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Institute for Software Systems Engineering
Technologies for building better software

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A Tool for Collaborative Consistency Checking During Modeling

CoPaMo'24

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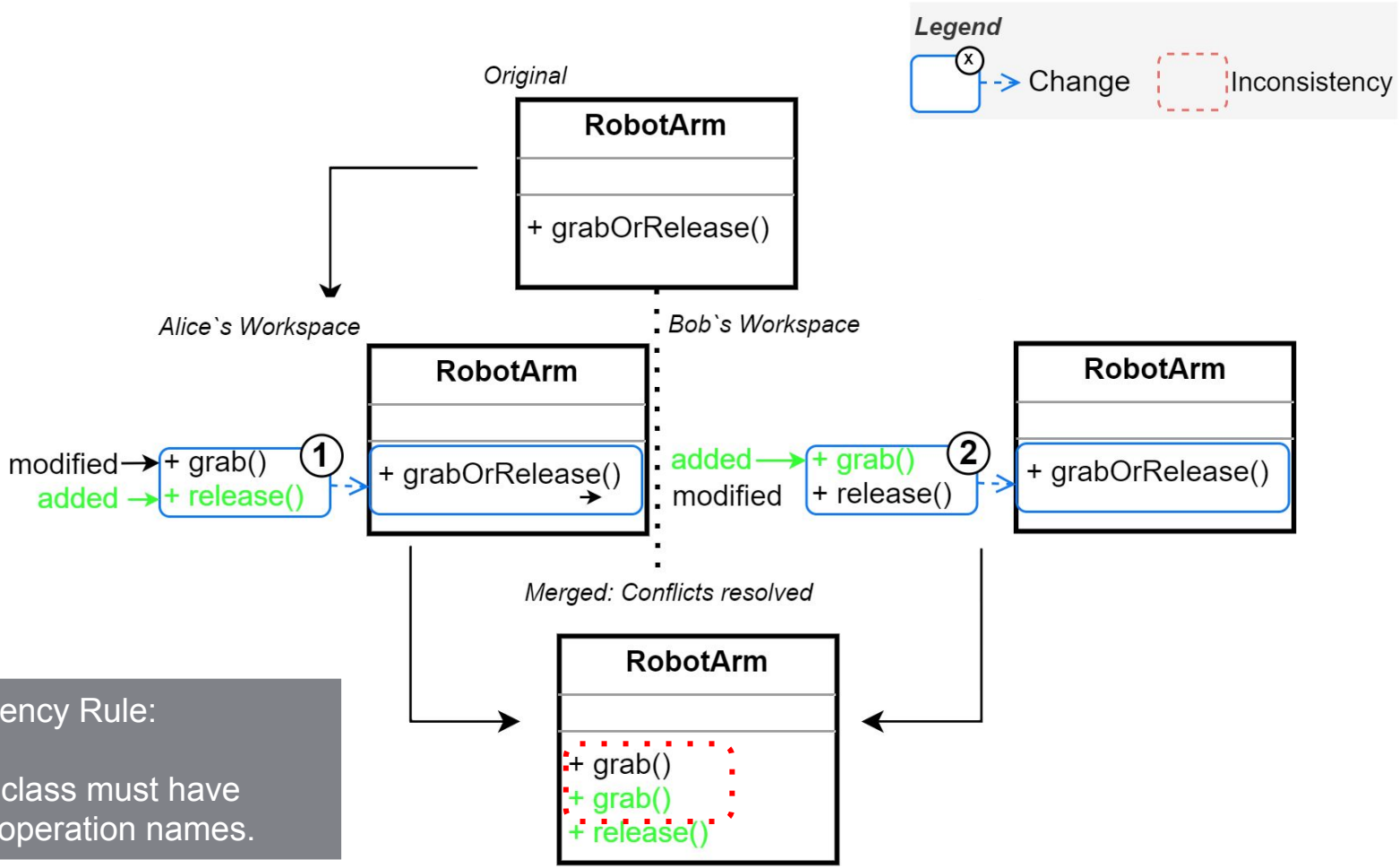
Illustrative example



Consistency Rule:

CR1: A class must have unique operation names.

