

A Methodology for Control Systems GUI Prototyping - a case study

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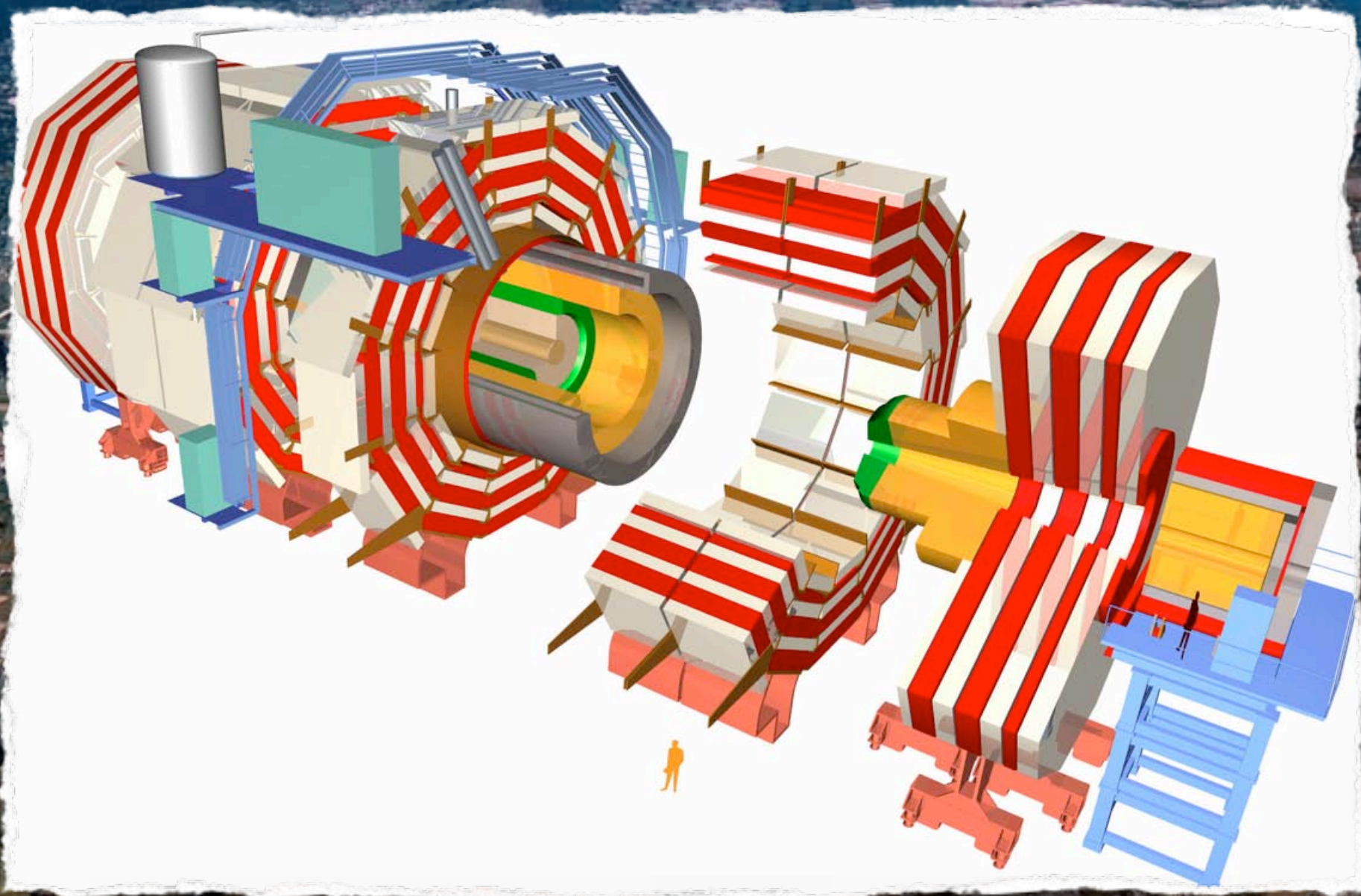
1. Introduction



