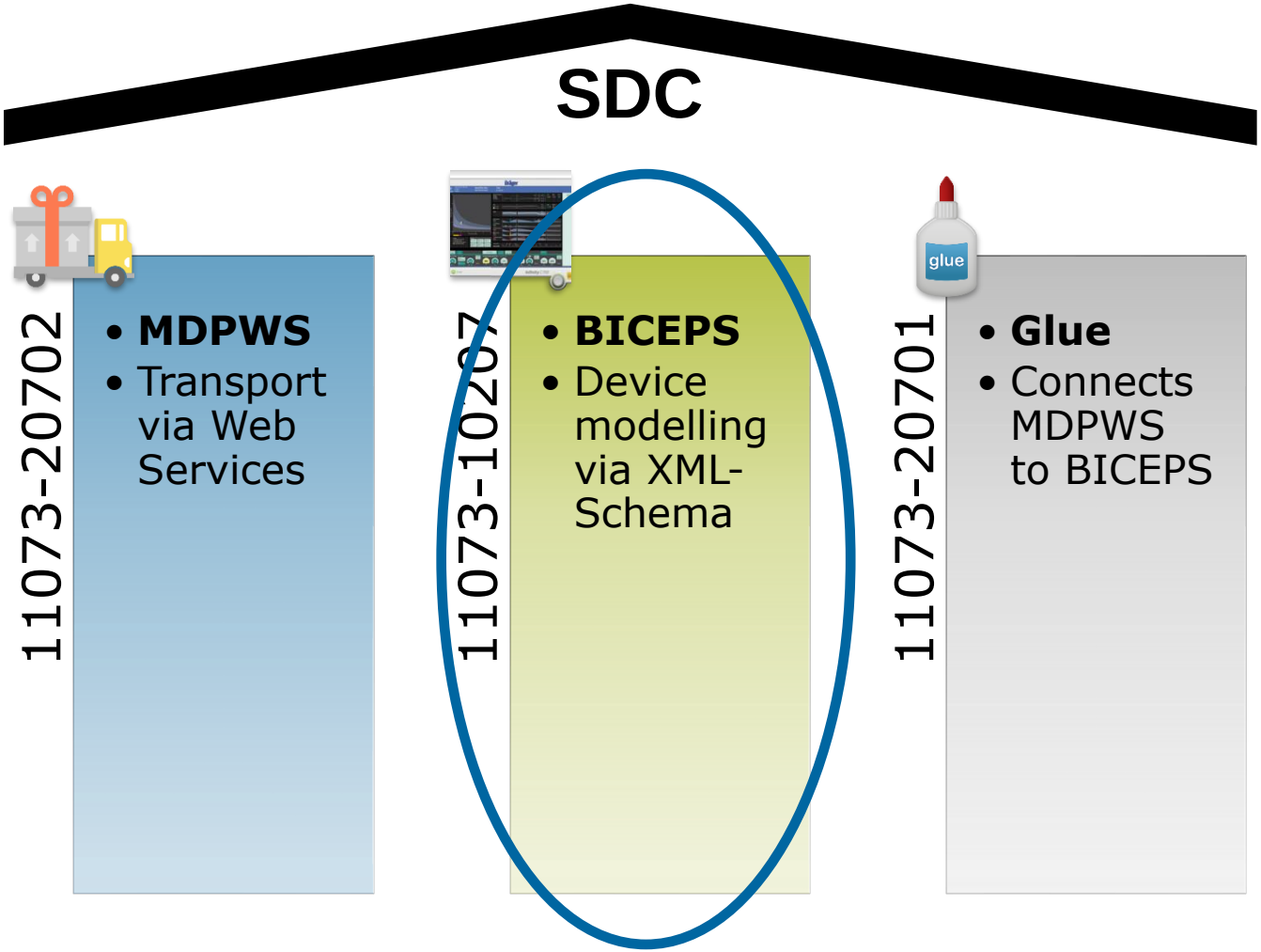
BICEPS
Modelling of Metrics

Revision 1,
2018-10-03

IEEE
Advancing Technology for Humanity

Orientation



DEFINITION

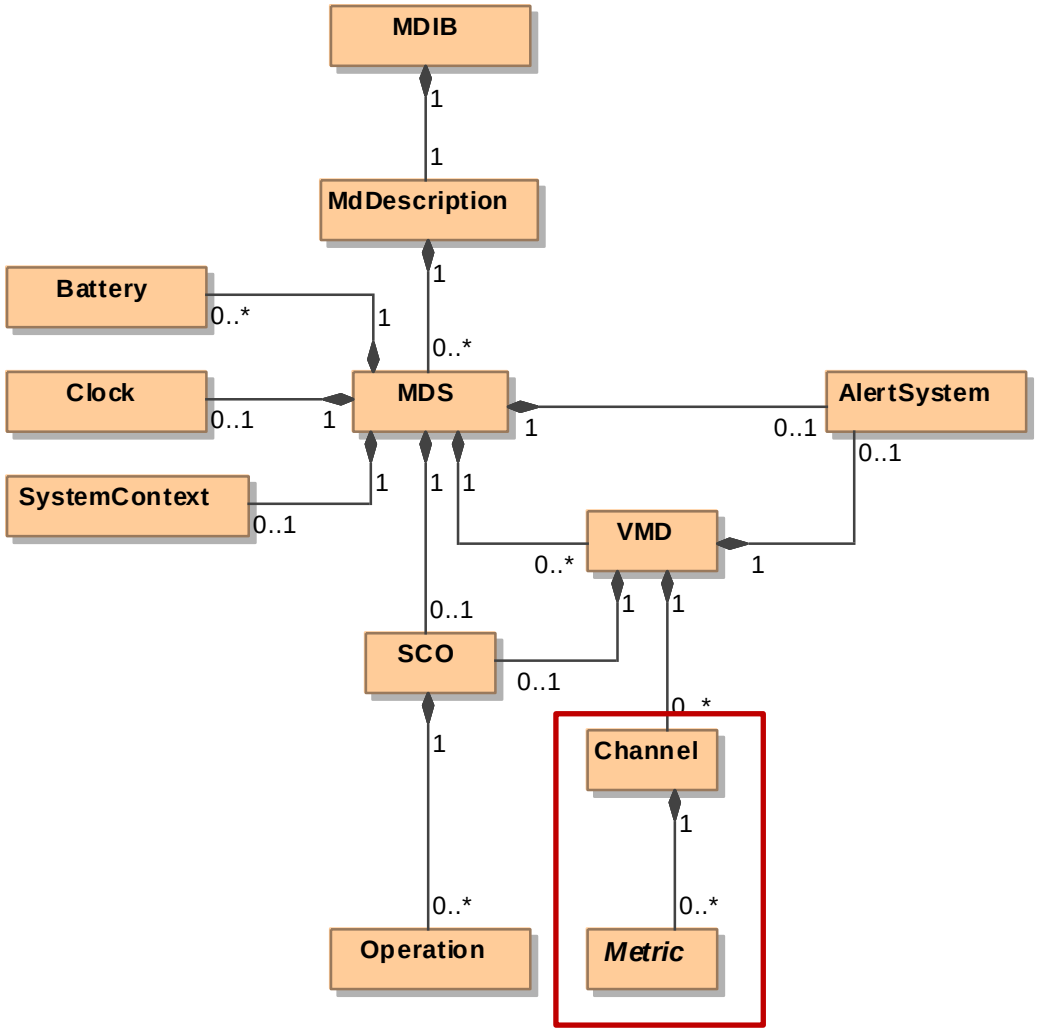
Definition

Metric

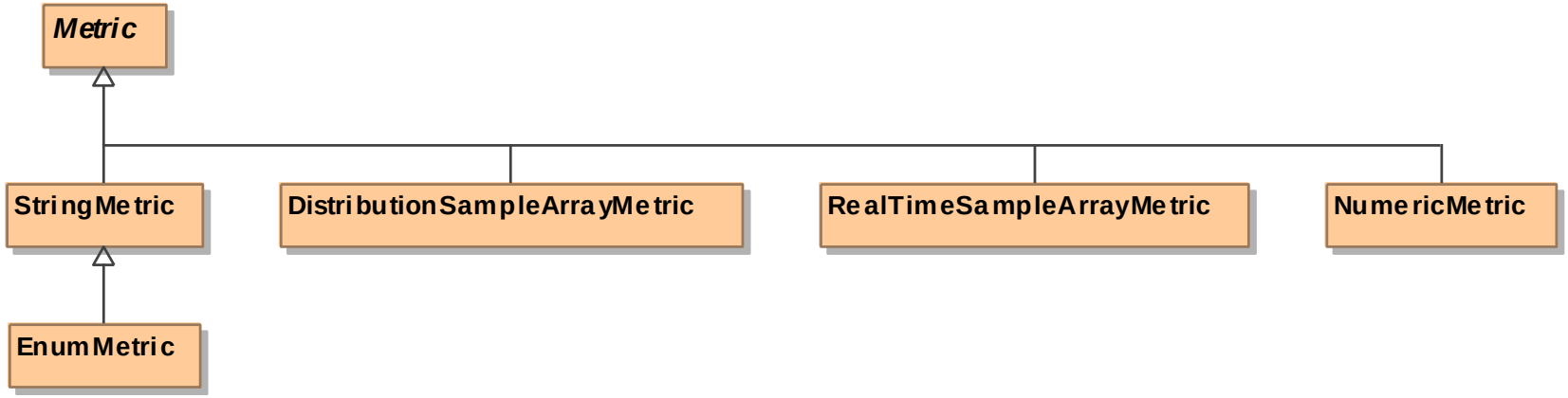
BICEPS defines a metric as component of a medical device