

Wodel: A DSL for Model Mutation; and Wodel-Edu: its Application to the Automated Generation of Exercises

Pablo Gómez-Abajo, Esther Guerra, Juan de Lara

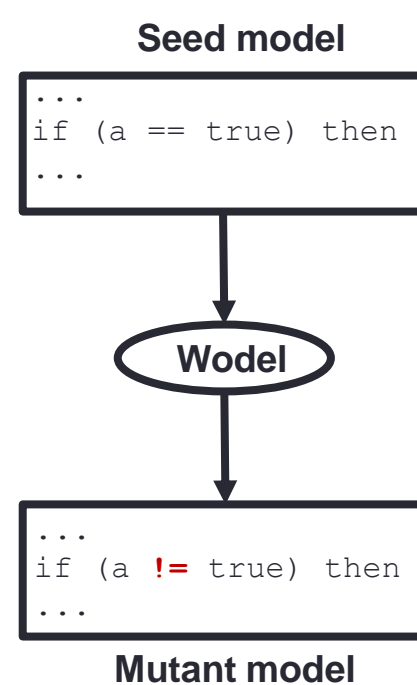
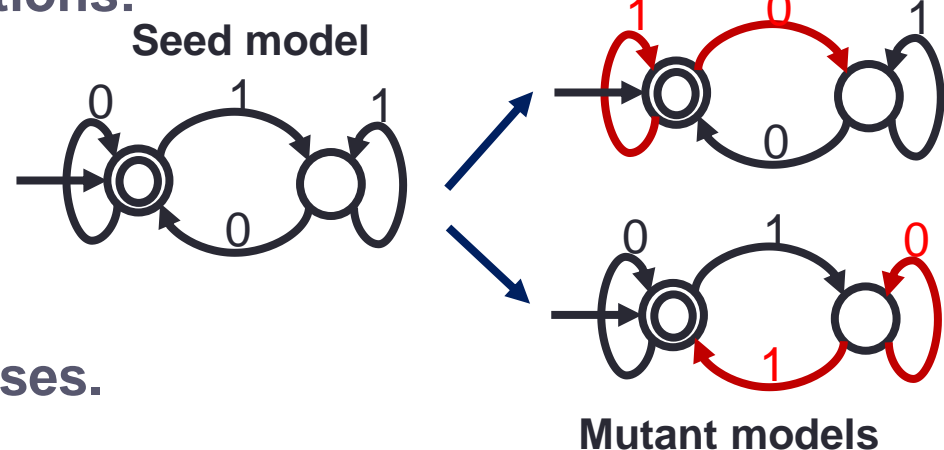
Universidad Autónoma de Madrid (Spain)

What is a Model Mutation?

A model mutation is a variation of a seed model by the application of one or more mutation operators.

Model mutation has many applications:

- Model transformation testing.
- Model-based software testing.
- Software product lines testing.
- Automated generation of exercises.
- Evolutionary algorithms.



Motivation

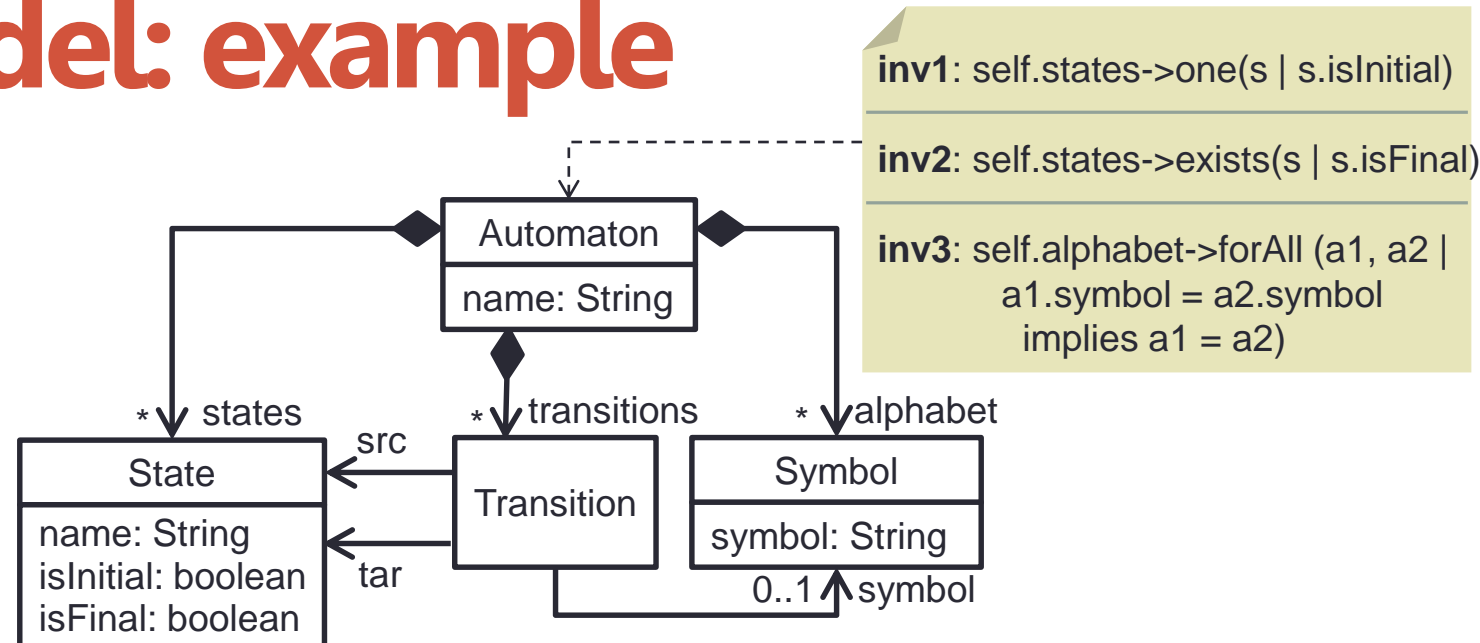
Existing frameworks for model mutation:

