One-way Model Transformations

In the Context of Technology Roadmapping

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Figure 1: *Obfuscation of the "Tank" block.* Given a model (**a**), the user selects a set of model elements to obfuscate (marked with ▭) and receives an interactive preview of the obfuscated model (**b**). This preview is continuously validated against the base model and allows to export the model for further use (i.e., communication with an industry partner).

Why?

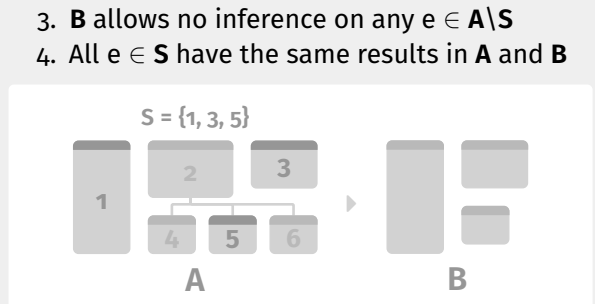
A lot of innovations require multiple parties to **exchange information**. However, with technology roadmapping, there are several reasons against sharing a complete model (e.g., the protection of **intellectual property**).

Currently, standalone models to be shared with others are produced manually. Hence, we propose an automated process to produce these models by removing or obfuscating unselected parts.

What?

Given a model **A** and a selection of its elements **S**, we want to produce a model **B**, that satisfies these constraints:

1. **B** has to be self-contained
2. **B** has all e ∈ **S**, but none from **A****S**
3. **B** allows no inference on any e ∈ **A****S**
4. All e ∈ **S** have the same results in **A** and **B**



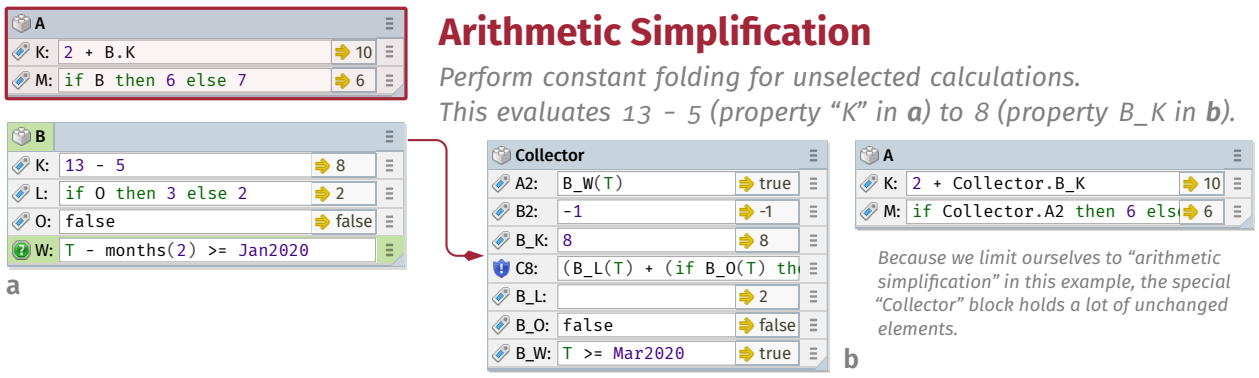
How?

We devised a set of **16 transformations** and analyzed them according to 9 properties (scope, …), as well as all four constraints (see "What?" above).

Furthermore, we've implemented a subset within the technology roadmapping tool **IRIS**, which is capable of modeling time, uncertainty, and more with its Excel-like syntax (cf. Figure 1).

Arithmetic Simplification

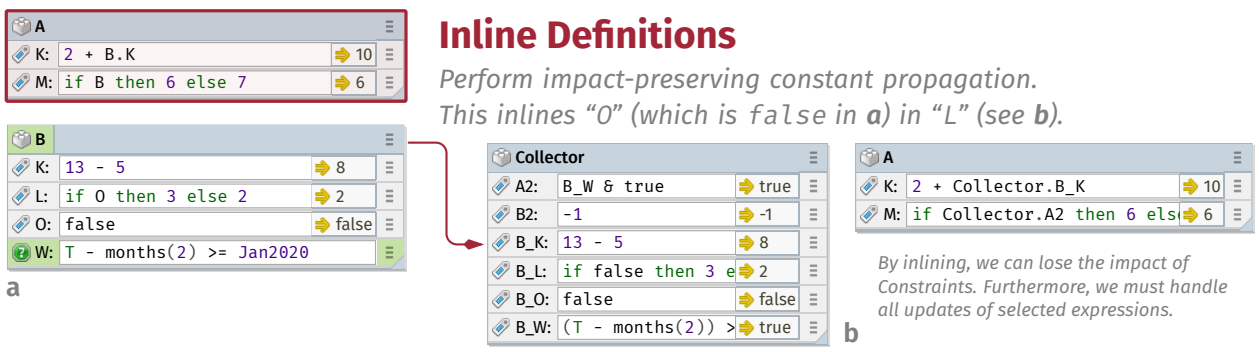
Perform constant folding for unselected calculations.
*This evaluates `13 - 5` (property "K" in **a**) to 8 (property `B_K` in **b**).*



