaction/TestCaseEvents MembershipConfigTransaction/DataStreamMembership/TestCaseMembership
annotation	documentation The date and time in UTC format of the event.
source	<xs:element name="EffectiveDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format of the event.</xs:documentation> </xs:annotation> </xs:element>

element **EndDateTime**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
used by	elements **CustomerTransaction/CustomerInformation** **MeasurementTransaction/Measurements**
annotation	documentation The date and time in UTC format for the end of the period.
source	<xs:element name="EndDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format for the end of the period.</xs:documentation> </xs:annotation> </xs:element>

element **FeederID**

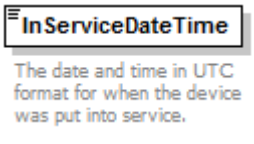
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **Location**
annotation	documentation A unique feeder identifier.
source	<xs:element name="FeederID" type="xs:string"> <xs:annotation> <xs:documentation>A unique feeder identifier.</xs:documentation> </xs:annotation> </xs:element>

element **HardwareVersion**

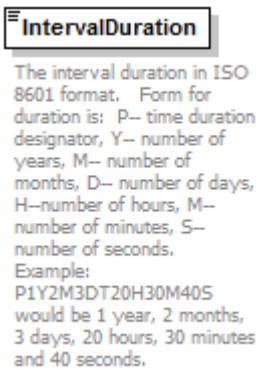
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**

annotation	documentation Device hardware version.
source	<xs:element name="HardwareVersion" type="xs:string"> <xs:annotation> <xs:documentation>Device hardware version.</xs:documentation> </xs:annotation> </xs:element>

element **InServiceDateTime**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**
annotation	documentation The date and time in UTC format for when the device was put into service.
source	<xs:element name="InServiceDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format for when the device was put into service.</xs:documentation> </xs:annotation> </xs:element>

element **IntervalDuration**

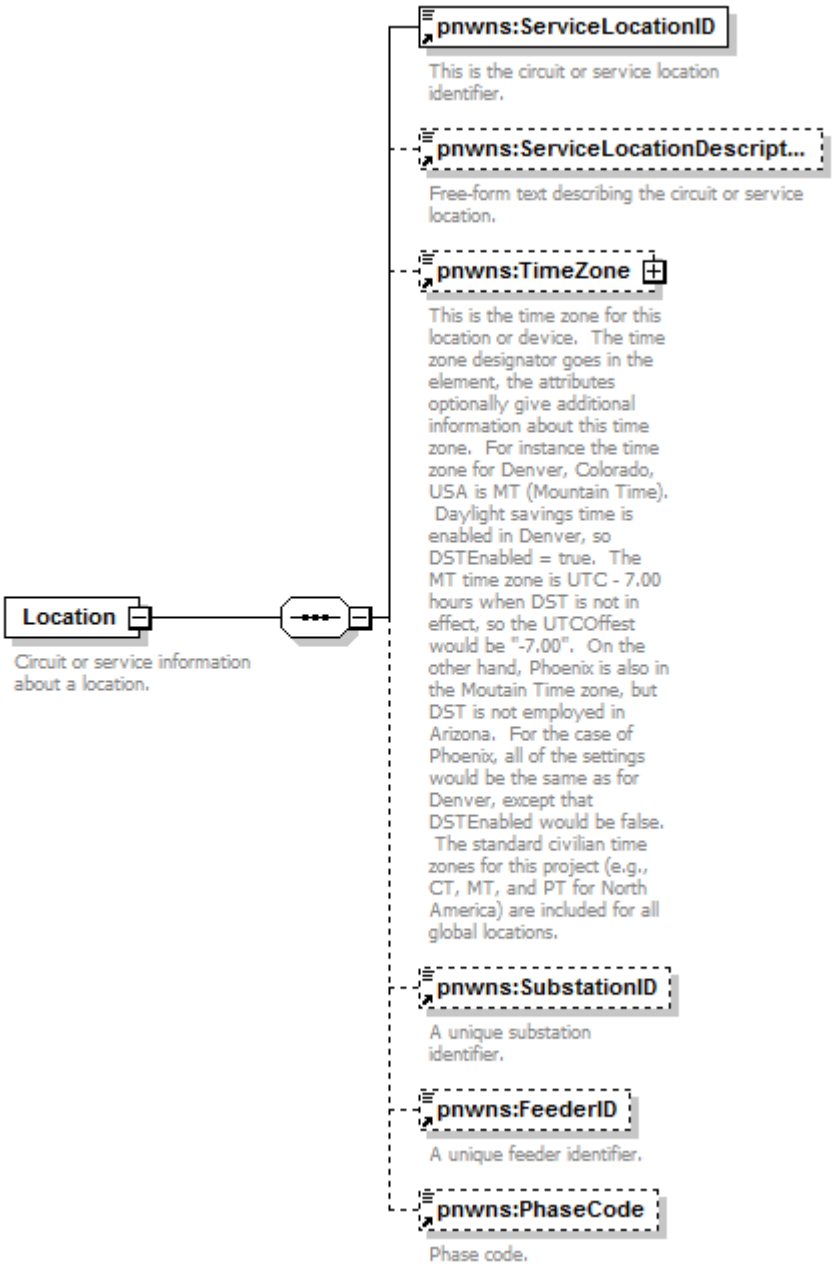
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:duration**
properties	content simple
used by	element **MeasurementTransaction/Measurements**
annotation	documentation The interval duration in ISO 8601 format. Form for duration is: P-- time duration designator, Y-- number of years, M-- number of months, D-- number of days, H--number of hours, M-- number of minutes, S-- number of seconds. Example: P1Y2M3DT20H30M40S would be 1 year, 2 months, 3 days, 20 hours, 30 minutes and 40 seconds.

source

```
<xs:element name="IntervalDuration" type="xs:duration">
  <xs:annotation>
    <xs:documentation>The interval duration in ISO 8601 format.  Form for duration is:  P--time duration designator, Y-- number of years, M-- number of months, D-- number of days, H--number of hours, M-- number of minutes, S-- number of seconds.  Example: P1Y2M3DT20H30M40S would be 1 year, 2 months, 3 days, 20 hours, 30 minutes and 40 seconds.</xs:documentation>
  </xs:annotation>
</xs:element>
```

element **Location**

diagram

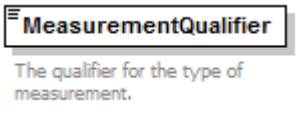


namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:ServiceLocationID** **pnwns:ServiceLocationDescription** **pnwns:TimeZone** **pnwns:SubstationID** **pnwns:FeederID** **pnwns:PhaseCode**
used by	element **ServiceLocationInformationTransaction**
annotation	documentation Circuit or service information about a location.
source	<xs:element name="Location"> <xs:annotation> <xs:documentation>Circuit or service information about a location.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:ServiceLocationID"/> <xs:element ref="pnwns:ServiceLocationDescription" minOccurs="0"/> <xs:element ref="pnwns:TimeZone" minOccurs="0"/> <xs:element ref="pnwns:SubstationID" minOccurs="0"/> <xs:element ref="pnwns:FeederID" minOccurs="0"/> <xs:element ref="pnwns:PhaseCode" minOccurs="0"/> </xs:sequence> </xs:complexType> </xs:element>

element **Manufacturer**

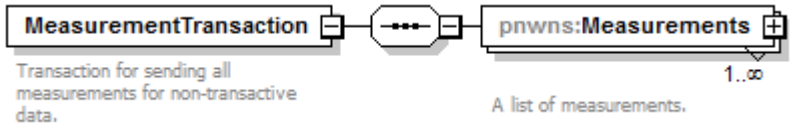
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**
annotation	documentation Manufacturer of the device.
source	<xs:element name="Manufacturer" type="xs:string"> <xs:annotation> <xs:documentation>Manufacturer of the device.</xs:documentation> </xs:annotation> </xs:element>

element **MeasurementQualifier**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**MeasurementQualifierType**

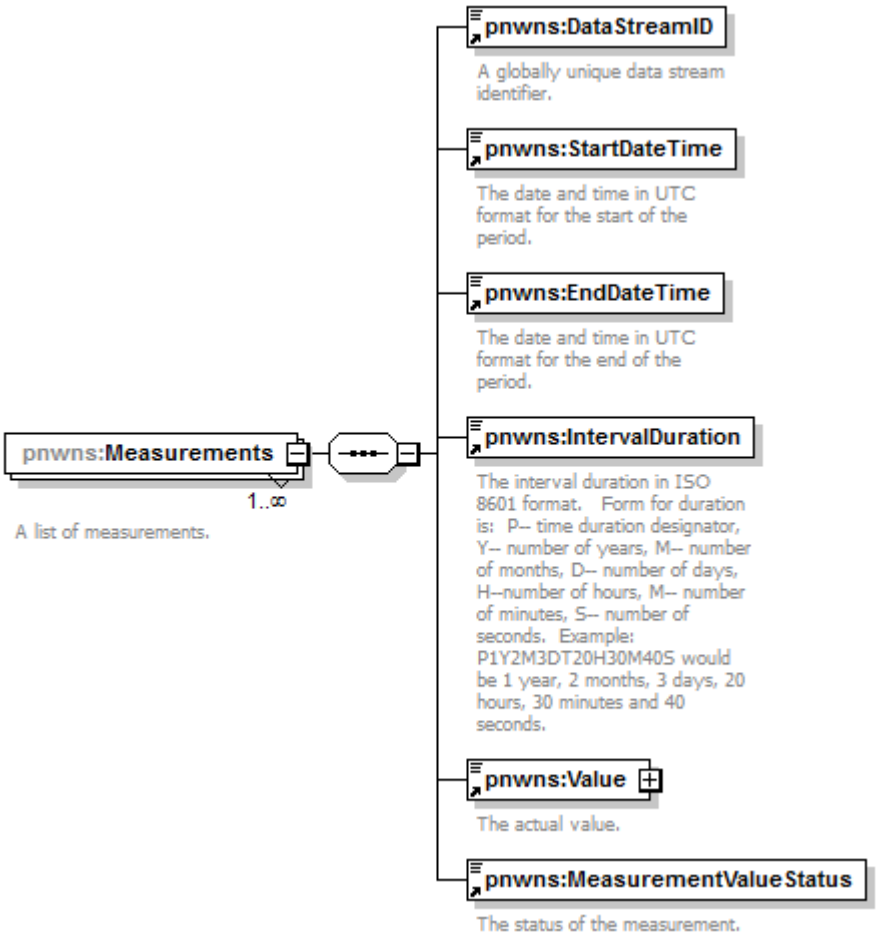
properties	content simple
used by	element **DataStreamInformation**
facets	Kind / Value / Annotation enumeration: During peak hour of interval enumeration: During off-peak hour of interval enumeration: Instantaneous (sampled nominal) enumeration: Interval (default interpretation) enumeration: Interval actual enumeration: Interval average (nominal) enumeration: Interval estimate enumeration: Interval maximum (peak) enumeration: Interval minimum enumeration: Interval standard deviation enumeration: Interval total (cumulative) enumeration: Quantity enumeration: Not applicable
annotation	documentation The qualifier for the type of measurement.
source	<xs:element name="MeasurementQualifier" type="pnwns:MeasurementQualifierType"> <xs:annotation> <xs:documentation>The qualifier for the type of measurement.</xs:documentation> </xs:annotation> </xs:element>

element **MeasurementTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:Measurements**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for sending all measurements for non-transactive data.
source	<xs:element name="MeasurementTransaction"> <xs:annotation> <xs:documentation>Transaction for sending all measurements for non-transactive data.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element name="Measurements" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A list of measurements.</xs:documentation> </xs:annotation> <xs:complexType>

```
        <xs:sequence>
          <xs:element ref="pnwns:DataStreamID"/>
          <xs:element ref="pnwns:StartDateTime"/>
          <xs:element ref="pnwns:EndDateTime"/>
          <xs:element ref="pnwns:IntervalDuration"/>
          <xs:element ref="pnwns:Value"/>
          <xs:element ref="pnwns:MeasurementValueStatus"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
 </xs:complexType>
</xs:element>
```

element **MeasurementTransaction/Measurements**

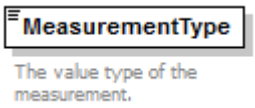
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	pnwns:DataStreamID pnwns:StartDateTime pnwns:EndDateTime pnwns:IntervalDuration pnwns:Value pnwns:MeasurementValueStatus
annotation	documentation A list of measurements.

source

```
<xs:element name="Measurements" maxOccurs="unbounded">
  <xs:annotation>
    <xs:documentation>A list of measurements.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="pnwns:DataStreamID"/>
      <xs:element ref="pnwns:StartDateTime"/>
      <xs:element ref="pnwns:EndDateTime"/>
      <xs:element ref="pnwns:IntervalDuration"/>
      <xs:element ref="pnwns:Value"/>
      <xs:element ref="pnwns:MeasurementValueStatus"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **MeasurementType**

diagram



namespace: http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions

type: **MeasurementValueType**

properties: content simple

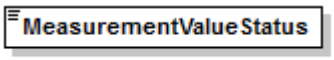
used by: element **DataStreamInformation**

facets

Kind	Value	Annotation
enumeration	Angle	
enumeration	Apparent energy	
enumeration	Apparent power	
enumeration	Boolean	
enumeration	CAIDI	
enumeration	CAIFI	
enumeration	CAIMI	
enumeration	Cost	
enumeration	Count	
enumeration	Demand charges	
enumeration	Direction	
enumeration	Electrical current	
enumeration	Electrical (real) energy	
enumeration	Electrical (real) power	
enumeration	Electrical (reactive) energy	
enumeration	Electrical (reactive) power	
enumeration	Electrical voltage	
enumeration	Frequency	
enumeration	Irradience	
enumeration	Losses	
enumeration	MAIFI	

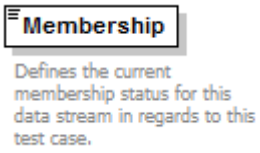
	enumeration Momentary service interruptions enumeration Percent enumeration Power factor enumeration Reactive energy enumeration Reactive power enumeration Relative humidity enumeration SAIDI enumeration SAIFI enumeration Speed enumeration Steam load indicator enumeration Sustained service interruptions enumeration Temperature enumeration Time duration enumeration Transactive enumeration Vehicle operations
annotation	documentation The value type of the measurement.
source	<xs:element name="MeasurementType" type="pnwns:MeasurementValueType"> <xs:annotation> <xs:documentation>The value type of the measurement.</xs:documentation> </xs:annotation> </xs:element>

element **MeasurementValueStatus**

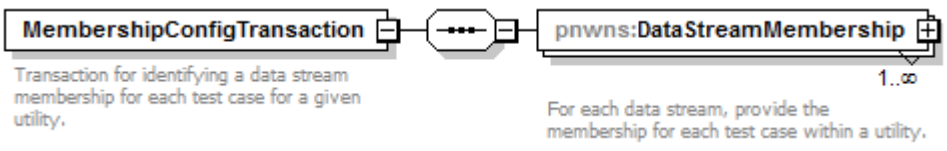
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **pnwns:MeasurementStatusType**
properties	content simple
used by	element **MeasurementTransaction/Measurements**
facets	Kind Value Annotation enumeration Actual Reading enumeration Calculated Reading enumeration Estimated Reading enumeration Edited Reading enumeration Missed Reading enumeration Missed and Interpolated Reading enumeration Missed and Edited Reading enumeration Unknown enumeration Not Applicable
annotation	documentation The status of the measurement.
source	<xs:element name="MeasurementValueStatus"> <xs:annotation> <xs:documentation>The status of the measurement.</xs:documentation> </xs:annotation>

	<xs:simpleType> <xs:restriction base="pnwns:MeasurementStatusType"/> </xs:simpleType> </xs:element>

element **Membership**

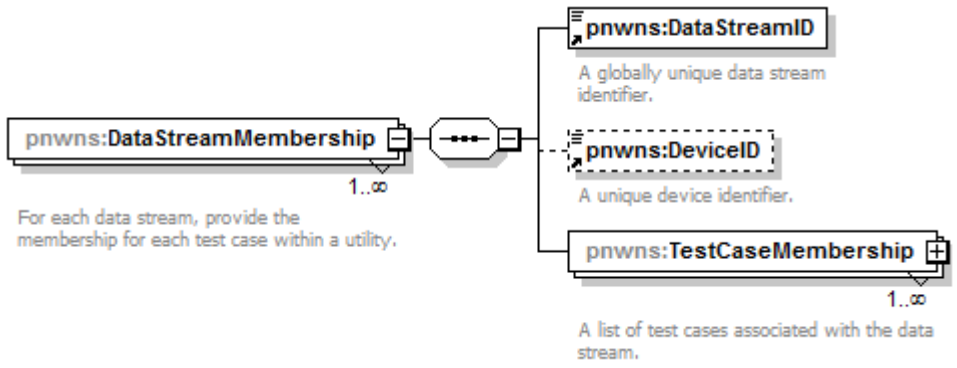
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**pnwns:MembershipAbbrType**
properties	content simple
used by	elements **MembershipEventTransaction/MembershipEvents** **MembershipConfigTransaction/DataStreamMembership/TestCaseMembership**
facets	Kind Value Annotation enumeration EM enumeration CM enumeration NM
annotation	documentation Defines the current membership status for this data stream in regards to this test case.
source	<xs:element name="Membership" type="pnwns:MembershipAbbrType"> <xs:annotation> <xs:documentation>Defines the current membership status for this data stream in regards to this test case.</xs:documentation> </xs:annotation> </xs:element>

element **MembershipConfigTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:DataStreamMembership**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying a data stream membership for each test case for a given utility.
source	<xs:element name="MembershipConfigTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying a data stream membership for each test case for a given utility.</xs:documentation> </xs:annotation> <xs:complexType>

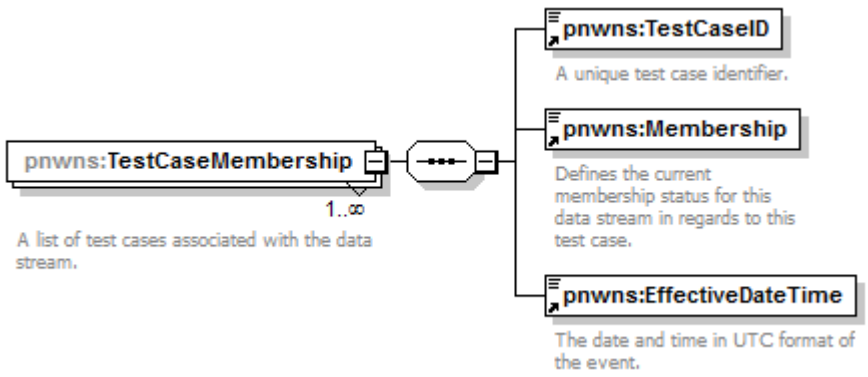
```
    <xs:sequence>
     <xs:element name="DataStreamMembership" maxOccurs="unbounded">
      <xs:annotation>
       <xs:documentation>For each data stream, provide the membership for each test case
within a utility.</xs:documentation>
      </xs:annotation>
      <xs:complexType>
       <xs:sequence>
        <xs:element ref="pnwns:DataStreamID"/>
        <xs:element ref="pnwns:DeviceID" minOccurs="0"/>
        <xs:element name="TestCaseMembership" maxOccurs="unbounded">
         <xs:annotation>
          <xs:documentation>A list of test cases associated with the data
stream.</xs:documentation>
         </xs:annotation>
         <xs:complexType>
          <xs:sequence>
           <xs:element ref="pnwns:TestCaseID"/>
           <xs:element ref="pnwns:Membership"/>
           <xs:element ref="pnwns:EffectiveDateTime"/>
          </xs:sequence>
         </xs:complexType>
        </xs:element>
       </xs:sequence>
      </xs:complexType>
     </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **MembershipConfigTransaction/DataStreamMembership**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	**pnwns:DataStreamID** **pnwns:DeviceID** **pnwns:TestCaseMembership**
annotation	documentation For each data stream, provide the membership for each test case within a utility.
source	<xs:element name="DataStreamMembership" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>For each data stream, provide the membership for each test case