that is able to generate or store direct and derived, quantitative and qualitative biosignal measurements, settings, and status values.

CLASS DIAGRAM

Class diagram
Placement in MDIB



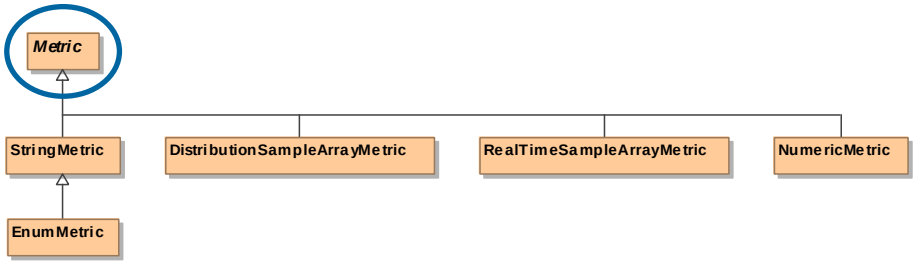
Class diagram
Derived types



PROPERTIES

Properties

pm:AbstractMetricDescriptor I



MetricCategory

- Defines if the metric is a measurement, setting, pre-setting, calculation, or recommendation

DerivationMethod

- Is the metric value derived manually or automatically?

MetricAvailability

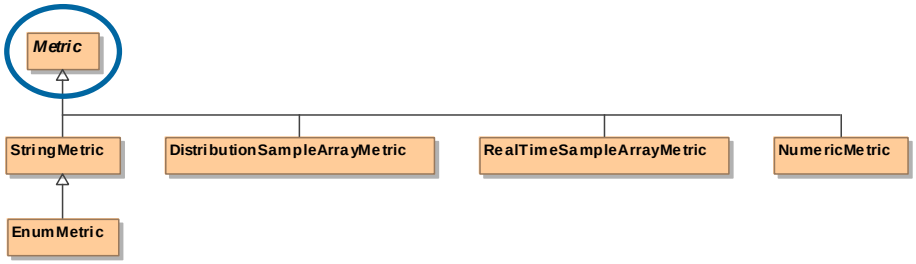
- Is the metric value available continuously or intermittently?