Because we limit ourselves to "arithmetic simplification" in this example, the special "Collector" block holds a lot of unchanged elements.

Inline Definitions

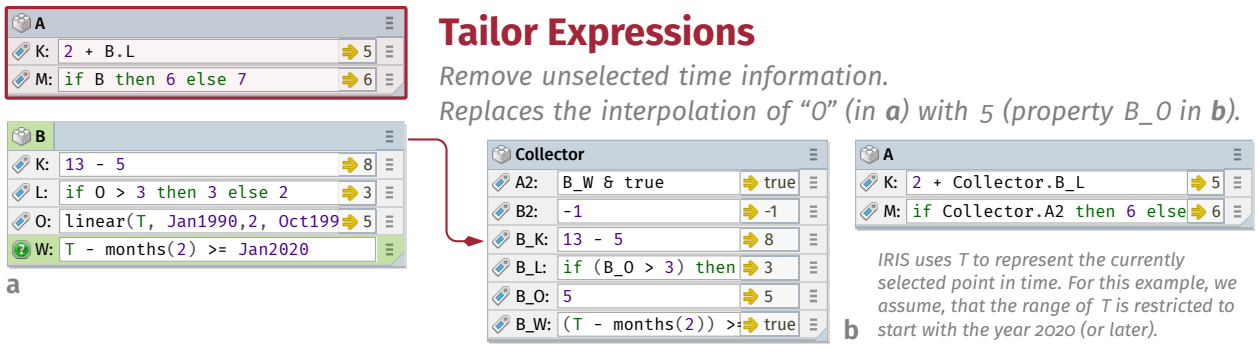
Perform impact-preserving constant propagation.
*This inlines "O" (which is `false` in **a**) in "L" (see **b**).*



By inlining, we can lose the impact of Constraints. Furthermore, we must handle all updates of selected expressions.

Tailor Expressions

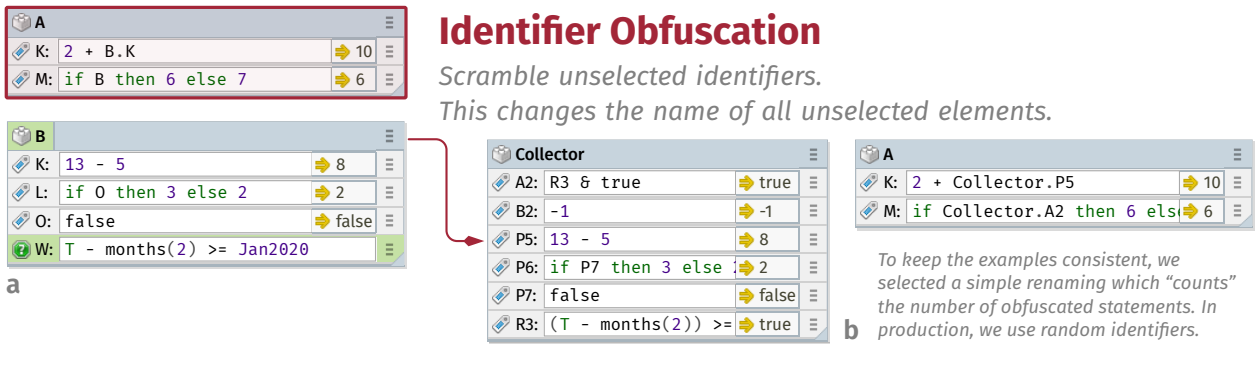
Remove unselected time information.
*Replaces the interpolation of "0" (in **a**) with 5 (property `B_O` in **b**).*



IRIS uses T to represent the currently selected point in time. For this example, we assume, that the range of T is restricted to start with the year 2020 (or later).

Identifier Obfuscation

Scramble unselected identifiers.
This changes the name of all unselected elements.



To keep the examples consistent, we selected a simple renaming which "counts" the number of obfuscated statements. In production, we use random identifiers.