Context and Motivation

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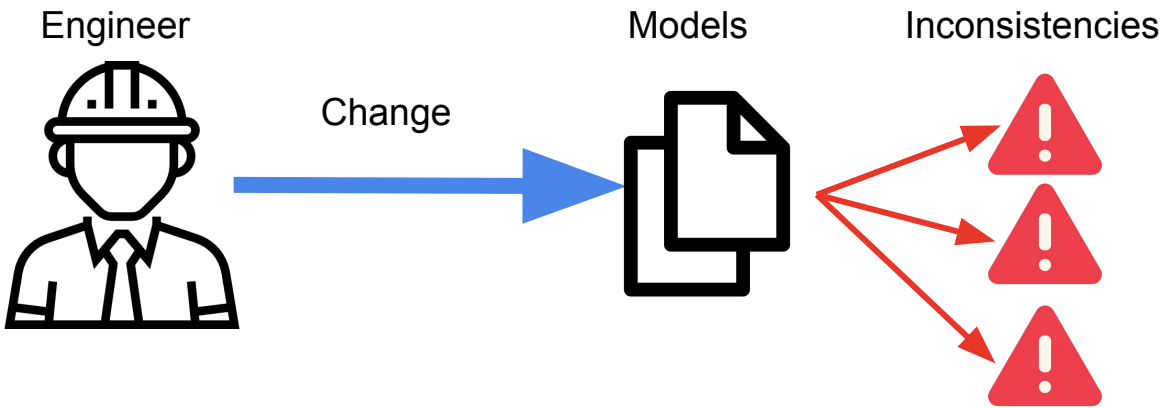
- In a collaborative modeling engineering environment, even a simple change can cause one or multiple inconsistencies



Context and Motivation

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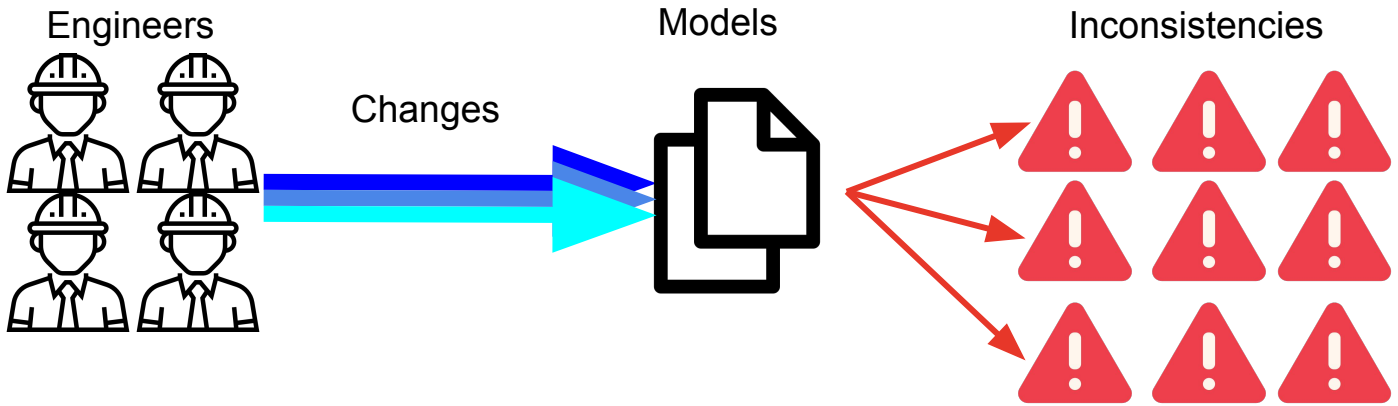
- In a collaborative modeling engineering environment, even a simple change can cause one or multiple inconsistencies
- Multiple engineers can generate a stream of multiple changes



