Ontology based Integration Platform for Modelling and Simulation - Simantics

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What is Simantics?

Open platform for modelling and simulation
- Developed at VTT since 2006
- Application development platform
- Integration solution for modelling and simulation
- Semantic graph based representation of data
- Licensed under Eclipse Public Licence

Goals
- Reusable components for modeling and simulation infrastructure (less focus on solver technology)
- Multi-disciplinary, multi-level simulation and modeling
- Supports the whole life cycle of the facility or product
- Distributed simulation
- Model integration
- Solver integration
- Team work
Different Generations of Information Management

Generation 5: ‘Simulation as Part of Semantic Product Model’

Knowledge management

Generation 4: ‘Semantic Product Model’

Information management

Generation 3: ‘DocHotel’

Document management

Generation 2: Filing cabinet

Information legacy

Generation 1: Campfire stories
Plug-in Architecture for Modelling and Simulation

Simantics Core
Triplestore modelling database management

Simantics Databoard
Simulation results and real time data management

Plug-in

Modcheck
Formal model checking

Plug-in

KCL-Eco
LCA Computations

Plug-in

APROS simulation engine

Plug-in

BALAS simulation engine

Plug-in

System Dynamics simulation environment

Plug-in

OpenModelica system simulation environment

Plug-in

OpenFoam CFD Environment

Plug-in

Flowbat simulation engine

Plug-in

DEVS Discrete Event Model Engine

Plug-in

???

For more information, visit: www.simantics.org
Simantics - Open Operating System for Modelling and Simulation
# Simantics Components

<table>
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<tr>
<th>Products</th>
<th>Perspectives</th>
<th>Components</th>
<th>External</th>
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## Development Environment

<table>
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<tr>
<th>Apros</th>
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## Ontology Development

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<th>Ontology Development</th>
<th>Project Management</th>
<th>Modeling and Simulation</th>
<th>Team Features</th>
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## Ontology Development - Project Management

<table>
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<tr>
<th>2D</th>
<th>Browsing</th>
<th>Experiment control</th>
<th>Events</th>
<th>Constraint Language</th>
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## Team Features

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## Eclipse

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<tr>
<th>Java</th>
<th>Dashboard</th>
<th>Core API</th>
<th>Core</th>
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Ontology Language – Layer0

Formal specification at http://dev.simantics.org/images/c/c8/Layer0.pdf
Used graphical notation is described at https://www.simantics.org/wiki/index.php/Graphical_ontology_notation
Why Ontologies?

- Flexibility: Quite different data models of different simulators and design systems expressed using the same language
- Model validation
  - Capturing knowledge of experienced modellers (rules)
- Semantic queries
- Model transformations
- Model annotations
Ontology challenges

- Performance issues
- Quite complex low level API’s
  - Need for experienced and skillful programmers in the core
- Ontology versioning
  - Model migration from one ontology version to another
  - Code plugins that would handle several ontology versions
Simantics Ecosystem

THTH/Simantics Division
Association for simulation interoperability and simulation based methods

Maintenance and development decisions

Simantics Platform

Users

Company A
VTT
Fortum
(Others)

Component and service providers

Software Company X
VTT
Software Company Y
(Others)

THTH ry:
Teollisuuden hajautetun tiedonhallinnan yhdistys
Association of Decentralized Information Management for Industry
http://www.ththry.org/
Some Members of the Simantics Development Team

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Tommi Karhela
Toni Kalajainen
VTT creates business from technology