What is Rosetta?

Rosetta is a modeling language for representing heterogeneous information about a system. It supports different design domains using formal semantics appropriate for each domain.

Rosetta Specifications

A system is composed of components that share information. A component consists of one or more facets, each of which defines one view of the component. A facet includes a domain that defines the universe of discourse for the facet and the semantic vocabulary. Different domains support models of computation for behaviour, or application-specific properties. Interactions describe the way information in one domain affects information in others.

Rosetta Core Domains

The core domains describe models of computation. Application-specific domains are derived from them. Simulation means different things for different models of computation. For state-based and discrete-time domains, simulation involves sequencing through time or state and computing values of variables in each state. For the continuous-time domain, simulation involves solving piecewise continuous equations.

The Rosetta discrete_time domain models time starting from \( t_0 \) and advancing in discrete steps:

- The domain variable \( t \) is the current time.
- \( x(t) \) means value of \( x \) at a step from now
- \( \dot{x}(t) \) means value of \( x \) at a step from the current state
- \( \dot{x}(t) \) means value of \( x \) at a step from now

Simulating Discrete-Time Domain Models

Many discrete-domain models have terms of the form
\[
x = f(x, y, z, ...)\]
Given initial values of variables at \( t = t_0 \) or \( t = 0 \), a simulator can advance \( t \) or a step by step. For each step, it calculates new values of variables from values in previous steps.

For models that aren't of this simple form, data flow analysis may reveal a dependency graph that allows computation to be done as \( t \) or a step advances. For example, in the autopilot model:

\[
\begin{align*}
\dot{P} &= \frac{d}{dt} P, \\
\dot{v} &= \frac{d}{dt} v, \\
\dot{x} &= \frac{d}{dt} x, \\
\dot{r} &= \frac{d}{dt} r
\end{align*}
\]
A simulator can perform forward-driven evaluation, continuing until a stopping condition is reached. Alternatively, it can perform lazy evaluation. The user requests values of variables at some time-state, and the simulator evaluates as needed to determine the requested values.

The TARP Simulator

The Adelaide Rosetta Project: Towards Simulation of Rosetta Descriptions

A Rosetta Example: A Boat Autopilot

This is a discrete-time model of an autopilot for a boat. The autopilot user sets the target speed (\( v \)) and heading (\( h \)). The system controls the engine power (\( P \)) and rudder deflection (\( d \)) to match the actual speed (\( v \)) and actual heading (\( h \)) match the target.

```plaintext
package george;

begin begin:

  \text{autopilot;}

end faceted Autopilot (v, h, \textit{in} real, v, h, \textit{in} real, real, \textit{out} real) { 

PMax = real 100; 

Δv = real 0.01; 

Kv = real 0.05; 

Kv = real 0.2; 

Kd = real 1; 

herr = real 0.5; 

max = real 0.2; 

max = real 0.4; 

\text{on_autopilot: autopilot (v, h, \textit{in} real, v, h, \textit{in} real, real, \textit{out} real)} 

\text{end}

\text{begin discrete_time} 

\text{begin} 

P1: \text{dot}(P) = 0; 

P2: \text{dot}(P) = \text{Kv} \cdot (v^2 - v) - \text{Kmax} \cdot Pmax; 

H1: \text{dot}(H) = 0; 

H2: \text{dot}(H) = -P; 

\text{end} 

\text{end} 

\text{end} 

\text{end}
```

A Brief History of Rosetta

Rosetta originated in the System-Level Design Language (SLDL) Committee, established by EDA Industry Council in 1990. Requirements for the language are published at www.accellera.org/SLDL.

A contract for the language design was let by US Air Force in 1999 to University of Kansas and AverStar, now part of Titan. Perry Alexander at Kansas and Dave Barton at AverStar are the main language designers.

The SLDL Committee has now morphed into the System-Level Design and Semantics Committee under Accellera. The Rosetta subcommittee is developing a draft standard language definition. The Semantics subcommittee is developing semantic definitions for models of computation domains.

The Rosetta draft standard will be put forward to IEEE or other accredited standards organization around end-2002.

Other development and prototyping contracts are being undertaken by University of Kansas, AverStar and EDAptive in USA, and Adelaide University and Ashenden Designs in Australia.

The Adelaide University Project: Toward Simulation of Rosetta Descriptions

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