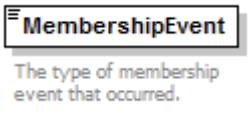
```
within a utility.</xs:documentation>
  </xs:annotation>
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="pnwns:DataStreamID"/>
      <xs:element ref="pnwns:DeviceID" minOccurs="0"/>
      <xs:element name="TestCaseMembership" maxOccurs="unbounded">
        <xs:annotation>
          <xs:documentation>A list of test cases associated with the data
stream.</xs:documentation>
        </xs:annotation>
        <xs:complexType>
          <xs:sequence>
            <xs:element ref="pnwns:TestCaseID"/>
            <xs:element ref="pnwns:Membership"/>
            <xs:element ref="pnwns:EffectiveDateTime"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **MembershipConfigTransaction/DataStreamMembership/TestCaseMembership**

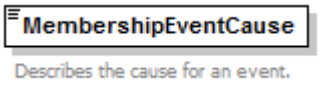
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	**pnwns:TestCaseID pnwns:Membership pnwns:EffectiveDateTime**
annotation	documentation A list of test cases associated with the data stream.
source	<xs:element name="TestCaseMembership" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A list of test cases associated with the data stream.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:TestCaseID"/> <xs:element ref="pnwns:Membership"/>

```
    <xs:element ref="pnwns:EffectiveDateTime"/>
   </xs:sequence>
  </xs:complexType>
</xs:element>
```

element **MembershipEvent**

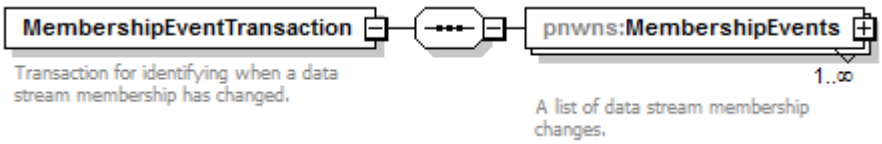
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**pnwns:MembershipEventType**
properties	content simple
used by	element **MembershipEventTransaction/MembershipEvents**
facets	Kind Value Annotation enumeration Enter enumeration Leave
annotation	documentation The type of membership event that occurred.
source	<xs:element name="MembershipEvent" type="pnwns:MembershipEventType"> <xs:annotation> <xs:documentation>The type of membership event that occurred.</xs:documentation> </xs:annotation> </xs:element>

element **MembershipEventCause**

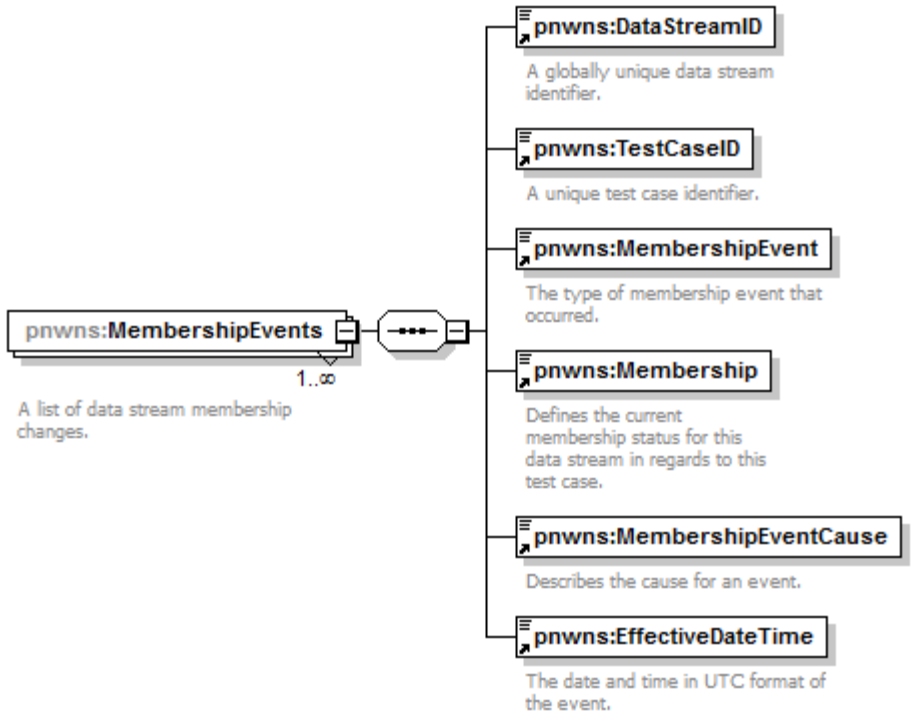
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**pnwns:MembershipEventCauseType**
properties	content simple
used by	element **MembershipEventTransaction/MembershipEvents**
facets	Kind Value Annotation enumeration Equipment installed and commissioned enumeration Equipment removed or decommissioned enumeration Equipment failed enumeration Change in customer participation enumeration Test period begins enumeration Test period ends enumeration Change in test case enumeration Change in test case topology
annotation	documentation Describes the cause for an event.
source	<xs:element name="MembershipEventCause" type="pnwns:MembershipEventCauseType">

	<xs:annotation> <xs:documentation>Describes the cause for an event.</xs:documentation> </xs:annotation> </xs:element>

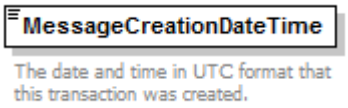
element **MembershipEventTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:MembershipEvents**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying when a data stream membership has changed.
source	<xs:element name="MembershipEventTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying when a data stream membership has changed.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element name="MembershipEvents" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A list of data stream membership changes.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DataStreamID"/> <xs:element ref="pnwns:TestCaseID"/> <xs:element ref="pnwns:MembershipEvent"/> <xs:element ref="pnwns:Membership"/> <xs:element ref="pnwns:MembershipEventCause"/> <xs:element ref="pnwns:EffectiveDateTime"/> </xs:sequence> </xs:complexType> </xs:element> </xs:sequence> </xs:complexType> </xs:element>

element **MembershipEventTransaction/MembershipEvents**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	**pnwns:DataStreamID pnwns:TestCaseID pnwns:MembershipEvent pnwns:Membership pnwns:MembershipEventCause pnwns:EffectiveDateTime**
annotation	documentation A list of data stream membership changes.
source	<xs:element name="MembershipEvents" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A list of data stream membership changes.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:DataStreamID"/> <xs:element ref="pnwns:TestCaseID"/> <xs:element ref="pnwns:MembershipEvent"/> <xs:element ref="pnwns:Membership"/> <xs:element ref="pnwns:MembershipEventCause"/> <xs:element ref="pnwns:EffectiveDateTime"/> </xs:sequence> </xs:complexType> </xs:element>

element **MessageCreationDateTime**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
used by	element **PNWSGDTransactions**
annotation	documentation The date and time in UTC format that this transaction was created.
source	<xs:element name="MessageCreationDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format that this transaction was created.</xs:documentation> </xs:annotation> </xs:element>

element **Model**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**
annotation	documentation Device model.
source	<xs:element name="Model" type="xs:string"> <xs:annotation> <xs:documentation>Device model.</xs:documentation> </xs:annotation> </xs:element>

element **OutServiceDateTime**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**

annotation	documentation The date and time in UTC format for when the device was removed from service.
source	<xs:element name="OutServiceDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format for when the device was removed from service.</xs:documentation> </xs:annotation> </xs:element>

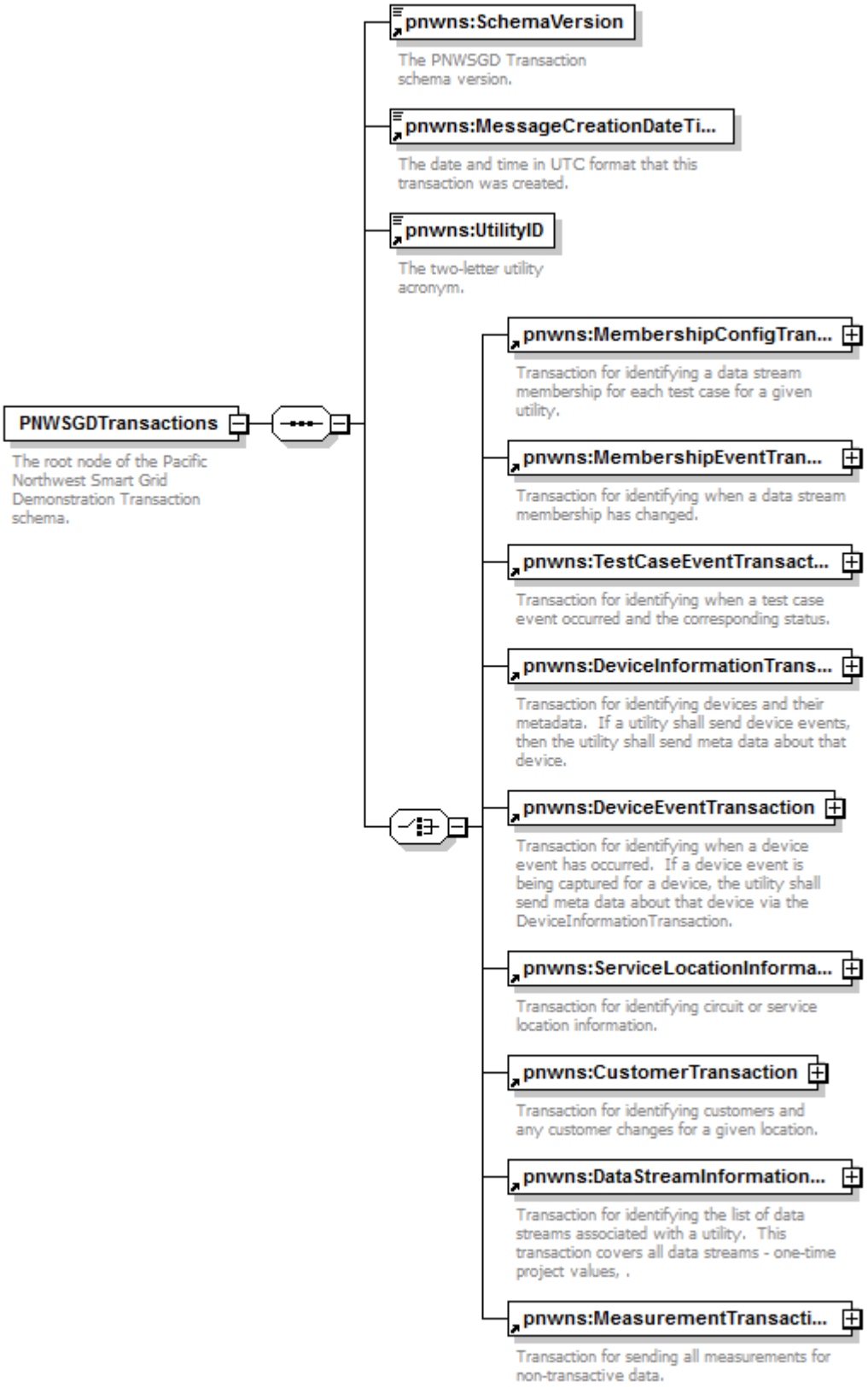
element **PhaseCode**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	content simple
used by	element **Location**
facets	Kind Value Annotation enumeration A enumeration B enumeration C enumeration AB enumeration AC enumeration BC enumeration ABC enumeration Unknown
annotation	documentation Phase code.
source	<xs:element name="PhaseCode"> <xs:annotation> <xs:documentation>Phase code.</xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:string"> <xs:enumeration value="A"> <xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="B"> <xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="C"> <xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="AB">

	<xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="AC"> <xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="BC"> <xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="ABC"> <xs:annotation> <xs:documentation/> </xs:annotation> </xs:enumeration> <xs:enumeration value="Unknown"/> </xs:restriction> </xs:simpleType> </xs:element>

element **PNWSGDTransactions**

diagram



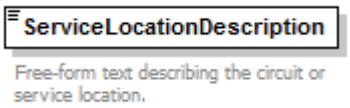
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:SchemaVersion pnwns:MessageCreationDateTime pnwns:UtilityID pnwns:MembershipConfigTransaction pnwns:MembershipEventTransaction pnwns:TestCaseEventTransaction pnwns:DeviceInformationTransaction pnwns:DeviceEventTransaction pnwns:ServiceLocationInformationTransaction pnwns:CustomerTransaction pnwns:DataStreamInformationTransaction pnwns:MeasurementTransaction**
annotation	documentation The root node of the Pacific Northwest Smart Grid Demonstration Transaction schema.
source	<xs:element name="PNWSGDTransactions"> <xs:annotation> <xs:documentation>The root node of the Pacific Northwest Smart Grid Demonstration Transaction schema.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:SchemaVersion"/> <xs:element ref="pnwns:MessageCreationDateTime"/> <xs:element ref="pnwns:UtilityID"/> <xs:choice> <xs:element ref="pnwns:MembershipConfigTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying a data stream membership for each test case for a given utility.</xs:documentation> </xs:annotation> </xs:element> <xs:element ref="pnwns:MembershipEventTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying when a data stream membership has changed.</xs:documentation> </xs:annotation> </xs:element> <xs:element ref="pnwns:TestCaseEventTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying when a test case event occurred and the corresponding status.</xs:documentation> </xs:annotation> </xs:element> <xs:element ref="pnwns:DeviceInformationTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying devices and their metadata. If a utility shall send device events, then the utility shall send meta data about that device.</xs:documentation> </xs:annotation> </xs:element> <xs:element ref="pnwns:DeviceEventTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying when a device event has occurred. If a device event is being captured for a device, the utility shall send meta data about that device via the DeviceInformationTransaction.</xs:documentation> </xs:annotation> </xs:element> <xs:element ref="pnwns:ServiceLocationInformationTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying circuit or service location

```
information.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element ref="pnwns:CustomerTransaction">
        <xs:annotation>
          <xs:documentation>Transaction for identifying customers and any customer changes
for a given location. </xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element ref="pnwns:DataStreamInformationTransaction">
        <xs:annotation>
          <xs:documentation>Transaction for identifying the list of data streams associated with
a utility.  This transaction covers all data streams - one-time project values,
.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element ref="pnwns:MeasurementTransaction">
        <xs:annotation>
          <xs:documentation>Transaction for sending all measurements for non-transactive
data.</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:choice>
  </xs:sequence>
 </xs:complexType>
</xs:element>
```

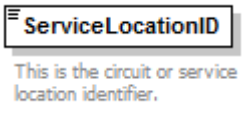
element **SchemaVersion**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	content simple
used by	element **PNWSGDTransactions**
facets	Kind Value Annotation pattern [1-9]+[0-9]*\.[0-9]+
annotation	documentation The PNWSGD Transaction schema version.
source	<xs:element name="SchemaVersion"> <xs:annotation> <xs:documentation>The PNWSGD Transaction schema version.</xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:string"> <xs:pattern value="[1-9]+[0-9]*\.[0-9]+"/> </xs:restriction> </xs:simpleType> </xs:element>

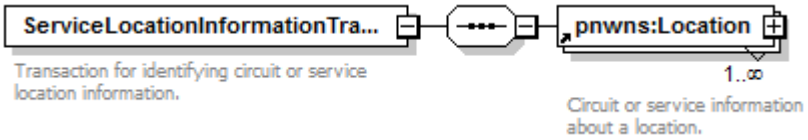
element **ServiceLocationDescription**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **Location**
annotation	documentation Free-form text describing the circuit or service location.
source	<xs:element name="ServiceLocationDescription" type="xs:string"> <xs:annotation> <xs:documentation>Free-form text describing the circuit or service location.</xs:documentation> </xs:annotation> </xs:element>

element **ServiceLocationID**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	elements **DataStreamInformation Location CustomerTransaction/CustomerInformation DeviceInformationTransaction/Devices**
annotation	documentation This is the circuit or service location identifier.
source	<xs:element name="ServiceLocationID" type="xs:string"> <xs:annotation> <xs:documentation>This is the circuit or service location identifier.</xs:documentation> </xs:annotation> </xs:element>

element **ServiceLocationInformationTransaction**

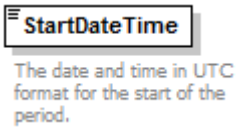
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:Location**

used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying circuit or service location information.
source	<xs:element name="ServiceLocationInformationTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying circuit or service location information.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:Location" maxOccurs="unbounded"/> </xs:sequence> </xs:complexType> </xs:element>

element **SoftwareVersion**

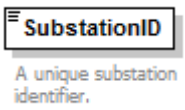
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **DeviceInformationTransaction/Devices**
annotation	documentation Device software version.
source	<xs:element name="SoftwareVersion" type="xs:string"> <xs:annotation> <xs:documentation>Device software version.</xs:documentation> </xs:annotation> </xs:element>

element **StartDateTime**

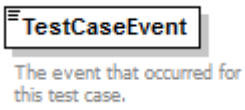
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:dateTime**
properties	content simple
used by	elements **CustomerTransaction/CustomerInformation** **MeasurementTransaction/Measurements**
annotation	documentation The date and time in UTC format for the start of the period.
source	<xs:element name="StartDateTime" type="xs:dateTime"> <xs:annotation> <xs:documentation>The date and time in UTC format for the start of the period.</xs:documentation>