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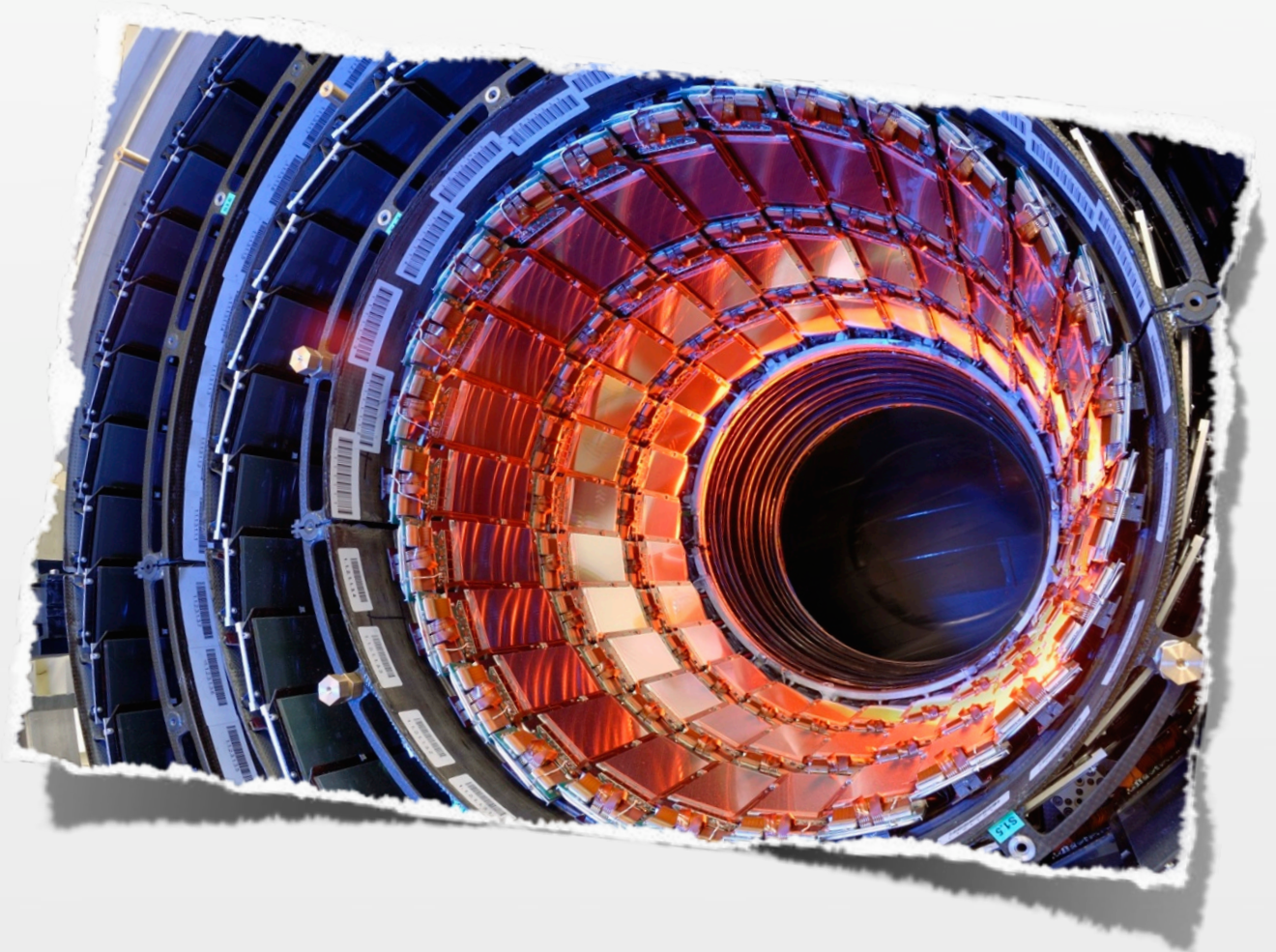
Language modeling
Language transformation
Rapid GUI prototyping

LHC and CMS



The CMS Tracker

15232 modules
1944 power groups
356 control groups



GUI for slow controls

3D visualization
Monitoring
Interaction
Simulation



?

Lots of components
Lots of man hours
Need to hire SW engineers

What is needed?

Geometry

Commands
Events

States

Hierarchy

Properties

What do already have?

