UNIVERSITÄT ZU LÜBECK
INSTITUTE FOR SOFTWARE ENGINEERING
AND PROGRAMMING LANGUAGES

HØGSKOLEN I BERGEN
BERGEN UNIVERSITY COLLEGE

Integration of Runtime Verification into Metamodeling for Simulation and Code Generation (Position Paper)

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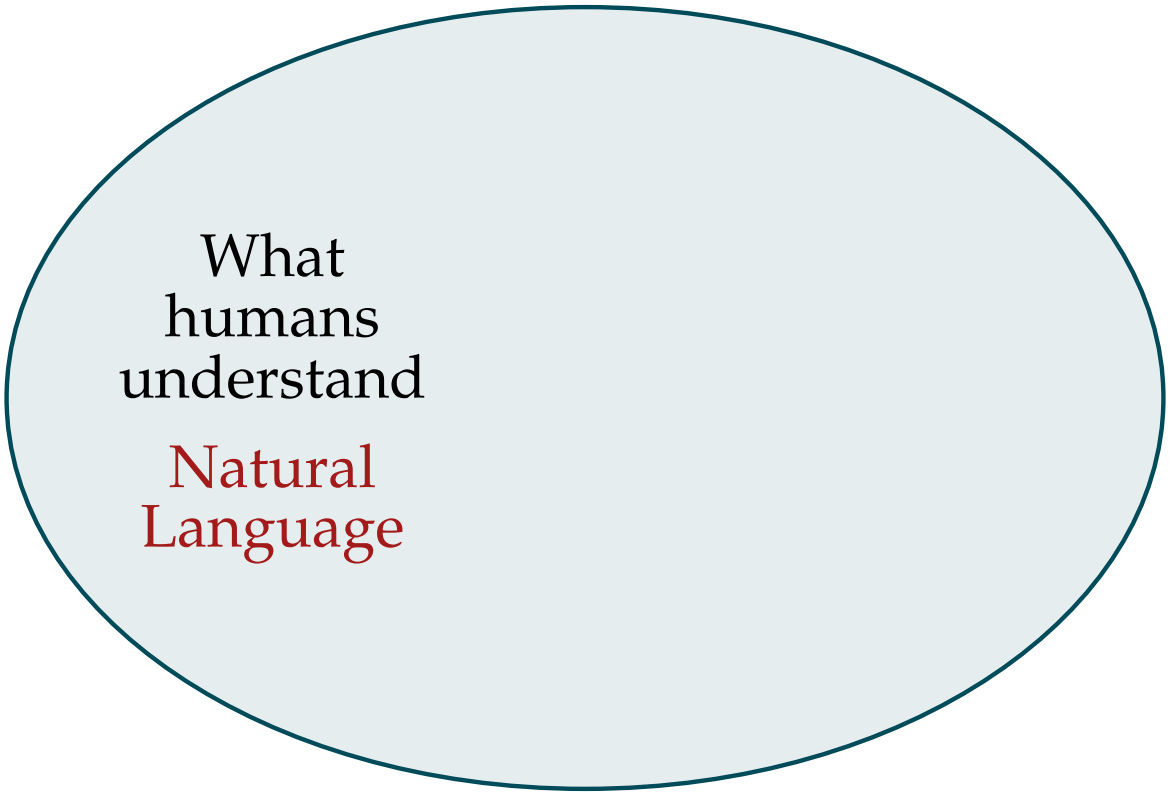
Why Modeling?



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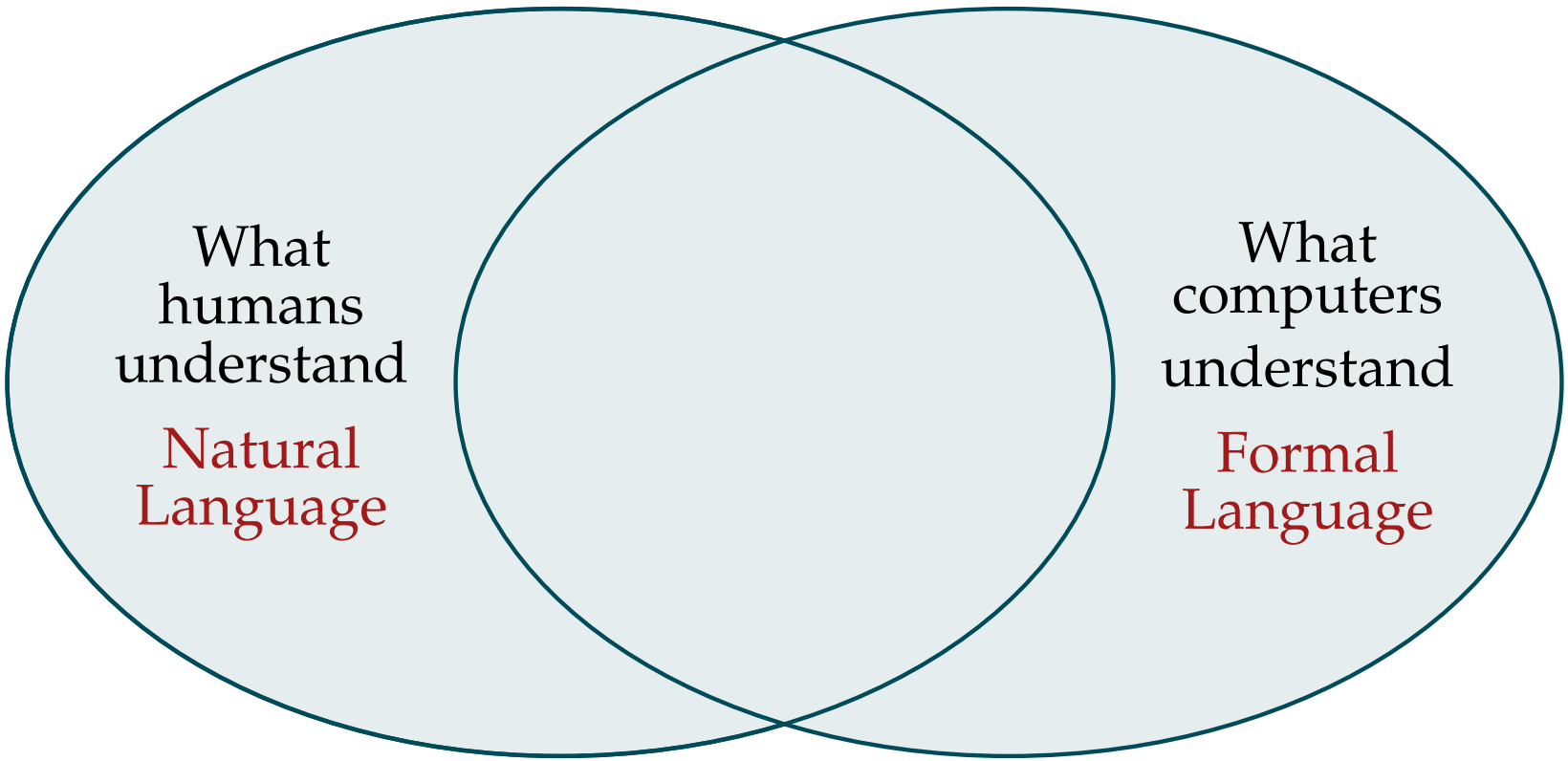