```
  </xs:annotation>
</xs:element>
```

element **SubstationID**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**xs:string**
properties	content simple
used by	element **Location**
annotation	documentation A unique substation identifier.
source	<xs:element name="SubstationID" type="xs:string"> <xs:annotation> <xs:documentation>A unique substation identifier.</xs:documentation> </xs:annotation> </xs:element>

element **TestCaseEvent**

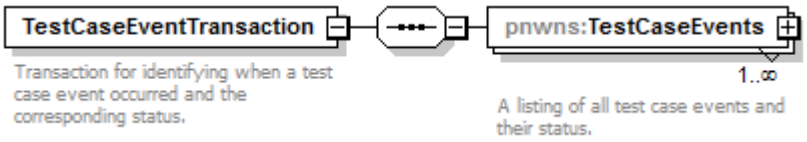
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**TestCaseEventType**
properties	content simple
used by	element **TestCaseEventTransaction/TestCaseEvents**
facets	Kind / Value / Annotation enumeration Changed asset system engagement enumeration Changed asset system engagement - air handler enumeration Changed asset system engagement - Battery storage enumeration Changed asset system engagement - battery storage enumeration Changed asset system engagement - chillers enumeration Changed asset system engagement - demand response unit (DRU) / water heater enumeration Changed asset system engagement - distributed energy resources enumeration Changed asset system engagement - EMS control enumeration Changed asset system engagement - generator enumeration Changed asset system engagement - GenOnSys enumeration Changed asset system engagement - HVAC enumeration Changed asset system engagement - information posted to IHD enumeration Changed asset system engagement - information posted to web portal enumeration Changed asset system engagement - lighting

	enumeration	Changed asset system engagement - load control switch
	enumeration	Changed asset system engagement - PHEV
	enumeration	Changed asset system engagement - smart appliance
	enumeration	Changed asset system engagement - thermostat
	enumeration	Changed asset system engagement - Volt/Var
	enumeration	Changed asset system engagement - CVR
	enumeration	Changed asset system engagement - Volt/VAr, CVR, voltage regulator, transformer tap
	enumeration	Changed asset system engagement - Volt/VAr; CVR; voltage regulator; transformer tap
	enumeration	Changed asset system engagement - water heater
	enumeration	Changed System Asset Helena ES CVR level 1
	enumeration	Changed System Asset Helena SS CVR level 1
	enumeration	Changed System Asset PBG CVR level 1
	enumeration	Changed System Asset Helena ES Volt/VAR level 1
	enumeration	Changed System Asset Helena SS Volt/VAR level 1
	enumeration	Changed System Asset PBG Volt/VAR level 1
	enumeration	Changed availability
	enumeration	Changed override status
	enumeration	Changed termination status
	enumeration	Device alarms detected
	enumeration	Device alarms detected - fault
	enumeration	Device alarms detected - high temperature
	enumeration	Device alarms detected - high voltage
	enumeration	Device alarms detected - High voltage
	enumeration	Device alarms detected - hot socket
	enumeration	Device alarms detected - low voltage
	enumeration	Device alarms detected - outage
	enumeration	Device alarms detected - tamper
	enumeration	Distribution switches have changed
	enumeration	Distribution switches have changed - capacitor bank
	enumeration	Distribution switches have changed - circuit configuration
	enumeration	Distribution switches have changed - microgrid
	enumeration	Distribution switches have changed - recloser
	enumeration	Peak time event occurrence
	enumeration	Battery status has changed
	enumeration	Change in asset engagement -config/control
	enumeration	Change in engagement of config/control
	enumeration	Changed asset system control strategy – Volt/Var
	enumeration	Changed asset system control strategy - Volt/Var
	enumeration	Changed Asset System Engagement - Commercial EMS Control
	enumeration	Changed Asset System Engagement - Water Heater
	enumeration	Changed asset system engagement - Water heater
	enumeration	Changed asset system engagement – diesel generator
	enumeration	Changed asset system engagement - diesel generator
	enumeration	Changed asset system engagement - GenOnSys
	enumeration	Changed asset system engagement – natural gas genset #1
	enumeration	Changed asset system engagement - natural gas genset #1

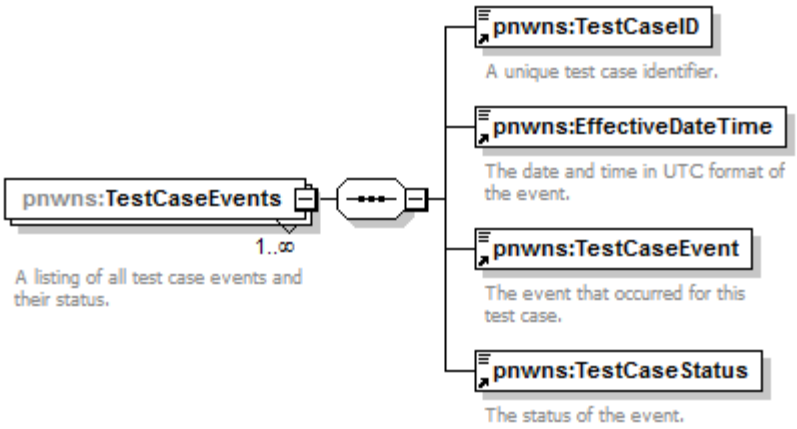
	enumeration	Changed asset system engagement – natural gas genset #2
	enumeration	Changed asset system engagement - natural gas genset #2
	enumeration	Changed Feeder Topology - switch
	enumeration	Change in asset system engagement - advanced switch gear
	enumeration	Change in asset system engagement – Bio-tech generator
	enumeration	Change in asset system engagement - Bio-tech generator
	enumeration	Change in asset system engagement – thermostat
	enumeration	Change in asset system engagement - thermostat
	enumeration	Change in FDIR engagement
	enumeration	Changed topology configuration
	enumeration	Changed feeder topology - switch
	enumeration	CVR change
	enumeration	CVR status has changed
	enumeration	DRU change
	enumeration	DRU status has changed
	enumeration	Mode Change
	enumeration	PV system availability has changed
	enumeration	SVC status has changed
	enumeration	Wind turbine availability has changed
	enumeration	RECLOSER 15KV - Disconnect Switch for Generation Assets
	enumeration	DRUs curtailed (TRUE)
	enumeration	Tier 1 - HVAC Load Shed: AGRS
	enumeration	Tier 1 - HVAC Load Shed: AGRS Acknowledge
	enumeration	Tier 1 - HVAC Load Shed: AGRS Response
	enumeration	Tier 1 - HVAC Load Shed: Asset Active
	enumeration	Tier 2 - CHW Load Shed: AGRS
	enumeration	Tier 2 - CHW Load Shed: AGRS Acknowledge
	enumeration	Tier 2 - CHW Load Shed: AGRS Response
	enumeration	Tier 2 - CHW Load Shed: Asset Active
	enumeration	Tier 3 - GWSP Generator #1 Dispatch: AGRS
	enumeration	Tier 3 - GWSP Generator #1 Dispatch: AGRS Acknowledge
	enumeration	Tier 3 - GWSP Generator #1 Dispatch: AGRS Response
	enumeration	Tier 3 - GWSP Generator #1 Dispatch: Asset Active
	enumeration	Tier 4 - GWSP Generator #2 Dispatch: AGRS
	enumeration	Tier 4 - GWSP Generator #2 Dispatch: AGRS Acknowledge
	enumeration	Tier 4 - GWSP Generator #2 Dispatch: AGRS Response
	enumeration	Tier 4 - GWSP Generator #2 Dispatch: Asset Active
	enumeration	Tier 5 - GWSP Generator #3 Dispatch: AGRS
	enumeration	Tier 5 - GWSP Generator #3 Dispatch: AGRS Acknowledge
	enumeration	Tier 5 - GWSP Generator #3 Dispatch: AGRS Response
	enumeration	Tier 5 - GWSP Generator #3 Dispatch: Asset Active
annotation	documentation The event that occurred for this test case.	
source	<xs:element name="TestCaseEvent" type="pnwns:TestCaseEventType"> <xs:annotation> <xs:documentation>The event that occurred for this test case.</xs:documentation> </xs:annotation>	

	</xs:element>

element **TestCaseEventTransaction**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	content complex
children	**pnwns:TestCaseEvents**
used by	element **PNWSGDTransactions**
annotation	documentation Transaction for identifying when a test case event occurred and the corresponding status.
source	<xs:element name="TestCaseEventTransaction"> <xs:annotation> <xs:documentation>Transaction for identifying when a test case event occurred and the corresponding status.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element name="TestCaseEvents" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A listing of all test case events and their status.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:TestCaseID"/> <xs:element ref="pnwns:EffectiveDateTime"/> <xs:element ref="pnwns:TestCaseEvent"/> <xs:element ref="pnwns:TestCaseStatus"/> </xs:sequence> </xs:complexType> </xs:element> </xs:sequence> </xs:complexType> </xs:element>

element **TestCaseEventTransaction/TestCaseEvents**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
properties	minOcc 1 maxOcc unbounded content complex
children	pnwns:TestCaseID pnwns:EffectiveDateTime pnwns:TestCaseEvent pnwns:TestCaseStatus
annotation	documentation A listing of all test case events and their status.
source	<xs:element name="TestCaseEvents" maxOccurs="unbounded"> <xs:annotation> <xs:documentation>A listing of all test case events and their status.</xs:documentation> </xs:annotation> <xs:complexType> <xs:sequence> <xs:element ref="pnwns:TestCaseID"/> <xs:element ref="pnwns:EffectiveDateTime"/> <xs:element ref="pnwns:TestCaseEvent"/> <xs:element ref="pnwns:TestCaseStatus"/> </xs:sequence> </xs:complexType> </xs:element>

element **TestCaseID**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	pnwns:TestCaseIDType
properties	content simple
used by	elements MembershipEventTransaction/MembershipEvents TestCaseEventTransaction/TestCaseEvents MembershipConfigTransaction/DataStreamMembership/TestCaseMembership
facets	Kind Value Annotation enumeration AV-01-1.4 enumeration AV-01-3.2 enumeration AV-02-3.2 enumeration AV-03-1.1

	enumeration AV-04-3.2 enumeration AV-05-1.4 enumeration AV-05-3.1 enumeration AV-05-4.1 enumeration AV-05-4.2 enumeration AV-05-4.3 enumeration AV-06-3.1 enumeration AV-07-2.1 enumeration AV-08-2.2 enumeration AV-09-1.1 enumeration AV-10-1.1 enumeration AV-11-1.1 enumeration AV-12-1.1 enumeration AV-13-1.1 enumeration BP-01-2.1 enumeration BP-01-2.2 enumeration BP-01-2.3 enumeration BP-01-3.2 enumeration BP-02-1.4 enumeration EB-01-2.1 enumeration EB-02-3.2 enumeration EB-03-3.2 enumeration EB-04-3.2 enumeration EB-05-3.2 enumeration EB-06-3.2 enumeration EB-07-3.2 enumeration EB-08-3.2 enumeration EB-09-3.2 enumeration EB-10-3.2 enumeration EB-11-3.2 enumeration EB-12-3.2 enumeration EB-13-3.2 enumeration FH-01-2.2 enumeration FH-02-1.1 enumeration FH-03-1.2 enumeration FH-04-1.2 enumeration FH-05-2.2 enumeration FH-06-1.1 enumeration FH-07-1.2 enumeration FH-08-1.2 enumeration FH-09-4.3 enumeration IF-01-1.4 enumeration IF-01-3.2 enumeration IF-02-3.2 enumeration IF-03-2.2 enumeration IF-04-1.3

	enumeration IF-04-3.2 enumeration IF-04-4.1 enumeration IF-04-4.2 enumeration IF-04-4.3 enumeration IF-05-1.3 enumeration IF-07-1.3 enumeration IF-07-2.2 enumeration IF-08-1.3 enumeration IF-08-3.2 enumeration IF-09-3.1 enumeration IF-10-1.2 enumeration IF-10-3.2 enumeration LV-01-3.1 enumeration LV-02-1.3 enumeration LV-02-2.1 enumeration LV-03-3.2 enumeration LV-04-3.2 enumeration LV-05-3.2 enumeration LV-06-1.4 enumeration LV-07-3.2 enumeration LV-08-1.1 enumeration LV-09-4.1 enumeration LV-09-4.2 enumeration LV-09-4.3 enumeration LV-10-3.2 enumeration MF-01-1.4 enumeration MF-02-1.2 enumeration MF-03-1.2 enumeration MF-04-3.2 enumeration NW-01-1.2 enumeration NW-01-3.2 enumeration NW-02-2.2 enumeration NW-03-1.3 enumeration NW-03-4.1 enumeration NW-04-1.2 enumeration NW-04-3.2 enumeration PG-01-1.2 enumeration PG-01-4.1 enumeration PG-01-4.2 enumeration PG-02-1.2 enumeration PG-03-1.2 enumeration PG-04-1.4 enumeration PG-04-3.2 enumeration PG-05-2.1 enumeration PL-01-1.4 enumeration PL-02-1.4

	enumeration PL-02-3.2 enumeration PL-03-2.2 enumeration UW-01-1.1 enumeration UW-02-1.1 enumeration UW-03-3.2 enumeration UW-04-1.1 enumeration UW-04-3.2 enumeration UW-04-3.2/1.1 enumeration UW-05-3.1 enumeration UW-06-3.2
annotation	documentation A unique test case identifier.
source	<xs:element name="TestCaseID" type="pnwns:TestCaseIDType"> <xs:annotation> <xs:documentation>A unique test case identifier.</xs:documentation> </xs:annotation> </xs:element>

element **TestCaseStatus**

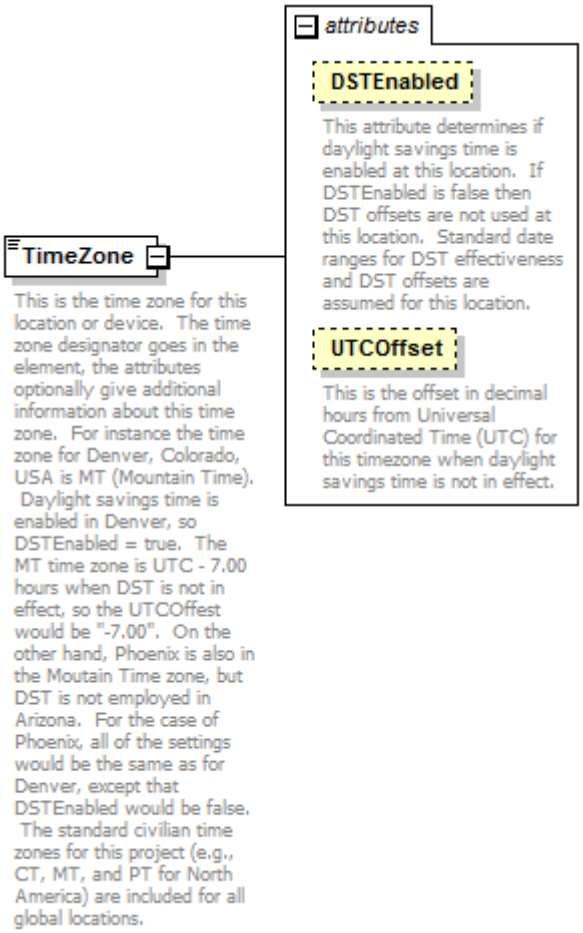
diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**TestCaseStatusType**
properties	content simple
used by	element **TestCaseEventTransaction/TestCaseEvents**
facets	Kind Value Annotation enumeration Low price signal - normal enumeration Normal operation enumeration Abnormal operation enumeration On enumeration Off enumeration Online enumeration Offline enumeration Connected enumeration Disconnected enumeration Active enumeration Inactive enumeration Available enumeration Not available enumeration Unavailable enumeration Closed enumeration Opened enumeration Overridden enumeration Terminated enumeration Customer opted out

	enumeration	Not curtailed
	enumeration	Curtailed
	enumeration	Generating
	enumeration	Not generating
	enumeration	Increased generation
	enumeration	Decreased generation
	enumeration	Charging
	enumeration	Discharging
	enumeration	Idle
	enumeration	Out for maintenance
	enumeration	Baseline - no engagement
	enumeration	Engagement with transactive control
	enumeration	Operational efficiency
	enumeration	Change of group (control or experimental)
	enumeration	CVR engaged ES substation level 1
	enumeration	CVR not engaged ES substation level 1
	enumeration	CVR engaged SS substation level 1
	enumeration	CVR not engaged SS substation level 1
	enumeration	Volt/VAr engaged ES substation level 1
	enumeration	Volt/VAr not engaged ES substation level 1
	enumeration	Volt/VAr engaged SS substation level 1
	enumeration	Volt/VAr not engaged SS substation level 1
	enumeration	CVR engaged level 1
	enumeration	CVR engaged level 2
	enumeration	CVR engaged level 3
	enumeration	Optimized without transactive control
	enumeration	Optimized with transactive control
	enumeration	Not optimized
	enumeration	Normal transactive mode start
	enumeration	Wind response mode start
	enumeration	Automated SVC active
	enumeration	Automated SVC inactive/offline
	enumeration	Active for testing
	enumeration	Out for maintenance
	enumeration	Battery charging
	enumeration	Battery discharging
	enumeration	Battery active/online
	enumeration	Battery idle/offline
	enumeration	Commercial EMS Control demand curtailment active
	enumeration	Commercial EMS curtailment inactive
	enumeration	CVR active
	enumeration	CVR inactive/offline
	enumeration	CVR engaged level 3
	enumeration	Normal operation (TRUE)
	enumeration	DRUs restored (FALSE)
	enumeration	DRU curtailed

	enumeration	DRUs curtailed (TRUE)
	enumeration	DRU not curtailed
	enumeration	DRU on
	enumeration	DRU off
	enumeration	DG ON
	enumeration	DG OFF
	enumeration	Baseline (No engagement)
	enumeration	Operational efficiency
	enumeration	Engagement with transactive control
	enumeration	Baseline Operation – Not Optimized
	enumeration	Baseline Operation - Not Optimized
	enumeration	DMS Optimized
	enumeration	DMS Optimized with Transactive Control
	enumeration	Optimized
	enumeration	Not Optimized
	enumeration	IHD green for non-peak all appliances and attachments run normally
	enumeration	IHD red for peak event - groups of appliances and attachments respond to signal but member may override signal
	enumeration	Generating
	enumeration	Not generating
	enumeration	Normal
	enumeration	Abnormal
	enumeration	Light and message on
	enumeration	Light off and message off
	enumeration	PV system available
	enumeration	PV system unavailable/offline
	enumeration	Switch Closed
	enumeration	Switch Open
	enumeration	Water heater demand curtailment active
	enumeration	Water heater demand curtailment inactive
	enumeration	Wind response mode start
	enumeration	Normal/transactive mode start
	enumeration	Wind turbine available
	enumeration	Wind turbine unavailable/offline
	enumeration	Recloser 15KV - OPEN, Generation assets are curtailed. Provide Load to BPA
	enumeration	Recloser 15KV - CLOSED, Generation assets are operating.
	enumeration	Residential
	enumeration	Short
	enumeration	Long
	enumeration	Islanded
	enumeration	Not islanded
	enumeration	Emergency
	enumeration	Tier 1
	enumeration	Tier 2
	enumeration	Tier 3
	enumeration	None
	enumeration	Low; Green; $0.03/kWh

	enumeration Medium; Yellow; $0.05/kWh enumeration High; Red; $0.09/kWh enumeration Disabled enumeration Engaged enumeration Engaged - Comm Restored enumeration Engaged - Scada Restored enumeration Engaged - Via Schedule enumeration Not engaged enumeration Not Engaged enumeration Not Engaged - By Scada (YFA) enumeration Not Engaged - Comm Loss enumeration Not Engaged - Comm Restored enumeration Not Engaged - Missing Data enumeration 0 enumeration 1 enumeration 2 enumeration 3 enumeration 4 enumeration 5 enumeration 6 enumeration 7 enumeration 8 enumeration 9 enumeration 10 enumeration 11 enumeration 12 enumeration 13 enumeration 14 enumeration 15 enumeration 16 enumeration 17 enumeration 18 enumeration 19 enumeration 20
annotation	documentation The status of the event.
source	<xs:element name="TestCaseStatus" type="pnwns:TestCaseStatusType"> <xs:annotation> <xs:documentation>The status of the event.</xs:documentation> </xs:annotation> </xs:element>

element **TimeZone**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **pnwns:TimeZoneType**
properties	content complex
used by	element **Location**
facets	Kind / Value / Annotation enumeration PT enumeration MT enumeration CT
attributes	Name: DSTEnabled Type: **xs:boolean** Use: Default: Fixed: Annotation: documentation: This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for

	UTCOffset **xs:decimal** optional	DST effectiveness and DST offsets are assumed for this location. documentation This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.
annotation	documentation This is the time zone for this location or device. The time zone designator goes in the element, the attributes optionally give additional information about this time zone. For instance the time zone for Denver, Colorado, USA is MT (Mountain Time). Daylight savings time is enabled in Denver, so DSTEnabled = true. The MT time zone is UTC - 7.00 hours when DST is not in effect, so the UTCOffest would be "-7.00". On the other hand, Phoenix is also in the Moutain Time zone, but DST is not employed in Arizona. For the case of Phoenix, all of the settings would be the same as for Denver, except that DSTEnabled would be false. The standard civilian time zones for this project (e.g., CT, MT, and PT for North America) are included for all global locations.	
source	<xs:element name="TimeZone"> <xs:annotation> <xs:documentation>This is the time zone for this location or device. The time zone designator goes in the element, the attributes optionally give additional information about this time zone. For instance the time zone for Denver, Colorado, USA is MT (Mountain Time). Daylight savings time is enabled in Denver, so DSTEnabled = true. The MT time zone is UTC - 7.00 hours when DST is not in effect, so the UTCOffest would be "-7.00". On the other hand, Phoenix is also in the Moutain Time zone, but DST is not employed in Arizona. For the case of Phoenix, all of the settings would be the same as for Denver, except that DSTEnabled would be false. The standard civilian time zones for this project (e.g., CT, MT, and PT for North America) are included for all global locations.</xs:documentation> </xs:annotation> <xs:complexType> <xs:simpleContent> <xs:restriction base="pnwns:TimeZoneType"> <xs:enumeration value="PT"/> <xs:enumeration value="MT"/> <xs:enumeration value="CT"/> <xs:attribute name="DSTEnabled" type="xs:boolean"> <xs:annotation> <xs:documentation>This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.</xs:documentation> </xs:annotation> </xs:attribute> <xs:attribute name="UTCOffset" type="xs:decimal" use="optional"> <xs:annotation> <xs:documentation>This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.</xs:documentation> </xs:annotation> </xs:attribute> </xs:restriction> </xs:simpleContent> </xs:complexType>	

	</xs:element>

attribute **TimeZone/@DSTEnabled**

type	**xs:boolean**
annotation	documentation This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.
source	<xs:attribute name="DSTEnabled" type="xs:boolean"> <xs:annotation> <xs:documentation>This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.</xs:documentation> </xs:annotation> </xs:attribute>

attribute **TimeZone/@UTCOffset**

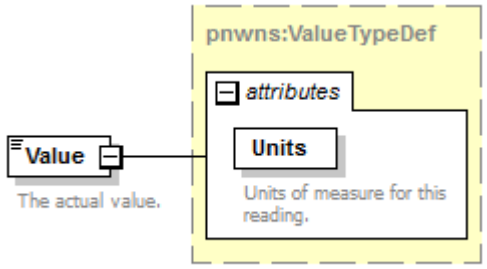
type	**xs:decimal**
properties	use optional
annotation	documentation This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.
source	<xs:attribute name="UTCOffset" type="xs:decimal" use="optional"> <xs:annotation> <xs:documentation>This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.</xs:documentation> </xs:annotation> </xs:attribute>

element **UtilityID**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**pnwns:UtilityNameAbbrType**
properties	content simple
used by	element **PNWSGDTransactions**
facets	Kind Value Annotation enumeration AV enumeration BP enumeration EB enumeration FH enumeration IF enumeration LV

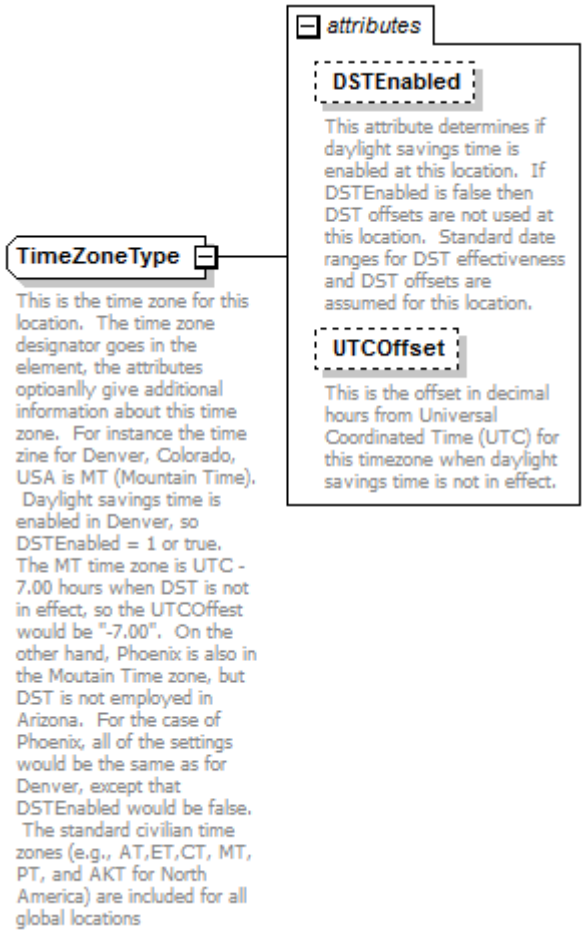
	enumeration MF enumeration NW enumeration PL enumeration PG enumeration UW
annotation	documentation The two-letter utility acronym.
source	<xs:element name="UtilityID" type="pnwns:UtilityNameAbbrType"> <xs:annotation> <xs:documentation>The two-letter utility acronym.</xs:documentation> </xs:annotation> </xs:element>

element **Value**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	**pnwns:ValueTypeDef**
properties	content complex nillable true
used by	element **MeasurementTransaction/Measurements**
attributes	Name: Units; Type: **UnitType**; Use: required; Default: ; Fixed: ; Annotation: documentation Units of measure for this reading.
annotation	documentation The actual value.
source	<xs:element name="Value" type="pnwns:ValueTypeDef" nillable="true"> <xs:annotation> <xs:documentation>The actual value.</xs:documentation> </xs:annotation> </xs:element>

complexType **TimeZoneType**

diagram



namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	extension of **xs:string**
properties	base xs:string
used by	element **TimeZone**

attributes

Name	Type	Use	Default	Fixed	Annotation
DSTEnabled	**xs:boolean**				documentation: This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.

	UTCOffset	**xs:decimal**	optional	documentation This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.
annotation	documentation This is the time zone for this location. The time zone designator goes in the element, the attributes optioanlly give additional information about this time zone. For instance the time zine for Denver, Colorado, USA is MT (Mountain Time). Daylight savings time is enabled in Denver, so DSTEnabled = 1 or true. The MT time zone is UTC - 7.00 hours when DST is not in effect, so the UTCOffest would be "-7.00". On the other hand, Phoenix is also in the Moutain Time zone, but DST is not employed in Arizona. For the case of Phoenix, all of the settings would be the same as for Denver, except that DSTEnabled would be false. The standard civilian time zones (e.g., AT,ET,CT, MT, PT, and AKT for North America) are included for all global locations			
source	<xs:complexType name="TimeZoneType"> <xs:annotation> <xs:documentation>This is the time zone for this location. The time zone designator goes in the element, the attributes optioanlly give additional information about this time zone. For instance the time zine for Denver, Colorado, USA is MT (Mountain Time). Daylight savings time is enabled in Denver, so DSTEnabled = 1 or true. The MT time zone is UTC - 7.00 hours when DST is not in effect, so the UTCOffest would be "-7.00". On the other hand, Phoenix is also in the Moutain Time zone, but DST is not employed in Arizona. For the case of Phoenix, all of the settings would be the same as for Denver, except that DSTEnabled would be false. The standard civilian time zones (e.g., AT,ET,CT, MT, PT, and AKT for North America) are included for all global locations</xs:documentation> </xs:annotation> <xs:simpleContent> <xs:extension base="xs:string"> <xs:attribute name="DSTEnabled" type="xs:boolean"> <xs:annotation> <xs:documentation>This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.</xs:documentation> </xs:annotation> </xs:attribute> <xs:attribute name="UTCOffset" type="xs:decimal" use="optional"> <xs:annotation> <xs:documentation>This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.</xs:documentation> </xs:annotation> </xs:attribute> </xs:extension> </xs:simpleContent> </xs:complexType>			

attribute **TimeZoneType/@DSTEnabled**

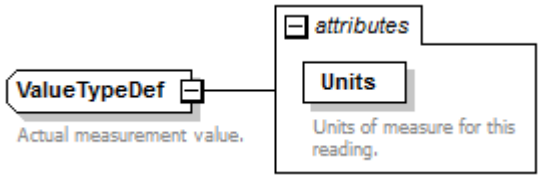
type	**xs:boolean**
annotation	documentation This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.

source	<xs:attribute name="DSTEnabled" type="xs:boolean"> <xs:annotation> <xs:documentation>This attribute determines if daylight savings time is enabled at this location. If DSTEnabled is false then DST offsets are not used at this location. Standard date ranges for DST effectiveness and DST offsets are assumed for this location.</xs:documentation> </xs:annotation> </xs:attribute>

attribute **TimeZoneType/@UTCOffset**

type	**xs:decimal**
properties	use optional
annotation	documentation This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.
source	<xs:attribute name="UTCOffset" type="xs:decimal" use="optional"> <xs:annotation> <xs:documentation>This is the offset in decimal hours from Universal Coordinated Time (UTC) for this timezone when daylight savings time is not in effect.</xs:documentation> </xs:annotation> </xs:attribute>

complexType **ValueTypeDef**

diagram	
namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	extension of **xs:float**
properties	base xs:float
used by	element **Value**
attributes	Name: Units; Type: **UnitType**; Use: required; Default: ; Fixed: ; Annotation documentation: Units of measure for this reading.
annotation	documentation Actual measurement value.
source	<xs:complexType name="ValueTypeDef"> <xs:annotation> <xs:documentation>Actual measurement value.</xs:documentation> </xs:annotation> <xs:simpleContent> <xs:extension base="xs:float"> <xs:attribute name="Units" type="pnwns:UnitType" use="required"> <xs:annotation> <xs:documentation>Units of measure for this reading.</xs:documentation>