Unit

- What is the metric's measurement unit?
  → pm:CodedValue

Properties

pm:AbstractMetricDescriptor II



BodySite [list]

- Where is the metric derived from? → pm:CodedValue

ActivationDuration [optional]

- Maximum time period the metric's activation is "On" before it changes to any other state.

Relation [list]

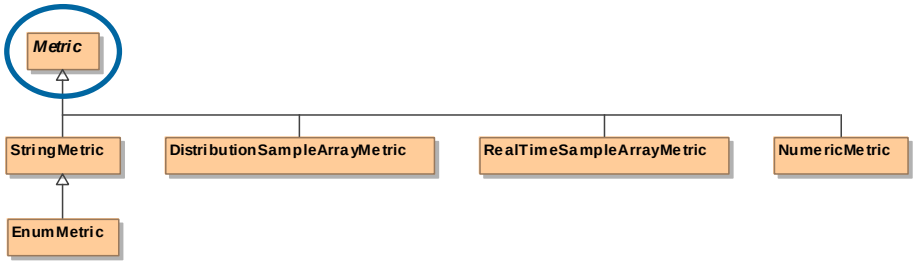
- Modelling of relationships between metrics
- Semantic description via pm:CodedValue
- Relationship flavors like recommendation, pre-setting, …

Temporal attributes [optional]

- MaxMeasurementTime, MaxDelayTime, DeterminationPeriod, LifeTimePeriod → later slide

Properties

pm:AbstractMetricState



ActivationState

- On, Off, NotReady, Shutdown, Standby, Failure

ActiveDeterminatonPeriod [optional]

- Overrides DeterminationPeriod from descriptor if present

LifeTimePeriod [optional]

- Overrides LifeTimePeriod from descriptor if present

BodySite [list]

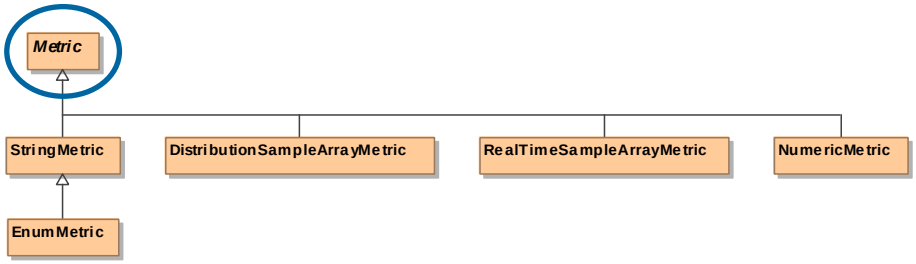
- Only for body sites that provide more details and change during runtime; others are defined in descriptor

PhysicalConnector [optional]

- Number to point out a physical entity of the device in order to guide clinical users in case of failures

Properties

pm:AbstractMetricState



ActivationState

- On, Off, NotReady, Shutdown, Standby, Failure

ActiveDeterminatonPeriod [optional]

- Overrides DeterminationPeriod from descriptor if present

LifeTimePeriod [optional]

- Overrides LifeTimePeriod from descriptor if present

BodySite [list]

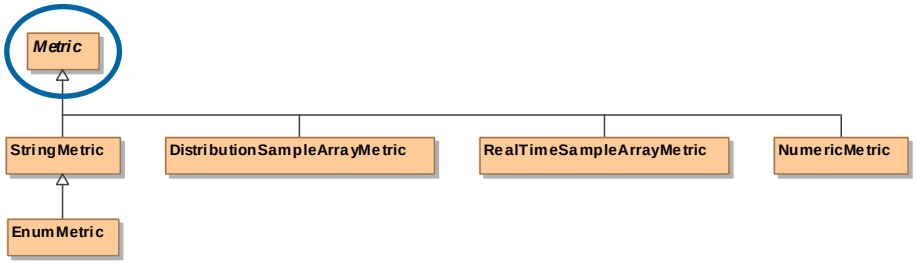
- Only for body sites that provide more details and change during runtime; others are defined in descriptor