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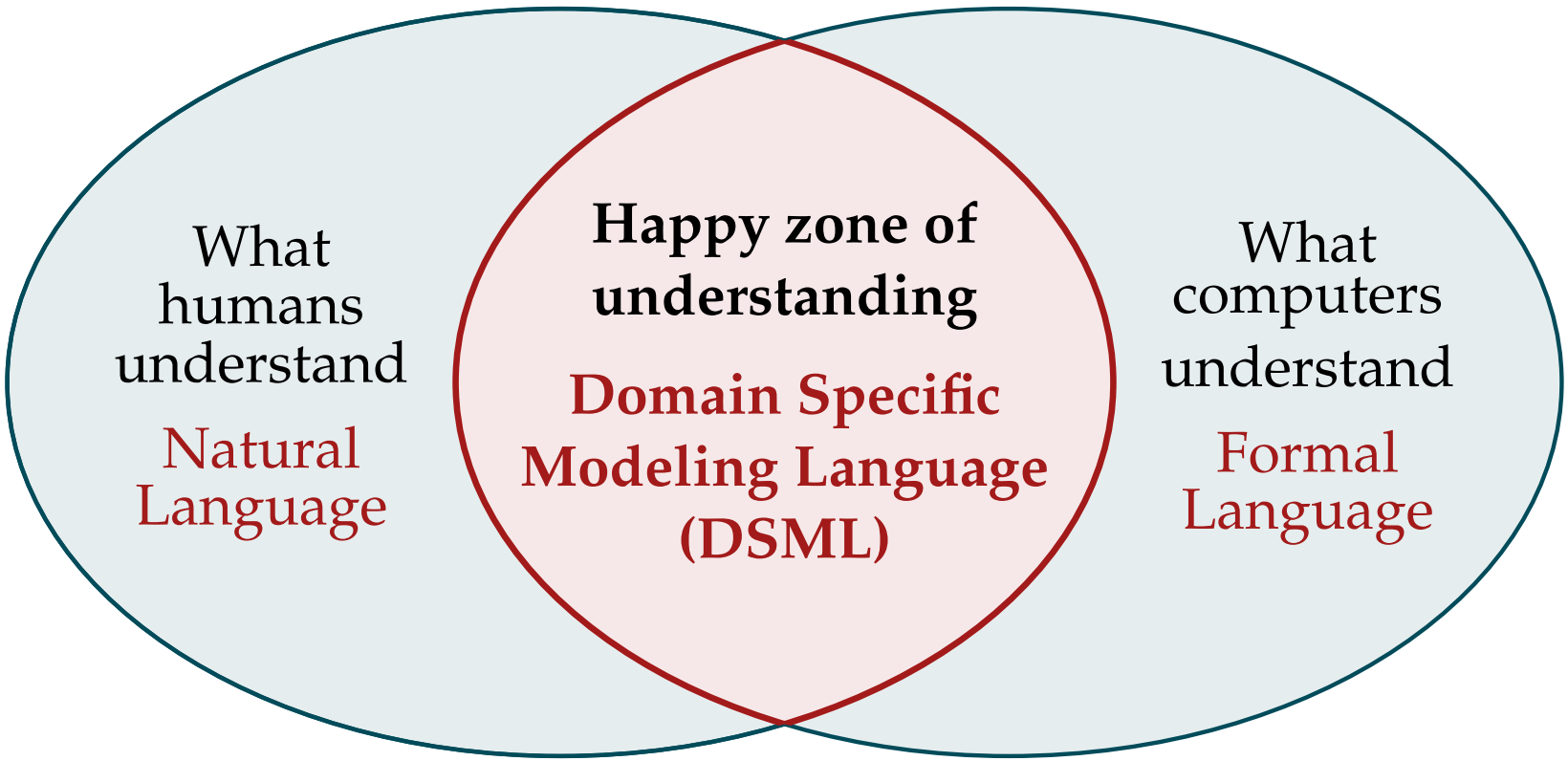


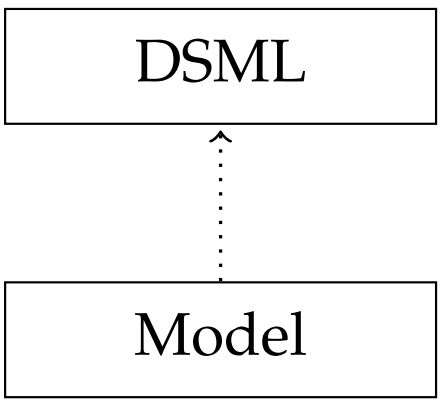
Runtime Verification

- DSMLs do not shield the software from design errors
- Testing is seldom exhaustive
- Model Checking can be performed on most models, but how to detect the unexpected on target platforms?
- Runtime Verification checks execution of real system
  - Consider environmental influences
  - React to failures

Integrating RV into Modeling

Goal

$\Rightarrow$ Integrate verification into software engineering process.
$\Rightarrow$ Domain experts and verification engineers use same model.



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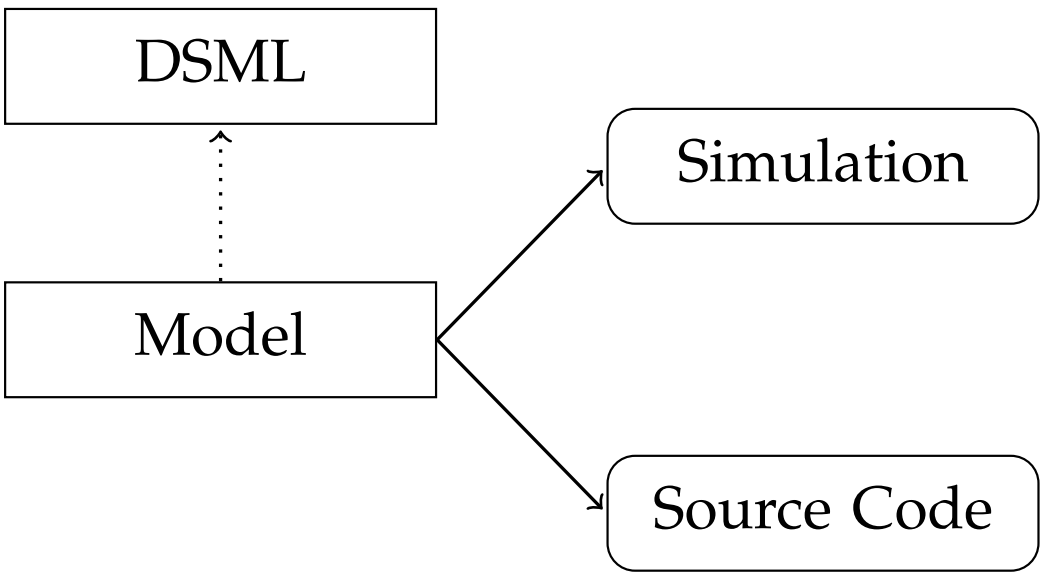

