

Unit Modelling

Units in CAMEL need to be defined to serve for two purposes: (a) to explicate the unit of measurement with respect to the measurement values produced in the context of metrics; (b) to denote the unit of time-based elements, like schedules, windows and timers. All units, irrespectively of their kind, are defined in a (CAMEL) unit model. Further, most of the units can be associated with a certain Dimension. Such a dimension denotes the physical entity for which the unit defines its scale of measurement. For instance, time-based units are associated with a *Time* dimension. Storage-based units are associated with a *Storage* dimension. However, also dimensionless units can be defined. Such units do not map to a certain dimension. They usually take the form of a percentage or ratio.

In the following, we supply the definition of a dimension which has been taken from the unit template model in the CAMEL repository (see oxygen-new branch, the camel/camel/examples sub-directory and the unit.camel textual CAMEL model contained in it).

```
dimension Time{  
}
```

As it can be seen, this is a quite simple specification of a dimension. However, it can be enriched through the supply of both annotations from the meta-data schema as well as of textual descriptions which explicate the semantics of such an element.

In the following fragment, we also showcase how a dimensionless unit can be defined. This is again taken, as all the examples in the page, from the unit template model from the CAMEL repository.

```
dimensionless Percentage{  
}
```

This is again a very simple element definition which can be enriched through annotations from the meta-data schema. A textual description of this element can be also specified. An example of how these could be done is the following (based on the current dimensionless unit):

```
dimensionless Percentage{  
  
    [...] here we provide an annotation from the meta-data schema.  
  
    description ["This is a dimensionless unit which denotes a certain percentage. Such a unit should be given to  
percentage-based metrics which take values in the domain of reals of integers of the form [0,100]' here we provide a textual  
description of the (dimensionless) unit."  
  
}
```

As it can be seen, we need to first provide the annotation, if needed. Then we can supply the textual description of the unit element.

Dimension units can be separated into single and composite. Single units cannot be decomposed into other simpler units. For instance, a time-based unit is always single. The following fragment denotes this:

```
single unit Seconds{  
  
    dimension Time a reference to the dimension of the unit  
  
}
```

In the above fragment, we just define the time-based unit by its name along with a reference to its dimension (Time).

On the other hand, composite units can be produced through the application of mathematical formulas over other, simpler units. For instance, a throughput/computational speed unit like *transactions per second* can be defined as a composite unit through the following definition:

```
composite unit TransactionsPerSecond{  
  
    dimension ComputationalSpeed a reference to the dimension of the unit  
  
    formula 'Transactions / Seconds' the definition of the formula used for its computation. In that formula, we need to define  
valid unit names which have been already specified.  
  
}
```

The above textual CAMEL fragment showcases that this component unit definition needs to both refer to the unit's dimension as well as supply its mathematical derivation formula from other units. Such a formula should be supplied according to the syntax of the Mathparser.org tool. In addition, it needs to refer to valid names of other units (which should have been already specified) as components/parts of this formula that map to its variables.