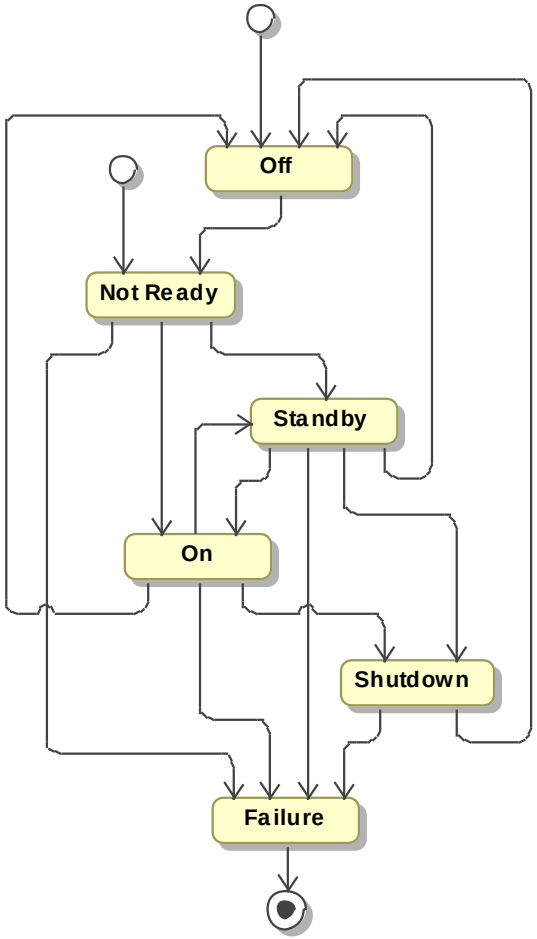
PhysicalConnector [optional]

- Number to point out a physical entity of the device in order to guide clinical users in case of failures

Properties

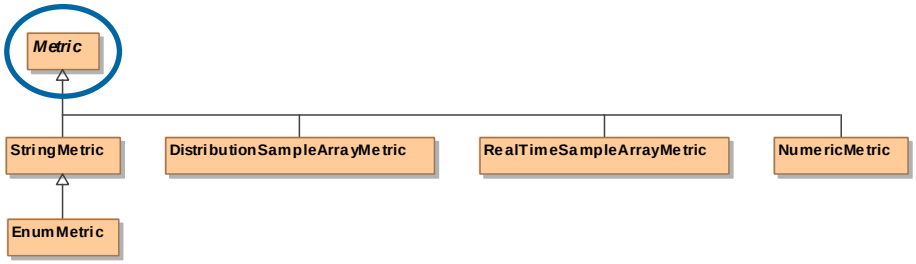
ActivationState state transitions





Properties

pm:AbstractMetricValue



Temporal attributes

- StartTime, StopTime, DeterminationTimeTime-related attributes → later slide

MetricQuality

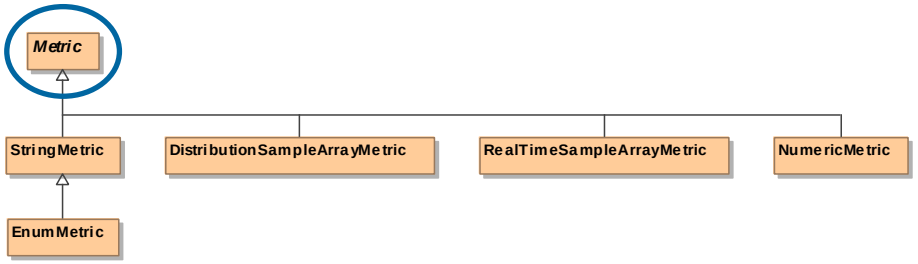
- Gives information on the validity of a value (e.g., questionable, valid) and generation mode (real, demo)

Annotation [list]

- Assign semantic information to metrics (e.g., triggers in waveform curves) → pm:CodedValue

