TAPI UML Model

gNMI STREAMING

Version 2.5.0

ONF Document Type: Technical Recommendation

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Document History

Version	Date	Description of Change
2.3	May 27, 2021	Model Dump *Gendoc generates documentation from Eclipse Modeling Framework (EMF) models using document templates in formats such as OpenOffice Writer (.odt), Microsoft Word (.docx), Microsoft Excel (.xlsx) and Microsoft Powerpoint (.pptx).*
2.4.0	December 2022	See high level diff document in Github
2.4.1	March 2023	See high level diff document in Github
2.5.0	October 2023	See high level diff document in Github

1 gNMI Streaming Model

TapiGnmiStreaming: This module contains TAPI Streaming GNMI Model definitions. Source: TapiStreamingGnmi.uml

1.1 Diagrams

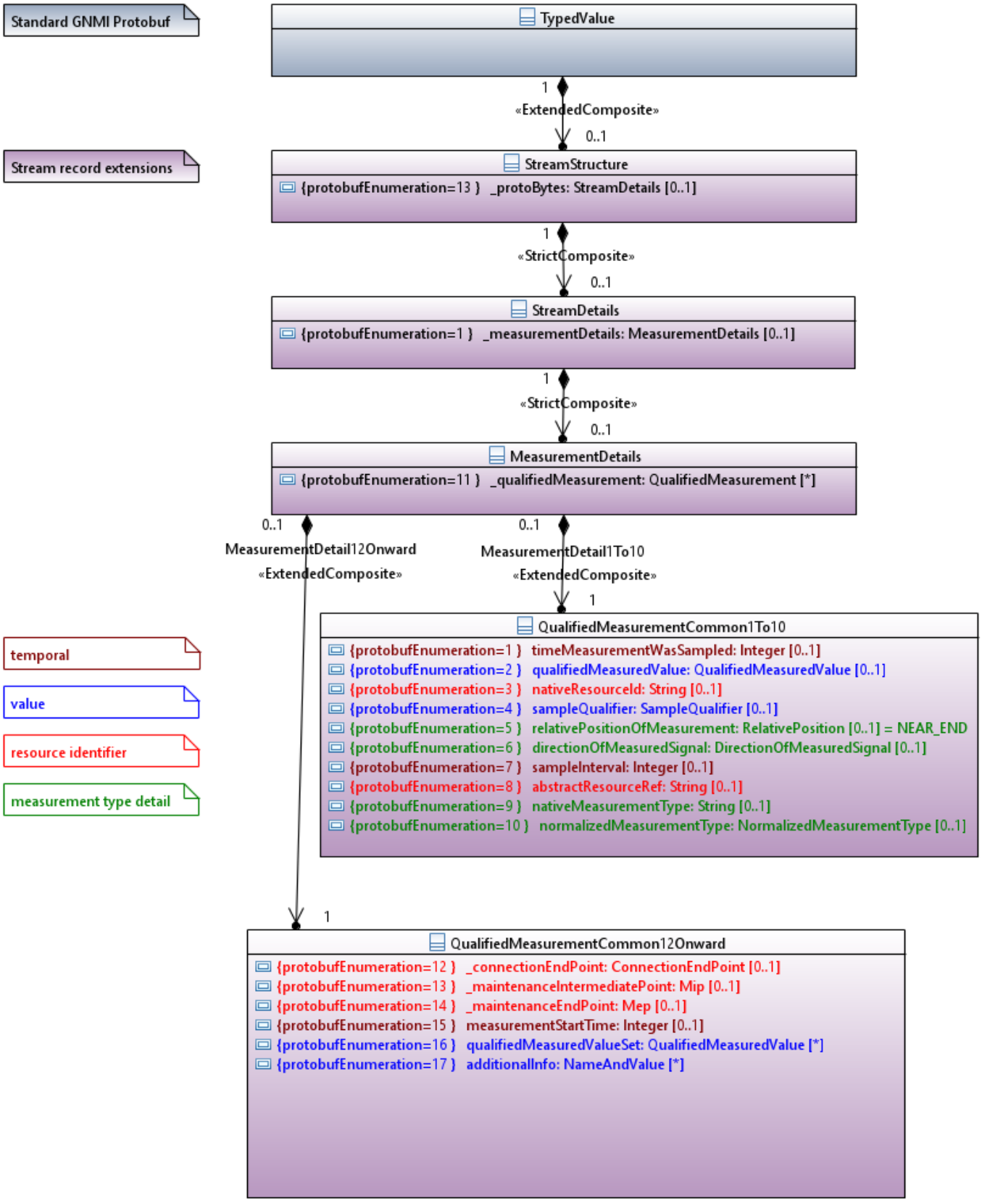

Figure 1 – Diagram *BasicMeasurementReportingStructure*

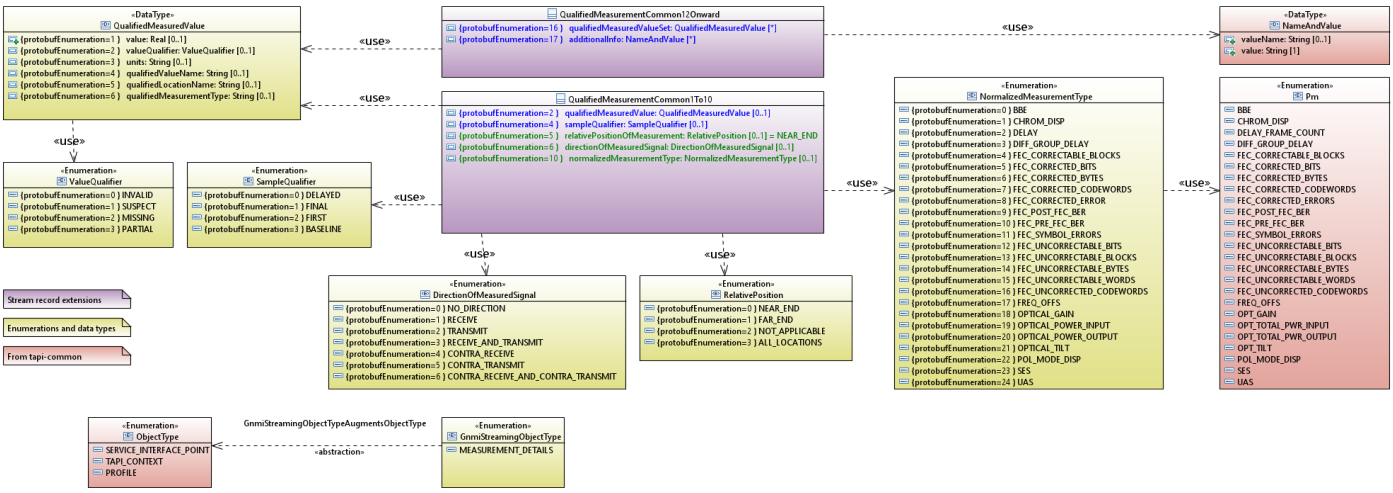

Figure 2 – Diagram *DataTypes*

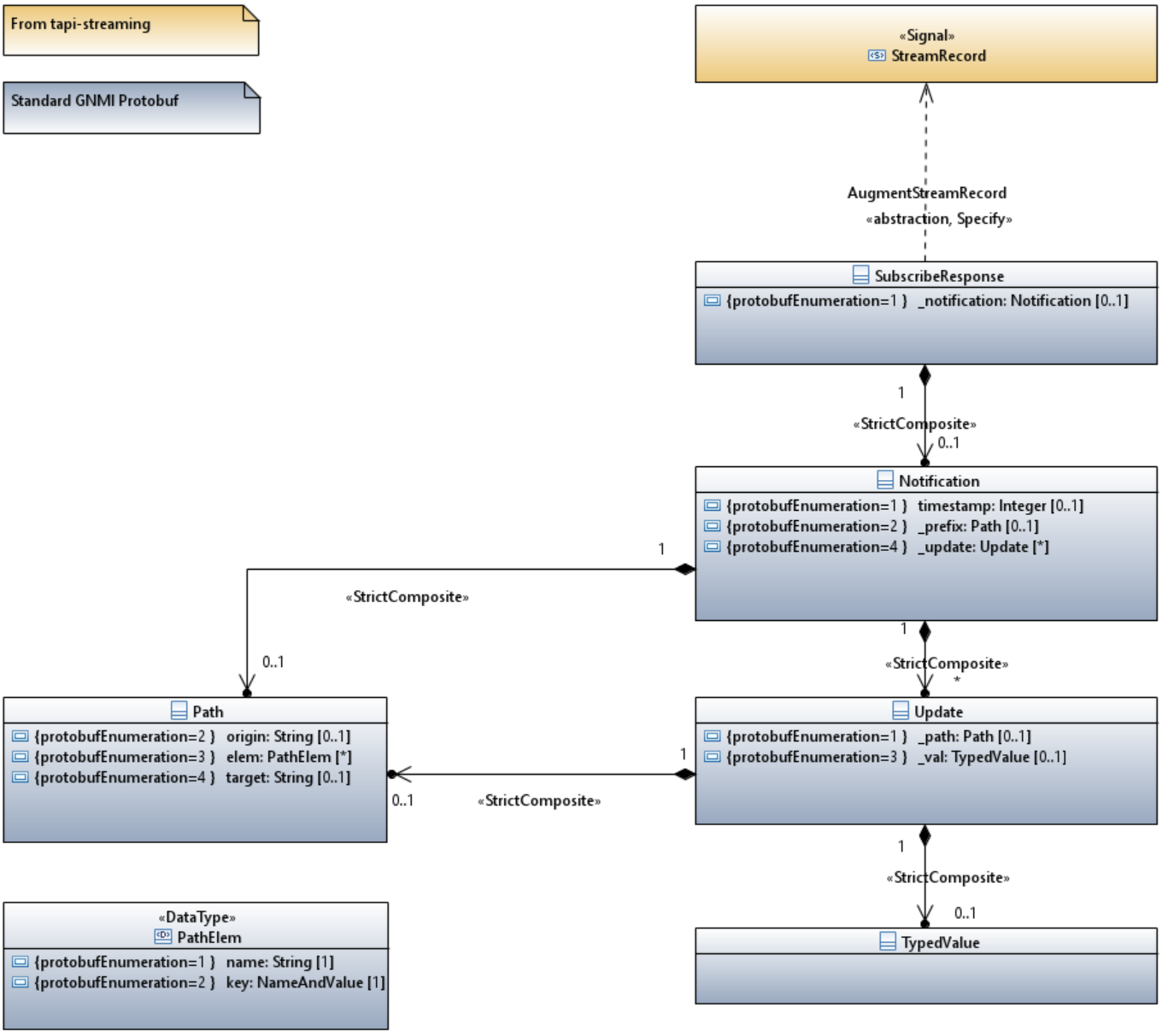

Figure 3 – Diagram *GnmiStreamStructure*

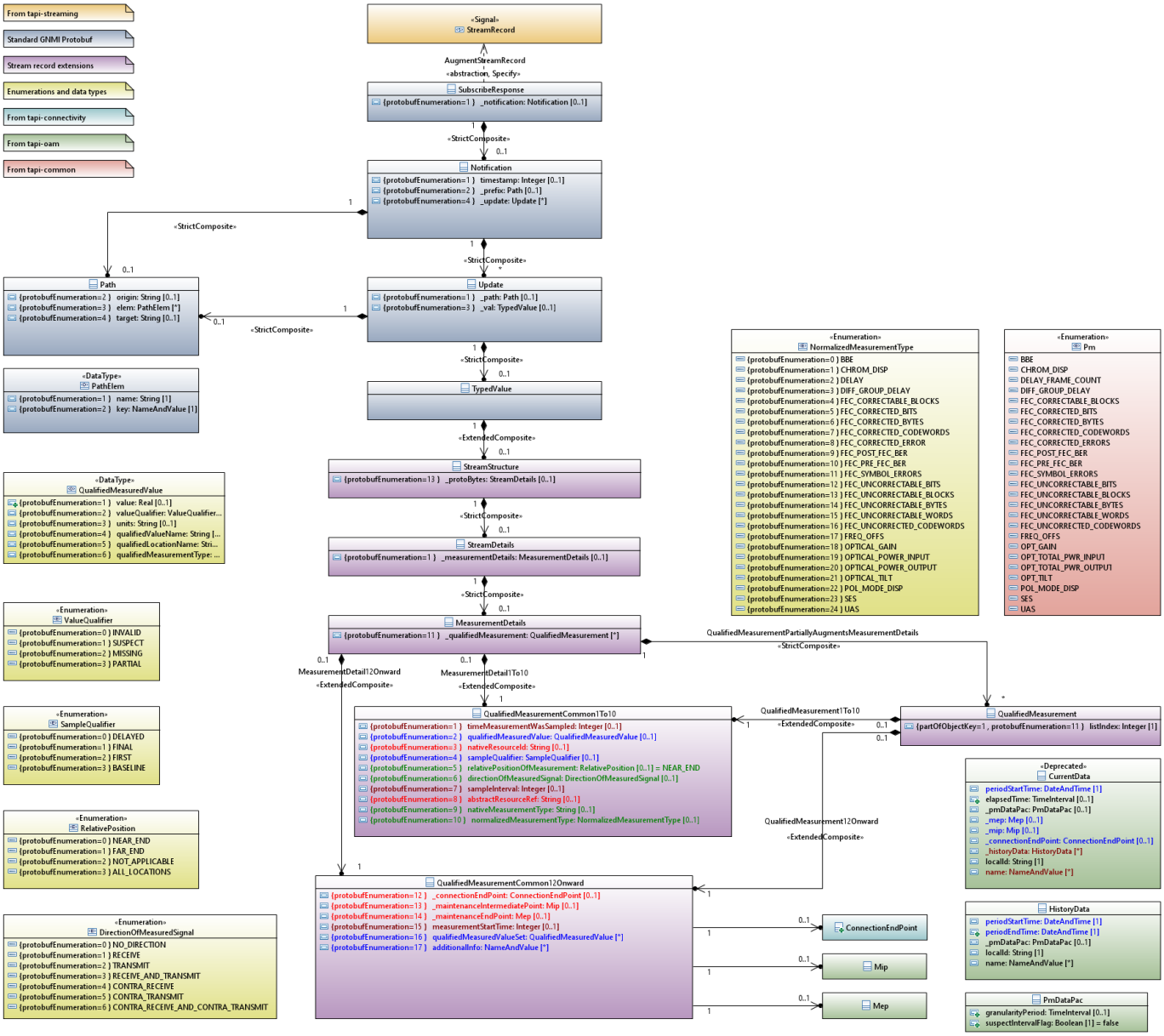

Figure 4 – Diagram *MeasurementStreamDetails*

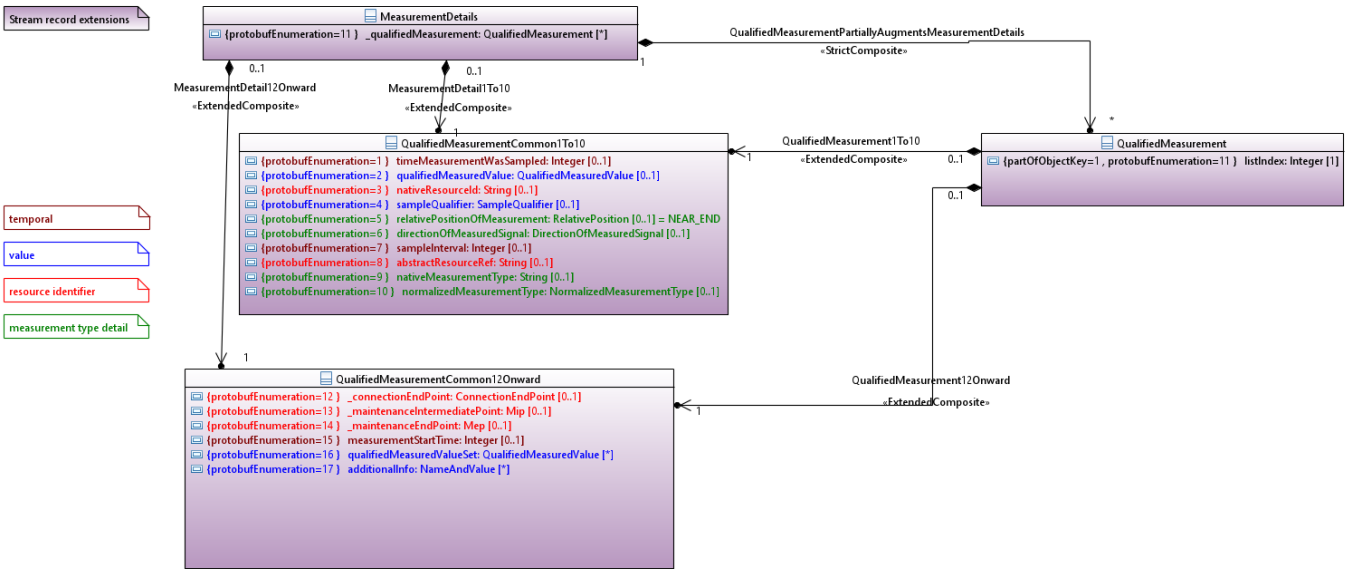

Figure 5 – Diagram *MultipleMeasurementReportingStructure*

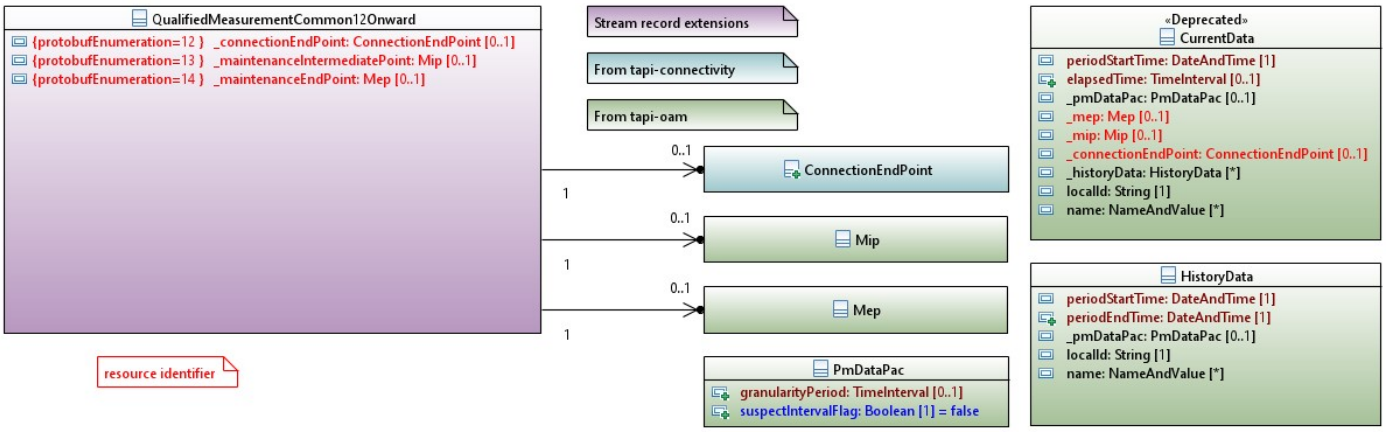

Figure 6 – Diagram *RelatedClasses*

1.2 Classes

1.2.1 MeasurementDetails

Description:

- Allows: o a single measurement record to be conveyed via the QualifiedMeasurementCommon structure o multiple measurements records to be conveyed via QualifiedMeasurement. When QualifiedMeasurement is used, multiple measurements can be conveyed in one stream record. Any properties, that have the same value across all measurements in the stream records, may be conveyed in the single measurement fields of the QualifiedMeasurementCommon augment of MeasurementDetails. Where at least one of the measurements to be conveyed in the stream record has a different value from others, the value for each measurment should be conveyed in its dedicated QualifiedMeasurement. If a value is provided for a field is provided in QualifiedMeasurementCommon and a value for the same field is provided in QualifiedMeasurement, the value in QualifiedMeasurement applies for that specific measurement (i.e., it overrides the common value).

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
qualifiedmeasurementcommon1to10 *Navigable association end of:* *MeasurementDetail1To10*	QualifiedMeasurementCommon1To10	1	RW	OpenModelAttribute • isKey: No • isInvariant: false • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA
	Description:			
_qualifiedMeasurement *Navigable association end of:* *QualifiedMeasurementPartiallyAugmentsMeasurementDetails*	QualifiedMeasurement	0..*	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 11
	Description: Used where multiple independent measurements are being reported in one record. CONDITION: Mandatory where multiple measures are to be reported.			
_qualifiedMeasurementCommon *Navigable association end of:* *MeasurementDetail12Onward*	QualifiedMeasurementCommon12Onward	1	RW	OpenModelAttribute • isKey: No • isInvariant: false • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA