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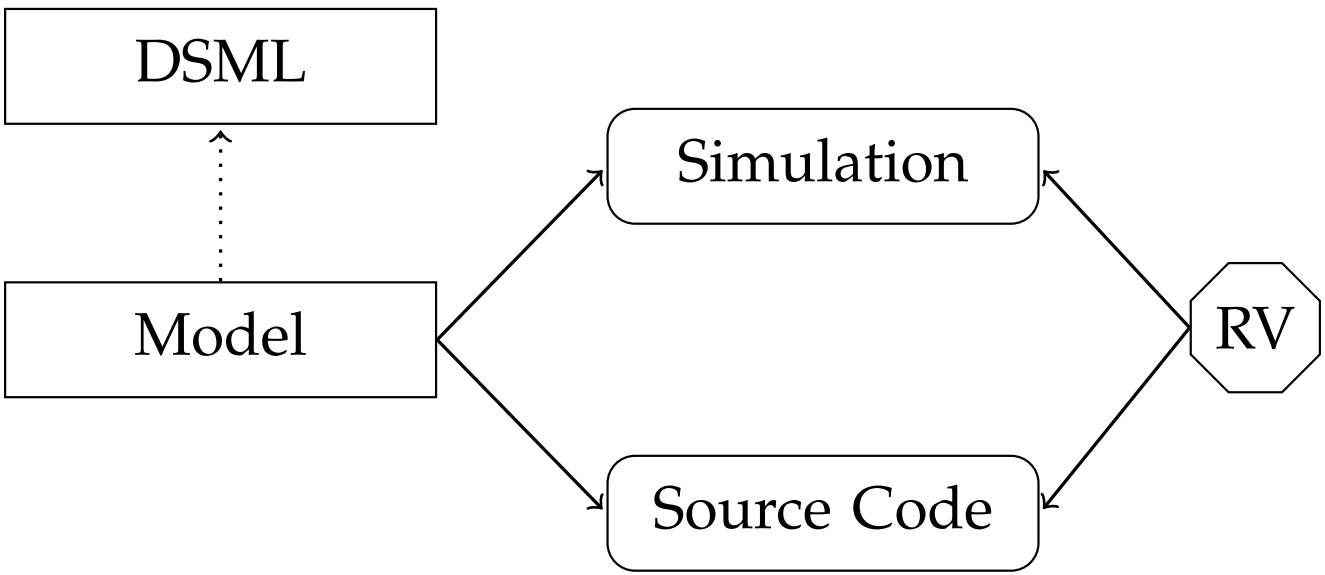
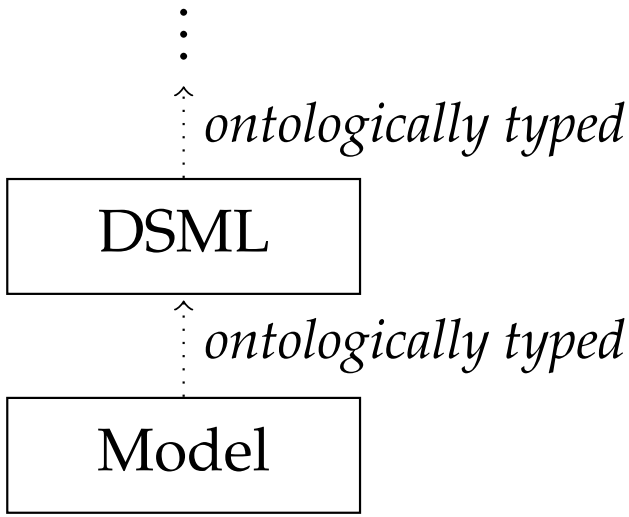


Multilevel Metamodeling



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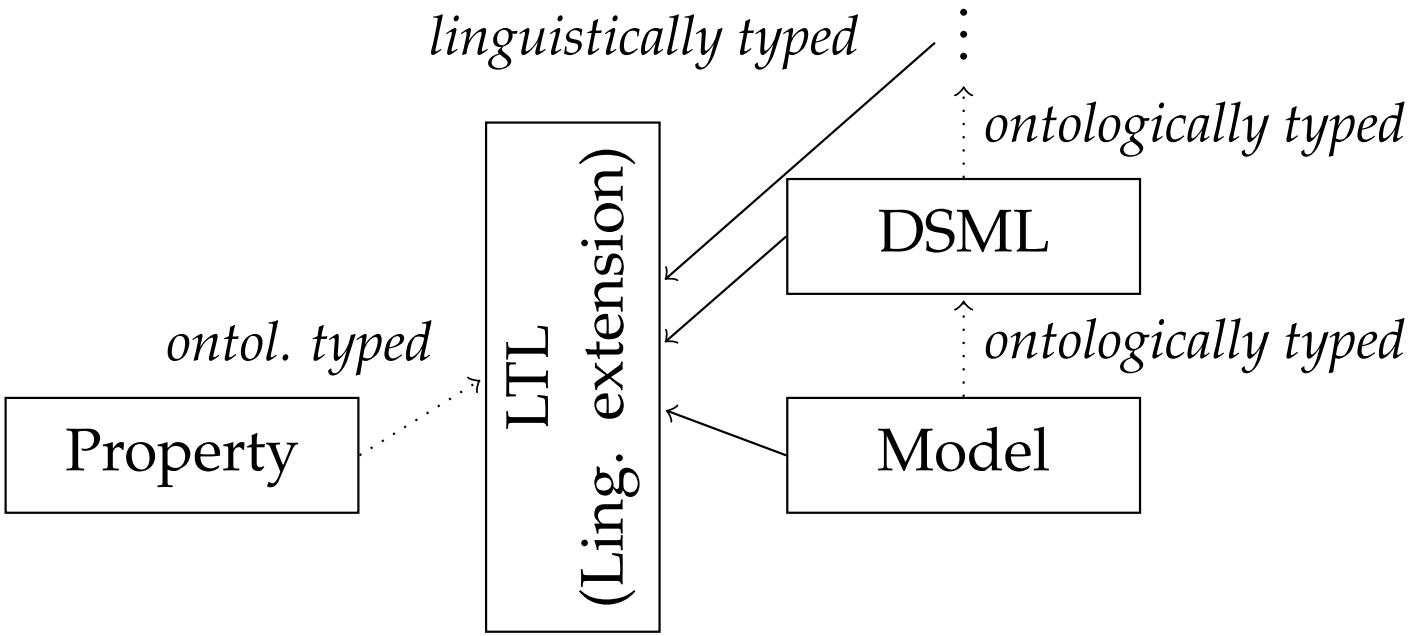

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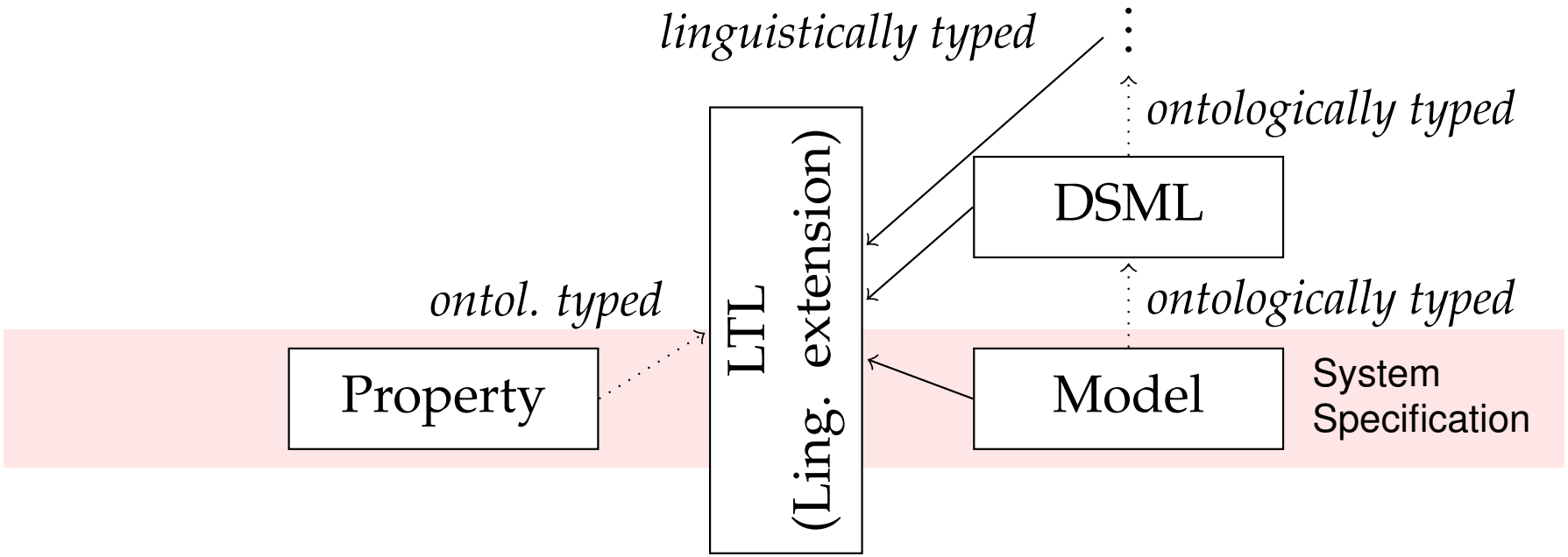