```
      </xs:annotation>
    </xs:attribute>
  </xs:extension>
 </xs:simpleContent>
</xs:complexType>
```

attribute **ValueTypeDef/@Units**

type	**UnitType**
properties	use required

facets

Kind	Value	Annotation
enumeration	#	
enumeration	#/cap bank/feeder	
enumeration	$ savings	
enumeration	$	
enumeration	$/#	
enumeration	$/day	
enumeration	$/gallon	
enumeration	$/GW	
enumeration	$/h	
enumeration	$/kBtu	
enumeration	$/kW	
enumeration	$/kWh	
enumeration	$/kW·h	
enumeration	$/mile	
enumeration	$/minute	
enumeration	$/month	
enumeration	$/customer/month	
enumeration	$/MW	
enumeration	$/MWh	
enumeration	$/MW·h	
enumeration	$/outage	
enumeration	$/outage/year	
enumeration	$/overload	
enumeration	$/truck roll	
enumeration	$/V	
enumeration	$/week	
enumeration	$/Wh	
enumeration	$/W·h	
enumeration	$/year	
enumeration	% nominal	
enumeration	%	
enumeration	¢/kWh	
enumeration	¢/kW·h	
enumeration	¢/MWh	
enumeration	¢/MW·h	
enumeration	°C	

	enumeration	°F
	enumeration	µs
	enumeration	A
	enumeration	alarms per type
	enumeration	customers
	enumeration	day
	enumeration	degrees
	enumeration	events
	enumeration	fractional
	enumeration	GA
	enumeration	GVA
	enumeration	GVAh
	enumeration	GVA·h
	enumeration	GVAR
	enumeration	Gvar
	enumeration	GVARh
	enumeration	Gvar·h
	enumeration	GW
	enumeration	GWh
	enumeration	GW·h
	enumeration	hour
	enumeration	hours
	enumeration	hours per customer interruption
	enumeration	hours per customer
	enumeration	Hz
	enumeration	interruptions per customer
	enumeration	K
	enumeration	kA
	enumeration	kHz
	enumeration	kV
	enumeration	kVA
	enumeration	kVAh
	enumeration	kVA·h
	enumeration	kVAR
	enumeration	kvar
	enumeration	kVARh
	enumeration	kvar·h
	enumeration	kW
	enumeration	kW/(W/m²)
	enumeration	kW/mph
	enumeration	kWh
	enumeration	kW·h
	enumeration	mA
	enumeration	MA
	enumeration	meters
	enumeration	mHz

	enumeration MHz enumeration miles driven enumeration miles/charge enumeration minute enumeration minutes per customer interruption enumeration minutes per customer enumeration month enumeration ms enumeration m/s enumeration MV enumeration MVA enumeration MVAh enumeration MVA·h enumeration MVAR enumeration Mvar enumeration MVARh enumeration Mvar·h enumeration MW enumeration MWh enumeration MW·h enumeration outages/year enumeration psi enumeration quarter enumeration radians enumeration service interruptions enumeration total hours enumeration total minutes enumeration truck rolls enumeration unitless enumeration units enumeration V enumeration VA enumeration VAh enumeration VA·h enumeration VAR enumeration var enumeration VARh enumeration var·h enumeration W enumeration Wh enumeration W·h enumeration W/m² enumeration W/m2 enumeration week enumeration year
annotation	documentation Units of measure for this reading.

source	<xs:attribute name="Units" type="pnwns:UnitType" use="required"> <xs:annotation> <xs:documentation>Units of measure for this reading.</xs:documentation> </xs:annotation> </xs:attribute>

simpleType **MeasurementStatusType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **MeasurementValueStatus**
facets	Kind / Value / Annotation enumeration Actual Reading enumeration Calculated Reading enumeration Estimated Reading enumeration Edited Reading enumeration Missed Reading enumeration Missed and Interpolated Reading enumeration Missed and Edited Reading enumeration Unknown enumeration Not Applicable
annotation	documentation Enumerated list of measurement status.
source	<xs:simpleType name="MeasurementStatusType"> <xs:annotation> <xs:documentation>Enumerated list of measurement status.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Actual Reading"/> <xs:enumeration value="Calculated Reading"/> <xs:enumeration value="Estimated Reading"/> <xs:enumeration value="Edited Reading"/> <xs:enumeration value="Missed Reading"/> <xs:enumeration value="Missed and Interpolated Reading"/> <xs:enumeration value="Missed and Edited Reading"/> <xs:enumeration value="Unknown"/> <xs:enumeration value="Not Applicable"/> </xs:restriction> </xs:simpleType>

simpleType **MembershipAbbrType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **Membership**
facets	Kind / Value / Annotation

	enumeration EM enumeration CM enumeration NM
annotation	documentation The abbreviation of membership categories.
source	<xs:simpleType name="MembershipAbbrType"> <xs:annotation> <xs:documentation>The abbreviation of membership categories.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="EM"/> <xs:enumeration value="CM"/> <xs:enumeration value="NM"/> </xs:restriction> </xs:simpleType>

simpleType **MembershipEventCauseType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **MembershipEventCause**
facets	Kind Value Annotation enumeration Equipment installed and commissioned enumeration Equipment removed or decommissioned enumeration Equipment failed enumeration Change in customer participation enumeration Test period begins enumeration Test period ends enumeration Change in test case enumeration Change in test case topology
annotation	documentation Enumerated list of causes for membership changes.
source	<xs:simpleType name="MembershipEventCauseType"> <xs:annotation> <xs:documentation>Enumerated list of causes for membership changes.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Equipment installed and commissioned"/> <xs:enumeration value="Equipment removed or decommissioned"/> <xs:enumeration value="Equipment failed"/> <xs:enumeration value="Change in customer participation"/> <xs:enumeration value="Test period begins"/> <xs:enumeration value="Test period ends"/> <xs:enumeration value="Change in test case"/> <xs:enumeration value="Change in test case topology"/> </xs:restriction> </xs:simpleType>

simpleType **MembershipEventType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **MembershipEvent**
facets	Kind Value Annotation enumeration Enter enumeration Leave
annotation	documentation Enumerated list of membership events.
source	<xs:simpleType name="MembershipEventType"> <xs:annotation> <xs:documentation>Enumerated list of membership events.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Enter"/> <xs:enumeration value="Leave"/> </xs:restriction> </xs:simpleType>

simpleType **MembershipLongFormType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
facets	Kind Value Annotation enumeration Experimental Member enumeration Control Member enumeration Not a Member
annotation	documentation The long-form description of membership categories.
source	<xs:simpleType name="MembershipLongFormType"> <xs:annotation> <xs:documentation>The long-form description of membership categories.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Experimental Member"/> <xs:enumeration value="Control Member"/> <xs:enumeration value="Not a Member"/> </xs:restriction> </xs:simpleType>

simpleType **TestCaseIDType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**

properties	base xs:string
used by	element **TestCaseID**
facets	Kind Value Annotation enumeration AV-01-1.4 enumeration AV-01-3.2 enumeration AV-02-3.2 enumeration AV-03-1.1 enumeration AV-04-3.2 enumeration AV-05-1.4 enumeration AV-05-3.1 enumeration AV-05-4.1 enumeration AV-05-4.2 enumeration AV-05-4.3 enumeration AV-06-3.1 enumeration AV-07-2.1 enumeration AV-08-2.2 enumeration AV-09-1.1 enumeration AV-10-1.1 enumeration AV-11-1.1 enumeration AV-12-1.1 enumeration AV-13-1.1 enumeration BP-01-2.1 enumeration BP-01-2.2 enumeration BP-01-2.3 enumeration BP-01-3.2 enumeration BP-02-1.4 enumeration EB-01-2.1 enumeration EB-02-3.2 enumeration EB-03-3.2 enumeration EB-04-3.2 enumeration EB-05-3.2 enumeration EB-06-3.2 enumeration EB-07-3.2 enumeration EB-08-3.2 enumeration EB-09-3.2 enumeration EB-10-3.2 enumeration EB-11-3.2 enumeration EB-12-3.2 enumeration EB-13-3.2 enumeration FH-01-2.2 enumeration FH-02-1.1 enumeration FH-03-1.2 enumeration FH-04-1.2 enumeration FH-05-2.2 enumeration FH-06-1.1 enumeration FH-07-1.2

	enumeration FH-08-1.2 enumeration FH-09-4.3 enumeration IF-01-1.4 enumeration IF-01-3.2 enumeration IF-02-3.2 enumeration IF-03-2.2 enumeration IF-04-1.3 enumeration IF-04-3.2 enumeration IF-04-4.1 enumeration IF-04-4.2 enumeration IF-04-4.3 enumeration IF-05-1.3 enumeration IF-07-1.3 enumeration IF-07-2.2 enumeration IF-08-1.3 enumeration IF-08-3.2 enumeration IF-09-3.1 enumeration IF-10-1.2 enumeration IF-10-3.2 enumeration LV-01-3.1 enumeration LV-02-1.3 enumeration LV-02-2.1 enumeration LV-03-3.2 enumeration LV-04-3.2 enumeration LV-05-3.2 enumeration LV-06-1.4 enumeration LV-07-3.2 enumeration LV-08-1.1 enumeration LV-09-4.1 enumeration LV-09-4.2 enumeration LV-09-4.3 enumeration LV-10-3.2 enumeration MF-01-1.4 enumeration MF-02-1.2 enumeration MF-03-1.2 enumeration MF-04-3.2 enumeration NW-01-1.2 enumeration NW-01-3.2 enumeration NW-02-2.2 enumeration NW-03-1.3 enumeration NW-03-4.1 enumeration NW-04-1.2 enumeration NW-04-3.2 enumeration PG-01-1.2 enumeration PG-01-4.1 enumeration PG-01-4.2

	enumeration PG-02-1.2 enumeration PG-03-1.2 enumeration PG-04-1.4 enumeration PG-04-3.2 enumeration PG-05-2.1 enumeration PL-01-1.4 enumeration PL-02-1.4 enumeration PL-02-3.2 enumeration PL-03-2.2 enumeration UW-01-1.1 enumeration UW-02-1.1 enumeration UW-03-3.2 enumeration UW-04-1.1 enumeration UW-04-3.2 enumeration UW-04-3.2/1.1 enumeration UW-05-3.1 enumeration UW-06-3.2
annotation	documentation An enumerated list of test cases.
source	<xs:simpleType name="TestCaseIDType"> <xs:annotation> <xs:documentation>An enumerated list of test cases.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="AV-01-1.4"/> <xs:enumeration value="AV-01-3.2"/> <xs:enumeration value="AV-02-3.2"/> <xs:enumeration value="AV-03-1.1"/> <xs:enumeration value="AV-04-3.2"/> <xs:enumeration value="AV-05-1.4"/> <xs:enumeration value="AV-05-3.1"/> <xs:enumeration value="AV-05-4.1"/> <xs:enumeration value="AV-05-4.2"/> <xs:enumeration value="AV-05-4.3"/> <xs:enumeration value="AV-06-3.1"/> <xs:enumeration value="AV-07-2.1"/> <xs:enumeration value="AV-08-2.2"/> <xs:enumeration value="AV-09-1.1"/> <xs:enumeration value="AV-10-1.1"/> <xs:enumeration value="AV-11-1.1"/> <xs:enumeration value="AV-12-1.1"/> <xs:enumeration value="AV-13-1.1"/> <xs:enumeration value="BP-01-2.1"/> <xs:enumeration value="BP-01-2.2"/> <xs:enumeration value="BP-01-2.3"/> <xs:enumeration value="BP-01-3.2"/> <xs:enumeration value="BP-02-1.4"/> <xs:enumeration value="EB-01-2.1"/> <xs:enumeration value="EB-02-3.2"/> <xs:enumeration value="EB-03-3.2"/> <xs:enumeration value="EB-04-3.2"/> <xs:enumeration value="EB-05-3.2"/>

```
<xs:enumeration value="EB-06-3.2"/>
<xs:enumeration value="EB-07-3.2"/>
<xs:enumeration value="EB-08-3.2"/>
<xs:enumeration value="EB-09-3.2"/>
<xs:enumeration value="EB-10-3.2"/>
<xs:enumeration value="EB-11-3.2"/>
<xs:enumeration value="EB-12-3.2"/>
<xs:enumeration value="EB-13-3.2"/>
<xs:enumeration value="FH-01-2.2"/>
<xs:enumeration value="FH-02-1.1"/>
<xs:enumeration value="FH-03-1.2"/>
<xs:enumeration value="FH-04-1.2"/>
<xs:enumeration value="FH-05-2.2"/>
<xs:enumeration value="FH-06-1.1"/>
<xs:enumeration value="FH-07-1.2"/>
<xs:enumeration value="FH-08-1.2"/>
<xs:enumeration value="FH-09-4.3"/>
<xs:enumeration value="IF-01-1.4"/>
<xs:enumeration value="IF-01-3.2"/>
<xs:enumeration value="IF-02-3.2"/>
<xs:enumeration value="IF-03-2.2"/>
<xs:enumeration value="IF-04-1.3"/>
<xs:enumeration value="IF-04-3.2"/>
<xs:enumeration value="IF-04-4.1"/>
<xs:enumeration value="IF-04-4.2"/>
<xs:enumeration value="IF-04-4.3"/>
<xs:enumeration value="IF-05-1.3"/>
<xs:enumeration value="IF-07-1.3"/>
<xs:enumeration value="IF-07-2.2"/>
<xs:enumeration value="IF-08-1.3"/>
<xs:enumeration value="IF-08-3.2"/>
<xs:enumeration value="IF-09-3.1"/>
<xs:enumeration value="IF-10-1.2"/>
<xs:enumeration value="IF-10-3.2"/>
<xs:enumeration value="LV-01-3.1"/>
<xs:enumeration value="LV-02-1.3"/>
<xs:enumeration value="LV-02-2.1"/>
<xs:enumeration value="LV-03-3.2"/>
<xs:enumeration value="LV-04-3.2"/>
<xs:enumeration value="LV-05-3.2"/>
<xs:enumeration value="LV-06-1.4"/>
<xs:enumeration value="LV-07-3.2"/>
<xs:enumeration value="LV-08-1.1"/>
<xs:enumeration value="LV-09-4.1"/>
<xs:enumeration value="LV-09-4.2"/>
<xs:enumeration value="LV-09-4.3"/>
<xs:enumeration value="LV-10-3.2"/>
<xs:enumeration value="MF-01-1.4"/>
<xs:enumeration value="MF-02-1.2"/>
<xs:enumeration value="MF-03-1.2"/>
<xs:enumeration value="MF-04-3.2"/>
<xs:enumeration value="NW-01-1.2"/>
<xs:enumeration value="NW-01-3.2"/>
<xs:enumeration value="NW-02-2.2"/>
<xs:enumeration value="NW-03-1.3"/>
<xs:enumeration value="NW-03-4.1"/>
```