- are specific for a language (e.g., logic formula).
- or specific for a domain (e.g., testing).
- mutation operators are manually encoded.

We propose the DSL Wodel for model mutation:

- high-level mutation primitives.
- independence from target language and domain.
- compiled into Java code.
- extensible through post-processors.

Wodel: example

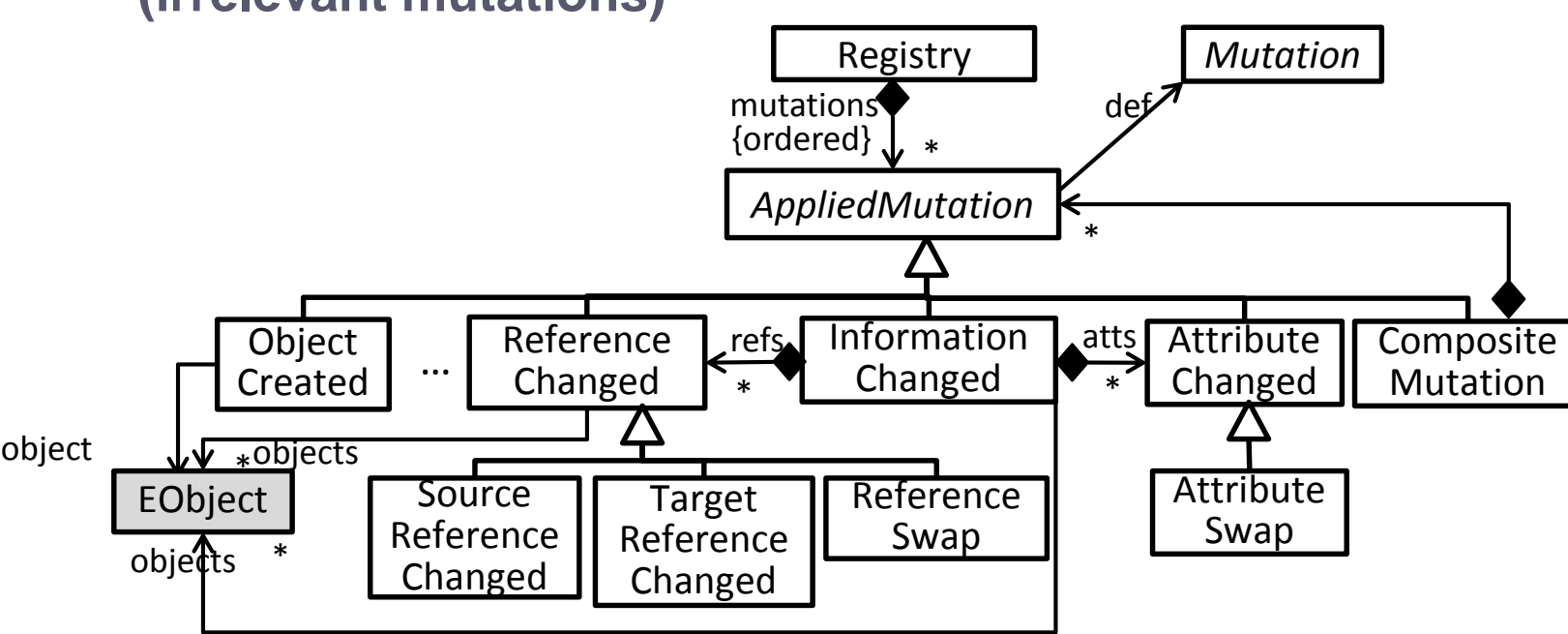


```
generate 3 mutants in "out/" from "evenBinary.fa"
metamodel "http://fa.com"
```

```
with commands {
  s0 = modify one State where {isFinal = true} with {reverse(isFinal)}
  s1 = create State with {isFinal = true}
  t0 = create Transition with {src = s0, tar = s1, symbol = one Symbol}
}
```