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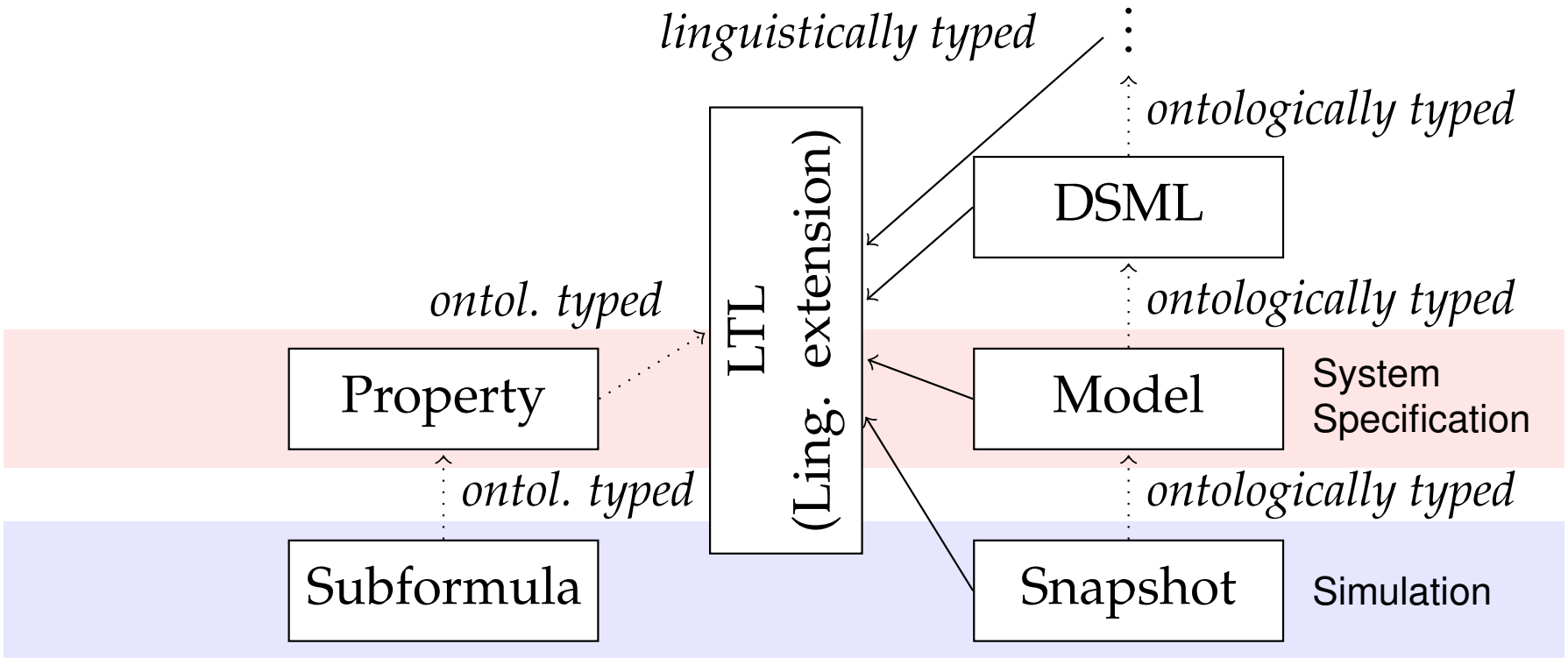

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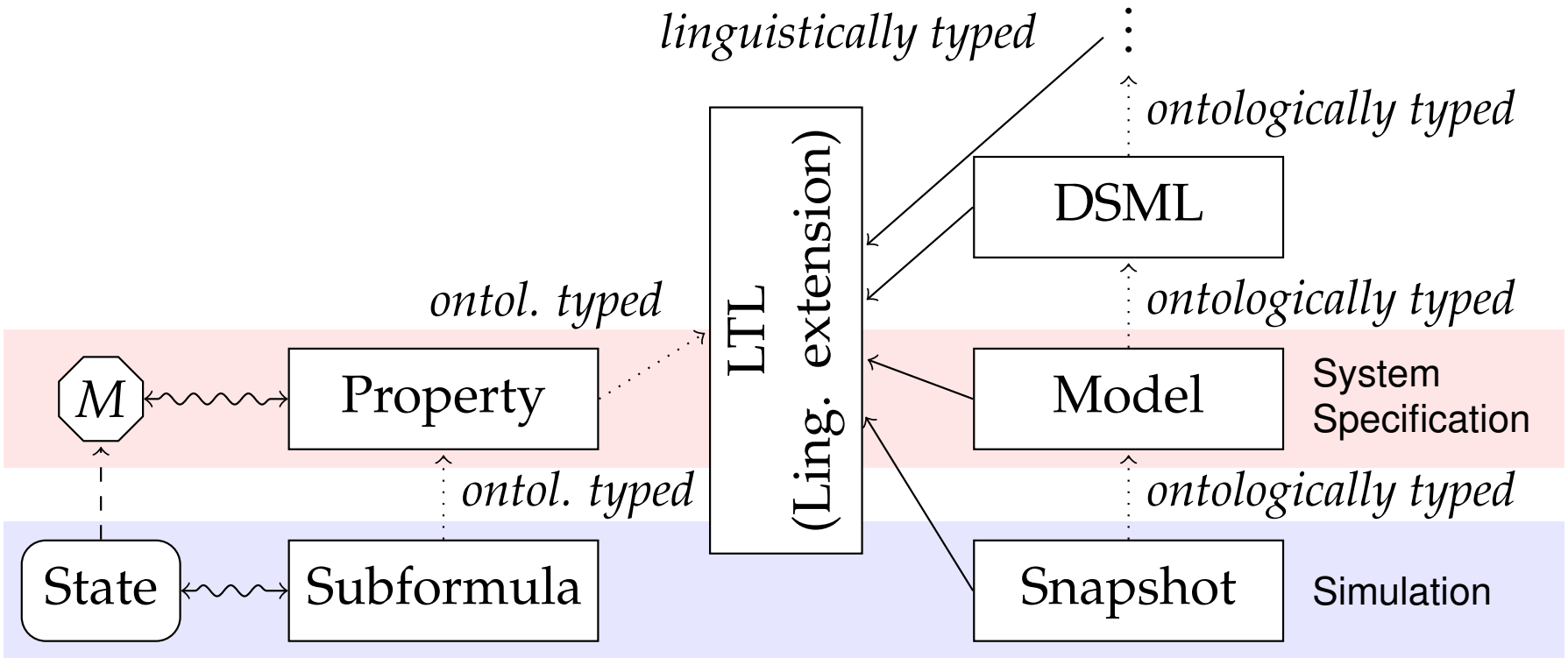
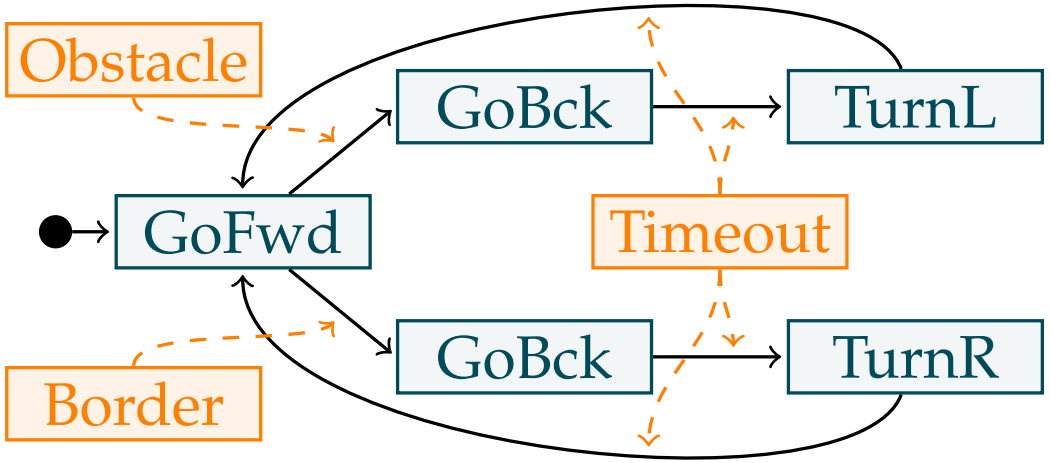