Geometry



Commands
Events



States



Hierarchy

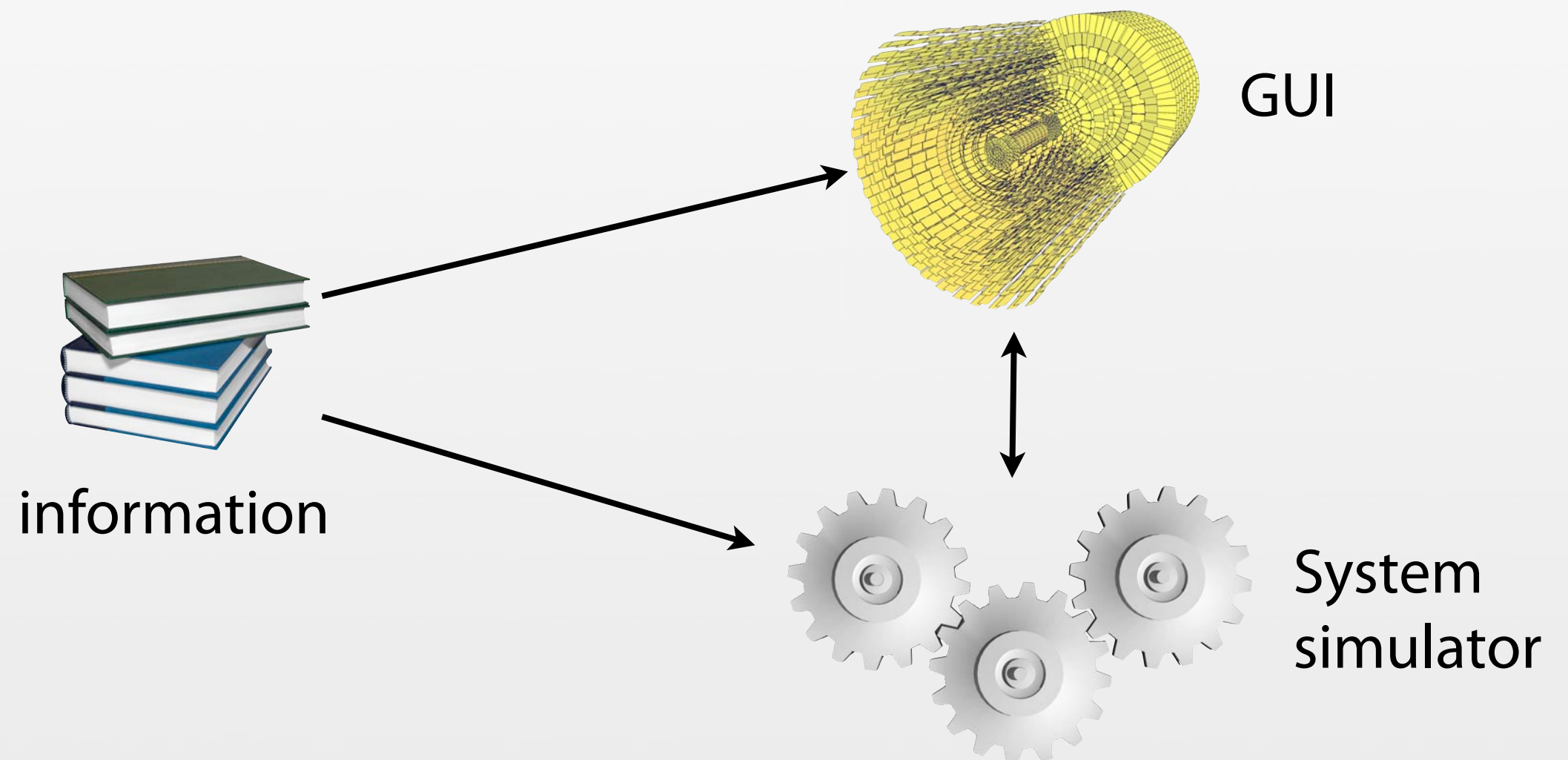


Properties



Idea

Generate a 3D GUI and system simulator from this information



2. Methodology

Language

Unify information formats

Domain specific

Support evolution

Machine- and human-readable

Language (cont.)