```
    <xs:enumeration value="NW-04-1.2"/>
    <xs:enumeration value="NW-04-3.2"/>
    <xs:enumeration value="PG-01-1.2"/>
    <xs:enumeration value="PG-01-4.1"/>
    <xs:enumeration value="PG-01-4.2"/>
    <xs:enumeration value="PG-02-1.2"/>
    <xs:enumeration value="PG-03-1.2"/>
    <xs:enumeration value="PG-04-1.4"/>
    <xs:enumeration value="PG-04-3.2"/>
    <xs:enumeration value="PG-05-2.1"/>
    <xs:enumeration value="PL-01-1.4"/>
    <xs:enumeration value="PL-02-1.4"/>
    <xs:enumeration value="PL-02-3.2"/>
    <xs:enumeration value="PL-03-2.2"/>
    <xs:enumeration value="UW-01-1.1"/>
    <xs:enumeration value="UW-02-1.1"/>
    <xs:enumeration value="UW-03-3.2"/>
    <xs:enumeration value="UW-04-1.1"/>
    <xs:enumeration value="UW-04-3.2"/>
    <xs:enumeration value="UW-04-3.2/1.1"/>
    <xs:enumeration value="UW-05-3.1"/>
    <xs:enumeration value="UW-06-3.2"/>
  </xs:restriction>
</xs:simpleType>
```

simpleType **UtilityNameAbbrType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **UtilityID**
facets	Kind / Value / Annotation enumeration AV enumeration BP enumeration EB enumeration FH enumeration IF enumeration LV enumeration MF enumeration NW enumeration PL enumeration PG enumeration UW
annotation	documentation The two-letter abbreviation of a utility.
source	<xs:simpleType name="UtilityNameAbbrType"> <xs:annotation> <xs:documentation>The two-letter abbreviation of a utility.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="AV"/>

```
    <xs:enumeration value="BP"/>
    <xs:enumeration value="EB"/>
    <xs:enumeration value="FH"/>
    <xs:enumeration value="IF"/>
    <xs:enumeration value="LV"/>
    <xs:enumeration value="MF"/>
    <xs:enumeration value="NW"/>
    <xs:enumeration value="PL"/>
    <xs:enumeration value="PG"/>
    <xs:enumeration value="UW"/>
  </xs:restriction>
</xs:simpleType>
```

simpleType **UtilityNameLongFormType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
facets	Kind / Value / Annotation enumeration Avista Utilities enumeration Benton PUD enumeration City of Ellensburg enumeration Flathead Electric Cooperative enumeration Idaho Falls Power enumeration Lower Valley Energy enumeration Milton-Freewater City Light and Power enumeration Northwestern Energy enumeration Peninsula Light enumeration Portland General Electric enumeration Seattle City Light - University of Washington
annotation	documentation The long-form name of a utility.

source

```
<xs:simpleType name="UtilityNameLongFormType">
  <xs:annotation>
    <xs:documentation>The long-form name of a utility.</xs:documentation>
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:enumeration value="Avista Utilities"/>
    <xs:enumeration value="Benton PUD"/>
    <xs:enumeration value="City of Ellensburg"/>
    <xs:enumeration value="Flathead Electric Cooperative"/>
    <xs:enumeration value="Idaho Falls Power"/>
    <xs:enumeration value="Lower Valley Energy"/>
    <xs:enumeration value="Milton-Freewater City Light and Power"/>
    <xs:enumeration value="Northwestern Energy"/>
    <xs:enumeration value="Peninsula Light"/>
    <xs:enumeration value="Portland General Electric"/>
    <xs:enumeration value="Seattle City Light - University of Washington"/>
  </xs:restriction>
</xs:simpleType>
```

simpleType **TestCaseEventType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **TestCaseEvent**

facets

Kind	Value	Annotation
enumeration	Changed asset system engagement	
enumeration	Changed asset system engagement - air handler	
enumeration	Changed asset system engagement - Battery storage	
enumeration	Changed asset system engagement - battery storage	
enumeration	Changed asset system engagement - chillers	
enumeration	Changed asset system engagement - demand response unit (DRU) / water heater	
enumeration	Changed asset system engagement - distributed energy resources	
enumeration	Changed asset system engagement - EMS control	
enumeration	Changed asset system engagement - generator	
enumeration	Changed asset system engagement - GenOnSys	
enumeration	Changed asset system engagement - HVAC	
enumeration	Changed asset system engagement - information posted to IHD	
enumeration	Changed asset system engagement - information posted to web portal	
enumeration	Changed asset system engagement - lighting	
enumeration	Changed asset system engagement - load control switch	
enumeration	Changed asset system engagement - PHEV	
enumeration	Changed asset system engagement - smart appliance	
enumeration	Changed asset system engagement - thermostat	
enumeration	Changed asset system engagement - Volt/Var	
enumeration	Changed asset system engagement - CVR	
enumeration	Changed asset system engagement - Volt/VAr, CVR, voltage regulator, transformer tap	
enumeration	Changed asset system engagement - Volt/VAr; CVR; voltage regulator; transformer tap	
enumeration	Changed asset system engagement - water heater	
enumeration	Changed System Asset Helena ES CVR level 1	
enumeration	Changed System Asset Helena SS CVR level 1	
enumeration	Changed System Asset PBG CVR level 1	
enumeration	Changed System Asset Helena ES Volt/VAR level 1	
enumeration	Changed System Asset Helena SS Volt/VAR level 1	
enumeration	Changed System Asset PBG Volt/VAR level 1	
enumeration	Changed availability	
enumeration	Changed override status	
enumeration	Changed termination status	
enumeration	Device alarms detected	
enumeration	Device alarms detected - fault	
enumeration	Device alarms detected - high temperature	
enumeration	Device alarms detected - high voltage	
enumeration	Device alarms detected - High voltage	
enumeration	Device alarms detected - hot socket	

	enumeration	Device alarms detected - low voltage
	enumeration	Device alarms detected - outage
	enumeration	Device alarms detected - tamper
	enumeration	Distribution switches have changed
	enumeration	Distribution switches have changed - capacitor bank
	enumeration	Distribution switches have changed - circuit configuration
	enumeration	Distribution switches have changed - microgrid
	enumeration	Distribution switches have changed - recloser
	enumeration	Peak time event occurrence
	enumeration	Battery status has changed
	enumeration	Change in asset engagement -config/control
	enumeration	Change in engagement of config/control
	enumeration	Changed asset system control strategy – Volt/Var
	enumeration	Changed asset system control strategy - Volt/Var
	enumeration	Changed Asset System Engagement - Commercial EMS Control
	enumeration	Changed Asset System Engagement - Water Heater
	enumeration	Changed asset system engagement - Water heater
	enumeration	Changed asset system engagement – diesel generator
	enumeration	Changed asset system engagement - diesel generator
	enumeration	Changed asset system engagement - GenOnSys
	enumeration	Changed asset system engagement – natural gas genset #1
	enumeration	Changed asset system engagement - natural gas genset #1
	enumeration	Changed asset system engagement – natural gas genset #2
	enumeration	Changed asset system engagement - natural gas genset #2
	enumeration	Changed Feeder Topology - switch
	enumeration	Change in asset system engagement - advanced switch gear
	enumeration	Change in asset system engagement – Bio-tech generator
	enumeration	Change in asset system engagement - Bio-tech generator
	enumeration	Change in asset system engagement – thermostat
	enumeration	Change in asset system engagement - thermostat
	enumeration	Change in FDIR engagement
	enumeration	Changed topology configuration
	enumeration	Changed feeder topology - switch
	enumeration	CVR change
	enumeration	CVR status has changed
	enumeration	DRU change
	enumeration	DRU status has changed
	enumeration	Mode Change
	enumeration	PV system availability has changed
	enumeration	SVC status has changed
	enumeration	Wind turbine availability has changed
	enumeration	RECLOSER 15KV - Disconnect Switch for Generation Assets
	enumeration	DRUs curtailed (TRUE)
	enumeration	Tier 1 - HVAC Load Shed: AGRS
	enumeration	Tier 1 - HVAC Load Shed: AGRS Acknowledge
	enumeration	Tier 1 - HVAC Load Shed: AGRS Response

	enumeration Tier 1 - HVAC Load Shed: Asset Active enumeration Tier 2 - CHW Load Shed: AGRS enumeration Tier 2 - CHW Load Shed: AGRS Acknowledge enumeration Tier 2 - CHW Load Shed: AGRS Response enumeration Tier 2 - CHW Load Shed: Asset Active enumeration Tier 3 - GWSP Generator #1 Dispatch: AGRS enumeration Tier 3 - GWSP Generator #1 Dispatch: AGRS Acknowledge enumeration Tier 3 - GWSP Generator #1 Dispatch: AGRS Response enumeration Tier 3 - GWSP Generator #1 Dispatch: Asset Active enumeration Tier 4 - GWSP Generator #2 Dispatch: AGRS enumeration Tier 4 - GWSP Generator #2 Dispatch: AGRS Acknowledge enumeration Tier 4 - GWSP Generator #2 Dispatch: AGRS Response enumeration Tier 4 - GWSP Generator #2 Dispatch: Asset Active enumeration Tier 5 - GWSP Generator #3 Dispatch: AGRS enumeration Tier 5 - GWSP Generator #3 Dispatch: AGRS Acknowledge enumeration Tier 5 - GWSP Generator #3 Dispatch: AGRS Response enumeration Tier 5 - GWSP Generator #3 Dispatch: Asset Active
annotation	documentation Enumerated list of test case events.
source	<xs:simpleType name="TestCaseEventType"> <xs:annotation> <xs:documentation>Enumerated list of test case events.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Changed asset system engagement"/> <xs:enumeration value="Changed asset system engagement - air handler"/> <xs:enumeration value="Changed asset system engagement - Battery storage"/> <xs:enumeration value="Changed asset system engagement - battery storage"/> <xs:enumeration value="Changed asset system engagement - chillers"/> <xs:enumeration value="Changed asset system engagement - demand response unit (DRU) / water heater"/> <xs:enumeration value="Changed asset system engagement - distributed energy resources"/> <xs:enumeration value="Changed asset system engagement - EMS control"/> <xs:enumeration value="Changed asset system engagement - generator"/> <xs:enumeration value="Changed asset system engagement - GenOnSys"/> <xs:enumeration value="Changed asset system engagement - HVAC"/> <xs:enumeration value="Changed asset system engagement - information posted to IHD"/> <xs:enumeration value="Changed asset system engagement - information posted to web portal"/> <xs:enumeration value="Changed asset system engagement - lighting"/> <xs:enumeration value="Changed asset system engagement - load control switch"/> <xs:enumeration value="Changed asset system engagement - PHEV"/> <xs:enumeration value="Changed asset system engagement - smart appliance"/> <xs:enumeration value="Changed asset system engagement - thermostat"/> <xs:enumeration value="Changed asset system engagement - Volt/Var"/> <xs:enumeration value="Changed asset system engagement - CVR"/> <xs:enumeration value="Changed asset system engagement - Volt/VAr, CVR, voltage regulator, transformer tap"/> <xs:enumeration value="Changed asset system engagement - Volt/VAr; CVR; voltage regulator; transformer tap"/>

```
    <xs:enumeration value="Changed asset system engagement - water heater"/>
    <xs:enumeration value="Changed System Asset Helena ES CVR level 1"/>
    <xs:enumeration value="Changed System Asset Helena SS CVR level 1"/>
    <xs:enumeration value="Changed System Asset PBG CVR level 1"/>
    <xs:enumeration value="Changed System Asset Helena ES Volt/VAR level 1"/>
    <xs:enumeration value="Changed System Asset Helena SS Volt/VAR level 1"/>
    <xs:enumeration value="Changed System Asset PBG Volt/VAR level 1"/>
    <xs:enumeration value="Changed availability"/>
    <xs:enumeration value="Changed override status"/>
    <xs:enumeration value="Changed termination status"/>
    <xs:enumeration value="Device alarms detected"/>
    <xs:enumeration value="Device alarms detected - fault"/>
    <xs:enumeration value="Device alarms detected - high temperature"/>
    <xs:enumeration value="Device alarms detected - high voltage"/>
    <xs:enumeration value="Device alarms detected - High voltage"/>
    <xs:enumeration value="Device alarms detected - hot socket"/>
    <xs:enumeration value="Device alarms detected - low voltage"/>
    <xs:enumeration value="Device alarms detected - outage"/>
    <xs:enumeration value="Device alarms detected - tamper"/>
    <xs:enumeration value="Distribution switches have changed"/>
    <xs:enumeration value="Distribution switches have changed - capacitor bank"/>
    <xs:enumeration value="Distribution switches have changed - circuit configuration"/>
    <xs:enumeration value="Distribution switches have changed - microgrid"/>
    <xs:enumeration value="Distribution switches have changed - recloser"/>
    <xs:enumeration value="Peak time event occurrence"/>
    <xs:enumeration value="Battery status has changed"/>
    <xs:enumeration value="Change in asset engagement -config/control"/>
    <xs:enumeration value="Change in engagement  of config/control"/>
    <xs:enumeration value="Changed asset system control strategy – Volt/Var"/>
    <xs:enumeration value="Changed asset system control strategy - Volt/Var"/>
    <xs:enumeration value="Changed Asset System Engagement - Commercial EMS
Control"/>
    <xs:enumeration value="Changed Asset System Engagement - Water Heater"/>
    <xs:enumeration value="Changed asset system engagement - Water heater"/>
    <xs:enumeration value="Changed asset system engagement – diesel generator"/>
    <xs:enumeration value="Changed asset system engagement - diesel generator"/>
    <xs:enumeration value="Changed asset system engagement - GenOnSys"/>
    <xs:enumeration value="Changed asset system engagement – natural gas genset #1"/>
    <xs:enumeration value="Changed asset system engagement - natural gas genset #1"/>
    <xs:enumeration value="Changed asset system engagement – natural gas genset #2"/>
    <xs:enumeration value="Changed asset system engagement - natural gas genset #2"/>
    <xs:enumeration value="Changed Feeder Topology - switch"/>
    <xs:enumeration value="Change in asset system engagement - advanced switch gear"/>
    <xs:enumeration value="Change in asset system engagement – Bio-tech generator"/>
    <xs:enumeration value="Change in asset system engagement - Bio-tech generator"/>
    <xs:enumeration value="Change in asset system engagement – thermostat"/>
    <xs:enumeration value="Change in asset system engagement - thermostat"/>
    <xs:enumeration value="Change in FDIR engagement"/>
    <xs:enumeration value="Changed topology configuration"/>
    <xs:enumeration value="Changed feeder topology - switch"/>
    <xs:enumeration value="CVR change"/>
    <xs:enumeration value="CVR status has changed"/>
    <xs:enumeration value="DRU change"/>
    <xs:enumeration value="DRU status has changed"/>
    <xs:enumeration value="Mode Change"/>
    <xs:enumeration value="PV system availability has changed"/>
```

```
    <xs:enumeration value="SVC status has changed"/>
    <xs:enumeration value="Wind turbine availability has changed"/>
    <xs:enumeration value="RECLOSER 15KV - Disconnect Switch for Generation Assets"/>
    <xs:enumeration value="DRUs curtailed (TRUE)"/>
    <xs:enumeration value="Tier 1 - HVAC Load Shed: AGRS"/>
    <xs:enumeration value="Tier 1 - HVAC Load Shed: AGRS Acknowledge"/>
    <xs:enumeration value="Tier 1 - HVAC Load Shed: AGRS Response"/>
    <xs:enumeration value="Tier 1 - HVAC Load Shed: Asset Active"/>
    <xs:enumeration value="Tier 2 - CHW Load Shed: AGRS"/>
    <xs:enumeration value="Tier 2 - CHW Load Shed: AGRS Acknowledge"/>
    <xs:enumeration value="Tier 2 - CHW Load Shed: AGRS Response"/>
    <xs:enumeration value="Tier 2 - CHW Load Shed: Asset Active"/>
    <xs:enumeration value="Tier 3 - GWSP Generator #1 Dispatch: AGRS"/>
    <xs:enumeration value="Tier 3 - GWSP Generator #1 Dispatch: AGRS Acknowledge"/>
    <xs:enumeration value="Tier 3 - GWSP Generator #1 Dispatch: AGRS Response"/>
    <xs:enumeration value="Tier 3 - GWSP Generator #1 Dispatch: Asset Active"/>
    <xs:enumeration value="Tier 4 - GWSP Generator #2 Dispatch: AGRS"/>
    <xs:enumeration value="Tier 4 - GWSP Generator #2 Dispatch: AGRS Acknowledge"/>
    <xs:enumeration value="Tier 4 - GWSP Generator #2 Dispatch: AGRS Response"/>
    <xs:enumeration value="Tier 4 - GWSP Generator #2 Dispatch: Asset Active"/>
    <xs:enumeration value="Tier 5 - GWSP Generator #3 Dispatch: AGRS"/>
    <xs:enumeration value="Tier 5 - GWSP Generator #3 Dispatch: AGRS Acknowledge"/>
    <xs:enumeration value="Tier 5 - GWSP Generator #3 Dispatch: AGRS Response"/>
    <xs:enumeration value="Tier 5 - GWSP Generator #3 Dispatch: Asset Active"/>
    <!-- Preferred Enumeration List for Events -->
    <!-- Additional Negotiated Enumerations Between Deputies and Subprojects -->
  </xs:restriction>
</xs:simpleType>
```

simpleType **TestCaseStatusType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **TestCaseStatus**

facets

Kind	Value	Annotation
enumeration	Low price signal - normal	
enumeration	Normal operation	
enumeration	Abnormal operation	
enumeration	On	
enumeration	Off	
enumeration	Online	
enumeration	Offline	
enumeration	Connected	
enumeration	Disconnected	
enumeration	Active	
enumeration	Inactive	
enumeration	Available	
enumeration	Not available	
enumeration	Unavailable	

	enumeration	Closed
	enumeration	Opened
	enumeration	Overridden
	enumeration	Terminated
	enumeration	Customer opted out
	enumeration	Not curtailed
	enumeration	Curtailed
	enumeration	Generating
	enumeration	Not generating
	enumeration	Increased generation
	enumeration	Decreased generation
	enumeration	Charging
	enumeration	Discharging
	enumeration	Idle
	enumeration	Out for maintenance
	enumeration	Baseline - no engagement
	enumeration	Engagement with transactive control
	enumeration	Operational efficiency
	enumeration	Change of group (control or experimental)
	enumeration	CVR engaged ES substation level 1
	enumeration	CVR not engaged ES substation level 1
	enumeration	CVR engaged SS substation level 1
	enumeration	CVR not engaged SS substation level 1
	enumeration	Volt/VAr engaged ES substation level 1
	enumeration	Volt/VAr not engaged ES substation level 1
	enumeration	Volt/VAr engaged SS substation level 1
	enumeration	Volt/VAr not engaged SS substation level 1
	enumeration	CVR engaged level 1
	enumeration	CVR engaged level 2
	enumeration	CVR engaged level 3
	enumeration	Optimized without transactive control
	enumeration	Optimized with transactive control
	enumeration	Not optimized
	enumeration	Normal transactive mode start
	enumeration	Wind response mode start
	enumeration	Automated SVC active
	enumeration	Automated SVC inactive/offline
	enumeration	Active for testing
	enumeration	Out for maintenance
	enumeration	Battery charging
	enumeration	Battery discharging
	enumeration	Battery active/online
	enumeration	Battery idle/offline
	enumeration	Commercial EMS Control demand curtailment active
	enumeration	Commercial EMS curtailment inactive
	enumeration	CVR active

	enumeration	CVR inactive/offline
	enumeration	CVR engaged level 3
	enumeration	Normal operation (TRUE)
	enumeration	DRUs restored (FALSE)
	enumeration	DRU curtailed
	enumeration	DRUs curtailed (TRUE)
	enumeration	DRU not curtailed
	enumeration	DRU on
	enumeration	DRU off
	enumeration	DG ON
	enumeration	DG OFF
	enumeration	Baseline (No engagement)
	enumeration	Operational efficiency
	enumeration	Engagement with transactive control
	enumeration	Baseline Operation – Not Optimized
	enumeration	Baseline Operation - Not Optimized
	enumeration	DMS Optimized
	enumeration	DMS Optimized with Transactive Control
	enumeration	Optimized
	enumeration	Not Optimized
	enumeration	IHD green for non-peak all appliances and attachments run normally
	enumeration	IHD red for peak event - groups of appliances and attachments respond to signal but member may override signal
	enumeration	Generating
	enumeration	Not generating
	enumeration	Normal
	enumeration	Abnormal
	enumeration	Light and message on
	enumeration	Light off and message off
	enumeration	PV system available
	enumeration	PV system unavailable/offline
	enumeration	Switch Closed
	enumeration	Switch Open
	enumeration	Water heater demand curtailment active
	enumeration	Water heater demand curtailment inactive
	enumeration	Wind response mode start
	enumeration	Normal/transactive mode start
	enumeration	Wind turbine available
	enumeration	Wind turbine unavailable/offline
	enumeration	Recloser 15KV - OPEN, Generation assets are curtailed. Provide Load to BPA
	enumeration	Recloser 15KV - CLOSED, Generation assets are operating.
	enumeration	Residential
	enumeration	Short
	enumeration	Long
	enumeration	Islanded
	enumeration	Not islanded
	enumeration	Emergency

	enumeration Tier 1 enumeration Tier 2 enumeration Tier 3 enumeration None enumeration Low; Green; $0.03/kWh enumeration Medium; Yellow; $0.05/kWh enumeration High; Red; $0.09/kWh enumeration Disabled enumeration Engaged enumeration Engaged - Comm Restored enumeration Engaged - Scada Restored enumeration Engaged - Via Schedule enumeration Not engaged enumeration Not Engaged enumeration Not Engaged - By Scada (YFA) enumeration Not Engaged - Comm Loss enumeration Not Engaged - Comm Restored enumeration Not Engaged - Missing Data enumeration 0 enumeration 1 enumeration 2 enumeration 3 enumeration 4 enumeration 5 enumeration 6 enumeration 7 enumeration 8 enumeration 9 enumeration 10 enumeration 11 enumeration 12 enumeration 13 enumeration 14 enumeration 15 enumeration 16 enumeration 17 enumeration 18 enumeration 19 enumeration 20
annotation	documentation Enumerated list of test case event status.
source	<xs:simpleType name="TestCaseStatusType"> <xs:annotation> <xs:documentation>Enumerated list of test case event status.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Low price signal - normal"/> <xs:enumeration value="Normal operation"/>