Example Scenario



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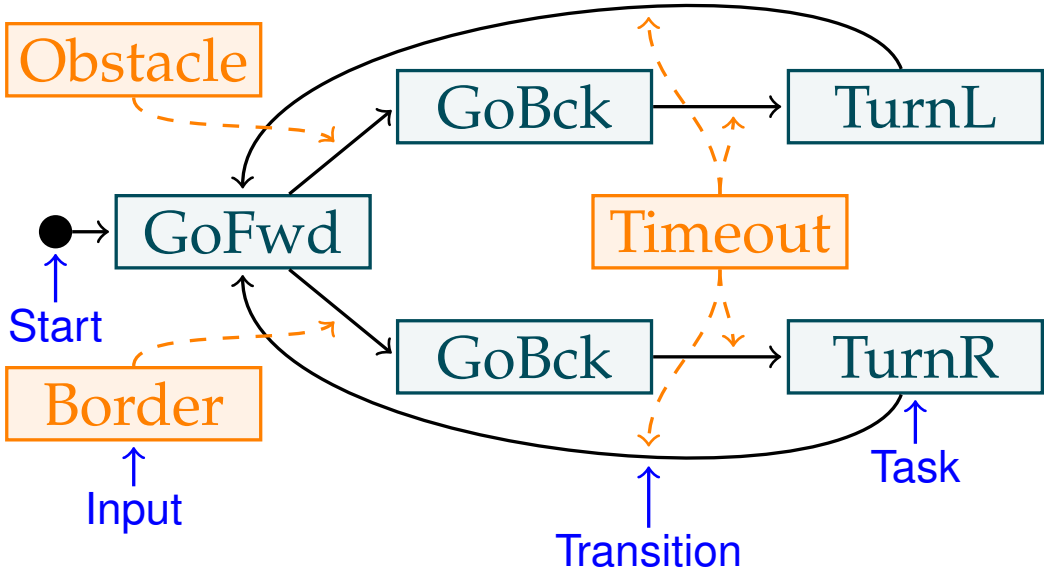

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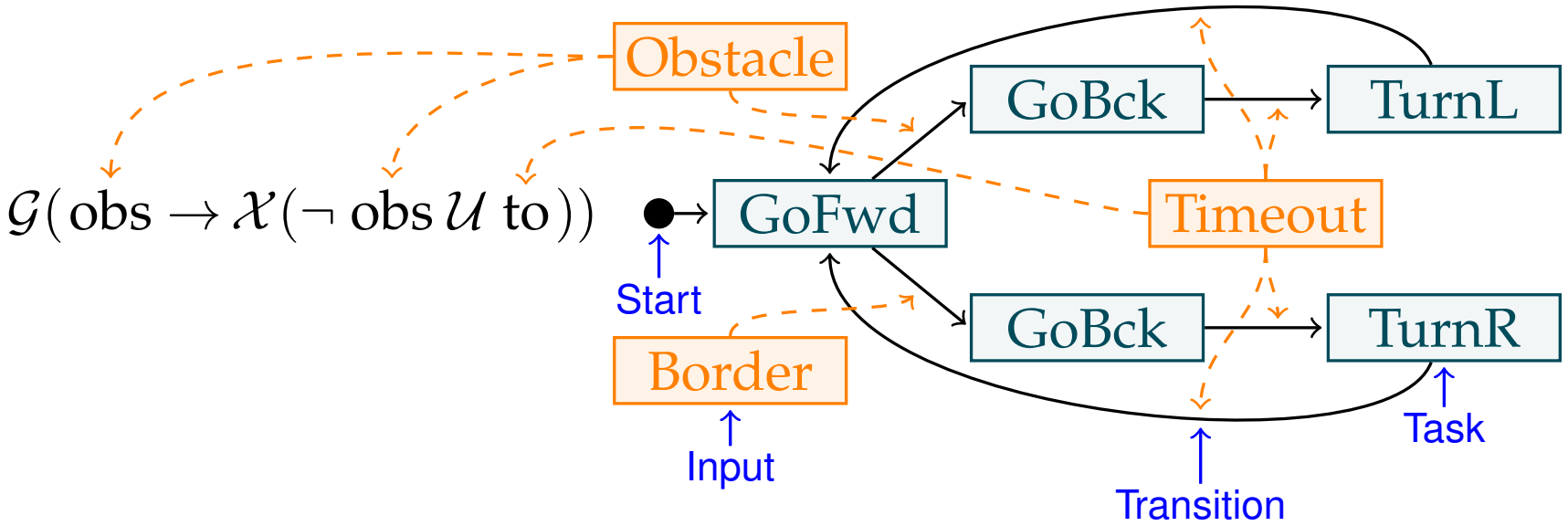
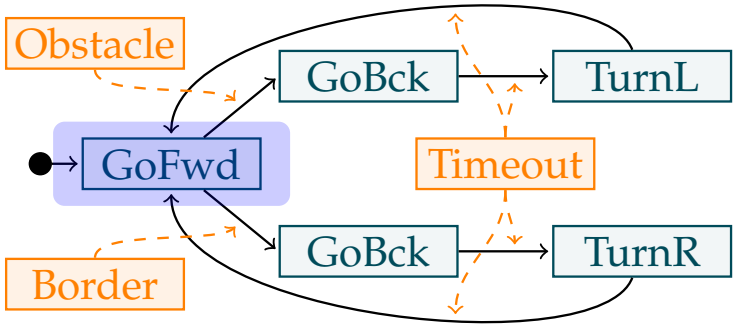


