Strategic vision and road mapping:

Industrial success stories of answer set / constraint programming What's still open?

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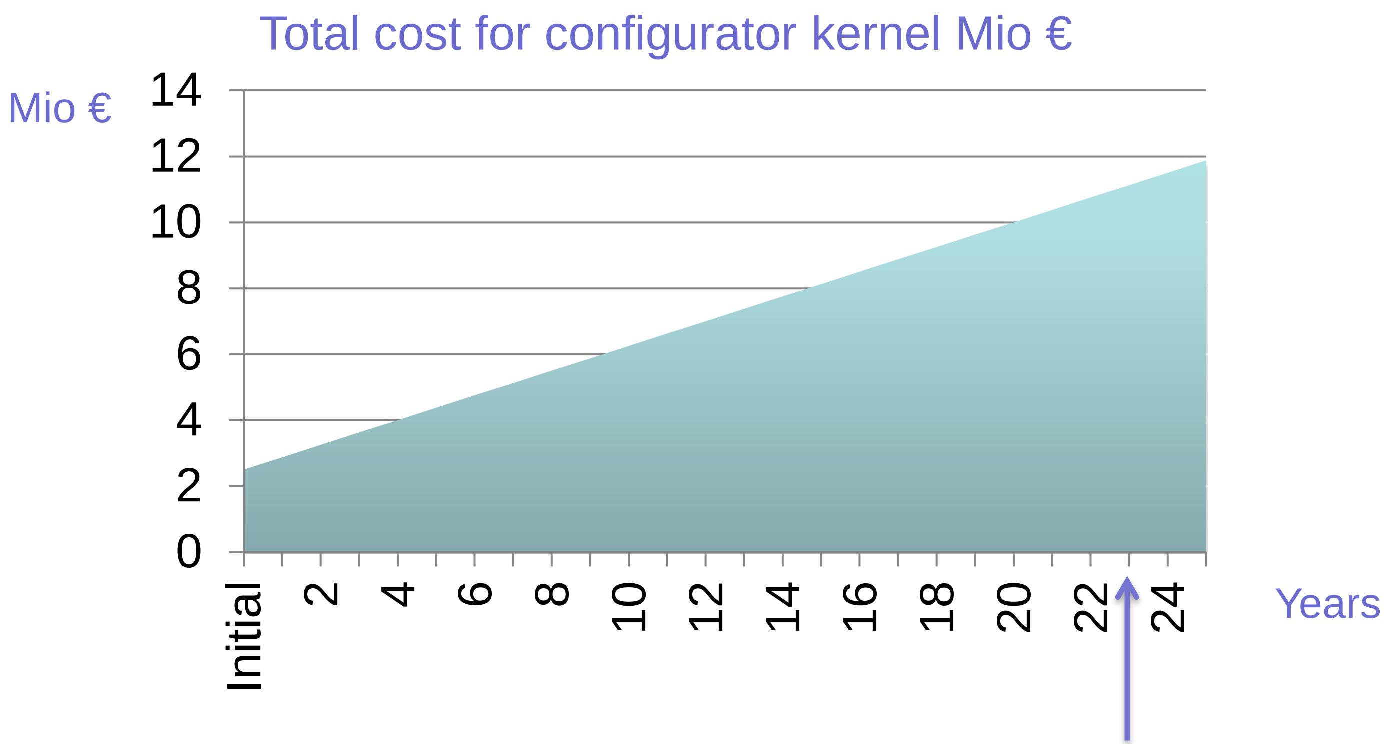
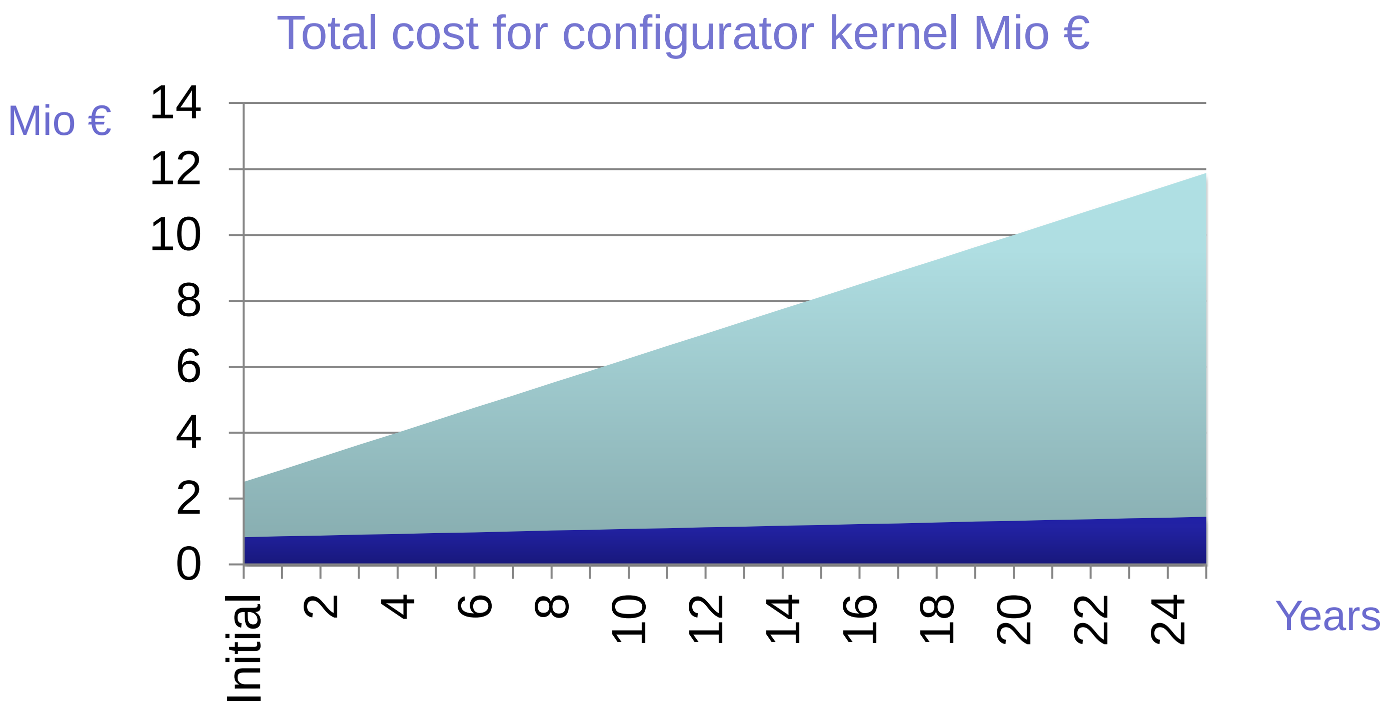
Automated engineering of large systems