```
<xs:enumeration value="Abnormal operation"/>
<xs:enumeration value="On"/>
<xs:enumeration value="Off"/>
<xs:enumeration value="Online"/>
<xs:enumeration value="Offline"/>
<xs:enumeration value="Connected"/>
<xs:enumeration value="Disconnected"/>
<xs:enumeration value="Active"/>
<xs:enumeration value="Inactive"/>
<xs:enumeration value="Available"/>
<xs:enumeration value="Not available"/>
<xs:enumeration value="Unavailable"/>
<xs:enumeration value="Closed"/>
<xs:enumeration value="Opened"/>
<xs:enumeration value="Overridden"/>
<xs:enumeration value="Terminated"/>
<xs:enumeration value="Customer opted out"/>
<xs:enumeration value="Not curtailed"/>
<xs:enumeration value="Curtailed"/>
<xs:enumeration value="Generating"/>
<xs:enumeration value="Not generating"/>
<xs:enumeration value="Increased generation"/>
<xs:enumeration value="Decreased generation"/>
<xs:enumeration value="Charging"/>
<xs:enumeration value="Discharging"/>
<xs:enumeration value="Idle"/>
<xs:enumeration value="Out for maintenance"/>
<xs:enumeration value="Baseline - no engagement"/>
<xs:enumeration value="Engagement with transactive control"/>
<xs:enumeration value="Operational efficiency"/>
<xs:enumeration value="Change of group (control or experimental)"/>
<xs:enumeration value="CVR engaged ES substation level 1"/>
<xs:enumeration value="CVR not engaged ES substation level 1"/>
<xs:enumeration value="CVR engaged SS substation level 1"/>
<xs:enumeration value="CVR not engaged SS substation level 1"/>
<xs:enumeration value="Volt/VAr engaged ES substation level 1"/>
<xs:enumeration value="Volt/VAr not engaged ES substation level 1"/>
<xs:enumeration value="Volt/VAr engaged SS substation level 1"/>
<xs:enumeration value="Volt/VAr not engaged SS substation level 1"/>
<xs:enumeration value="CVR engaged level 1"/>
<xs:enumeration value="CVR engaged level 2"/>
<xs:enumeration value="CVR engaged level 3"/>
<xs:enumeration value="Optimized without transactive control"/>
<xs:enumeration value="Optimized with transactive control"/>
<xs:enumeration value="Not optimized"/>
<xs:enumeration value="Normal transactive mode start"/>
<xs:enumeration value="Wind response mode start"/>
<xs:enumeration value="Automated SVC active"/>
<xs:enumeration value="Automated SVC inactive/offline"/>
<xs:enumeration value="Active for testing"/>
<xs:enumeration value="Out for maintenance"/>
<xs:enumeration value="Battery charging"/>
<xs:enumeration value="Battery discharging"/>
<xs:enumeration value="Battery active/online"/>
<xs:enumeration value="Battery idle/offline"/>
<xs:enumeration value="Commercial EMS Control demand curtailment active"/>
```

```
    <xs:enumeration value="Commercial EMS curtailment inactive"/>
    <xs:enumeration value="CVR active"/>
    <xs:enumeration value="CVR inactive/offline"/>
    <xs:enumeration value="CVR engaged level 3"/>
    <xs:enumeration value="Normal operation (TRUE)"/>
    <xs:enumeration value="DRUs restored (FALSE)"/>
    <xs:enumeration value="DRU curtailed"/>
    <xs:enumeration value="DRUs curtailed (TRUE)"/>
    <xs:enumeration value="DRU not curtailed"/>
    <xs:enumeration value="DRU on"/>
    <xs:enumeration value="DRU off"/>
    <xs:enumeration value="DG ON"/>
    <xs:enumeration value="DG OFF"/>
    <xs:enumeration value="Baseline (No engagement)"/>
    <xs:enumeration value="Operational  efficiency"/>
    <xs:enumeration value="Engagement with transactive control"/>
    <xs:enumeration value="Baseline Operation – Not Optimized"/>
    <xs:enumeration value="Baseline Operation - Not Optimized"/>
    <xs:enumeration value="DMS Optimized"/>
    <xs:enumeration value="DMS Optimized with Transactive Control"/>
    <xs:enumeration value="Optimized"/>
    <xs:enumeration value="Not Optimized"/>
    <xs:enumeration value="IHD green for non-peak all appliances and attachments run
normally"/>
    <xs:enumeration value="IHD red for peak event - groups of appliances and attachments
respond to signal but member may override signal"/>
    <xs:enumeration value="Generating"/>
    <xs:enumeration value="Not generating"/>
    <xs:enumeration value="Normal"/>
    <xs:enumeration value="Abnormal"/>
    <xs:enumeration value="Light and message on"/>
    <xs:enumeration value="Light off and message off"/>
    <xs:enumeration value="PV system available"/>
    <xs:enumeration value="PV system unavailable/offline"/>
    <xs:enumeration value="Switch Closed"/>
    <xs:enumeration value="Switch Open"/>
    <xs:enumeration value="Water heater demand curtailment active"/>
    <xs:enumeration value="Water heater demand curtailment inactive"/>
    <xs:enumeration value="Wind response mode start"/>
    <xs:enumeration value="Normal/transactive mode start"/>
    <xs:enumeration value="Wind turbine available"/>
    <xs:enumeration value="Wind turbine unavailable/offline"/>
    <xs:enumeration value="Recloser 15KV - OPEN, Generation assets are curtailed. Provide
Load to BPA"/>
    <xs:enumeration value="Recloser 15KV - CLOSED, Generation assets are operating."/>
    <xs:enumeration value="Residential"/>
    <xs:enumeration value="Short"/>
    <xs:enumeration value="Long"/>
    <xs:enumeration value="Islanded"/>
    <xs:enumeration value="Not islanded"/>
    <xs:enumeration value="Emergency"/>
    <xs:enumeration value="Tier 1"/>
    <xs:enumeration value="Tier 2"/>
    <xs:enumeration value="Tier 3"/>
    <xs:enumeration value="None"/>
    <xs:enumeration value="Low; Green; $0.03/kWh"/>
```

```
    <xs:enumeration value="Medium; Yellow; $0.05/kWh"/>
    <xs:enumeration value="High; Red; $0.09/kWh"/>
    <xs:enumeration value="Disabled"/>
    <xs:enumeration value="Engaged"/>
    <xs:enumeration value="Engaged - Comm Restored"/>
    <xs:enumeration value="Engaged - Scada Restored"/>
    <xs:enumeration value="Engaged - Via Schedule"/>
    <xs:enumeration value="Not engaged"/>
    <xs:enumeration value="Not Engaged"/>
    <xs:enumeration value="Not Engaged - By Scada (YFA)"/>
    <xs:enumeration value="Not Engaged - Comm Loss"/>
    <xs:enumeration value="Not Engaged - Comm Restored"/>
    <xs:enumeration value="Not Engaged - Missing Data"/>
    <xs:enumeration value="0"/>
    <xs:enumeration value="1"/>
    <xs:enumeration value="2"/>
    <xs:enumeration value="3"/>
    <xs:enumeration value="4"/>
    <xs:enumeration value="5"/>
    <xs:enumeration value="6"/>
    <xs:enumeration value="7"/>
    <xs:enumeration value="8"/>
    <xs:enumeration value="9"/>
    <xs:enumeration value="10"/>
    <xs:enumeration value="11"/>
    <xs:enumeration value="12"/>
    <xs:enumeration value="13"/>
    <xs:enumeration value="14"/>
    <xs:enumeration value="15"/>
    <xs:enumeration value="16"/>
    <xs:enumeration value="17"/>
    <xs:enumeration value="18"/>
    <xs:enumeration value="19"/>
    <xs:enumeration value="20"/>
    <!-- Preferred Enumeration List for Status -->
    <!-- Additional Negotiated Enumerations Between Deputies and Subprojects -->
    <!-- replace with Battery active/online -->
    <!-- replace with Battery active/online -->
    <!-- Additional Negotiated Enumerations for PG -->
  </xs:restriction>
</xs:simpleType>
```

simpleType **DeviceEventType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **DeviceEvent**
facets	Kind / Value / Annotation enumeration Device Alarm enumeration Device Alarm - High voltage enumeration Device Alarm - Hot socket

	enumeration Device Alarm - Low voltage enumeration Device Alarm - Outage enumeration Device Alarm - Tamper detected enumeration Device Alarm - High temperature enumeration Device Alarm - Fault enumeration Device/Appliance opt out enumeration Device coniditon has changed enumeration Device Engagement enumeration Equipment failures enumeration Equipment failures - Device enumeration Demand Shifter Status Change enumeration Demand Shifter Charging Status enumeration Switch setting enumeration System requests overridden
annotation	documentation Enumerated list of device events.
source	<xs:simpleType name="DeviceEventType"> <xs:annotation> <xs:documentation>Enumerated list of device events.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Device Alarm"/> <xs:enumeration value="Device Alarm - High voltage"/> <xs:enumeration value="Device Alarm - Hot socket"/> <xs:enumeration value="Device Alarm - Low voltage"/> <xs:enumeration value="Device Alarm - Outage"/> <xs:enumeration value="Device Alarm - Tamper detected"/> <xs:enumeration value="Device Alarm - High temperature"/> <xs:enumeration value="Device Alarm - Fault"/> <xs:enumeration value="Device/Appliance opt out"/> <xs:enumeration value="Device coniditon has changed"/> <xs:enumeration value="Device Engagement"/> <xs:enumeration value="Equipment failures"/> <xs:enumeration value="Equipment failures - Device"/> <xs:enumeration value="Demand Shifter Status Change"/> <xs:enumeration value="Demand Shifter Charging Status"/> <xs:enumeration value="Switch setting"/> <xs:enumeration value="System requests overridden"/> </xs:restriction> </xs:simpleType>

simpleType **DeviceStatusType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **DeviceStatus**
facets	Kind Value Annotation enumeration Bit set 1 for high voltage enumeration Bit set 0 for normal voltage

	enumeration	Bit set 1 for hot socket
	enumeration	Bit set 0 for normal temperature
	enumeration	Bit set 1 for low voltage
	enumeration	Bit set 0 for normal voltage
	enumeration	Bit set to 1 for outage
	enumeration	Bit set to 0 for outage restored
	enumeration	Bit set to 1 for tampering
	enumeration	Bit set to 0 for no tampering
	enumeration	Bit set to 1 for high temperature
	enumeration	Bit set to 0 for normal temperature
	enumeration	Fault indicator tripped
	enumeration	Fault indicator reset
	enumeration	Override
	enumeration	Opt out
	enumeration	Normal
	enumeration	Change in appurtenance group
	enumeration	Charging
	enumeration	Charging begin
	enumeration	Discharging
	enumeration	Discharging begin
	enumeration	Standby begin
	enumeration	Discharging while driving
	enumeration	Faulty PHEV
	enumeration	PHEV sitting idle at charger
	enumeration	DG failure
	enumeration	DER failure
	enumeration	Customer opted out
	enumeration	Level 1
	enumeration	Configuration 1
	enumeration	Tap 1
	enumeration	Equipment failure
	enumeration	Outage
	enumeration	Tampering
	enumeration	Communication failure
	enumeration	Transmission failure
	enumeration	Stuck meter
	enumeration	Slow meter
	enumeration	Device failure
	enumeration	On
	enumeration	Off
	enumeration	Disconnected
	enumeration	Open
	enumeration	Closed
	enumeration	Pt Created
	enumeration	Reconnected
	enumeration	Maintenance

	enumeration Retired enumeration Engagement on enumeration Engagement off enumeration Curtailing enumeration Non-curtailing enumeration Demand response participation on enumeration Demand response participation off enumeration Manual enumeration Auto
annotation	documentation Enumerated list of device event status.
source	<xs:simpleType name="DeviceStatusType"> <xs:annotation> <xs:documentation>Enumerated list of device event status.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Bit set 1 for high voltage"/> <xs:enumeration value="Bit set 0 for normal voltage"/> <xs:enumeration value="Bit set 1 for hot socket"/> <xs:enumeration value="Bit set 0 for normal temperature"/> <xs:enumeration value="Bit set 1 for low voltage"/> <xs:enumeration value="Bit set 0 for normal voltage"/> <xs:enumeration value="Bit set to 1 for outage"/> <xs:enumeration value="Bit set to 0 for outage restored"/> <xs:enumeration value="Bit set to 1 for tampering"/> <xs:enumeration value="Bit set to 0 for no tampering"/> <xs:enumeration value="Bit set to 1 for high temperature"/> <xs:enumeration value="Bit set to 0 for normal temperature"/> <xs:enumeration value="Fault indicator tripped"/> <xs:enumeration value="Fault indicator reset"/> <xs:enumeration value="Override"/> <xs:enumeration value="Opt out"/> <xs:enumeration value="Normal"/> <xs:enumeration value="Change in appurtenance group"/> <xs:enumeration value="Charging"/> <xs:enumeration value="Charging begin"/> <xs:enumeration value="Discharging"/> <xs:enumeration value="Discharging begin"/> <xs:enumeration value="Standby begin"/> <xs:enumeration value="Discharging while driving"/> <xs:enumeration value="Faulty PHEV"/> <xs:enumeration value="PHEV sitting idle at charger"/> <xs:enumeration value="DG failure"/> <xs:enumeration value="DER failure"/> <xs:enumeration value="Customer opted out"/> <xs:enumeration value="Level 1"/> <xs:enumeration value="Configuration 1"/> <xs:enumeration value="Tap 1"/> <xs:enumeration value="Equipment failure"/> <xs:enumeration value="Outage"/> <xs:enumeration value="Tampering"/> <xs:enumeration value="Communication failure"/> <xs:enumeration value="Transmission failure"/> <xs:enumeration value="Stuck meter"/>

```
    <xs:enumeration value="Slow meter"/>
    <xs:enumeration value="Device failure"/>
    <xs:enumeration value="On"/>
    <xs:enumeration value="Off"/>
    <xs:enumeration value="Disconnected"/>
    <xs:enumeration value="Open"/>
    <xs:enumeration value="Closed"/>
    <xs:enumeration value="Pt Created"/>
    <xs:enumeration value="Reconnected"/>
    <xs:enumeration value="Maintenance"/>
    <xs:enumeration value="Retired"/>
    <xs:enumeration value="Engagement on"/>
    <xs:enumeration value="Engagement off"/>
    <xs:enumeration value="Curtailing"/>
    <xs:enumeration value="Non-curtailing"/>
    <xs:enumeration value="Demand response participation on"/>
    <xs:enumeration value="Demand response participation off"/>
    <xs:enumeration value="Manual"/>
    <xs:enumeration value="Auto"/>
  </xs:restriction>
</xs:simpleType>
```

simpleType **DeviceType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **Device**

facets

Kind	Value	Annotation
enumeration	Electric meter	
enumeration	Gas meter	
enumeration	Water meter	
enumeration	Demand meter	
enumeration	Harmonic meter	
enumeration	Phase angle meter	
enumeration	Line potential meter	
enumeration	Line current meter	
enumeration	Recloser	
enumeration	Substation bus potential meter	
enumeration	Substation bus current meter	
enumeration	Substation breaker potential meter	
enumeration	Substation breaker current meter	
enumeration	Switch	
enumeration	Thermometer	
enumeration	Transactive Node	
enumeration	Virtual Meter	
enumeration	EMS Control Add-on	
enumeration	Head Line Sensor	
enumeration	Middle Line Sensor	

	enumeration End Line Sensor enumeration Synchrophasor enumeration Relay meter controller
annotation	documentation Enumerated list of device types.
source	<xs:simpleType name="DeviceType"> <xs:annotation> <xs:documentation>Enumerated list of device types.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Electric meter"/> <xs:enumeration value="Gas meter"/> <xs:enumeration value="Water meter"/> <xs:enumeration value="Demand meter"/> <xs:enumeration value="Harmonic meter"/> <xs:enumeration value="Phase angle meter"/> <xs:enumeration value="Line potential meter"/> <xs:enumeration value="Line current meter"/> <xs:enumeration value="Recloser"/> <xs:enumeration value="Substation bus potential meter"/> <xs:enumeration value="Substation bus current meter"/> <xs:enumeration value="Substation breaker potential meter"/> <xs:enumeration value="Substation breaker current meter"/> <xs:enumeration value="Switch"/> <xs:enumeration value="Thermometer"/> <xs:enumeration value="Transactive Node"/> <xs:enumeration value="Virtual Meter"/> <xs:enumeration value="EMS Control Add-on"/> <xs:enumeration value="Head Line Sensor"/> <xs:enumeration value="Middle Line Sensor"/> <xs:enumeration value="End Line Sensor"/> <xs:enumeration value="Synchrophasor"/> <xs:enumeration value="Relay meter controller"/> </xs:restriction> </xs:simpleType>

simpleType **MeasurementValueType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **MeasurementType**
facets	Kind Value Annotation enumeration Angle enumeration Apparent energy enumeration Apparent power enumeration Boolean enumeration CAIDI enumeration CAIFI enumeration CAIMI enumeration Cost

	enumeration Count enumeration Demand charges enumeration Direction enumeration Electrical current enumeration Electrical (real) energy enumeration Electrical (real) power enumeration Electrical (reactive) energy enumeration Electrical (reactive) power enumeration Electrical voltage enumeration Frequency enumeration Irradience enumeration Losses enumeration MAIFI enumeration Momentary service interruptions enumeration Percent enumeration Power factor enumeration Reactive energy enumeration Reactive power enumeration Relative humidity enumeration SAIDI enumeration SAIFI enumeration Speed enumeration Steam load indicator enumeration Sustained service interruptions enumeration Temperature enumeration Time duration enumeration Transactive enumeration Vehicle operations
annotation	documentation Enumerated list depicting the type of measurement.
source	<xs:simpleType name="MeasurementValueType"> <xs:annotation> <xs:documentation>Enumerated list depicting the type of measurement.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="Angle"/> <xs:enumeration value="Apparent energy"/> <xs:enumeration value="Apparent power"/> <xs:enumeration value="Boolean"/> <xs:enumeration value="CAIDI"/> <xs:enumeration value="CAIFI"/> <xs:enumeration value="CAIMI"/> <xs:enumeration value="Cost"/> <xs:enumeration value="Count"/> <xs:enumeration value="Demand charges"/> <xs:enumeration value="Direction"/> <xs:enumeration value="Electrical current"/> <xs:enumeration value="Electrical (real) energy"/> <xs:enumeration value="Electrical (real) power"/>