Example Simulation



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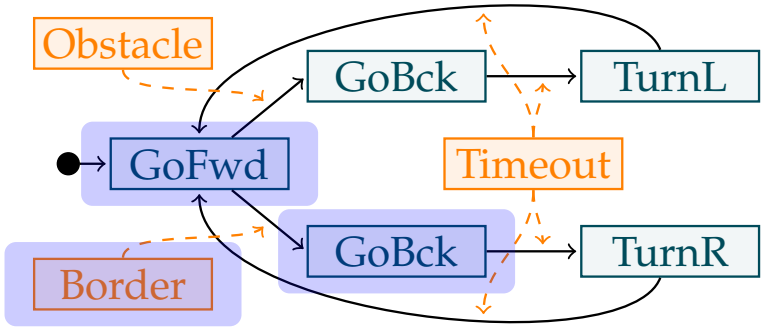

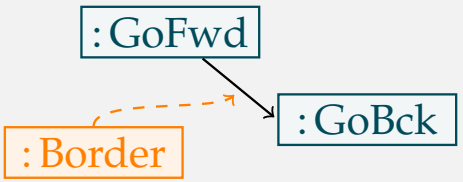

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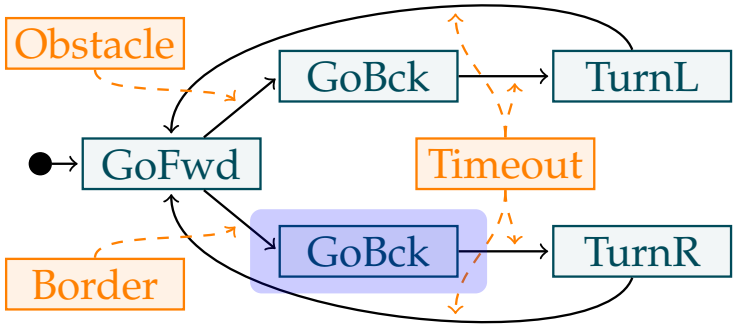

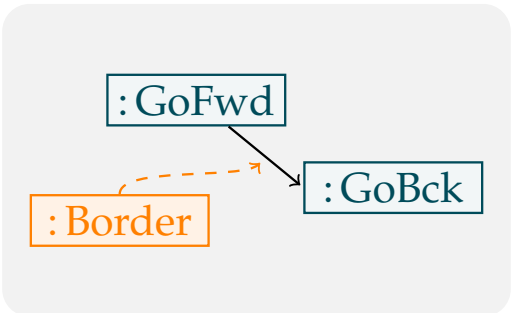

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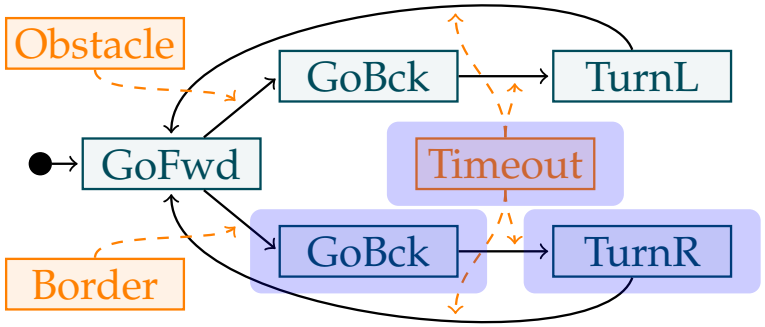

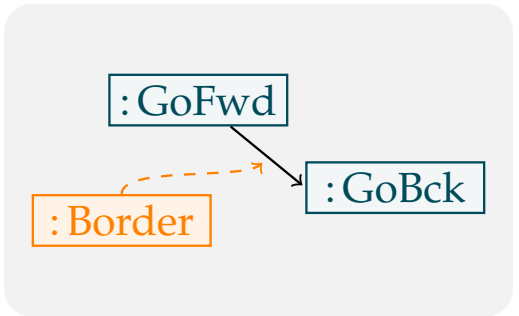

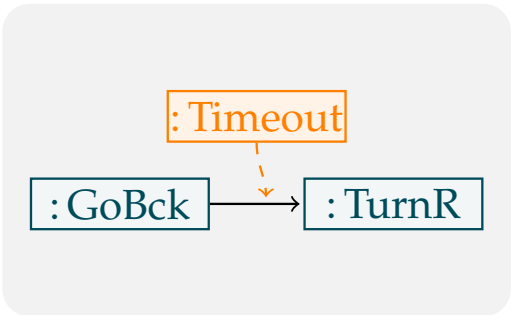

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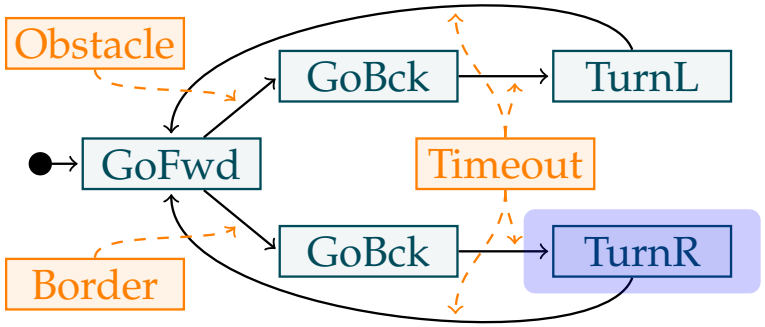