Total cost of ownership for configurator kernel



Maintenance cost: approx. 15% per year of initial development cost

Achievements by moving to constraints



- Reduction of initial development cost by 66%
- Reduction of yearly maintenance cost by 80%
- Productivity increase by 300% (no additional staff)
- ROI in 1 year for the telecommunication domain
- Enhanced user interaction: explanations, incremental configuration, repair …

Why did it work?

1. Lazy expansion of the constraint network, i.e. instantiation of objects
2. Heuristics how to expand and to search

This worked in almost all cases

Falkner, A. A., Friedrich, G., Haselböck, A., Schenner, G., & Schreiner, H. (2016). Twenty- five years of successful application of constraint technologies at Siemens. AI Magazine, 37(4), 67–80.

But

- Ad hoc representation of constraints and heuristics embedded in a procedural programming language
- Handcrafted heuristics

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GOF vision of automated problem solving

Input for the solver:

- Input data D (dynamic): encoding the specific requirements
- Program P (“stable”): encoded by constraints or logic program
- Optimization criterion (“stable”)

Output (solution):

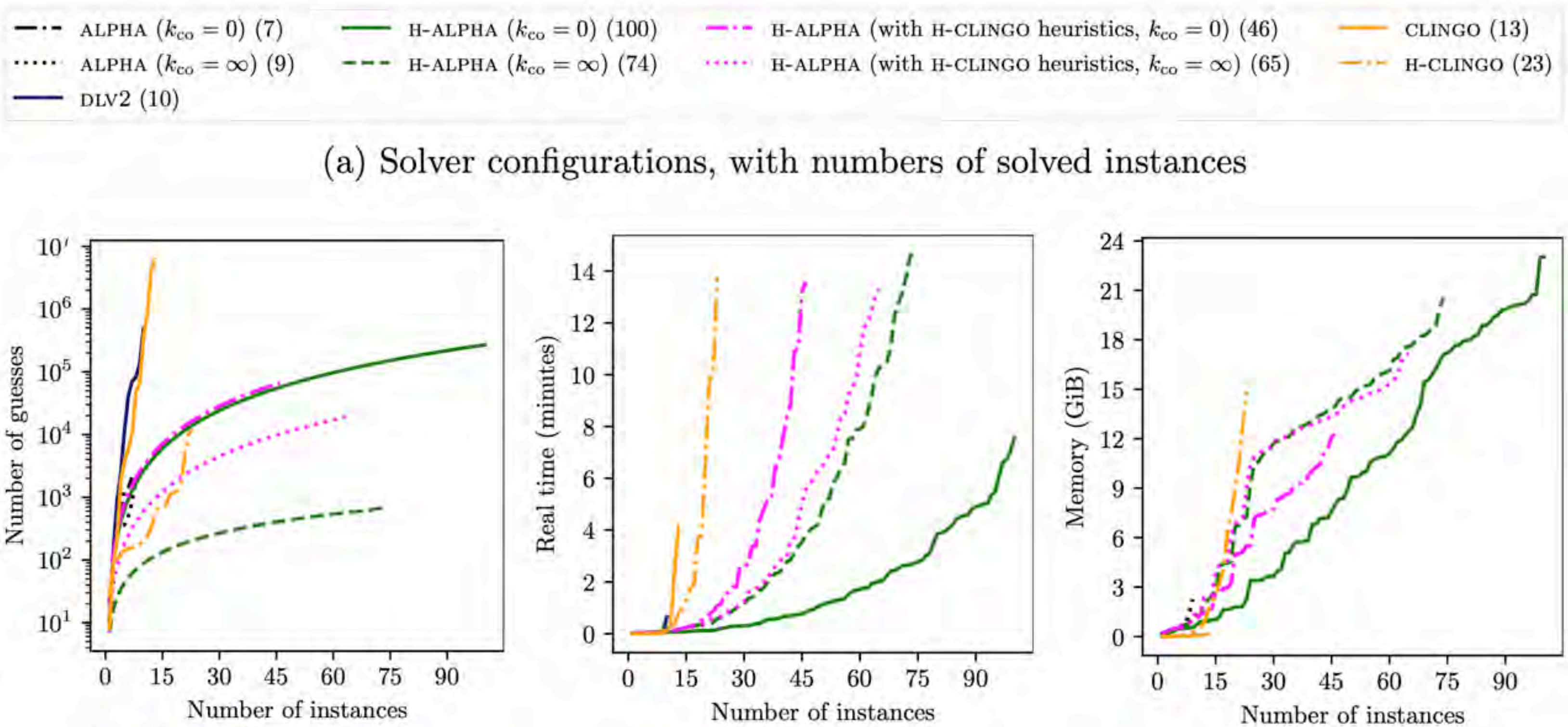
- Part of the (logical) model encoding the solution
  - Variable assignments
  - Facts
  - (Cost of a solution)

Some challenges

- **Memory consumption:**
  - Main stream tools of automated problem solving (logic programming, constraints, OR-methods, SAT, ...) follow the **ground-and-solve** principle
  - Superlinear memory consumption in size of problem instances
  - **Goal**: grounding as needed
- **Problem specific heuristics:**
  - Where do all these clever, handcrafted problem specific heuristics come from?
  - **Goal**: automated generation of problem specific heuristics
- **Learning of constraint models and optimization criteria:**
  - In some domains the (engineering) constraints cannot be specified with reasonable effort by humans
  - **Goal**: integration of first-principle reasoning (e.g. laws of physics) and empirical knowledge

Some results

Domain-Specific Heuristics in Answer Set Programming: A Declarative Non-Monotonic Approach. Comploi-Taupe, Friedrich, Schekotihin, Weinzierl



(a) Solver configurations, with numbers of solved instances

(b) Number of guesses (c) Time consumption (d) Memory consumption

Figure 6: Resource consumption for solving each simple PUP instance