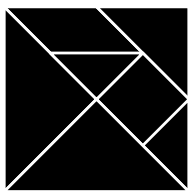
Optimized Translation of Clafer Models to Alloy



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CS744 Course Project. July 19, 2011

Course Project

CS 744: Advanced Compiler Design

Data flow analysis, redundancy elimination, optimizations

Individual project

Duration: 2 months

Clafer Update

Analysis of variability models

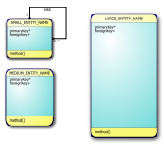
Translation to Alloy (uses SAT solvers)

clafer2alloy translator: a year ago

Some work on formal semantics

Examples of variability models

The Toolchain



Clafer Model

$\rightarrow$

Clafer Translator

$\rightarrow$

Alloy Model

$\rightarrow$

Alloy Analyzer

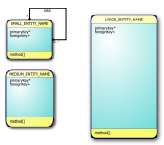
$\rightarrow$

$P \wedge Q$

Formula

Demo

Problems


Clafer Model

$\rightarrow$


Clafer Translator

$\rightarrow$


Alloy Model

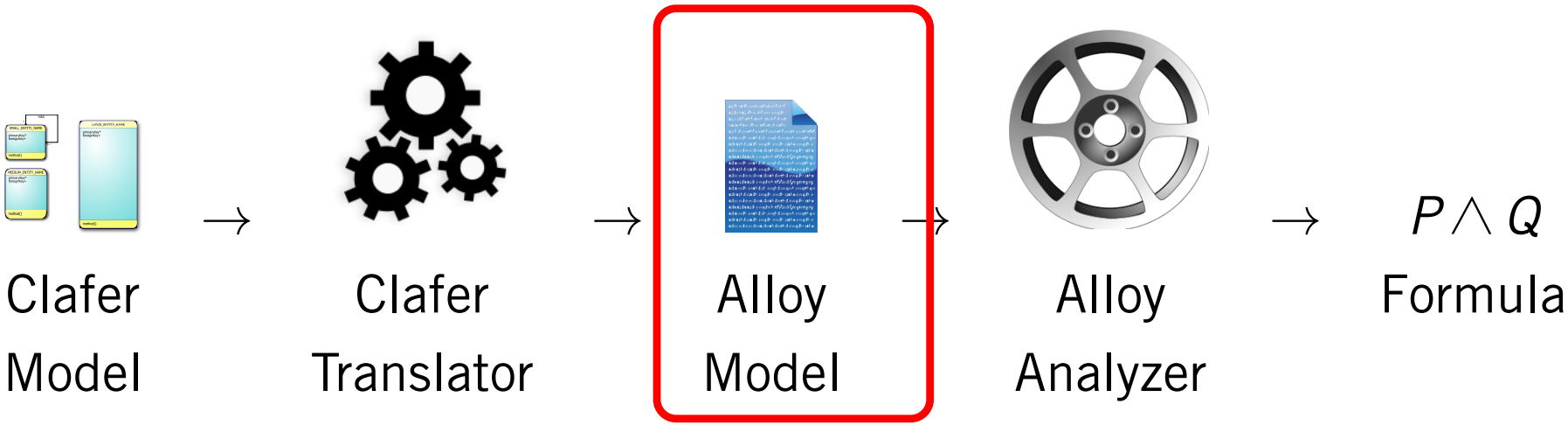
$\rightarrow$


Alloy Analyzer

$\rightarrow$ $P \wedge Q$ Formula

Translation rules heavily influence reasoning time in Alloy

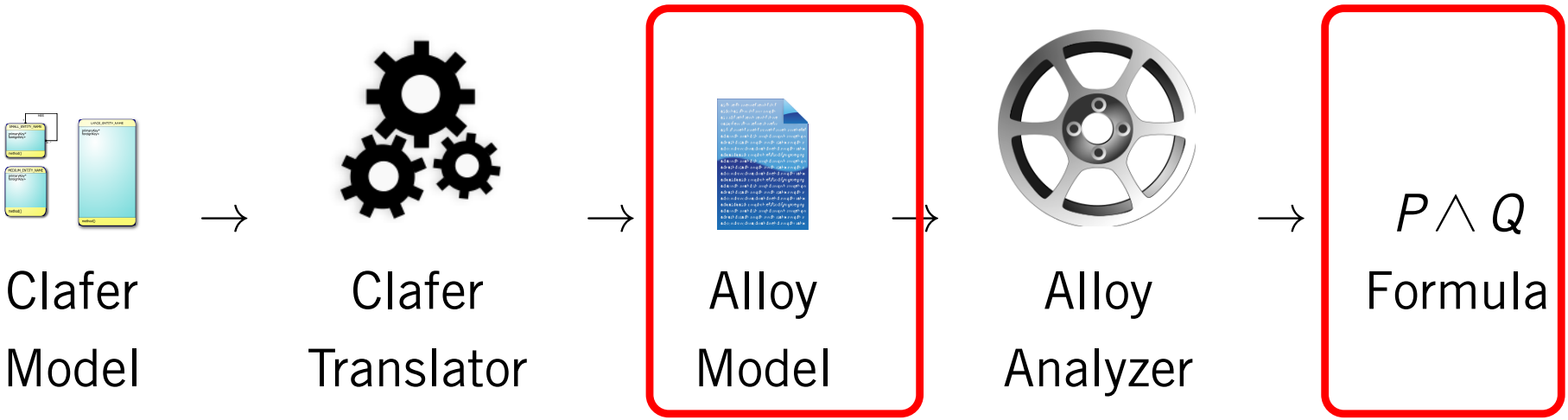
Problems



Translation rules heavily influence reasoning time in Alloy

Large Alloy files (complex models)

Problems

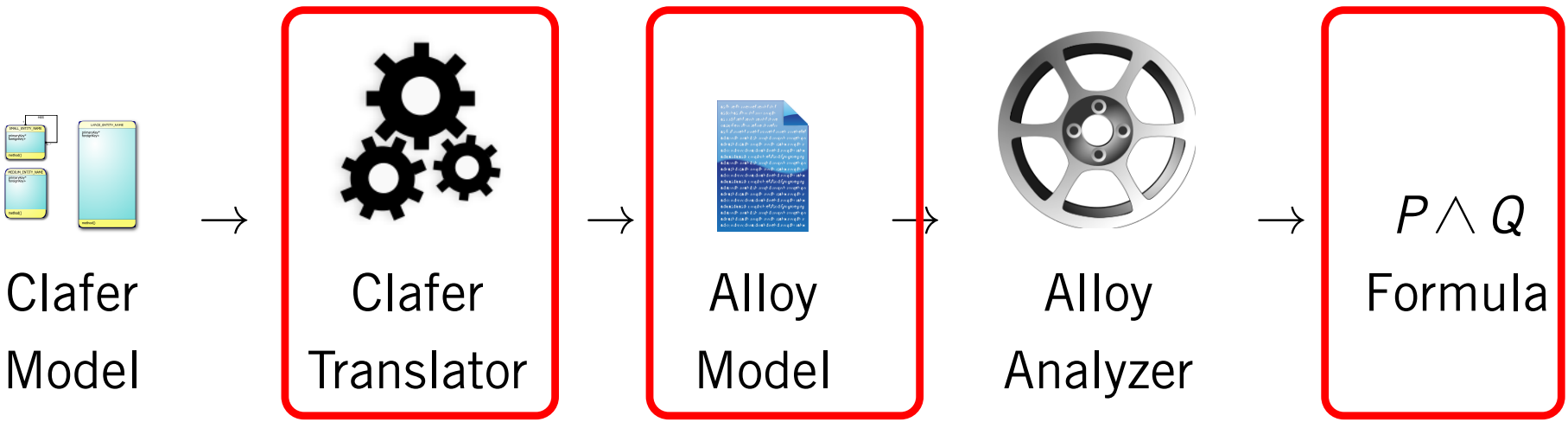


Translation rules heavily influence reasoning time in Alloy

Large Alloy files (complex models)

Ineffective Alloy representation (complex formulas)

Problems



Translation rules heavily influence reasoning time in Alloy

Large Alloy files (complex models)

Ineffective Alloy representation (complex formulas)

Slow clafer2alloy translator

Solution

Refactored and modular code architecture

User has control over the translation process

Intermediate language representation

Optimization of translation rules

The Translator

(Old) clafer2alloy Translator

Parser, desugarer, semantic analyzer, code generator

Monolithic

Haskell

Available online

Released source code

(New) clafer Translator

Front-end, intermediate representation, optimizer, generators

User can turn on/off modules (has extra knowledge)

Easy to add new code generators

Optimizations

No Unused Abstract Clafers

```
abstract display
  server ?

OnBoardComputer
```

OnBoardComputer

No Unused Abstract Clafers

```
abstract display
  server ?

OnBoardComputer
```

```
OnBoardComputer
```

No Redundant Hierarchical Constraints

Improved Name Resolution

Global Cardinality Constraints

Integers as Attributes

References are Relations

Unrolled Inheritance

Model Statistics

Evaluation

Conclusion

Conclusion

Modeling and analyzing SPLs

Concept modeling

Common infrastructure

Non-trivial analyses

Conclusion

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Thanks for listening!

Questions?

gsd.uwaterloo.ca/clafer