Context and Motivation

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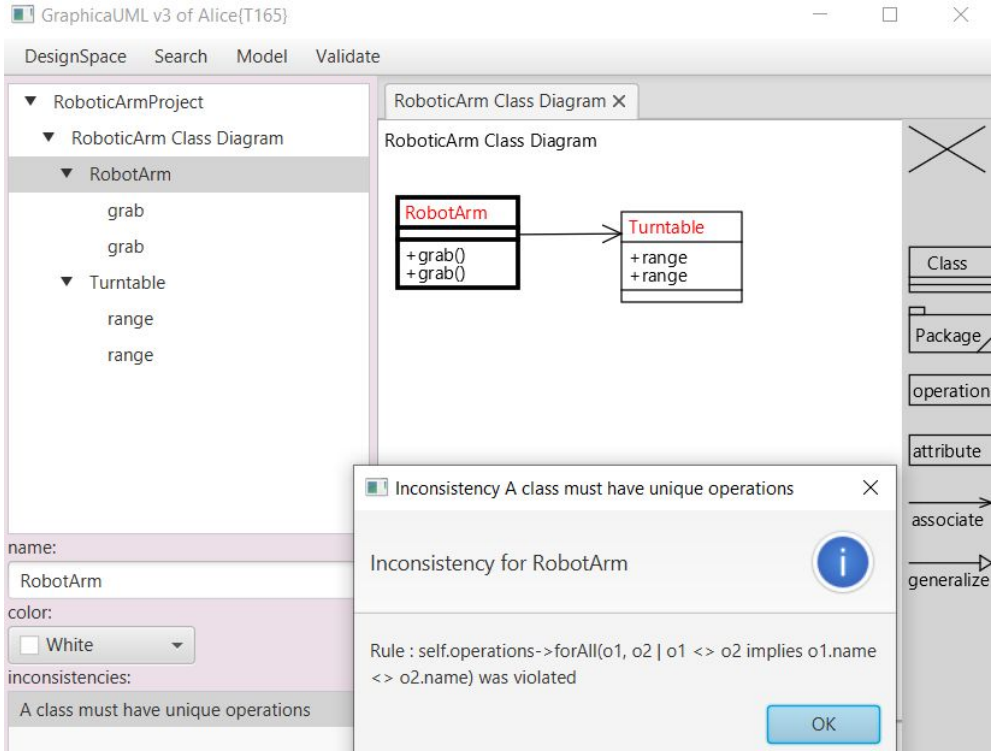
- State of the practice in consistency checking[1]:
  - Limited adoption due to effort/time required
  - Lack of guidance leads to cascading problems
  - Manual repairs are performed (an error-prone activity)

- Current approaches [2]:
  - Collaborative modelling tools can enhance the consistency checking process
  - Consistency checking tools lack collaborative features

1. Jongeling, R., Ciccozzi, F., Carlson, J., & Cicchetti, A. (2022). Consistency management in industrial continuous model-based development settings: a reality check. Software and Systems Modeling, 21(4), 1511-1530.
2. Torres, W., Van den Brand, M. G., & Serebrenik, A. (2021). A systematic literature review of cross-domain model consistency checking by model management tools. Software and Systems Modeling, 20, 897-916.