Properties

Temporal attributes



Maximum time interval between two determination steps of observed values

Period after a metric value has become useless

LifeTimePeriod

Start of measurement activity

DeterminationPeriod

StartTime t

Physical Event n

StopTime

DeterminationTime

StartTime t=t+1

Physical Event n=n+1

Stop of measurement activity

MaxDelayTime

MaxDelayTime

MaxMeasurementTime

MaxMeasurementTime

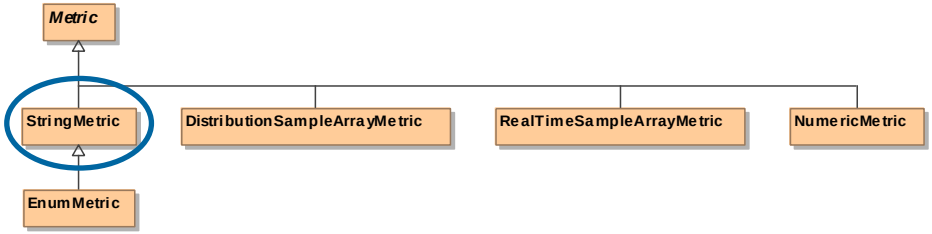
Timepoint when a metric value has been derived

Maximum duration between StartTime and StopTime of measurment

Maximum delay to real time

Properties

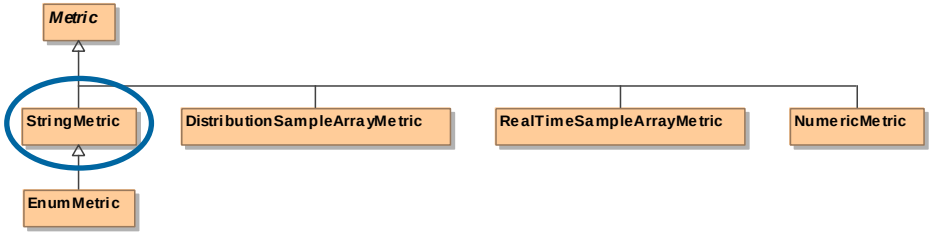
pm:StringMetricDescriptor



- String metrics provide an arbitrary sequence of characters.
- The pm:StringMetricDescriptor type does not define further attributes.

Properties

pm:StringMetricDescriptor

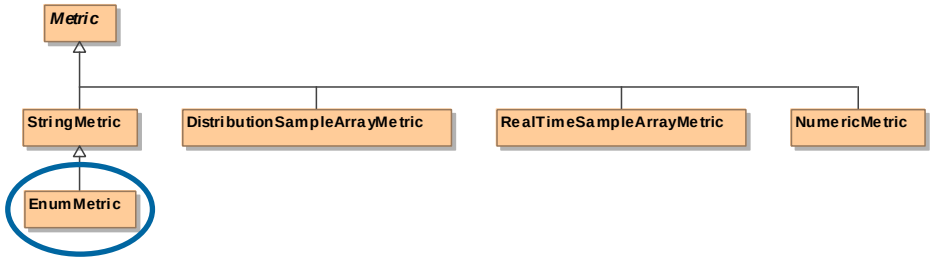


MetricValue [optional]

- MetricValue is of type pm:StringMetricValue, which is derived from pm:AbstractStringMetricValue and supplements the base type by a string value

Properties

pm:EnumStringMetricDescriptor



Temporal attributes

- StartTime, StopTime, DeterminationTimeTime-related attributes → later slide

MetricQuality

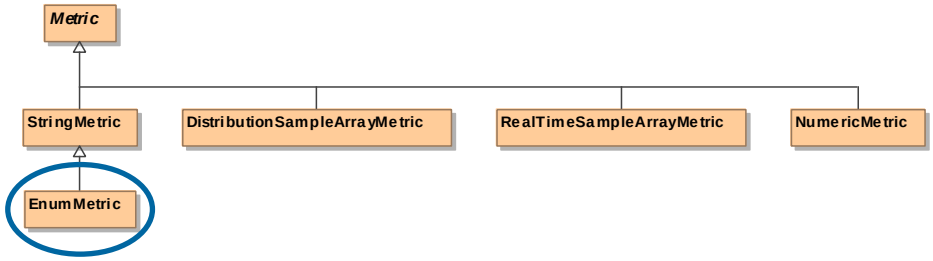
- Gives information on the validity of a value (e.g., questionable, valid) and generation mode (real, demo)