Object

Type

Hierarchy

FSM

Command

Event

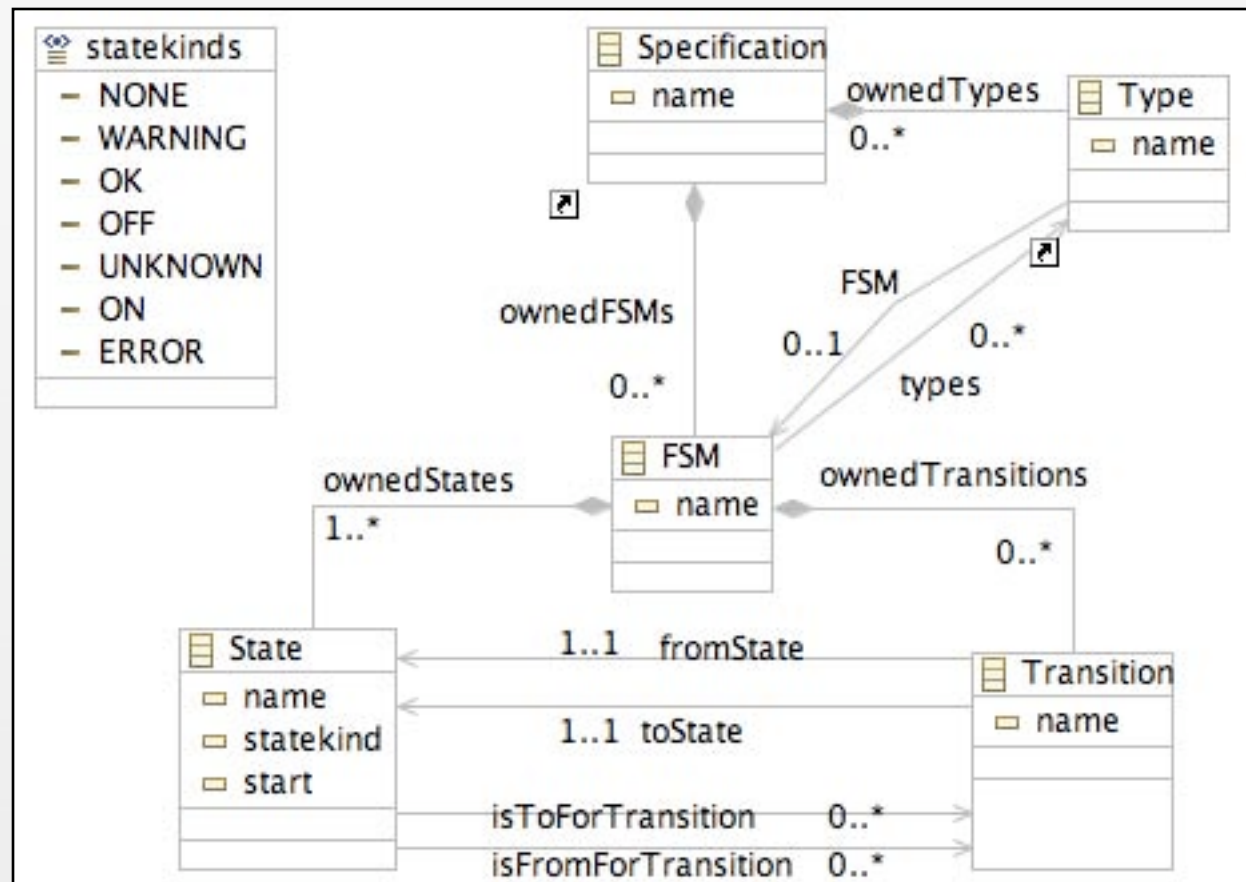
Property

Rules

Geometry

Cospel

Cospel



***cosmicrack.cospel**

Resource Set

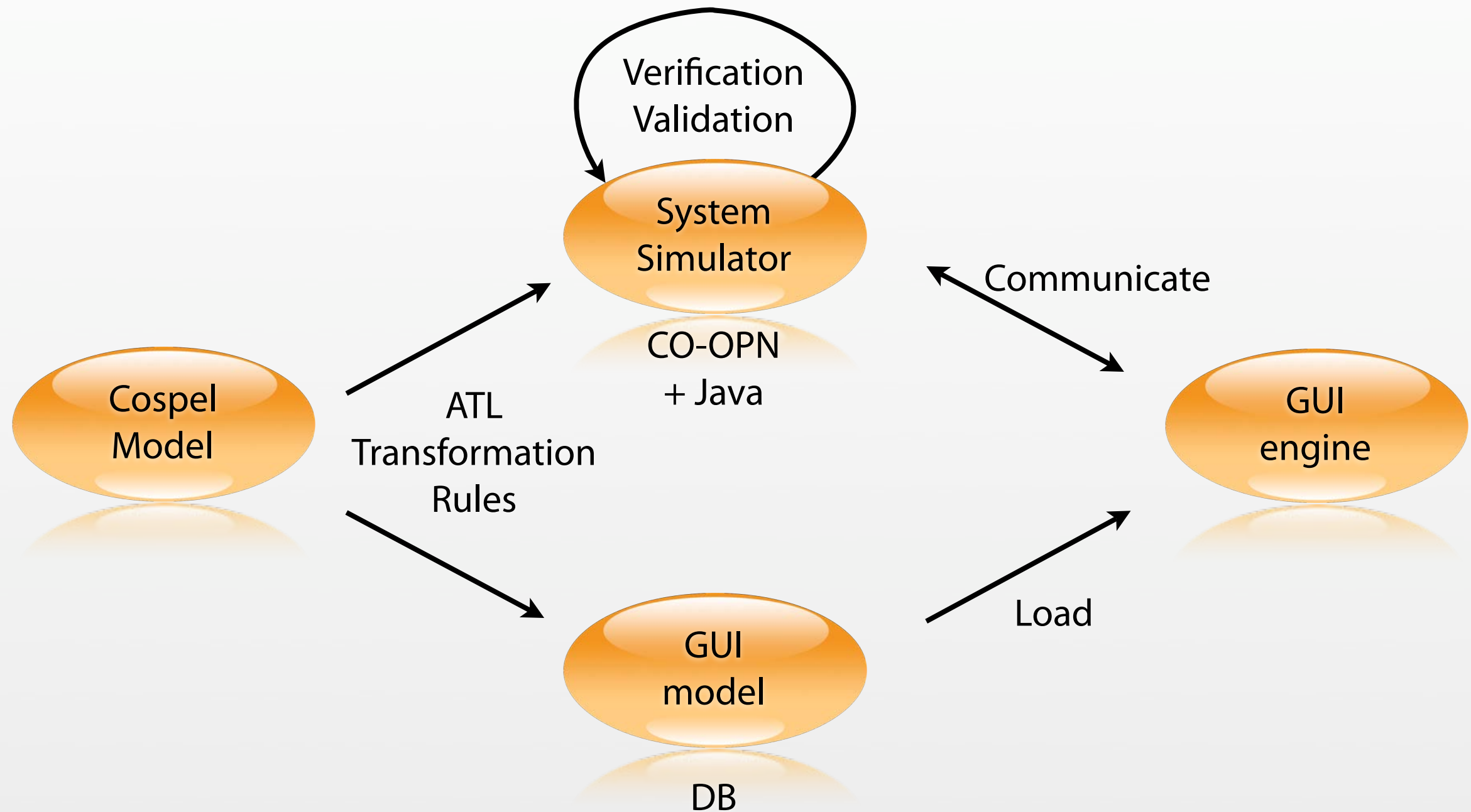
- platform:/resource/CosmicRack/cosmicrack.cospel
 - Specification CosmicRack
 - Object CG6-10
 - Absolute Coordinates
 - Geomfile cube
 - Type CTRL-GRP
 - Command off
 - One Child In State Rule
 - Contains 1 CTRL-CHN
 - Contains 10 POWER-GRP
 - FSM FSMControlGroup
 - Transition ON-CTRL-TO-OFF
 - State OFF in FSMControlGroup
 - State ON-CTRL in FSMControlGroup

