Properties and Expressions Draft RFP Requirements

SysML v2 Working Group

Wiki page: http://www.omgwiki.org/OMGSysML/doku.php?id=sysml-roadmap:property_modeling_core_team

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Team

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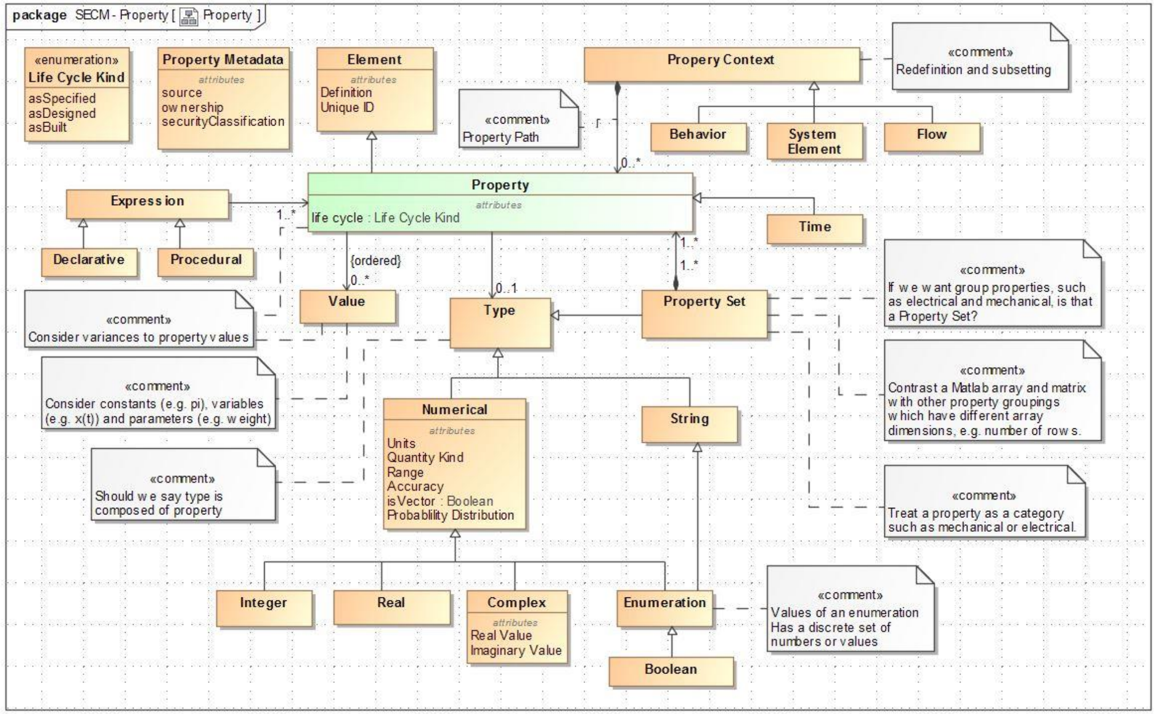
Scope / Starting Point

- SysML v1.4 & v1.5, in particular:
  - Concepts **ValueType** and **ValueProperty**
  - Annex E.5, Model Library for Quantities, Units, Dimensions, and Values (QUDV)
- Initial SECM - Property Thoughts R5 document by John Watson and Sandy Friedenthal


package SECM - Property [Property]
«enumeration»
Life Cycle Kind
asSpecified
asDesigned
asBuilt
Property Metadata
attributes
source
ownership
securityClassification
Element
attributes
Definition
Unique ID
«comment»
Property Path
Propery Context
«comment»
Redefinition and subsetting
Behavior
System Element
Flow
0..*
Property
attributes
life cycle : Life Cycle Kind
Expression
1..*
Declarative
Procedural
Time
{ordered}
0..*
0..1
1..*
1..*
Value
Type
Property Set
«comment»
Consider variances to property values
«comment»
If we want group properties, such as electrical and mechanical, is that a Property Set?
«comment»
Consider constants (e.g. pi), variables (e.g. x(t)) and parameters (e.g. weight)
Numerical
attributes
Units
Quantity Kind
Range
Accuracy
isVector : Boolean
Probablility Distribution
String
«comment»
Contrast a Matlab array and matrix with other property groupings which have different array dimensions, e.g. number of rows.
«comment»
Should we say type is composed of property
«comment»
Treat a property as a category such as mechanical or electrical.
Integer
Real
Complex
attributes
Real Value
Imaginary Value
Enumeration
«comment»
Values of an enumeration Has a discrete set of numbers or values
Boolean