Annotation [list]

- Assign semantic information to metrics (e.g., triggers in waveform curves) → pm:CodedValue

Properties

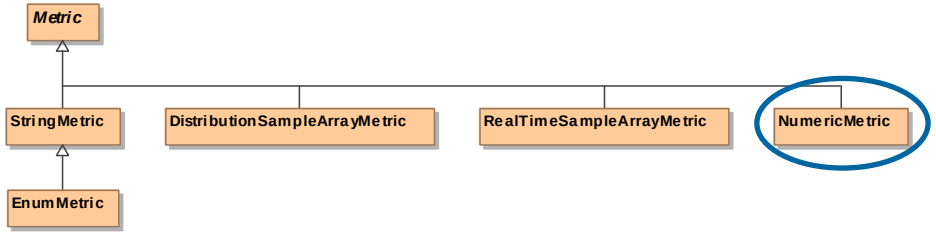
pm:EnumStringMetricState



- The pm:EnumMetricState type is derived from pm:StringMetricState and does not define further attributes
- The string value of the StringMetricState represents the current enumeration selection
- Multiple selection is not supported

Properties

pm:NumericMetricDescriptor



Resolution

- Minimum determinable difference between two observed values

AveragingPeriod [optional]

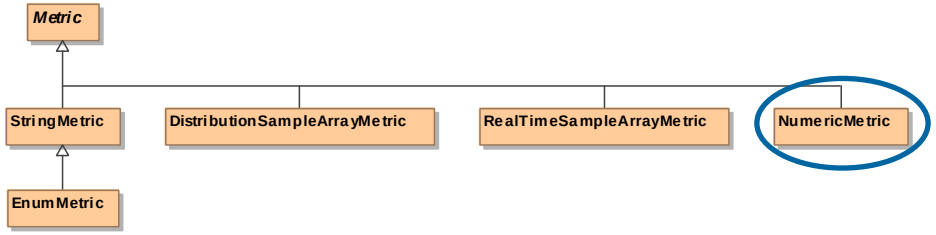
- Timespan from where the measured values are used to determine the observed value by averaging with some algorithm

TechnicalRange [list]

- Technical possible range that determined values can accept
- A list is used to facilitate modelling of gaps

Properties

pm:NumericMetricState



ActiveAveragingPeriod [optional]

- Overrides the period from descriptor if present

MetricValue [optional]

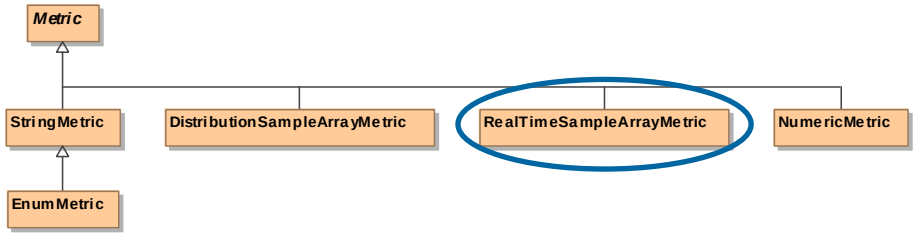
- MetricValue is of type pm:NumericMetricValue, which is derived from pm:AbstractMetricValue and supplements the base type by a decimal value

PhysiologicalRange [list]

- Physiological reasonable range of determined values
- A list is used to facilitate modelling of gaps

Properties

pm:RealTimeSampleArrayMetric Descriptor



[Definition]

- Declares a sample array that represents a real-time continuous waveform. RealTimeSampleArrayMetric is conceivable as a two dimensional graph with a temporal domain unit and any range unit.