```
    <xs:enumeration value="Electrical (reactive) energy"/>
    <xs:enumeration value="Electrical (reactive) power"/>
    <xs:enumeration value="Electrical voltage"/>
    <xs:enumeration value="Frequency"/>
    <xs:enumeration value="Irradience"/>
    <xs:enumeration value="Losses"/>
    <xs:enumeration value="MAIFI"/>
    <xs:enumeration value="Momentary service interruptions"/>
    <xs:enumeration value="Percent"/>
    <xs:enumeration value="Power factor"/>
    <xs:enumeration value="Reactive energy"/>
    <xs:enumeration value="Reactive power"/>
    <xs:enumeration value="Relative humidity"/>
    <xs:enumeration value="SAIDI"/>
    <xs:enumeration value="SAIFI"/>
    <xs:enumeration value="Speed"/>
    <xs:enumeration value="Steam load indicator"/>
    <xs:enumeration value="Sustained service interruptions"/>
    <xs:enumeration value="Temperature"/>
    <xs:enumeration value="Time duration"/>
    <xs:enumeration value="Transactive"/>
    <xs:enumeration value="Vehicle operations"/>
  </xs:restriction>
</xs:simpleType>
```

simpleType **MeasurementQualifierType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	element **MeasurementQualifier**
facets	Kind / Value / Annotation enumeration During peak hour of interval enumeration During off-peak hour of interval enumeration Instantaneous (sampled nominal) enumeration Interval (default interpretation) enumeration Interval actual enumeration Interval average (nominal) enumeration Interval estimate enumeration Interval maximum (peak) enumeration Interval minimum enumeration Interval standard deviation enumeration Interval total (cumulative) enumeration Quantity enumeration Not applicable
annotation	documentation Enumerated list that qualifies the type of measurement.
source	<xs:simpleType name="MeasurementQualifierType"> <xs:annotation> <xs:documentation>Enumerated list that qualifies the type of measurement.</xs:documentation>

```
  </xs:annotation>
  <xs:restriction base="xs:string">
    <xs:enumeration value="During peak hour of interval"/>
    <xs:enumeration value="During off-peak hour of interval"/>
    <xs:enumeration value="Instantaneous (sampled nominal)"/>
    <xs:enumeration value="Interval (default interpretation)"/>
    <xs:enumeration value="Interval actual"/>
    <xs:enumeration value="Interval average (nominal)"/>
    <xs:enumeration value="Interval estimate"/>
    <xs:enumeration value="Interval maximum (peak)"/>
    <xs:enumeration value="Interval minimum"/>
    <xs:enumeration value="Interval standard deviation"/>
    <xs:enumeration value="Interval total (cumulative)"/>
    <xs:enumeration value="Quantity"/>
    <xs:enumeration value="Not applicable"/>
  </xs:restriction>
</xs:simpleType>
```

simpleType **UnitType**

namespace	http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
type	restriction of **xs:string**
properties	base xs:string
used by	attribute **ValueTypeDef/@Units**

facets

Kind	Value	Annotation
enumeration	#	
enumeration	#/cap bank/feeder	
enumeration	$ savings	
enumeration	$	
enumeration	$/#	
enumeration	$/day	
enumeration	$/gallon	
enumeration	$/GW	
enumeration	$/h	
enumeration	$/kBtu	
enumeration	$/kW	
enumeration	$/kWh	
enumeration	$/kW·h	
enumeration	$/mile	
enumeration	$/minute	
enumeration	$/month	
enumeration	$/customer/month	
enumeration	$/MW	
enumeration	$/MWh	
enumeration	$/MW·h	
enumeration	$/outage	
enumeration	$/outage/year	
enumeration	$/overload	

	enumeration	$/truck roll
	enumeration	$/V
	enumeration	$/week
	enumeration	$/Wh
	enumeration	$/W·h
	enumeration	$/year
	enumeration	% nominal
	enumeration	%
	enumeration	¢/kWh
	enumeration	¢/kW·h
	enumeration	¢/MWh
	enumeration	¢/MW·h
	enumeration	°C
	enumeration	°F
	enumeration	µs
	enumeration	A
	enumeration	alarms per type
	enumeration	customers
	enumeration	day
	enumeration	degrees
	enumeration	events
	enumeration	fractional
	enumeration	GA
	enumeration	GVA
	enumeration	GVAh
	enumeration	GVA·h
	enumeration	GVAR
	enumeration	Gvar
	enumeration	GVARh
	enumeration	Gvar·h
	enumeration	GW
	enumeration	GWh
	enumeration	GW·h
	enumeration	hour
	enumeration	hours
	enumeration	hours per customer interruption
	enumeration	hours per customer
	enumeration	Hz
	enumeration	interruptions per customer
	enumeration	K
	enumeration	kA
	enumeration	kHz
	enumeration	kV
	enumeration	kVA
	enumeration	kVAh
	enumeration	kVA·h

	enumeration	kVAR
	enumeration	kvar
	enumeration	kVARh
	enumeration	kvar·h
	enumeration	kW
	enumeration	kW/(W/m²)
	enumeration	kW/mph
	enumeration	kWh
	enumeration	kW·h
	enumeration	mA
	enumeration	MA
	enumeration	meters
	enumeration	mHz
	enumeration	MHz
	enumeration	miles driven
	enumeration	miles/charge
	enumeration	minute
	enumeration	minutes per customer interruption
	enumeration	minutes per customer
	enumeration	month
	enumeration	ms
	enumeration	m/s
	enumeration	MV
	enumeration	MVA
	enumeration	MVAh
	enumeration	MVA·h
	enumeration	MVAR
	enumeration	Mvar
	enumeration	MVARh
	enumeration	Mvar·h
	enumeration	MW
	enumeration	MWh
	enumeration	MW·h
	enumeration	outages/year
	enumeration	psi
	enumeration	quarter
	enumeration	radians
	enumeration	service interruptions
	enumeration	total hours
	enumeration	total minutes
	enumeration	truck rolls
	enumeration	unitless
	enumeration	units
	enumeration	V
	enumeration	VA
	enumeration	VAh

	enumeration VA·h enumeration VAR enumeration var enumeration VARh enumeration var·h enumeration W enumeration Wh enumeration W·h enumeration W/m² enumeration W/m2 enumeration week enumeration year
annotation	documentation Enumerated list of measuring units.
source	<xs:simpleType name="UnitType"> <xs:annotation> <xs:documentation>Enumerated list of measuring units.</xs:documentation> </xs:annotation> <xs:restriction base="xs:string"> <xs:enumeration value="#"/> <xs:enumeration value="#/cap bank/feeder"/> <xs:enumeration value="$ savings"/> <xs:enumeration value="$"/> <xs:enumeration value="$/#"/> <xs:enumeration value="$/day"/> <xs:enumeration value="$/gallon"/> <xs:enumeration value="$/GW"/> <xs:enumeration value="$/h"/> <xs:enumeration value="$/kBtu"/> <xs:enumeration value="$/kW"/> <xs:enumeration value="$/kWh"/> <xs:enumeration value="$/kW·h"/> <xs:enumeration value="$/mile"/> <xs:enumeration value="$/minute"/> <xs:enumeration value="$/month"/> <xs:enumeration value="$/customer/month"/> <xs:enumeration value="$/MW"/> <xs:enumeration value="$/MWh"/> <xs:enumeration value="$/MW·h"/> <xs:enumeration value="$/outage"/> <xs:enumeration value="$/outage/year"/> <xs:enumeration value="$/overload"/> <xs:enumeration value="$/truck roll"/> <xs:enumeration value="$/V"/> <xs:enumeration value="$/week"/> <xs:enumeration value="$/Wh"/> <xs:enumeration value="$/W·h"/> <xs:enumeration value="$/year"/> <xs:enumeration value="% nominal"/> <xs:enumeration value="%"/> <xs:enumeration value="¢/kWh"/> <xs:enumeration value="¢/kW·h"/> <xs:enumeration value="¢/MWh"/>

```
<xs:enumeration value="¢/MW·h"/>
<xs:enumeration value="°C"/>
<xs:enumeration value="°F"/>
<xs:enumeration value="µs"/>
<xs:enumeration value="A"/>
<xs:enumeration value="alarms per type"/>
<xs:enumeration value="customers"/>
<xs:enumeration value="day"/>
<xs:enumeration value="degrees"/>
<xs:enumeration value="events"/>
<xs:enumeration value="fractional"/>
<xs:enumeration value="GA"/>
<xs:enumeration value="GVA"/>
<xs:enumeration value="GVAh"/>
<xs:enumeration value="GVA·h"/>
<xs:enumeration value="GVAR"/>
<xs:enumeration value="Gvar"/>
<xs:enumeration value="GVARh"/>
<xs:enumeration value="Gvar·h"/>
<xs:enumeration value="GW"/>
<xs:enumeration value="GWh"/>
<xs:enumeration value="GW·h"/>
<xs:enumeration value="hour"/>
<xs:enumeration value="hours"/>
<xs:enumeration value="hours per customer interruption"/>
<xs:enumeration value="hours per customer"/>
<xs:enumeration value="Hz"/>
<xs:enumeration value="interruptions per customer"/>
<xs:enumeration value="K"/>
<xs:enumeration value="kA"/>
<xs:enumeration value="kHz"/>
<xs:enumeration value="kV"/>
<xs:enumeration value="kVA"/>
<xs:enumeration value="kVAh"/>
<xs:enumeration value="kVA·h"/>
<xs:enumeration value="kVAR"/>
<xs:enumeration value="kvar"/>
<xs:enumeration value="kVARh"/>
<xs:enumeration value="kvar·h"/>
<xs:enumeration value="kW"/>
<xs:enumeration value="kW/(W/m²)"/>
<xs:enumeration value="kW/mph"/>
<xs:enumeration value="kWh"/>
<xs:enumeration value="kW·h"/>
<xs:enumeration value="mA"/>
<xs:enumeration value="MA"/>
<xs:enumeration value="meters"/>
<xs:enumeration value="mHz"/>
<xs:enumeration value="MHz"/>
<xs:enumeration value="miles driven"/>
<xs:enumeration value="miles/charge"/>
<xs:enumeration value="minute"/>
<xs:enumeration value="minutes per customer interruption"/>
<xs:enumeration value="minutes per customer"/>
<xs:enumeration value="month"/>
<xs:enumeration value="ms"/>
```

```
      <xs:enumeration value="m/s"/>
      <xs:enumeration value="MV"/>
      <xs:enumeration value="MVA"/>
      <xs:enumeration value="MVAh"/>
      <xs:enumeration value="MVA·h"/>
      <xs:enumeration value="MVAR"/>
      <xs:enumeration value="Mvar"/>
      <xs:enumeration value="MVARh"/>
      <xs:enumeration value="Mvar·h"/>
      <xs:enumeration value="MW"/>
      <xs:enumeration value="MWh"/>
      <xs:enumeration value="MW·h"/>
      <xs:enumeration value="outages/year"/>
      <xs:enumeration value="psi"/>
      <xs:enumeration value="quarter"/>
      <xs:enumeration value="radians"/>
      <xs:enumeration value="service interruptions"/>
      <xs:enumeration value="total hours"/>
      <xs:enumeration value="total minutes"/>
      <xs:enumeration value="truck rolls"/>
      <xs:enumeration value="unitless"/>
      <xs:enumeration value="units"/>
      <xs:enumeration value="V"/>
      <xs:enumeration value="VA"/>
      <xs:enumeration value="VAh"/>
      <xs:enumeration value="VA·h"/>
      <xs:enumeration value="VAR"/>
      <xs:enumeration value="var"/>
      <xs:enumeration value="VARh"/>
      <xs:enumeration value="var·h"/>
      <xs:enumeration value="W"/>
      <xs:enumeration value="Wh"/>
      <xs:enumeration value="W·h"/>
      <xs:enumeration value="W/m²"/>
      <xs:enumeration value="W/m2"/>
      <xs:enumeration value="week"/>
      <xs:enumeration value="year"/>
    </xs:restriction>
  </xs:simpleType>
```

Appendix C – MembershipConfigTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-27\PNWSGDSchema-2012-02-27.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-04T12:00:00.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>AV</pnwns:UtilityID>
        <pnwns:MembershipConfigTransaction>
                <pnwns:DataStreamMembership>
                        <pnwns:DataStreamID>AV-01-1.4-IM-1-F3-C120</pnwns:DataStreamID>
                        <pnwns:DeviceID>AV_M2567</pnwns:DeviceID>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-01-3.2</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-02-3.2</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-03-1.1</pnwns:TestCaseID>
                                <pnwns:Membership>EM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-04-3.2</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-05-1.2</pnwns:TestCaseID>
                                <pnwns:Membership>EM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-05-3.1</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-05-4.1</pnwns:TestCaseID>
                                <pnwns:Membership>EM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
```

```
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-05-4.2</pnwns:TestCaseID>
                                <pnwns:Membership>EM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-05-4.3</pnwns:TestCaseID>
                                <pnwns:Membership>EM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-06-3.1</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-07-2.1</pnwns:TestCaseID>
                                <pnwns:Membership>CM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-08-2.2</pnwns:TestCaseID>
                                <pnwns:Membership>CM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                </pnwns:DataStreamMembership>
                <pnwns:DataStreamMembership>
                        <pnwns:DataStreamID>AV-01-1.4-IM-1-F3-C120</pnwns:DataStreamID>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-01-3.2</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2011-11-24T10:25:02.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <pnwns:TestCaseMembership>
                                <pnwns:TestCaseID>AV-01-3.2</pnwns:TestCaseID>
                                <pnwns:Membership>NM</pnwns:Membership>
                                <pnwns:EffectiveDateTime>2001-12-17T09:30:47.0Z</pnwns:EffectiveDateTime>
                        </pnwns:TestCaseMembership>
                        <!-- And more test cases follow -->
                </pnwns:DataStreamMembership>
                <!-- And more data streams follow -->
        </pnwns:MembershipConfigTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix D – MembershipEventTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-27\PNWSGDSchema-2012-02-27.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-04T12:00:00.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>FH</pnwns:UtilityID>
        <pnwns:MembershipEventTransaction>
                <pnwns:MembershipEvents>
                        <pnwns:DataStreamID>FH-01-2.2-IM-60-T1205</pnwns:DataStreamID>
                        <pnwns:TestCaseID>FH-01-2.2</pnwns:TestCaseID>
                        <pnwns:MembershipEvent>Enter</pnwns:MembershipEvent>
                        <pnwns:Membership>EM</pnwns:Membership>
                        <pnwns:MembershipEventCause>Equipment installed and commissioned</pnwns:MembershipEventCause>
                        <pnwns:EffectiveDateTime>2011-12-03T18:34:02.0Z</pnwns:EffectiveDateTime>
                </pnwns:MembershipEvents>
                <pnwns:MembershipEvents>
                        <pnwns:DataStreamID>FH-02-1.1-IM-1-D12</pnwns:DataStreamID>
                        <pnwns:TestCaseID>FH-02-1.1</pnwns:TestCaseID>
                        <pnwns:MembershipEvent>Enter</pnwns:MembershipEvent>
                        <pnwns:Membership>EM</pnwns:Membership>
                        <pnwns:MembershipEventCause>Equipment installed and commissioned</pnwns:MembershipEventCause>
                        <pnwns:EffectiveDateTime>2011-12-03T10:53:23.0Z</pnwns:EffectiveDateTime>
                </pnwns:MembershipEvents>
                <pnwns:MembershipEvents>
                        <pnwns:DataStreamID>FH-02-1.1-IM-1-D12</pnwns:DataStreamID>
                        <pnwns:TestCaseID>FH-02-1.1</pnwns:TestCaseID>
                        <pnwns:MembershipEvent>Leave</pnwns:MembershipEvent>
                        <pnwns:Membership>EM</pnwns:Membership>
                        <pnwns:MembershipEventCause>Equipment failed</pnwns:MembershipEventCause>
                        <pnwns:EffectiveDateTime>2011-12-04T01:23:22.0Z</pnwns:EffectiveDateTime>
                </pnwns:MembershipEvents>
                <pnwns:MembershipEvents>
                        <pnwns:DataStreamID>FH-02-1.1-IM-1-D12</pnwns:DataStreamID>
                        <pnwns:TestCaseID>FH-02-1.1</pnwns:TestCaseID>
                        <pnwns:MembershipEvent>Enter</pnwns:MembershipEvent>
                        <pnwns:Membership>NM</pnwns:Membership>
                        <pnwns:MembershipEventCause>Equipment failed</pnwns:MembershipEventCause>
                        <pnwns:EffectiveDateTime>2011-12-04T01:23:22.0Z</pnwns:EffectiveDateTime>
                </pnwns:MembershipEvents>
                <pnwns:MembershipEvents>
                        <pnwns:DataStreamID>FH-02-1.1-IM-1-D10</pnwns:DataStreamID>
                        <pnwns:TestCaseID>FH-02-1.1</pnwns:TestCaseID>
                        <pnwns:MembershipEvent>Leave</pnwns:MembershipEvent>
                        <pnwns:Membership>EM</pnwns:Membership>
                        <pnwns:MembershipEventCause>Change in customer participation</pnwns:MembershipEventCause>
```

```
                        <pnwns:EffectiveDateTime>2011-12-03T09:00:00.0Z</pnwns:EffectiveDateTime>
                </pnwns:MembershipEvents>
                <pnwns:MembershipEvents>
                        <pnwns:DataStreamID>FH-02-1.1-IM-1-D10</pnwns:DataStreamID>
                        <pnwns:TestCaseID>FH-02-1.1</pnwns:TestCaseID>
                        <pnwns:MembershipEvent>Enter</pnwns:MembershipEvent>
                        <pnwns:Membership>CM</pnwns:Membership>
                        <pnwns:MembershipEventCause>Change in customer participation</pnwns:MembershipEventCause>
                        <pnwns:EffectiveDateTime>2011-12-03T09:00:00.0Z</pnwns:EffectiveDateTime>
                </pnwns:MembershipEvents>
        </pnwns:MembershipEventTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix E – TestCaseEventTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-03\PNWSGDSchema-2012-02-03.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-03T23:00:00.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>FH</pnwns:UtilityID>
        <pnwns:TestCaseEventTransaction>
                <pnwns:TestCaseEvents>
                        <pnwns:TestCaseID>FH-02-1.1</pnwns:TestCaseID>
                        <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        <pnwns:TestCaseEvent>Changed asset system engagement</pnwns:TestCaseEvent>
                        <pnwns:TestCaseStatus>Low price signal</pnwns:TestCaseStatus>
                </pnwns:TestCaseEvents>
                <pnwns:TestCaseEvents>
                        <pnwns:TestCaseID>FH-03-1.2</pnwns:TestCaseID>
                        <pnwns:EffectiveDateTime>2011-12-03T09:12:34.0Z</pnwns:EffectiveDateTime>
                        <pnwns:TestCaseEvent>Changed asset system engagement</pnwns:TestCaseEvent>
                        <pnwns:TestCaseStatus>Curtailed</pnwns:TestCaseStatus>
                </pnwns:TestCaseEvents>
                <pnwns:TestCaseEvents>
                        <pnwns:TestCaseID>FH-03-1.2</pnwns:TestCaseID>
                        <pnwns:EffectiveDateTime>2011-12-03T14:02:39.0Z</pnwns:EffectiveDateTime>
                        <pnwns:TestCaseEvent>Device alarms detected - Outage</pnwns:TestCaseEvent>
                        <pnwns:TestCaseStatus>On</pnwns:TestCaseStatus>
                </pnwns:TestCaseEvents>
                <pnwns:TestCaseEvents>
                        <pnwns:TestCaseID>FH-03-1.2</pnwns:TestCaseID>
                        <pnwns:EffectiveDateTime>2011-12-03T11:12:34.0Z</pnwns:EffectiveDateTime>
                        <pnwns:TestCaseEvent>Changed asset system engagement</pnwns:TestCaseEvent>
                        <pnwns:TestCaseStatus>Normal</pnwns:TestCaseStatus>
                </pnwns:TestCaseEvents>
                <pnwns:TestCaseEvents>
                        <pnwns:TestCaseID>FH-03-1.2</pnwns:TestCaseID>
                        <pnwns:EffectiveDateTime>2011-12-03T14:22:39.0Z</pnwns:EffectiveDateTime>
                        <pnwns:TestCaseEvent>Device alarms detected - Outage</pnwns:TestCaseEvent>
                        <pnwns:TestCaseStatus>Off</pnwns:TestCaseStatus>
                </pnwns:TestCaseEvents>
        </pnwns:TestCaseEventTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix F – DeviceInformationTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-03\PNWSGDSchema-2012-02-03.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2001-12-17T09:30:47.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>MF</pnwns:UtilityID>
        <pnwns:DeviceInformationTransaction>
                <pnwns:Devices>
                        <pnwns:DeviceID>123456</pnwns:DeviceID>
                        <pnwns:Device>Electric meter</pnwns:Device>
                        <pnwns:Model>Centron</pnwns:Model>
                        <pnwns:Manufacturer>Itron</pnwns:Manufacturer>
                        <pnwns:InServiceDateTime>2001-12-15T09:30:47.0Z</pnwns:InServiceDateTime>
                        <pnwns:ServiceLocationID>123</pnwns:ServiceLocationID>
                        <pnwns:CustomerID>456</pnwns:CustomerID>
                        <pnwns:AssociatedDataStreams>
                                <pnwns:DataStreamID>DS004</pnwns:DataStreamID>
                                <pnwns:DataStreamID>DS004-a</pnwns:DataStreamID>
                                <pnwns:DataStreamID>DS004-b</pnwns:DataStreamID>
                                <pnwns:DataStreamID>DS004-c</pnwns:DataStreamID>
                        </pnwns:AssociatedDataStreams>
                </pnwns:Devices>
                <pnwns:Devices>
                        <pnwns:DeviceID>234567</pnwns:DeviceID>
                        <pnwns:Device>Demand meter</pnwns:Device>
                        <pnwns:Manufacturer>GE</pnwns:Manufacturer>
                        <pnwns:InServiceDateTime>2001-11-12T10:30:47.0Z</pnwns:InServiceDateTime>
                        <pnwns:OutServiceDateTime>2001-12-17T09:30:47.0Z</pnwns:OutServiceDateTime>
                        <pnwns:ServiceLocationID>234</pnwns:ServiceLocationID>
                        <pnwns:CustomerID>378</pnwns:CustomerID>
                        <pnwns:AssociatedDataStreams>
                                <pnwns:DataStreamID>DS034</pnwns:DataStreamID>
                        </pnwns:AssociatedDataStreams>
                </pnwns:Devices>
                <pnwns:Devices>
                        <pnwns:DeviceID>345678</pnwns:DeviceID>
                        <pnwns:Device>Electric meter</pnwns:Device>
                        <pnwns:Model>Centron II</pnwns:Model>
                        <pnwns:Manufacturer>Itron</pnwns:Manufacturer>
                        <pnwns:InServiceDateTime>2001-04-04T13:05:47.0Z</pnwns:InServiceDateTime>
                        <pnwns:ServiceLocationID>134</pnwns:ServiceLocationID>
                        <pnwns:CustomerID>234</pnwns:CustomerID>
                        <pnwns:AssociatedDataStreams>
                                <pnwns:DataStreamID>DS023</pnwns:DataStreamID>
                        </pnwns:AssociatedDataStreams>
```

```
                </pnwns:Devices>
        </pnwns:DeviceInformationTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix G – DeviceEventTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-03\PNWSGDSchema-2012-02-03.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-03T23:00:00.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>FH</pnwns:UtilityID>
        <pnwns:DeviceEventTransaction>
                <pnwns:DeviceEvents>
                        <pnwns:DeviceID>M001</pnwns:DeviceID>
                        <pnwns:EffectiveDateTime>2011-12-03T12:45:22.0Z</pnwns:EffectiveDateTime>
                        <pnwns:DeviceEvent>Device Alarm - High voltage</pnwns:DeviceEvent>
                        <pnwns:DeviceStatus>On</pnwns:DeviceStatus>
                </pnwns:DeviceEvents>
                <pnwns:DeviceEvents>
                        <pnwns:DeviceID>VF-025</pnwns:DeviceID>
                        <pnwns:EffectiveDateTime>2011-12-03T09:12:34.0Z</pnwns:EffectiveDateTime>
                        <pnwns:DeviceEvent>Equipment failures</pnwns:DeviceEvent>
                        <pnwns:DeviceStatus>Disconnected</pnwns:DeviceStatus>
                </pnwns:DeviceEvents>
                <pnwns:DeviceEvents>
                        <pnwns:DeviceID>TN01</pnwns:DeviceID>
                        <pnwns:EffectiveDateTime>2011-12-03T14:02:39.0Z</pnwns:EffectiveDateTime>
                        <pnwns:DeviceEvent>System requests overridden</pnwns:DeviceEvent>
                        <pnwns:DeviceStatus>Device failure</pnwns:DeviceStatus>
                </pnwns:DeviceEvents>
        </pnwns:DeviceEventTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix H – CustomerChangeTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-03\PNWSGDSchema-2012-02-03.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-17T16:00:00.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>AV</pnwns:UtilityID>
        <pnwns:CustomerTransaction>
                <pnwns:CustomerInformation>
                        <pnwns:CustomerID>10045</pnwns:CustomerID>
                        <pnwns:CustomerType>Residential</pnwns:CustomerType>
                        <pnwns:ServiceLocationID>37568</pnwns:ServiceLocationID>
                        <pnwns:StartDateTime>2011-12-17T09:30:47.0Z</pnwns:StartDateTime>
                </pnwns:CustomerInformation>
                <pnwns:CustomerInformation>
                        <pnwns:CustomerID>200</pnwns:CustomerID>
                        <pnwns:CustomerType>Irrigation</pnwns:CustomerType>
                        <pnwns:ServiceLocationID>27483</pnwns:ServiceLocationID>
                        <pnwns:StartDateTime>2010-12-17T09:30:47.0Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-17T09:30:47.0Z</pnwns:EndDateTime>
                </pnwns:CustomerInformation>
                <pnwns:CustomerInformation>
                        <pnwns:CustomerID>2517</pnwns:CustomerID>
                        <pnwns:CustomerType>Industrial</pnwns:CustomerType>
                        <pnwns:ServiceLocationID>17283</pnwns:ServiceLocationID>
                        <pnwns:StartDateTime>2011-12-17T13:35:00.0Z</pnwns:StartDateTime>
                </pnwns:CustomerInformation>
        </pnwns:CustomerTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix I – ServiceLocationInformationTransaction XML Instance Example