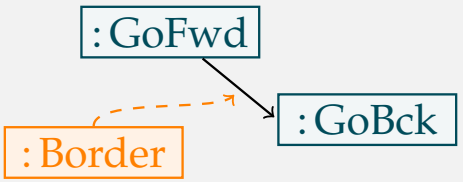

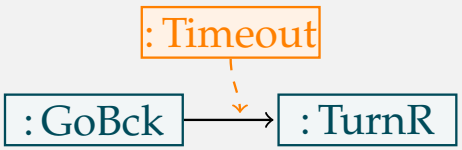

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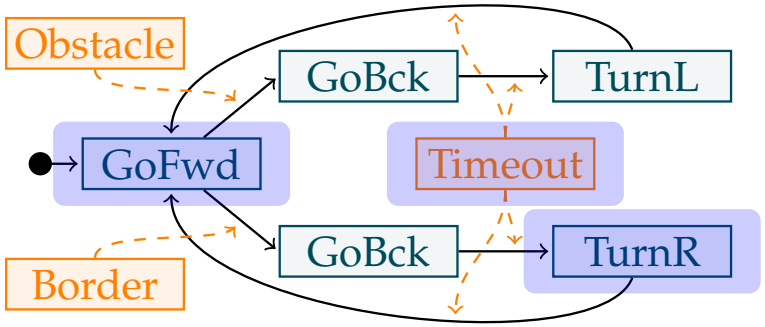
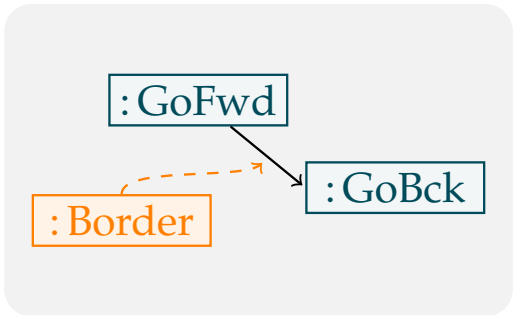
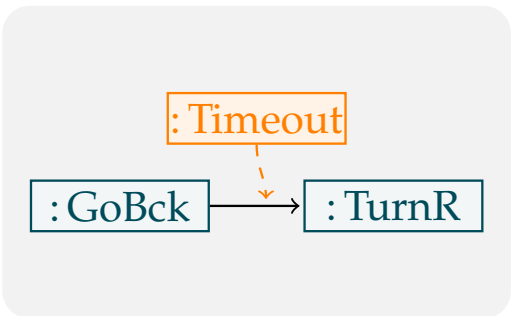
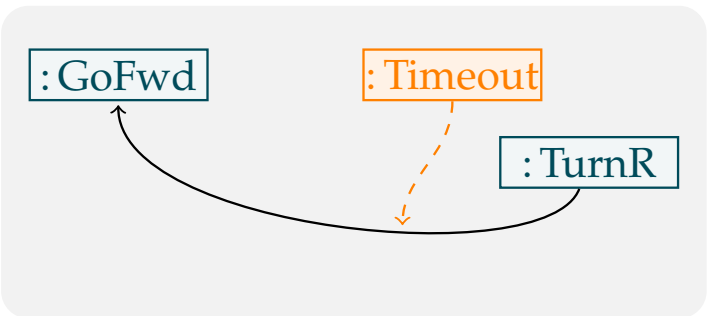
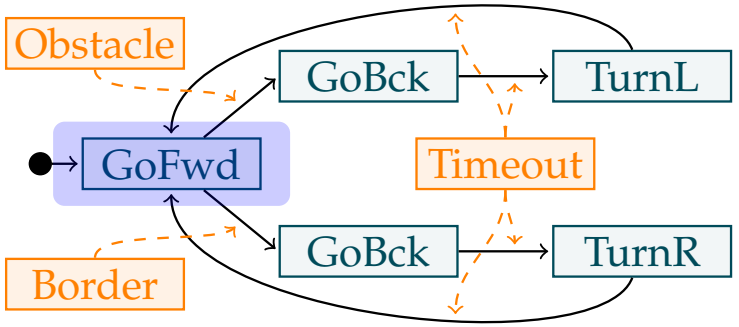








Example Simulation II



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$\mathcal{G}(\text{obs} \rightarrow \mathcal{X}(\neg\, \text{obs}\, \mathcal{U}\, \text{to}))$

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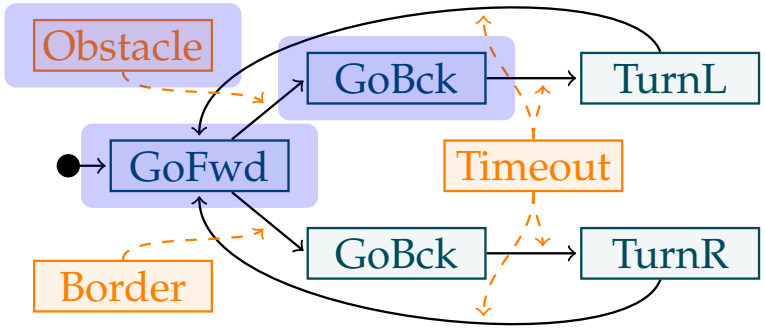

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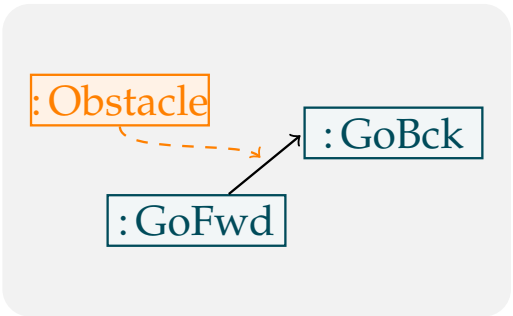

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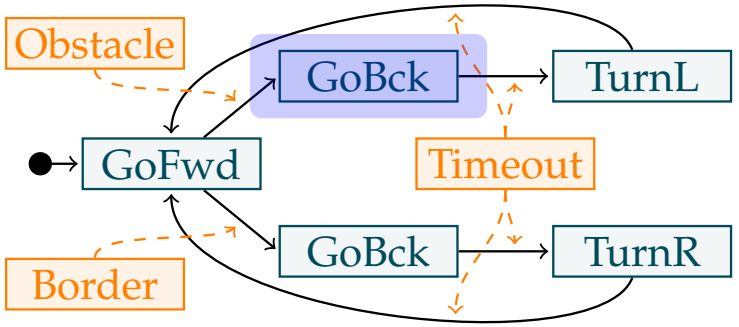

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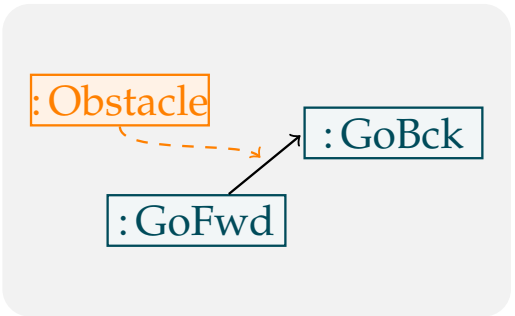

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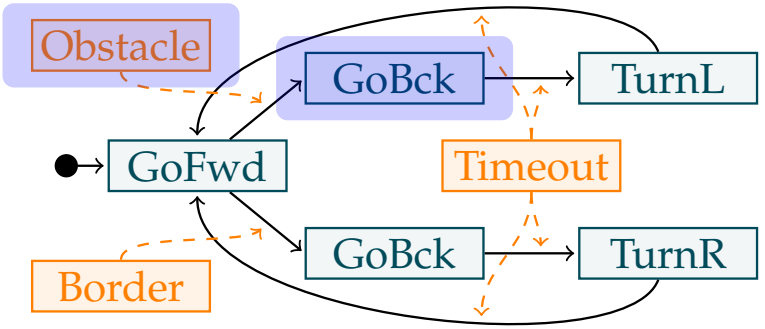

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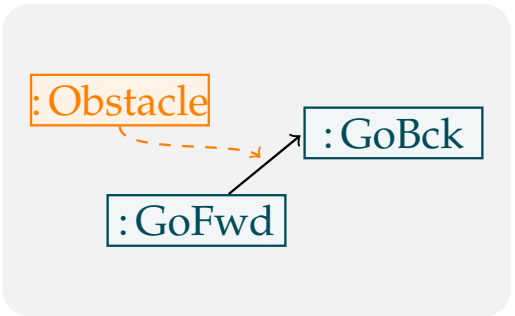