Resolution

- Minimum determinable difference between two determined values

SamplePeriod

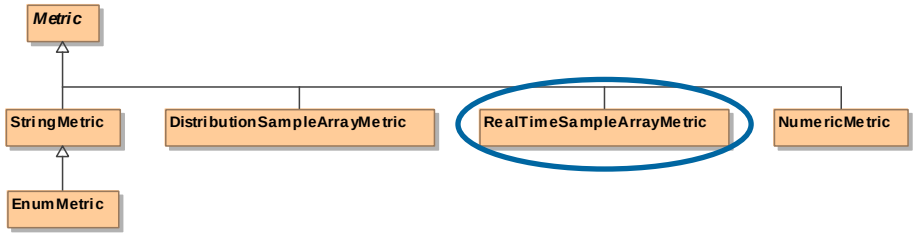
- "How often are samples generated", e.g., every 5ms
- SamplePeriod does not reflect the rate in which frames are sent; this is done through pm:RealTimeSampleArrayMetricDescriptor/@DeterminationPeriod

TechnicalRange [list]

- Technical possible range that determined values can accept
- A list is used to facilitate modelling of gaps

Properties

pm:RealTimeSampleArrayMetric State



MetricValue [optional]

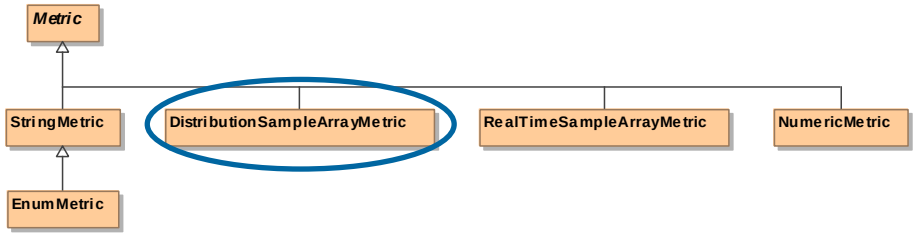
- MetricValue is of type pm:SampleArrayValue, which is derived from pm:AbstractMetricValue and supplements the base class with a whitespace separated list of decimal numbers
- pm:RealTimeSampleArrayMetricState/@DeterminationTime points to the first decimal number of the MetricValue's whitespace separated list
- Successive determination times detTime(smpIdx) are computable by
  - `smpPrd = pm:RealTimeSampleArrayMetricDescriptor/@SamplePeriod`
  - `detTime(0) = pm:RealTimeSampleArrayMetricState/@DeterminationTime`
  - `detTime(smpIdx) = detTime(0) + smpPrd * smpIdx`

PhysiologicalRange [list]

- Physiological reasonable range of observed values
- A list is used to facilitate modelling of gaps

Properties

pm:DistributionSampleArrayMetric Descriptor



Resolution

- Minimum determinable difference between two determined values

TechnicalRange [list]

- Technical possible range that determined values can accept
- A list is used to facilitate modelling of gaps

DomainUnit

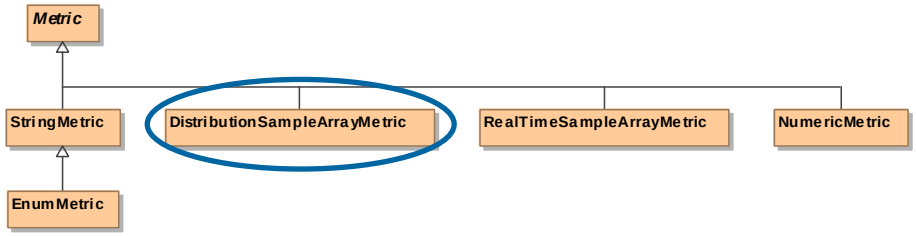
- A pm:CodedValue to designate the unit on the x axis

DistributionRange

- Minimum and maximum domain value range

Properties

pm:DistributionSampleArrayMetric State



MetricValue [optional]

- MetricValue is of type pm:SampleArrayValue, which is derived from pm:AbstractMetricValue and supplements the base class with a whitespace separated list of decimal numbers

PhysiologicalRange [list]

- Physiological reasonable range of observed values
- A list is used to facilitate modelling of gaps

Thank you for your attention!

Contact information

David Gregorczyk

david.gregorczyk@draeger.com