CHESS
CENTER FOR HYBRID & EMBEDDED SOFTWARE SYSTEMS

COLLEGE OF ENGINEERING, UC BERKELEY

Lattice Composition for Ontology Analysis

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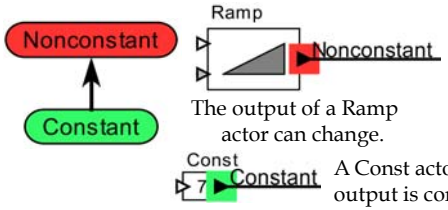
http://chess.eecs.berkeley.edu/

125 Bosch 1886–2011

Motivation

Ontologies can be used to analyze models. A developer defines lattices plus actor constraint rules. Here are some examples:

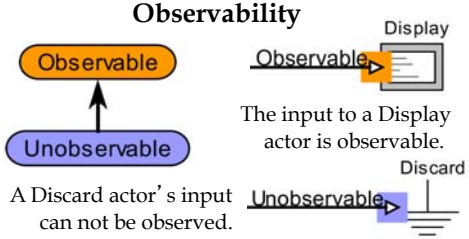
Constant / Non-constant



The output of a Ramp actor can change.

A Const actor's output is constant.

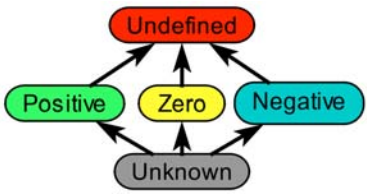
Observability

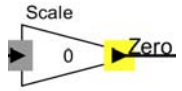


The input to a Display actor is observable.

A Discard actor's input can not be observed.

Abstract Interpretation (for scalar values)





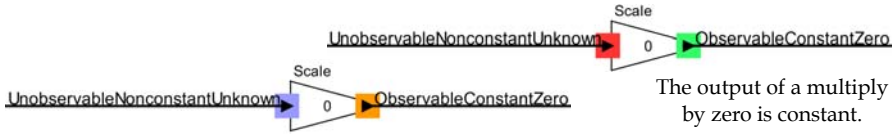
The output of a multiplication by zero is zero.

If an ontology is a lattice, the Rehof and Mogensen algorithm performs model analysis in linear time ("Tractable Constraints in Finite Semilattices", 1996). (Time is linear in the number of constraints, for finite height lattices.)

Why compose lattices?

A product lattice can be more powerful than a set of orthogonal individual lattices (Click and Cooper, "Combining Analyses, Combining Optimizations", 1995).

- The original rules from all sub-lattices are inherited.
- The developer writes a few new rules taking advantage of all sub-lattices.

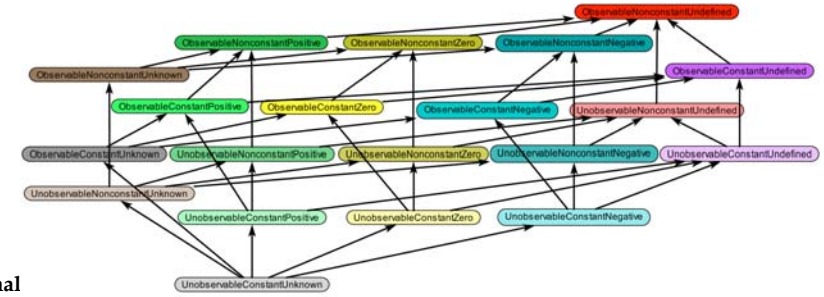


The output of a multiply by zero is constant.

The input to a multiply be zero operation is unobservable.

This approach **Supports multiple developers**, **Minimizes dependencies**, and **Gives maximum anal**

Product Lattice



Current status and objectives

The product lattice is:

- Automatically created from sub-lattices.
- Checked to ensure that the result is also a lattice.

Remaining challenges include:

- Allowing the user to edit the product lattice, especially Top and Bottom concepts.
- Some concepts in the product lattice don't make sense. Allow users to note these with acceptance criteria.
- Combining finite and infinite width lattices.
- Combining inherited and new rules and ensuring monotonicity.

Learn more!

Try the ptolemy.data.ontologies package.

Publication: "Scalable Semantic Annotation using Lattice-based Ontologies", MODELS 2009