	Description:			

Table 1 – Attributes for class *MeasurementDetails*

1.2.2 Notification

Description:

- Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Notification is a re-usable message that is used to encode data from the // target to the client. .... // Reference: gNMI Specification Section 2.1

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA

- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
timestamp	PrimitiveTypes::Integer	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Timestamp in nanoseconds since Epoch.			
_prefix *Navigable association end of:* A_Q6Dt8LzrEe2tPvK7TLwO7Q	Path	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 2
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Prefix used for paths in the message.			
_update *Navigable association end of:* A_OOMkoLzrEe2tPvK7TLwO7Q	Update	0..*	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 4
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Data elements that have changed values.			

Table 2 – Attributes for class *Notification*

1.2.3 Path

Description:

- Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Elements of the path are no longer encoded as a string, but rather within // the elem field as a PathElem message.

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
origin	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 2
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Label to disambiguate path.			
elem	PathElem	0..*	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 3
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Elements of the path.			
target	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 4
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // The name of the target Note that target is essentially the provider as other documentation notes that // Notification is a re-usable message that is used to encode data from the // target to the client.			

Table 3 – Attributes for class *Path*

1.2.4 QualifiedMeasurement

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
qualifiedmeasurementcommon1to10 *Navigable association end of:* *QualifiedMeasurement1To10*	QualifiedMeasurementCommon1To10	1	RW	OpenModelAttribute • isKey: No • isInvariant: false • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA
	Description:			
listIndex	PrimitiveTypes::Integer	1	R	OpenModelAttribute • isKey: yes – part: 1 • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 11
	Description: Index to the list of measurements.			
_qualifiedMeasurementCommon *Navigable association end of:* *QualifiedMeasurement12Onward*	QualifiedMeasurementCommon12Onward	1	RW	OpenModelAttribute • isKey: No • isInvariant: false • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA
	Description:			

Table 4 – Attributes for class *QualifiedMeasurement*

1.2.5 QualifiedMeasurementCommon12Onward

Description:

- Provides the details of the measurement(s) being streamed from protobufEnumeration 12 onwards.