Work performed since Chicago meeting (Sep 2016)

- Iterated on revisions 4, 5, 6, 7 of draft RFP requirements
    - Revisions up to 6 were found too prescriptive
        - A number of requirements were prescribing “how?”
    - Revision 7 is currently being completed. Expected ready early Jan 2017.
- Scope widened to “Values, Value Types and Expressions”
    - From original scope “Properties and Expressions”
    - Because besides Properties there are many more value typed model elements
    - Core team name change TBD
- Started on formal Glossary of Terms
    - To build up the RFP / requirements specification based on ‘first principles’, attempting to get as close as possible to an ‘axiomatic approach’

Why Value Type? Excerpt from Glossary of Terms

Term	Definition	Notes & Examples
reference type	type of model elements that are identified by a particular kind of identifier that is unique within a namespace	Note 1: Two elements typed by the same reference type can be identical in every feature except for their (namespace qualified) reference identifier. Two such objects would be considered 'value equal' but still different elements, i.e. not 'reference equal'.
value type	type of model elements that are identified by their own value	Note 1: A value type may define elements with compound values, i.e. where the value of the elements are a tuple of multiple values, each typed by its own value type. See also compound value type. Note 2: The value of a value-element is defined directly by a literal value or indirectly by a value expression.
reference element	model element typed by a reference type	Example: Any model element that represents an 'entity' of the system of interest: a 'block', a 'part', a 'behavior'.
value element	model element typed by a value type	Example: A 'property' of a system element.

More Excerpts from Glossary of Terms

Term	Definition	Notes & Examples
system	combination of interacting elements organized to achieve one or more stated purposes	
system element	member of a set of elements that constitutes a system	
property	named observable characteristic of a system or system element	
scalar value type	value type prescribing a single value	
compound value type	value type prescribing a tuple of multiple component values, each typed by a value type	Note: The component value types may be nested. For reasons of implementation and verification the permissible number of nesting levels may be constrained.

Shaping up the RFP – Requirements formulation

- As part of requirement elicitation and elaboration we use – sometimes rather detailed – concept models
- Major problem while establishing the requirements is finding a good balance between staying at the problem / “what?”,
  without jumping to solution / “how?”,
  while still remaining sufficiently concrete,
  taking into account SysML v1 heritage and future transition,
  and promoting convergent solutions / RPF responses
- A possibility is to accompany the RFP with the full SECM as a ‘good source of ideas’ without prescribing the SECM concepts
  and align the SECM terminology with the RFP Glossary of Terms

Overview of Some Major Requirements

Req. Type	Id	v1.5?	Name	Text	Rationale
Functional	1	Y	Reference type versus value type	SysML v2 shall encompass an integrated type formalism that distinguishes between reference type and value type, and supports both.	Differentation between reference and value types is a fundamental aspect of building system models, already included in SysML v1.
Functional	2	P	Type specialization	The SysML v2 integrated type formalism shall support type generalization, and its inverse, type specialization, founded in mathematical set theory.	Type generalization and specialization, equivalent to named superset or subset extents of elements conforming to the more general or to the more specialized type respectively, is the established generic pattern in all major information modeling theories to enable precise and formal concept definition and facilitate effective complexity management, concept abstraction, reusability as well as automated reasoning.
Functional	4	P	Scalar and compound value types	SysML v2 shall support both scalar value type and compound value type concepts.	Compound value types are needed in addition to scalar value types to represent more complex values like vectors, matrices, nth order tensors, computer data record, etc.
Functional	5	Y	Scalar value types	The scalar value type shall include representation of numerical and non-numerical values, including boolean, text, enumeration, date, date-and-time, time-of-day and reference element identifiers.	
Functional	6	N	Variable length value collections	The value type shall support representation of collections of values, where all collection items are typed by one value type.	
Functional	9	N	Discretely sampled function value	The value type shall support representation of a discretely sampled function, with an option to define an interpolation scheme for derivation of the function 'range' values for 'domain' values in-between sampled values.	In many engineering applications there is a need and an established practice to represent observations or predictions as discretely sampled sets of independent and dependent values, both for univariate (scalar) and multivariate (vector space) sets.

Next Steps

- Finalize proposed set of RFP requirements by early Jan 2017
  - Open for review by larger WG
- Finalize corresponding part of SECM by early Jan 2017
- Integrate “Values, Value Types and Expressions” concept model into SECM by end Jan 2017