Selection | **Parent** | **List** | **Tree** | **Table** | **Tree with Columns**

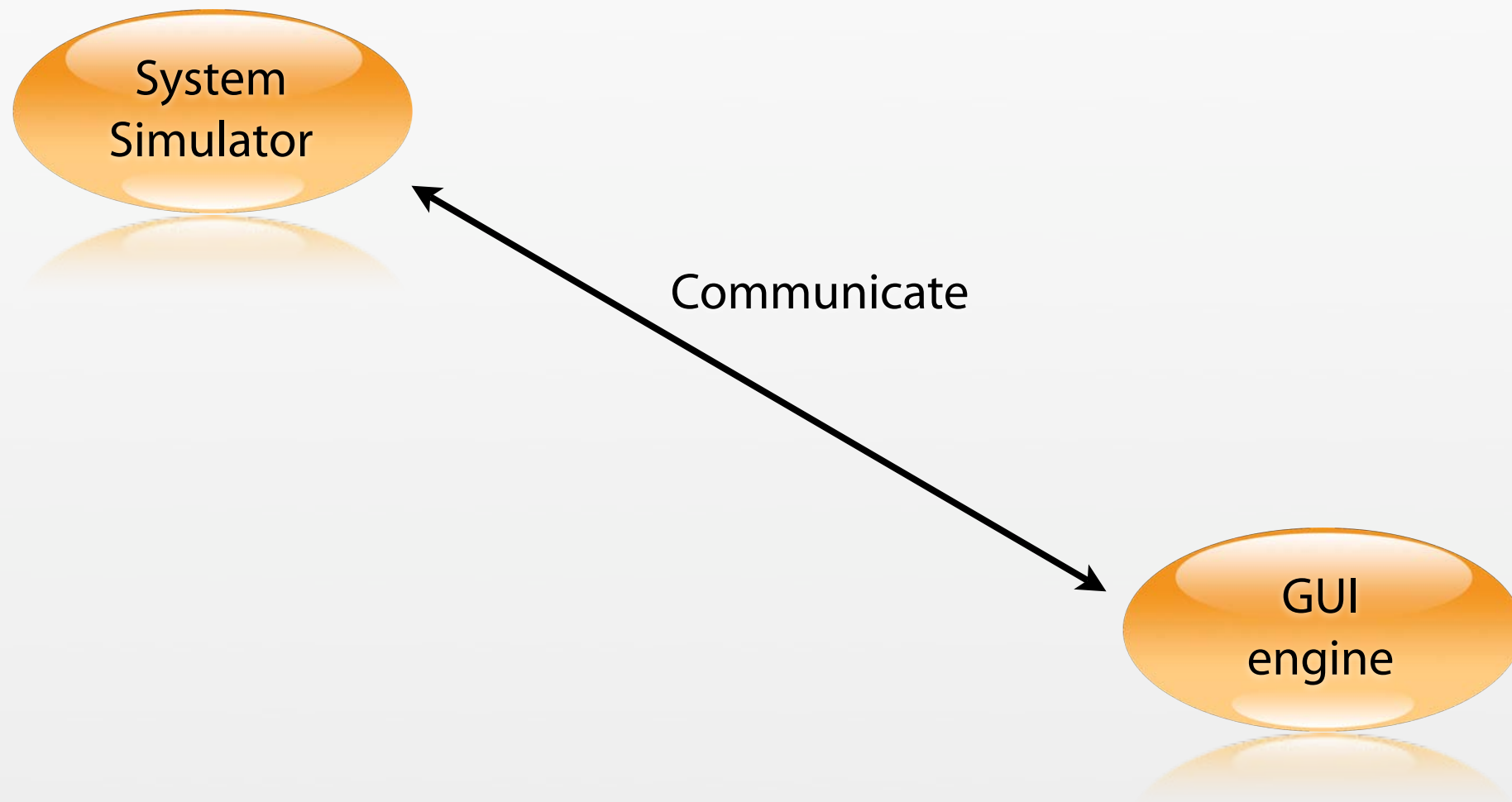
Properties

Property	Value
Childobject of atom	
Name	CG6-10
Parent	Object CosmicRack
Rotation	
Type	Type CTRL-GRP