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
_connectionEndPoint *Navigable association end of:* A_a8-IwLv4Ee2tPvK7TLwO7Q	TapiConnectivity::ObjectClasses::ConnectionEndPoint	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 12
	Description: The path to the CEP that represents the resources against which the measures were made (where the path includes topology-uuid etc.). CONDITION: Mandatory where abstract resource ref is not being used and a CEP is being measured.			
_maintenanceIntermediatePoint *Navigable association end of:* A_h4IkELv4Ee2tPvK7TLwO7Q	TapiOam::ObjectClasses::Mip	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 13
	Description: The path to the MIP that represents the resources against which the measures were made (where the path includes topology-uuid etc.). CONDITION: Mandatory where abstract resource ref is not being used and a MIP is being measured.			
_maintenanceEndPoint *Navigable association end of:* A_kXUjULv4Ee2tPvK7TLwO7Q	TapiOam::ObjectClasses::Mep	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 14
	Description: The path to the MEP that represents the resources against which the measures were made (where the path includes topology-uuid etc.). CONDITION: Mandatory where abstract resource ref is not being used and a MEP is being measured.			
measurementStartTime	PrimitiveTypes::Integer	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 15
	Description: The time the measurement started. This will usually be the time a moment, after the last measurement sample opportunity (i.e., essentially the previous timeMeasurementWasSampled). Where this is essentially a moment after the last sample opportunity, the field may be omitted. Where the measurementStartTime can be derived from the profile, the field may be omitted. Where the measurement started an an unexpected or unusual time, the field should be included. CONDITION: Mandatory as identified in the description above.			

Attribute Name	Type	Mult.	Access	Stereotypes
qualifiedMeasuredValueSet	QualifiedMeasuredValue	0..*	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 16
	Description: A separate measurment as part of a list of related Provides a simple list of values where there are multiple measurement values available in one measurement. In this case, each value must have a qualified value name to distinguish each member of the set. An example could be where mean, max and min are considered as multiple measurement values for the same measurement. CONDITION: Mandatory where a list of values is to be provided.			
additionalInfo	TapiCommon::TypeDefinitions::NameAndValue	0..*	RW	OpenModelAttribute • isKey: No • isInvariant: false • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 17
	Description: Named properties that add to the measurement data as a map of name to value (string, string). Hence the YANG should convert into a protobuf map.			

Table 5 – Attributes for class *QualifiedMeasurementCommon12Onward*

1.2.6 QualifiedMeasurementCommon1To10

Description:

- Provides the details of the measurement(s) being streamed from protobufEnumeration 1 to 10.

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
timeMeasurementWasSampled	PrimitiveTypes::Integer	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1

Attribute Name	Type	Mult.	Access	Stereotypes
	Description: The time at which the measurement was sampled. In a single measurement, this field is mandatory. In a list of measurements, the field must be present either in the direct augment of MeasurementDetails or in every member of the qualifierMeasurement list. This could be the time of a snapshots of an ongoing measure or the time at which the measurement was taken and the counter reset. The precise definition depends upon the specification of the measurement. CONDITION: Mandatory as identified in the description above.			
qualifiedMeasuredValue	QualifiedMeasuredValue	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 2
	Description: The value result of the measurement. In a single measurement case, this field is mandatory. In a list of measurements, it is assumed that in most cases each measurement will be different and hence it is most likely to be provided in every member of the qualifierMeasurement list in MeasurementDetails. In the case where there are multiple qualified measurements identified against one point the qualifiedMeasuredValuSet field should be used. CONDITION: Mandatory as identified in the description above.			
nativeResourceId	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 3
	Description: The name of the resource that was measured used by the owner of the resource (e.g., the device) to identify the resource. CONDITION: Mandatory under most circumstances (should be provided unless not available from the owner of the resource).			
sampleQualifier	SampleQualifier	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 4
	Description: A qualifier indicating how the measurement should be interpreted. CONDITION: Mandatory where the measurement is not a "normal" measurement.			
relativePositionOfMeasurement	RelativePosition Default value: *NEAR_END*	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 5

Attribute Name	Type	Mult.	Access	Stereotypes
	Description: Indicates whether the measurement was taken for signal/propertiesat the resource point against which it is reported or at a remote location related to the resource identified in the report. The default is NEAR_END. The property is conditional and must be stated unless the value is NEAR_END. CONDITION: Mandatory where the value is not NEAR_END.			
directionOfMeasuredSignal	DirectionOfMeasuredSignal	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 6
	Description: Relevant to measurements related to signal flow. Indicates the flow which the measurement relates to. The property is conditional and need not be stated where the measurement type clearly indicates the directionality. The property intentionally has no default as the absence of the property means interpret using measurement type. CONDITION: Mandatory as identified in the description above.			
sampleInterval	PrimitiveTypes::Integer	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 7
	Description: The period since the last measurement. This is a conditional property that may indicate a period of: - accumulation (up to the end of the period) - no information (where there is no measurement available) Unless stated elsewhere the assumption is that for: - an accumulating measurement, the accumulation has taken place over the entire period - sample measurement the sample is taken exactly at the end of the period (timeMeasurementWasSampled) No cases have yet been identified that do not require this parameter.This is the time from the previous sample. This will usually be the same from sample to sample of the same Measurement Type against the same Resource. There may be variation from sample to sample in the sample Interval due to: - measurement policy. - a specific change in the Sample Interval. - where an additional sample was inserted. - where the sampling is rephased. - where there is some fluctuation in the sampling process (perhaps due to load on the measurement device causing it to operate slowly). The Sample Interval may also not be the same as the normal ongoing interval that is explained by the Sample Qualifier: - FIRST: the first sample where the time is from start of the measurement which may not be the normal interval for the measurement. - FINAL: the final sample which may be taken with less than the normal interval. - DELAYED: if the reporting delay was due to a delay in sampling (as opposed to simply a delay in reporting). - BASELINE: where a special sample has been made to set a baseline against which to assess following samples. The Sample Interval may be not provided when the interval is as expected or when there is another indication of the interval. Where the measurement was not running for some part of the time since the previous sample, the Measured Value will be qualified to indicate this. Note that some measurement devices: - reset on sampling. - run continually independent of the sampling process. - reset on some other basis within a sample interval. Note that any type of measurement etc. may be sampled including: - an incrementing counter - a varying value - a statistical report with multiple values CONDITION: Mandatory as identified in the description above.			