Mutations Registry

- Optional, it is activated through the preferences page
- Useful when generating text options in test exercises
- References to seed models and mutant models
- Optionally, the framework can reduce the registry (irrelevant mutations)



Blocks and OCL Constraints

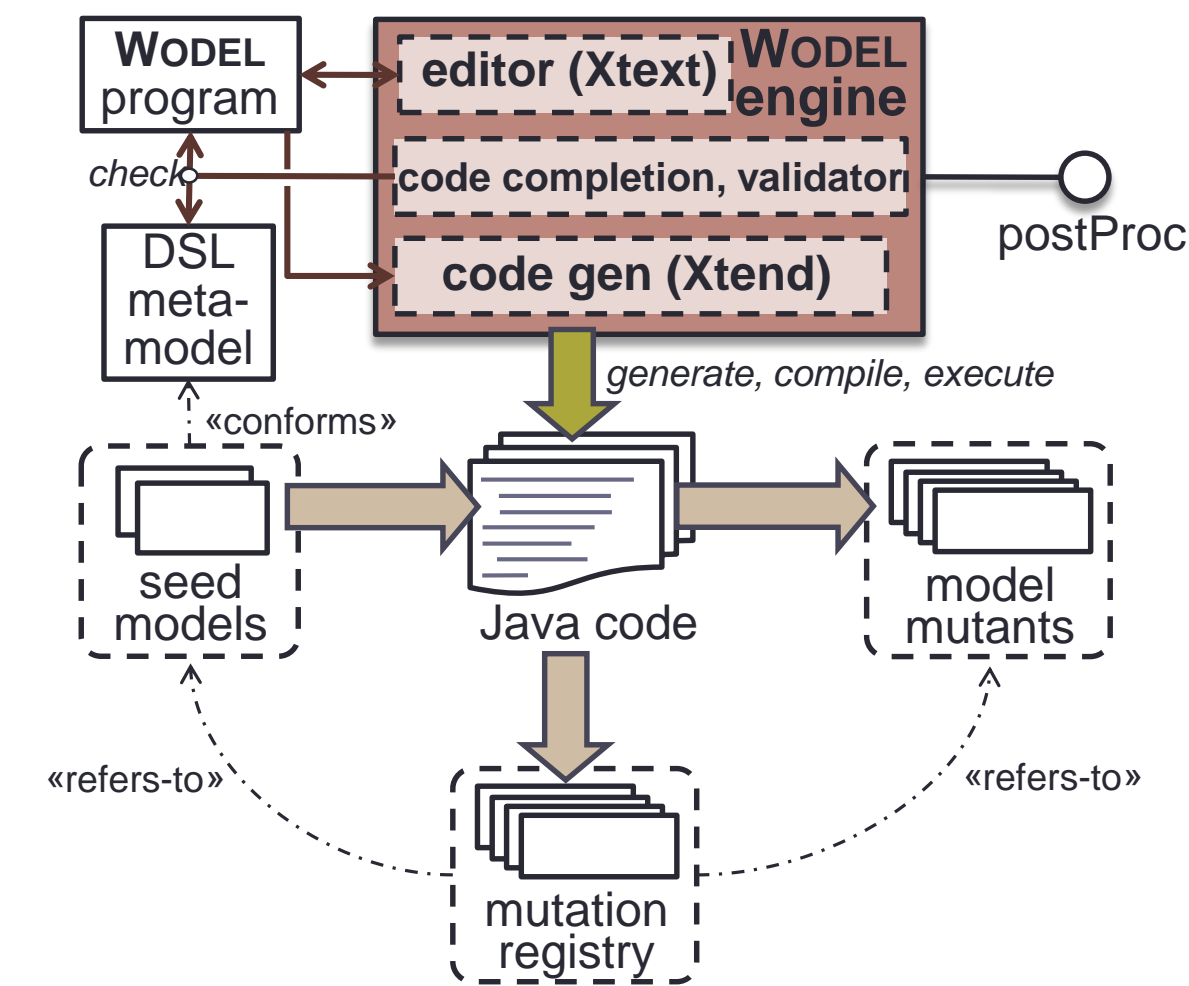
Wodel supports mutation blocks:

- Mutants generation by stages
- A block can take as seed models the mutants generated in previous blocks
- Folders hierarchy for mutants identification
- Duplicated mutants control with directive repeat=no

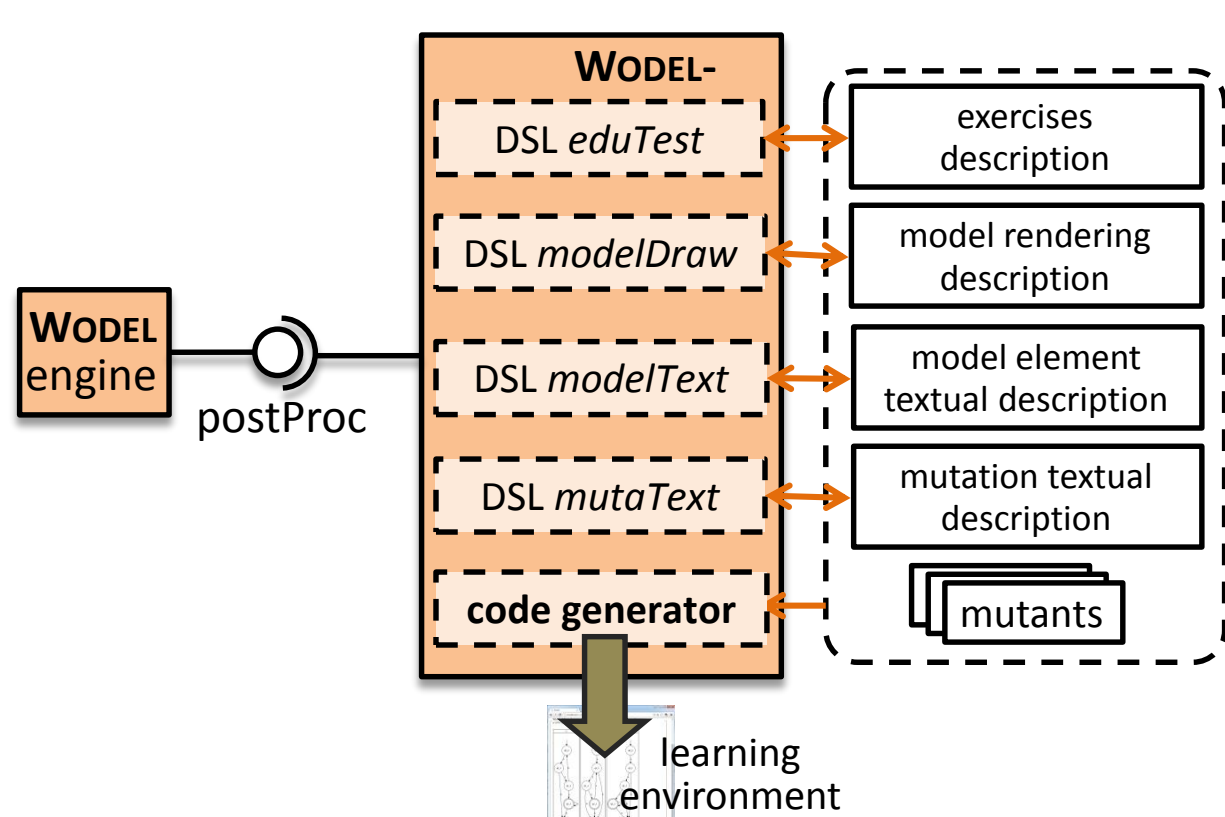
OCL Constraints in Wodel Code:

- Applied over the generated mutants, although they are not in the domain meta-model

Tool Architecture



Wodel-Edu: Architecture



- Wodel-Edu is a post-processing extension to Wodel for the automated generation of exercises that is domain independent
- Wodel-Edu generates a web application (<http://www.wodel.eu>) with three kinds of test exercises:
 - Alternative response
 - Multiple diagram choice
 - Multiple emendation choice

Wodel-Edu: Exercises Schema