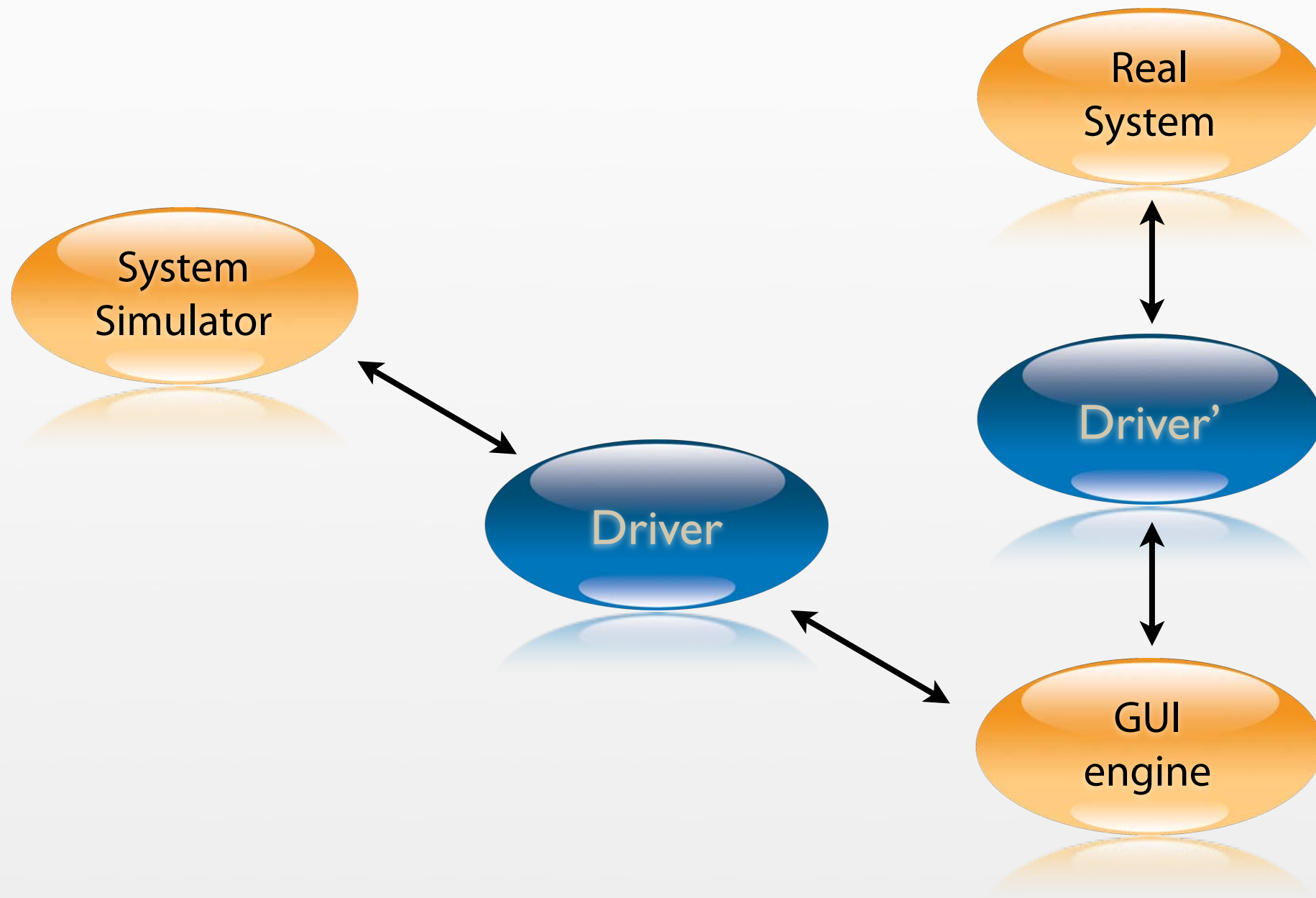
Generative approach



Communication

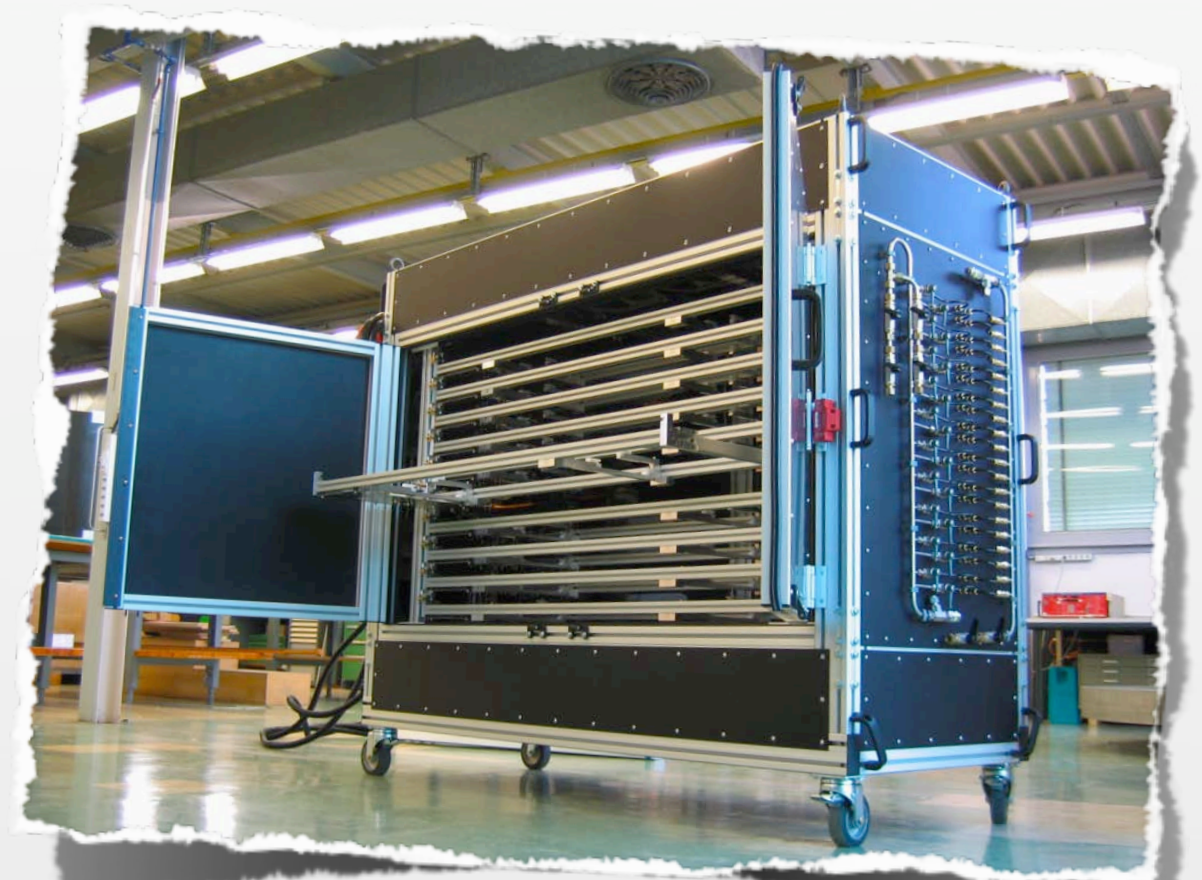


Communication

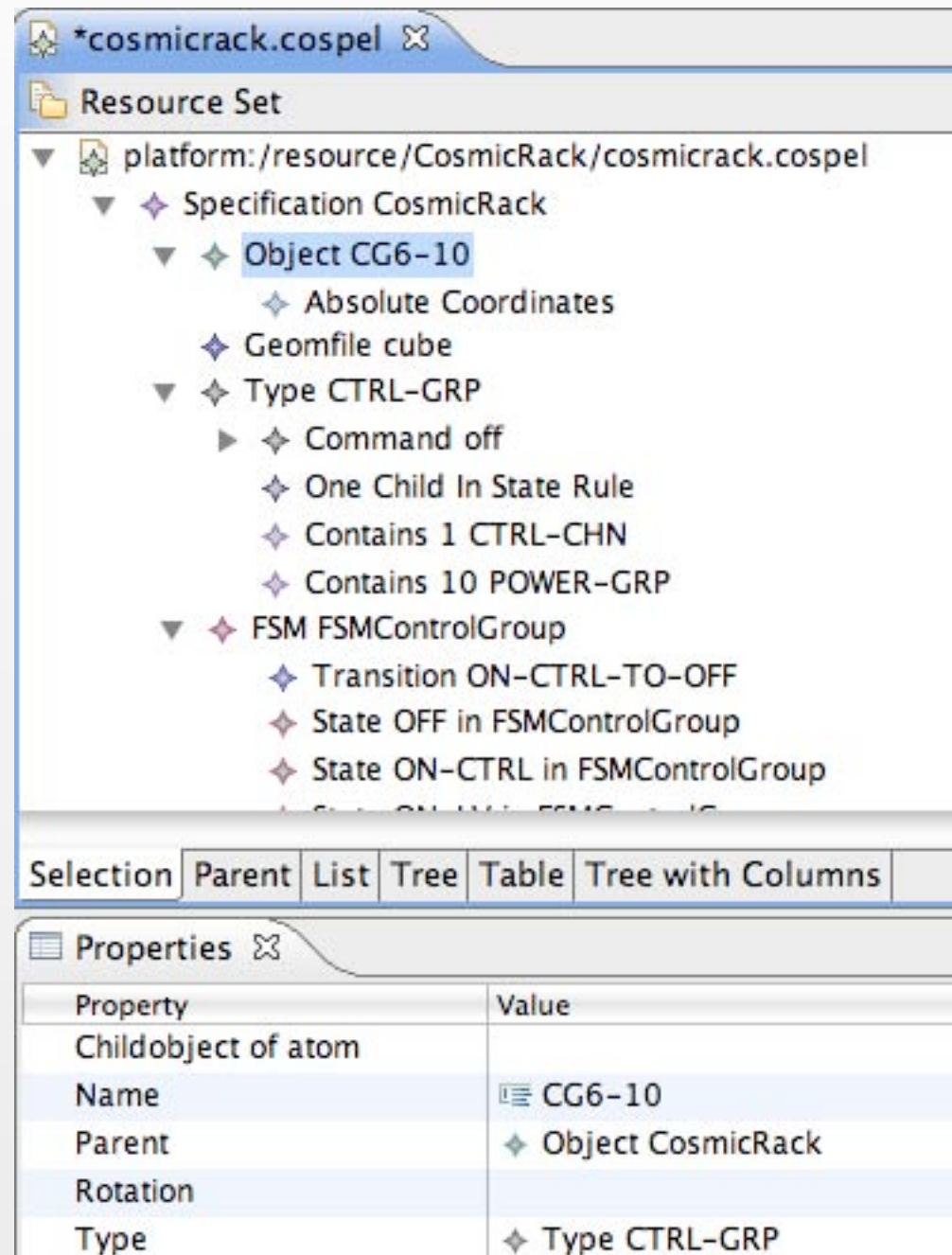


The CMS Tracker Cosmic Rack

20 power groups
2 control groups



Specification



Made by hand

Could have been
made automatically
from information
sources

Result after transformation

The screenshot displays a software interface with several panels:

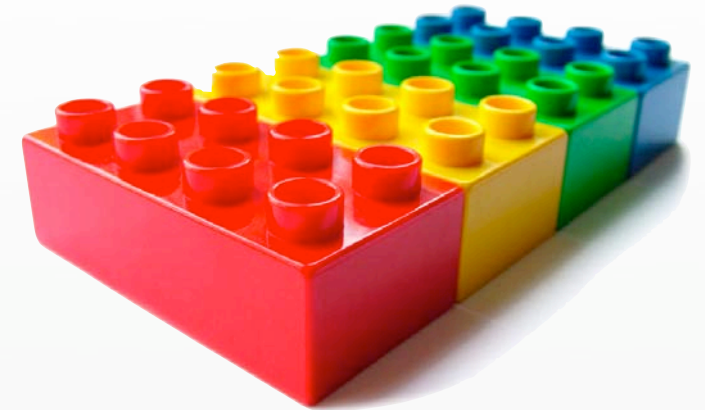
- Hierarchy Panel:** Shows a tree structure under 'CosmicRack'. The node 'CG1_5' is highlighted in red. Below it, a list of objects is shown, including 'Ctrl_Channel_1_5', 'PG_Layer_1_Rod_1', 'PG_Layer_1_Rod_2', 'PG_Layer_2_Rod_1', 'PG_Layer_2_Rod_2', 'PG_Layer_3_Rod_1', 'PG_Layer_3_Rod_2' (highlighted with a blue box), 'PG_Layer_4_Rod_1', 'PG_Layer_4_Rod_2', 