Attribute Name	Type	Mult.	Access	Stereotypes
abstractResourceRef	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 8
	Description: An identifier that is independent of the identifier of the resource being measured that is recorded in model entity representing the resource being measured and is used in the PM stream (via this attribute). This allows correlation without full normalization of resource identifiers and resource modelling. A resource may have a list of abstractResourceIds. If measurement that states a value for abstractResourceId that appears in a list in an entity representing a resource (and does not appear in any entity representing any other resource) then the measurement is against the resource represented by that entity. A specific value for abstractResourceId may appear in more than one entity. In this case a measurement stating that value will be for one of the resources that list the specific abstractResourceId. Other aspects of the entity can be used, in conjunction with the properties of the measure itself, to determine which one the measurement is against. This is a conditional property that is required if an abstractResourceId method is being used to identify the resource measured.			
nativeMeasurementType	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 9
	Description: The name used for the type of measurement at the sources/originator of the measurement. CONDITION: Mandatory where a normalized measurement type is not available.			
normalizedMeasurementType	NormalizedMeasurementType	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 10
	Description: The standard name used for the type of measurement, i.e., the type of the measurement as identified in the TAPI normalized scheme. This is a conditional property. CONDITION: Mandatory where a normalized measurement type is available.			

Table 6 – Attributes for class *QualifiedMeasurementCommon1To10*

1.2.7 StreamDetails

Description:

- Defines the protobuf structures for the stream of measurement data.

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA

- objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
_measurementDetails *Navigable association end of:* A_eQ-SQOi9Ee2WXqIYPh2wfQ	MeasurementDetails	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1
	Description: Measurement details. CONDITION: Mandatory where stream is being used for measurment data.			

Table 7 – Attributes for class *StreamDetails*

1.2.8 StreamStructure

Description:

- TAPI Augmentation of proto_bytes adding TAPI structured content to the TypedValue protobuf message. This model fragment defines the structure.

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
_protoBytes *Navigable association end of:* A_LqfOkLznEe2tPvK7TLwO7Q	StreamDetails	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 13
	Description: This is substituted for "bytes proto_bytes = 13;" in message typed value. (see https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto) CONDITION: Mandatory where stream details is being used.			

Table 8 – Attributes for class *StreamStructure*

1.2.9 SubscribeResponse

Description:

- Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // SubscribeResponse is the message used by the target within a Subscribe RPC. // The target includes

a Notification message which is used to transmit values // of the path(s) that are associated with the subscription. The same message // is to indicate that the target has sent all data values once (is // synchronized). // Reference: gNMI Specification Section 3.5.1.4

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
_notification *Navigable association end of:* A_CNum8LzsEe2tPvK7TLwO7Q	Notification	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Changed or sampled value for a path.			

Table 9 – Attributes for class *SubscribeResponse*

1.2.10 TypedValue

Description:

- Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // TypedValue is used to encode a value being sent between the client and // target (originated by either entity). Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // One of the fields within the val oneof is populated with the value // of the update. The type of the value being included in the Update // determines which field should be populated. In the case that the // encoding is a particular form of the base protobuf type, a specific // field is used to store the value (e.g., json_val). TAPI only uses, via augmentation, bytes proto_bytes = 13; Which is defined as Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Protobuf binary encoded bytes. The message type is not included. // See the specification at // github.com/openconfig/reference/blob/master/rpc/gnmi/protobuf-vals.md // for a complete specification. [Experimental]

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
measurement *Navigable association end of:* A_zx-10EOEEe6bIJjw8ZnZGQ	StreamStructure	0..1	RW	OpenModelAttribute • isKey: No • isInvariant: false • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA
	Description:			

Table 10 – Attributes for class *TypedValue*

1.2.11 Update

Description:

- Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Update is a re-usable message that is used to store a particular Path, // Value pair. // Reference: gNMI Specification Section 2.1

Applied stereotypes:

- OpenInterfaceModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
- OpenModelClass
  - support: MANDATORY

Attribute Name	Type	Mult.	Access	Stereotypes
_path *Navigable association end of:* A_R_-CkLzqEe2tPvK7TLwO7Q	Path	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // The path (key) for the update.			
_val *Navigable association end of:* A_aU9CcLzoEe2tPvK7TLwO7Q	TypedValue	0..1	R	OpenModelAttribute • isKey: No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 3
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // The explicitly typed update value.			

Table 11 – Attributes for class *Update*

1.3 Signals

1.4 Associations

1.5 Abstractions

1.5.1 AugmentStreamRecord

Augmenting Class	Augmented Class	Comment
SubscribeResponse	TapiStreaming::Notifications::StreamRecord	
target: "/TapiStreaming:StreamRecord:_streamRecord"		

Table 12 – Member ends for class abstraction *AugmentStreamRecord*

1.5.2 GnmiStreamingObjectTypeAugmentsObjectType

Augmenting Enumeration	Augmented Enumeration
GnmiStreamingObjectType - MEASUREMENT_DETAILS	ObjectType - PROFILE - SERVICE INTERFACE POINT - TAPI_CONTEXT
Comment Enumeration Augment.	

Table 13 – Member ends for enum abstraction *GnmiStreamingObjectTypeAugmentsObjectType*

1.6 Data Types

1.6.1 PathElem

Description:

- Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // PathElem encodes an element of a gNMI path, along with any attributes (keys) // that may be associated with it. // Reference: gNMI Specification Section 2.2.2.

Attribute Name	Type	Mult.	Access	Stereotypes
name	PrimitiveTypes::String	1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // The name of the element in the path.			

Attribute Name	Type	Mult.	Access	Stereotypes
key	TapiCommon::TypeDefinitions::NameAndValue	1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 2
	Description: Extract from https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto // Map of key (attribute) name to value. Hence the YANG should convert into a protobuf map.			