```
<?xml version="1.0" encoding="UTF-8"?>
<!--Sample XML file generated by XMLSpy v2007 rel. 3 sp1 (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-02-03\PNWSGDSchema-2012-02-03.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-31T00:00:00.0Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>FH</pnwns:UtilityID>
        <pnwns:ServiceLocationInformationTransaction>
                <pnwns:Location>
                        <pnwns:ServiceLocationID>T1205</pnwns:ServiceLocationID>
                        <pnwns:ServiceLocationDescription>Transformer</pnwns:ServiceLocationDescription>
                        <pnwns:SubstationID>Libby</pnwns:SubstationID>
                        <pnwns:FeederID>T1205</pnwns:FeederID>
                </pnwns:Location>
                <pnwns:Location>
                        <pnwns:ServiceLocationID>T3667</pnwns:ServiceLocationID>
                        <pnwns:ServiceLocationDescription>Transformer</pnwns:ServiceLocationDescription>
                        <pnwns:SubstationID>Libby</pnwns:SubstationID>
                        <pnwns:FeederID>T3667</pnwns:FeederID>
                </pnwns:Location>
                <pnwns:Location>
                        <pnwns:ServiceLocationID>Libby-All</pnwns:ServiceLocationID>
                        <pnwns:ServiceLocationDescription>Data computations for the whole utility</pnwns:ServiceLocationDescription>
                </pnwns:Location>
        </pnwns:ServiceLocationInformationTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix J – MeasurementTransaction XML Instance Example (AV)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2012 sp1 (x64) (http://www.altova.com) by Cristina Marinovici (PNNL) -->
<!--Sample XML file generated by XMLSpy v2012 sp1 (x64) (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-01-16\PNWSGDSchema-2012-01-16.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-17T09:40:47Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>AV</pnwns:UtilityID>
        <pnwns:MeasurementTransaction>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>AV-06-3.1-IM-41-1211</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="MW">3.8559</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>AV-06-3.1-IM-41B-1211</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="MW">3.14159</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Edited Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>AV-06-3.1-IM-42-3211</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="MVAR">6.1059</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Estimated Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>AV-06-3.1-IM-42B-3211</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="MVAR">5.9965</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
        </pnwns:MeasurementTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix K – MeasurementTransaction XML Instance Example (EB)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2012 sp1 (x64) (http://www.altova.com) by Cristina Marinovici (PNNL) -->
<!--Sample XML file generated by XMLSpy v2012 sp1 (x64) (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-01-16\PNWSGDSchema-2012-01-16.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2011-12-17T09:45:47Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>EB</pnwns:UtilityID>
        <pnwns:MeasurementTransaction>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>EB-02-3.2-IM-80-1</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="kW">5.8559E1</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>EB-02-3.2-IM-81-1</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2010-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2010-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="%">3.14159E0</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>EB-04-3.2-IM-508-1</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2010-12-17T09:30:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2010-12-17T09:35:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="$/kW•h">48.14159E0</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
        </pnwns:MeasurementTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix L – MeasurementTransaction XML Instance Example (LV)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2012 sp1 (x64) (http://www.altova.com) by Cristina Marinovici (PNNL) -->
<!--Sample XML file generated by XMLSpy v2012 sp1 (x64) (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-01-16\PNWSGDSchema-2012-01-16.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2001-12-17T09:30:47Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>LV</pnwns:UtilityID>
        <pnwns:MeasurementTransaction>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-02-2.1-IM-523-1</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-19T09:45:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="Hz">5.9559E1</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-02-2.1-IM-15-231</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-19T09:45:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="V" xsi:nil="true"/>  <!-- This is how you create a null value -->
                        <pnwns:MeasurementValueStatus>Not Applicable</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-02-2.1-IM-15-231</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-19T10:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT1H</pnwns:IntervalDuration>
                        <pnwns:Value Units="V">240</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-02-2.1-IM-60-East Jackson</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2012-12-19T09:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>P1Y</pnwns:IntervalDuration>
                        <pnwns:Value Units="fractional">1.61</pnwns:Value>  <!--SAIFI-->
                        <pnwns:MeasurementValueStatus>Calculated Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-05-3.2-IM-51-SVC A</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-12-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2012-12-19T09:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>P1Y</pnwns:IntervalDuration>
```

```
                        <pnwns:Value Units="fractional">0.76</pnwns:Value>  <!--Power factor is dimensionless-->
                        <pnwns:MeasurementValueStatus>Calculated Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-02-1.3-IM-800-1</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-11-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-19T09:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT1M</pnwns:IntervalDuration>
                        <pnwns:Value Units="$">12.89</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Calculated Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>LV-04-3.2-IM-501</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-11-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-11-19T09:45:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT5M</pnwns:IntervalDuration>
                        <pnwns:Value Units="kWh">142.9789</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
        </pnwns:MeasurementTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix M – MeasurementTransaction XML Instance Example (NW)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2012 sp1 (x64) (http://www.altova.com) by Cristina Marinovici (PNNL) -->
<!--Sample XML file generated by XMLSpy v2012 sp1 (x64) (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-01-16\PNWSGDSchema-2012-01-16.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2001-12-17T09:30:47Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>NW</pnwns:UtilityID>
        <pnwns:MeasurementTransaction>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>NW-02-2.1-IM-52-1</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-11-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-19T09:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>P1M</pnwns:IntervalDuration>
                        <pnwns:Value Units="truck rolls">6</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Calculated Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>NW-01-3.2-IM-50-1234</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-11-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-12-19T09:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT1M</pnwns:IntervalDuration>
                        <pnwns:Value Units="MWh">2046</pnwns:Value>
                        <pnwns:MeasurementValueStatus>Calculated Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
                <pnwns:Measurements>
                        <pnwns:DataStreamID>NW-04-1.2-IM-15-1234-12</pnwns:DataStreamID>
                        <pnwns:StartDateTime>2011-11-19T09:40:00Z</pnwns:StartDateTime>
                        <pnwns:EndDateTime>2011-11-20T09:40:00Z</pnwns:EndDateTime>
                        <pnwns:IntervalDuration>PT1H</pnwns:IntervalDuration>
                        <pnwns:Value Units="V">59.99</pnwns:Value> <!-- feeder voltage-->
                        <pnwns:MeasurementValueStatus>Actual Reading</pnwns:MeasurementValueStatus>
                </pnwns:Measurements>
        </pnwns:MeasurementTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix N – PNWSGSchema-MeasurementValueTypes.xsd

NOTE: The schema depicted in this appendix is as of the time of this writing. This schema is being updated as utilities are creating their data streams.

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2007 rel. 3 sp1 (http://www.altova.com) by Olga A Kuchar (Battelle) updated 7/03/2012 by Steve Elbert -->
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified" attributeFormDefault="unqualified"
version="1.4">
	<xs:simpleType name="MeasurementValueType">
		<xs:annotation>
			<xs:documentation>Enumerated list depicting the type of measurement.</xs:documentation>
		</xs:annotation>
		<xs:restriction base="xs:string">
			<xs:enumeration value="Angle"/>
			<xs:enumeration value="Apparent energy"/>
			<xs:enumeration value="Apparent power"/>
			<xs:enumeration value="Boolean"/>
			<xs:enumeration value="CAIDI"/>
			<xs:enumeration value="CAIFI"/>
			<xs:enumeration value="CAIMI"/>
			<xs:enumeration value="Cost"/>
			<xs:enumeration value="Count"/>
			<xs:enumeration value="Demand charges"/>
			<xs:enumeration value="Direction"/>
			<xs:enumeration value="Electrical current"/>
			<xs:enumeration value="Electrical (real) energy"/>
			<xs:enumeration value="Electrical (real) power"/>
			<xs:enumeration value="Electrical (reactive) energy"/>
			<xs:enumeration value="Electrical (reactive) power"/>
			<xs:enumeration value="Electrical voltage"/>
			<xs:enumeration value="Frequency"/>
			<xs:enumeration value="Irradience"/>
			<xs:enumeration value="Losses"/>
			<xs:enumeration value="MAIFI"/>
			<xs:enumeration value="Momentary service interruptions"/>
			<xs:enumeration value="Percent"/>
			<xs:enumeration value="Power factor"/>
			<xs:enumeration value="Reactive energy"/>
			<xs:enumeration value="Reactive power"/>
			<xs:enumeration value="Relative humidity"/>
			<xs:enumeration value="SAIDI"/>
			<xs:enumeration value="SAIFI"/>
			<xs:enumeration value="Speed"/>
			<xs:enumeration value="Steam load indicator"/>
			<xs:enumeration value="Sustained service interruptions"/>
			<xs:enumeration value="Temperature"/>
			<xs:enumeration value="Time duration"/>
			<xs:enumeration value="Transactive"/>
```

```
                    <xs:enumeration value="Vehicle operations"/>
                </xs:restriction>
            </xs:simpleType>
</xs:schema>
```

Appendix O – DataStreamInformationTransaction XML Instance Example (LV)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2012 sp1 (x64) (http://www.altova.com) by Cristina Marinovici (PNNL) -->
<!--Sample XML file generated by XMLSpy v2012 sp1 (x64) (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-01-22\PNWSGDSchema-2012-01-22.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2001-12-17T09:30:47Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>LV</pnwns:UtilityID>
        <pnwns:DataStreamInformationTransaction>
                <pnwns:DataStreamInformation>
                        <pnwns:DataStreamID>LV_E Jackson_CustomerInterruptions</pnwns:DataStreamID>
                        <pnwns:DataStreamDescription>LV-02-2.1-IM-60-East Jackson</pnwns:DataStreamDescription>
                        <!-- no DeviceID is required since this is a calculated value:  sum of customer interrupted over total customers
served, calculated yearly -->
                        <pnwns:ServiceLocationID>East Jackson</pnwns:ServiceLocationID>
                        <pnwns:MeasurementType>SAIFI</pnwns:MeasurementType>
                        <pnwns:MeasurementQualifier>Interval (default interpretation)</pnwns:MeasurementQualifier>
                </pnwns:DataStreamInformation>
                <pnwns:DataStreamInformation>
                        <pnwns:DataStreamID>LV-Hoback PF</pnwns:DataStreamID>
                        <pnwns:DataStreamDescription>LV-05-3.2-IM-51-SVC-A</pnwns:DataStreamDescription>
                        <!-- no device since this is a calculated value -->
                        <pnwns:ServiceLocationID>Hoback</pnwns:ServiceLocationID>
                        <pnwns:MeasurementType>Power factor</pnwns:MeasurementType>
                        <pnwns:MeasurementQualifier>Interval (default interpretation)</pnwns:MeasurementQualifier>
                </pnwns:DataStreamInformation>
                <pnwns:DataStreamInformation>
                        <pnwns:DataStreamID>LV_Teton_DemandCharges</pnwns:DataStreamID>
                        <pnwns:DataStreamDescription>LV-02-1.3-IM-800-1-</pnwns:DataStreamDescription>
                        <!-- no device since this is a calculated value -->
                        <pnwns:ServiceLocationID>Teton</pnwns:ServiceLocationID>
                        <pnwns:MeasurementType>Demand charges</pnwns:MeasurementType>
                        <pnwns:MeasurementQualifier>Interval total (cumulative)</pnwns:MeasurementQualifier>
                </pnwns:DataStreamInformation>
        </pnwns:DataStreamInformationTransaction>
</pnwns:PNWSGDTransactions>
```

Appendix P – DataStreamInformationTransaction XML Instance Example (NW)

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSpy v2012 sp1 (x64) (http://www.altova.com) by Cristina Marinovici (PNNL) -->
<!--Sample XML file generated by XMLSpy v2012 sp1 (x64) (http://www.altova.com)-->
<pnwns:PNWSGDTransactions xsi:schemaLocation="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions
C:\Documents%20and%20Settings\D3K508\Desktop\Work\SmartGrid\Modelling\XMLSchemas\PNWSGDSchema-2012-01-22\PNWSGDSchema-2012-01-22.xsd"
xmlns:pnwns="http://www.pnwsmartgrid.org/2012/dc/PNWSGTransactions" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <pnwns:SchemaVersion>2.0</pnwns:SchemaVersion>
        <pnwns:MessageCreationDateTime>2001-12-17T09:30:47Z</pnwns:MessageCreationDateTime>
        <pnwns:UtilityID>LV</pnwns:UtilityID>
        <pnwns:DataStreamInformationTransaction>
                <pnwns:DataStreamInformation>
                        <pnwns:DataStreamID>NW_Helena_TruckRolls</pnwns:DataStreamID>
                        <pnwns:DataStreamDescription>NW-02-2.2-IM-52-1-</pnwns:DataStreamDescription>
                        <!-- no device since this is a calculated value -->
                        <pnwns:ServiceLocationID>NW-Helena</pnwns:ServiceLocationID>
                        <pnwns:MeasurementType>Vehicle operations</pnwns:MeasurementType>
                        <pnwns:MeasurementQualifier>Interval total (cumulative)</pnwns:MeasurementQualifier>
                </pnwns:DataStreamInformation>
                <pnwns:DataStreamInformation>
                        <pnwns:DataStreamID>NW_Helena_Distr Losses</pnwns:DataStreamID>
                        <pnwns:DataStreamDescription>NW-01-3.2-IM-50-1234-</pnwns:DataStreamDescription>
                        <pnwns:DeviceID>1234</pnwns:DeviceID> <!-- feeder number -->
                        <pnwns:ServiceLocationID>NW-Helena</pnwns:ServiceLocationID>
                        <pnwns:MeasurementType>Losses</pnwns:MeasurementType>
                        <pnwns:MeasurementQualifier>Interval total (cumulative)</pnwns:MeasurementQualifier>
                </pnwns:DataStreamInformation>
        </pnwns:DataStreamInformationTransaction>
</pnwns:PNWSGDTransactions>
```