Main Contribution

UI of the consistency service for creating a CR



The DesignSpace Environment Considering Collaborative Consistency Checking

Main Contribution - Architecture

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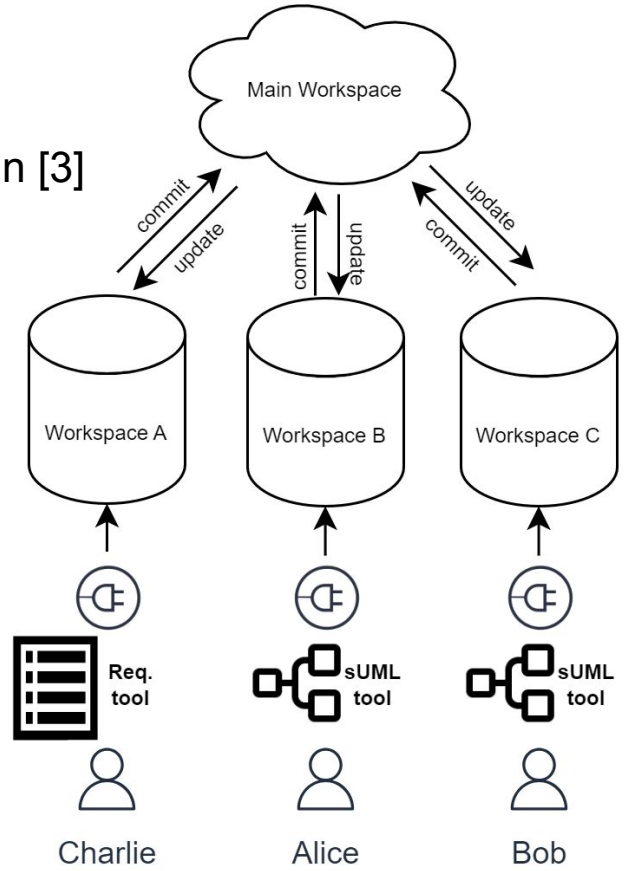
The architecture was proposed in [3]



3. Herac, Edvin, et al. "A flexible operation-based infrastructure for collaborative model-driven engineering."

Main Contribution - Metamodel

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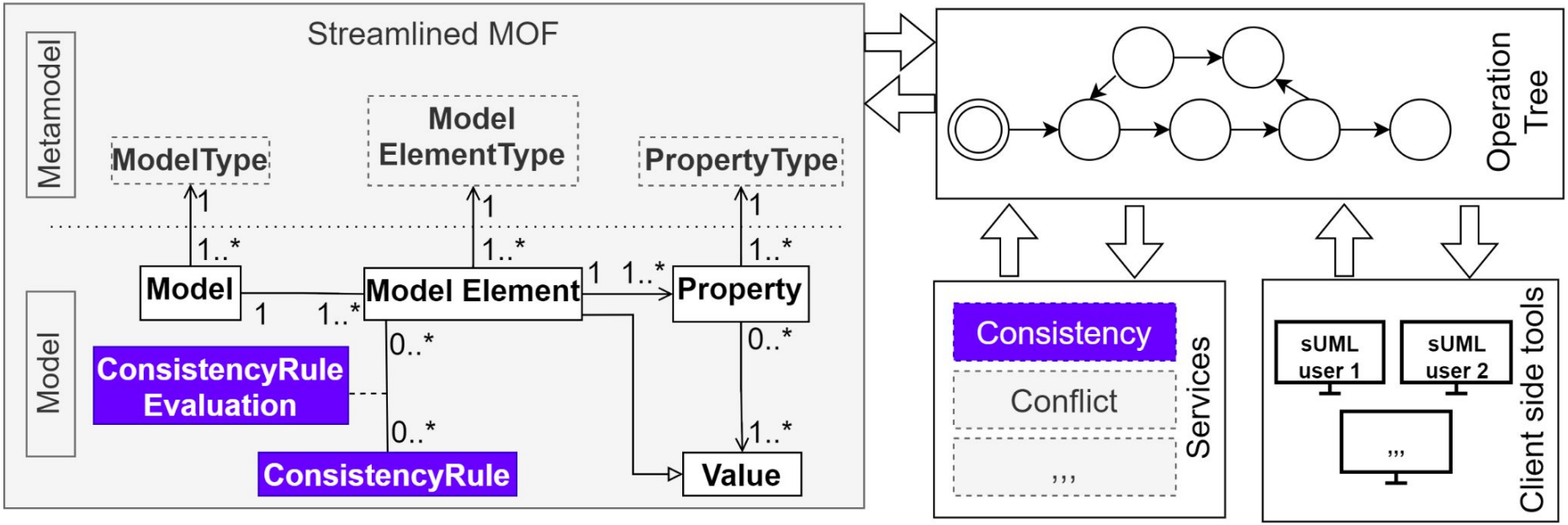