Table 14 – Attributes for data type *PathElem*

1.6.2 QualifiedMeasuredValue

Description:

- This structure allows for various value qualifications: - Where the value is valid and is for the complete period, then only the value will be provided (valueQualifier will not be present). - Where there are issues with the value, then the valueQualifier will be provided and there may be no value depending upon the valueQualifier.

Attribute Name	Type	Mult.	Access	Stereotypes
value	PrimitiveTypes::Real	0..1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 1
	Description: The measured value (provided when available). CONDITION: Mandatory where the value is available.			
valueQualifier	ValueQualifier	0..1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 2
	Description: Qualifies the measurment. Provides an explanation for an absent value and indicates the quality of the value. When this property is not present, the value can be assumed to be valid. CONDITION: Mandatory as identified in the description above.			

Attribute Name	Type	Mult.	Access	Stereotypes
units	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 3
	Description: Provided where the units of the value may be different from measurement to measurement the units must be stated. Where the units are defined by the type, the units should not be stated States the system and scale of the measurement (e.g., metric system "cm"). Note that the units of a measure would normally be defined in a specification (ideally machine readable and referenced from the measurement point) and would be fixed for all measurements. It is possible that the scale may differ from measurement to measurement (e.g., some measurements in in cm and some in mm) or the system may differ (e.g., some measurements are in Celcius and some in Farenheit). CONDITION: Mandatory as identified in the description above.			
qualifiedValueName	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 4
	Description: Used where the measurement type (elsewhere in the structure) is not sufficient to distinguish the measurement. This field will normally be omitted. Deals with the case where there is a set of values related to one measurement type where each value in the set needs to be named. For example, there may be a min, max and mean value. Note that this may require further formalization in a later release of this model. This can be used when using qualified measured value set where this attribute distinguished each member of the set. CONDITION: Mandatory as identified in the description above.			
qualifiedLocationName	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 5
	Description: Used where the measurement location (e.g., a CEP) is not sufficient to distinguish the measurement. This field will normally be omitted. Deals with the case where there are two or more measurements with the same Measurement Type on a single Resource that therefore need to be distinguished. For example, the resource may encapsulate several signals where each signal can have an SES measurement such that the signal name needs to be provided. This name corresponds to a functional location in the resource. This field is used to provide the additional signal name. CONDITION: Mandatory as identified in the description above.			

Attribute Name	Type	Mult.	Access	Stereotypes
qualifiedMeasurementType	PrimitiveTypes::String	0..1	R	OpenModelAttribute • isKey:No • isInvariant: true • valueRange: no range constraint • support: MANDATORY OpenInterfaceModelAttribute • AVC: NA • Protobuf Index: 6
	Description: Used where the measurement type (elsewhere in the structure) is not sufficient to distinguish the measurement. This field will normally be omitted. Deals with the case where there is a set of values of different types related to one measurement where each value type in the set needs to be named. For example, there may be a power value and a spectral density value. Note that this may require further formalization in a later release of this model. This can be used when using qualified measured value set where this attribute distinguished each member of the set. CONDITION: Mandatory as identified in the description above.			

Table 15 – Attributes for data type *QualifiedMeasuredValue*

1.7 Enumerations

1.7.1 DirectionOfMeasuredSignal

Description:

- Flow directions.

Contains Enumeration Literals:

- NO_DIRECTION
  - Where the measurement has no directionality, e.g., Temperature.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration:
- RECEIVE
  - Where the measurement is against a flow that is considered received with respect to the points directional model.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration: 1
- TRANSMIT
  - where the measurement is against a flow that is considered received with respect to the points directional model.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration: 2
- RECEIVE_AND_TRANSMIT
  - Where the measurement is against both the receive and transmit flows.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral

        - protobufEnumeration: 3
- CONTRA_RECEIVE
    - Where the measurement is against a flow that is considered "contra receive" with respect to the points directional model. To clarify, consider the CEP. A CEP direction relates to the layer stack orientation. The transmit direction is down the layer stack and the receive is up the layer stack. The direction is stated with respect to the lower face of the CEP. The CEP has two faces, and each has two directions. The upper face of the CEP (and the face of the CEP facing a connection where that CEP is set to carry traffic down the layer stack) is not normally measured. The signal received on the upper face of the CEP is in the CEP transmit direction. Stating transmit for a measurement of a signal received is counter-intuitive. The contra-directional terminology allows the correct measurement direction to be stated. CONTRA_RECEIVE is the receive aspect of the upper face of the CEP (or the face taking signal from the connection to then go down the layer stack) CONTRA_TRANSMIT is the transmit aspect of the upper face (or the face passing signal to the connection where that signal has just passed up the layer stack). Note that a CEP taking signal from a connection to pass up the layer stack uses normal directionality as the signal reaches the CEP at its lower face.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 4
- CONTRA_TRANSMIT
    - Where the measurement is against a flow that is considered "contra transmit" with respect to the points directional model. See CONTRA_RECEIVE for more details.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 5
- CONTRA_RECEIVE_AND_CONTRA_TRANSMIT
    - Where the measurement is against both the contra receive and contra transmit flows.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 6

1.7.2 GnmiStreamingObjectType

Contains Enumeration Literals:

- MEASUREMENT_DETAILS

1.7.3 NormalizedMeasurementType

Contains Enumeration Literals:

- BBE

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration:
- CHROM_DISP

    - Chromatic Dispersion

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 1
- DELAY

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 2
- DIFF_GROUP_DELAY
    - Differential Group Delay

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 3
- FEC_CORRECTABLE_BLOCKS
    - FEC Correctable Blocks. Reference: OpenROADM.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 4
- FEC_CORRECTED_BITS
    - The number of bits that were corrected by the FEC. Reference: OpenConfig.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 5
- FEC_CORRECTED_BYTES
    - Bytes corrected between those that were received corrupted. Reference: OpenConfig.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 6
- FEC_CORRECTED_CODEWORDS
    - FEC Corrected Codewords Counter. References: - OpenROADM - 100 GE: IEEE802.3-2018 sections 91.6.9 (FEC_corrected_cw_counter), 45.2.1.112 (MDIO) - 400 GE: IEEE802.3-2018 sections 119.3.1 (FEC_corrected_cw_counter), 45.2.3.61 (MDIO)

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 7
- FEC_CORRECTED_ERROR
    - ITU-T G798: The number of bits corrected by the FEC are counted over one second and reported to the MI at the end of the second. For the application of this filter, see the specific atomic functions. During signal fail conditions of the data signal, no corrected bits shall be counted. For details on the signal fail conditions, see the specific atomic functions. Other reference: OpenROADM.

