UML & SysML Overview

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UML

Modeling Language (not only) for Software Engineers
UML Overview

- Unified Modeling Language
  - An OMG (Object Management Group) standard
- 1.x series
  - 1997 – Initial version (v1.1 – first adopted version)
    - by James Rumbaugh, Grady Booch, Ivar Jacobson at Rational
  - 2000 – v1.3, v1.4
  - 2003 – v1.5
- 2.x series
  - 2005 – v2.0
  - 2007 – v2.1.2
  - 2009 – v2.2
  - 2010 – v2.3
  - 2011 – v2.4.1
  - 2012 – v2.5 – „In Process”
History

1990
Methodologies proliferate
- Ada/Booch
- Booch '91
- Booch '93
- OMT
- OOSE

1995
- OOPSLA '95
- "3 amigos"
- UML 0.8
- UML 0.9
- UML 1.1

1997
- Accepted by OMG Nov. 97
- Standardization
- UML 1.3
- UML 1.4
- UML 1.5

2005
- Language proliferate
- UML 2.0
- UML 2.1.2
- UML 2.2

from WikiMedia Commons
Related Standards

- **MOF – Meta Object Facility Core**
  - 2011 – v2.4.1
  - Modeling language for defining modeling languages

- **OCL – Object Constraint Language**
  - 2012 – v2.3.1
  - Textual language for formulating constraints and queries over models

- **fUML – Foundational UML**
  - 2013 – v1.1
  - Semantics of a Foundational Subset for Executable UML Models

- **ALF – Action Language for Foundational UML**
  - 2012 – v1.0.1 Beta3
  - Concrete Syntax for a UML Action Language

- **XMI – XML Metadata Interchange**
  - 2011 – v2.4.1
  - XML representation of models

- **DD – Diagram Definition**
  - 2012 – v1.0
  - for modeling and interchanging graphical notations
UML Diagram Taxonomy
SysML

Modeling Language (not only) for Systems Engineers
Systems Engineering

- Systems Engineering is a multidisciplinary approach to develop balanced system solutions in response to diverse stakeholder needs

- ~ Integration Engineering
  - Software engineering
  - Hardware engineering
  - Mechanical engineering
  - Safety engineering
  - Security engineering
  - ...

- ~ Process Engineering

- System
  - Military, airplane, car, aviation, railway interlocking, notebook, etc.
“UML for Systems Engineering”
- Supports the specification, analysis, design, verification and validation of systems that include hardware, software, data, personnel, procedures, and facilities

Developed by OMG and International Council on Systems Engineering (INCOSE)

OMG SysML™ (http://www.omgsysml.org)
- RFP – March 2003
- Version 1.0 – September 2007
- Version 1.1 – November 2008
- Version 1.2 – June 2010
- Version 1.3 – June 2012
Relationship Between SysML and UML

UML 2

SysML

UML4SysML

UML reused by SysML

SysML extensions to UML

UML not required by SysML (UML - UML4SysML)

SysML Profile
SysML Diagram Taxonomy
Aspects of SysML

Diagram
- Structure model
- Behavior model
- Block definition diagram
- Internal block diagram
- Parametric diagram
- Package diagram
- Activity diagram
- Use case diagram
- State machine diagram
- Sequence diagram
- Requirement diagram, stereotype,
  model view, AP-233, XMI Metadata Interchange format

Model
Diagram Frames in SysML

- Each SysML diagram represents a model element
- Each SysML diagram must have a diagram frame
- Diagram context is indicated in the header
  - Diagram kind
    - e.g. *act* for Activity Diagrams
  - Model element type
    - e.g. Package, Block, Activity
  - Model element name
    - the represented model element
  - Diagram description
    - e.g. “Context model for Cyber-Physical Agricultural System”
SysML Diagram Kinds

- pkg – Package Diagram
- bdd – Block Definition Diagram
- ibd – Internal Block Diagram
- par – Parametric Diagram
- uc – Use Case Diagram
- act – Activity Diagram
- sd – Sequence Diagram
- stm – State Machine Diagram
Summary
Organizing Models with Packages

Package Diagrams
Package Diagrams
Modeling Aspect

How to organize the model?
Objectives

- Packages are used to group elements
  - Provides a containment hierarchy for model elements
  - Similar to directories for files

- Provides a namespace for the grouped elements
  - Modeling elements are identified by their qualified name
    - E.g. Cyber-Physical Agricultural System::System Design::Structure::Cyber Physical Agricultural System

- Not for modeling real world entities
Special packages

- **Profile (UML)**
  - extends metamodel

- **Model (UML)**
  - contains set of elements that describe the domain of interest

- **Model library (SysML)**
  - contains reusable elements
Package relationships

- Containment
  - Packageable elements
  - Other packages

- Package import
  - Import all elements from another package to the namespace

- Element import
  - Import one element from another package to the namespace
Package example

Pkg [package type] package name [diagram name]

Package name

Containment

Containment

Package import

Element import
Summary

- **Goal**
  - Group model elements hierarchically
  - Provide namespace for model elements

- **Modeling aspect**
  - *How to organize the model?*
  - Not real modeling