The DesignSpace Environment Considering Collaborative Consistency Checking

Main Contribution - Eval. Tree

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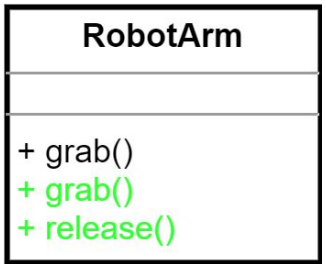
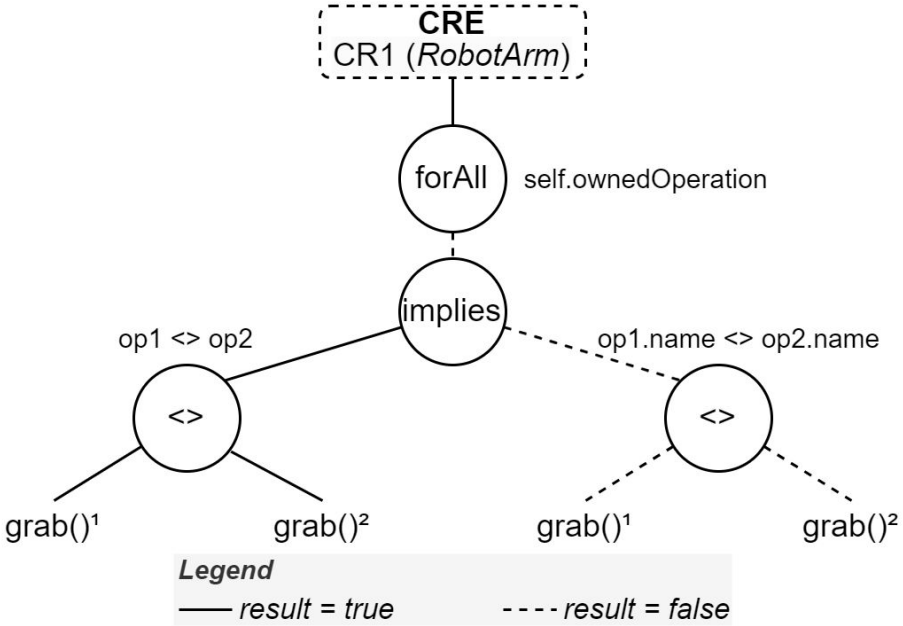
Consistency Rule:

CR1: A class must have unique operation names.

Context: Class

Def: self.ownedOperation->ForAll(op1,op2| op1<>op2 implies op1.name<>op2.name).





Evaluation Tree for CR1 Applied to RobotArm

Video demo

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https://www.youtube.com/watch?v=9kweKeBHx5Y

Conclusion and Future Work

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- The DesignSpace metamodel allows extending support to heterogeneous tools like IntelliJ
  - We need visualization mechanisms to display inconsistencies

- DesignSpace also supports metamodel evolution and co-evolution of models [4], enabling modeling across different metamodel versions.
  - We plan to extend the co-evolution to also consider consistency rules

4. Homolka, Marcel, et al. ""What Happened to my Models?" History-Aware Co-Existence and Co-Evolution of Metamodels and Models."

Conclusion and Future Work

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- Add missing QoL features:
  - better description of inconsistencies
  - support for visualizing inconsistencies from multiple diagrams at once
- Add a visualization for the repairs generated for the inconsistencies, based on [5]
- Perform a user study to evaluate the tool's usability and benefits, based on [6]

5. Marchezan, Luciano, et al. "Generating repairs for inconsistent models." Software and systems modeling 22.1 (2023): 297-329.
6. Marchezan, Luciano, et al. "Do developers benefit from recommendations when repairing inconsistent design models? a controlled experiment." Proceedings of the 27th International Conference on Evaluation and Assessment in Software Engineering. 2023.

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Thank you!

Q&A

Video

Doc. and JAR

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