'PG_Layer_5_Rod_1', and 'PG_Layer_5_Rod_2'. Below this, the node 'CG6_10' is highlighted in red, followed by a list of objects including 'Ctrl_Channel_6_10', 'PG_Layer_6_Rod_1', 'PG_Layer_6_Rod_2', 'PG_Layer_7_Rod_1', 'PG_Layer_7_Rod_2', 'PG_Layer_8_Rod_1', 'PG_Layer_8_Rod_2', 'PG_Layer_9_Rod_1', and 'PG_Layer_9_Rod_2'.
- Resource Set Panel:** Shows a tree structure under 'platform:/resource/CosmicRack/cosmicrack.cospel'. The node 'Object CG6-10' is highlighted in blue. Below it, a list of properties is shown, including 'Absolute Coordinates', 'Geomfile cube', 'Type CTRL-GRP', 'Command off', 'One Child In State Rule', 'Contains 1 CTRL-CHN', 'Contains 10 POWER-GRP', 'FSM FSMControlGroup', 'Transition ON-CTRL-TO-OFF', 'State OFF in FSMControlGroup', and 'State ON-CTRL in FSMControlGroup'.
- Properties Panel:** Shows a table with the following data:

Property	Value
Childobject of atom	
Name	CG6-10
Parent	Object CosmicRack
Rotation	
Type	Type CTRL-GRP
- 3D Visualization Window:** Shows a 3D model of a structure with a blue 'Controls' button and a 'clear' button.

Remarks




1. Modular language



Easy to add/remove/refine features

Remarks



2. Flexible framework

Can easily make richer editors
(visual syntaxes, constraint checking,
design-time validation)

Remarks



3. Java-based from A to Z



Cross-platform (with some limitations)

Remarks



4. Stereoscopy supported



Evaluate the stereo-perception
influence on system navigation

Remarks



“Fatter” clients possible, but involves
more GUI specification
(language scope extension)

Present & Future

Full-scale CMS Tracker

Application to similar domains

Natural interaction



Thank you.