    - Applied stereotype:

        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 8
- FEC_POST_FEC_BER
    - Bit error rate after correction by FEC. Reference: OpenConfig.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 9
- FEC_PRE_FEC_BER
    - Bit error rate before correction by FEC. References: - OpenConfig - OpenROADM

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 10
- FEC_SYMBOL_ERRORS
    - FEC Symbol Error Counter. references: - OpenROADM - 100 GE: IEEE802.3-2018 sections 91.6.12 (FEC_symbol_error_counter_i), 45.2.1.115/116 (MDIO) - 400 GE: IEEE802.3-2018 sections 119.3.1 (FEC_symbol_error_counter_i), 45.2.3.57/58 (MDIO)

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 11
- FEC_UNCORRECTABLE_BITS
    - Bits that could not be corrected by FEC.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 12
- FEC_UNCORRECTABLE_BLOCKS
    - FEC Uncorrectable Blocks. References: - OpenConfig - OpenROADM

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 13
- FEC_UNCORRECTABLE_BYTES
    - Bytes that could not be corrected by FEC.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 14
- FEC_UNCORRECTABLE_WORDS
    - The number of words that were uncorrectable by the FEC. Reference: OpenConfig.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 15
- FEC_UNCORRECTED_CODEWORDS
    - FEC Uncorrected Codewords Counter. references: - OpenROADM - 100 GE: IEEE802.3-2018 sections 91.6.10 (FEC_uncorrected_cw_counter), 45.2.1.113 (MDIO) - 400 GE: IEEE802.3-2018 sections 119.3.1 (FEC_uncorrected_cw_counter), 45.2.3.62 (MDIO)

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 16
- FREQ_OFFS
    - Frequency Offset

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 17
- OPTICAL_GAIN

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 18
- OPTICAL_POWER_INPUT

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 19
- OPTICAL_POWER_OUTPUT

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 20
- OPTICAL_TILT

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 21
- POL_MODE_DISP
    - Polarization Mode Dispersion

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 22
- SES

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 23
- UAS

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 24

1.7.4 RelativePosition

Description:

- Position of the measurement relative to the point against which the measurement was reported.

Contains Enumeration Literals:

- NEAR_END
  - The measurement is about the point against which it is reported.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration:
- FAR_END
  - The measurement is about the point that is at the other end of the trail (represented by a top level connection) in which the point is participating.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration: 1
- NOT_APPLICABLE
  - The measurement about a property that has no ends, e.g., fan speed. It is acceptable to set NEAR_END when the value should be NOT_APPLICABLE as NEAR_END carries the same essential semantic. Where NEAR_END is the default, it is acceptable to not set NOT_APPLICABLE.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration: 2
- ALL_LOCATIONS
  - The measurement is about a property that applies everywhere in a multi-pointed connection.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral
      - protobufEnumeration: 3

1.7.5 SampleQualifier

Description:

- The sample qualifiers.

Description:

- The value qualifiers.

Contains Enumeration Literals:

- DELAYED
  - The report about the sample is (significantly) delayed. It may be that this is a late report of a value that was previously missing. Where it is not known, the sample can be unqualified. If this is a final report, then that it is delayed is ignored and it is stated as FINAL. If this is an initial report, then that it is delayed is ignored and it is stated as FIRST. It is assumed that a BASELINE will never be delayed.

    - Applied stereotype:
      - OpenInterfaceEnumerationLiteral

        - protobufEnumeration:
- FINAL
    - Where this is the final measurement for a particular detector. The detector has been turned off after the measurement was taken and no further measurements will be provided. Where it is not known, the sample can be unqualified.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 1
- FIRST
    - Where this is the first measurement reported for the detector. Where it is not known, the sample can be unqualified.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 2
- BASELINE
    - Used for measurements where the report is normally of change since previous measurement (and where no report is made if there has been no change). This report provides the absolute value. This would be provided on initial subscription to the stream and potentially upon request. The baseline samples must be qualified.

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 3

1.7.6 ValueQualifier

Contains Enumeration Literals:

- INVALID
    - This indicates that although there was a value provided by the measured system, it was clearly invalid. The value should be stated unless this is not possible in the value field (e.g., because a string was reported in place of a numeric value).

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration:
- SUSPECT
    - This indicates that although there was a value provided by the measured system, it does not seem correct. The value must be stated (along with units etc. as necessary).

    - Applied stereotype:
        - OpenInterfaceEnumerationLiteral
        - protobufEnumeration: 1
- MISSING
    - This indicates there should have been a measured value provided by the measured system, but the value was no provided. The value field must be omitted (as there is no value). The units field should also be omitted. Note: The measurement value may appear in a later report allowing the client to recover the data.

- Applied stereotype:
  - OpenInterfaceEnumerationLiteral
  - protobufEnumeration: 2

- PARTIAL
  - This indicates that although there was a value provided by the measured system, it does not cover the entire period of measurement or has some parts missing. Covers the case where the sample start time was delayed and hence the measurement was potentially not over the normal interval. In this case, providing the measurementStartTime is beneficial. The value must be stated.

  - Applied stereotype:
    - OpenInterfaceEnumerationLiteral
    - protobufEnumeration: 3

1.8 Primitives