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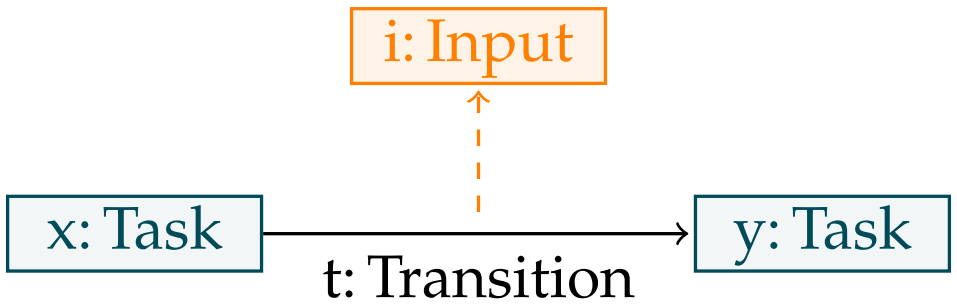
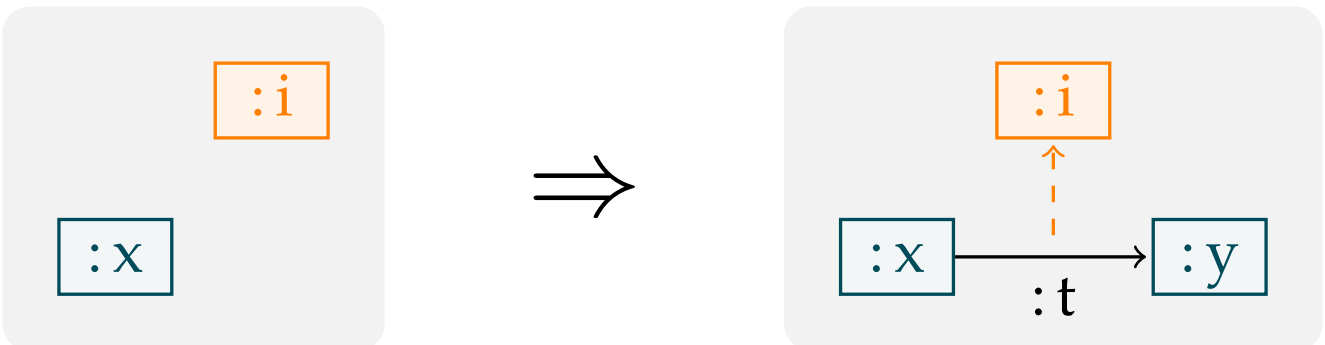
Coupled Model Transformation Rules





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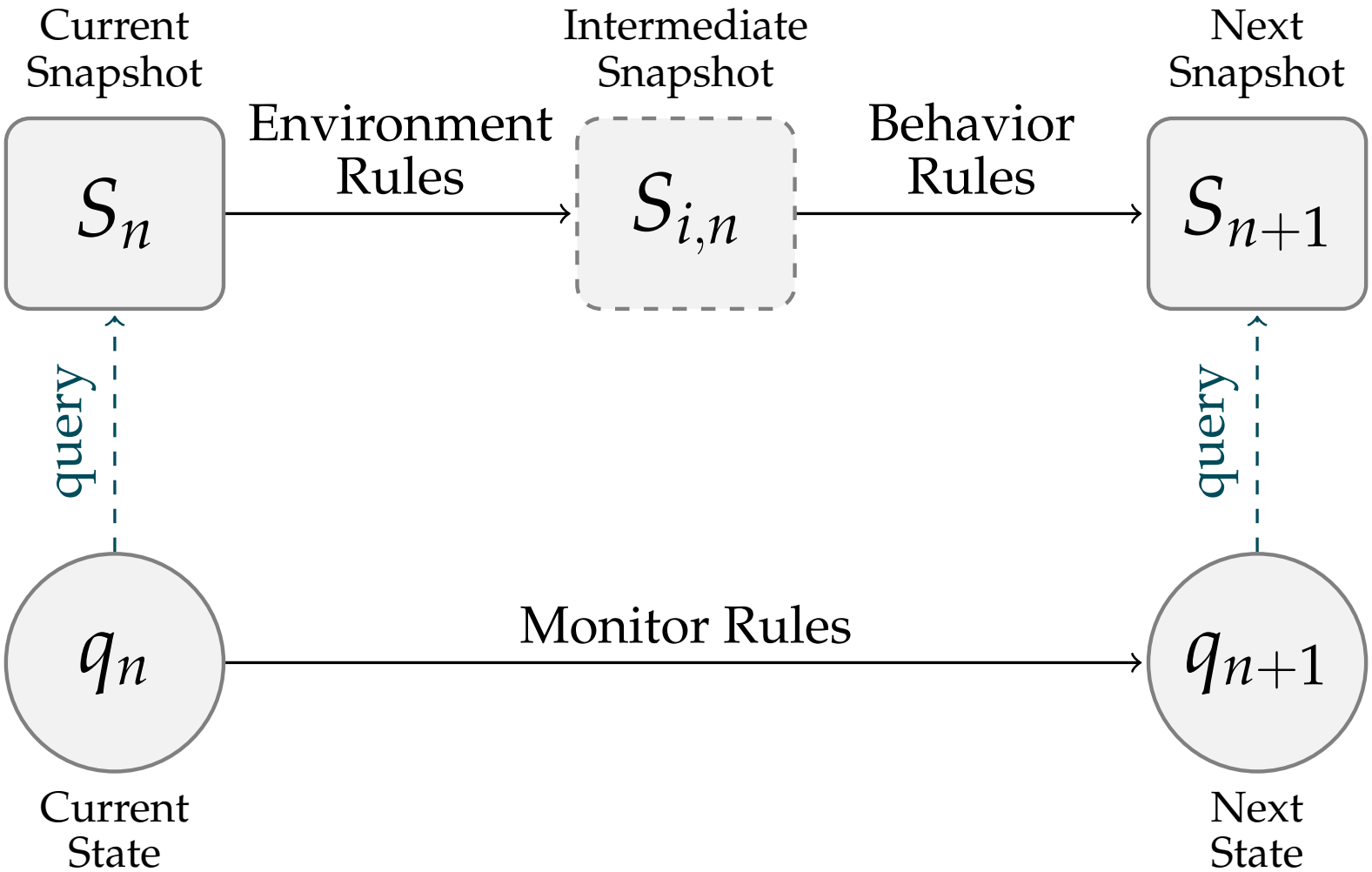
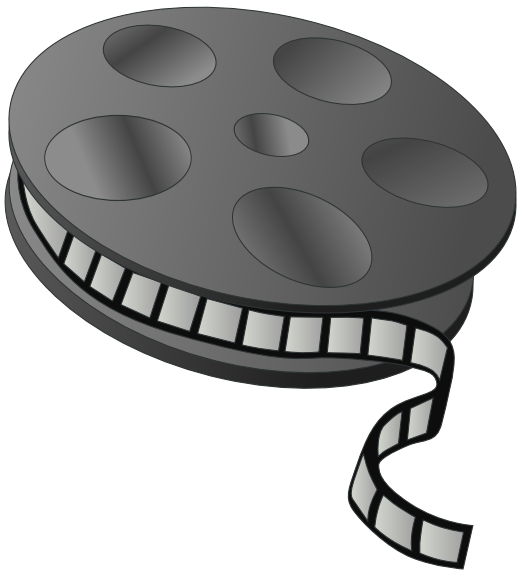


Code Generation



Conclusion

- Synchronize correctness property specification with behavioral model
- Check correctness of behavior model in
  - Simulation through coupled model transformation and
  - Target hardware through code generation.
- Integrate verification into early stages of development and check same properties on deployed software.

Outlook

- More Formalization
  - Coupled Model Transformation Rules
- More Application
  - Distributed Systems
  - Healthcare workflows
- More Expressiveness
  - Time
  - Data