# From Constraints to Application Conditions Presentation

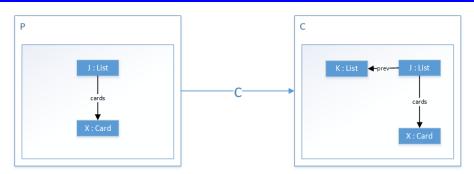
Robin Oppermann and Patrick Robrecht

06/02/2017

Fundamentals of Model-Driven Engineering
Jun.-Prof. Anthony Anjorin
Research Group Database and Information Systems
Department of Computer Science
Paderborn University

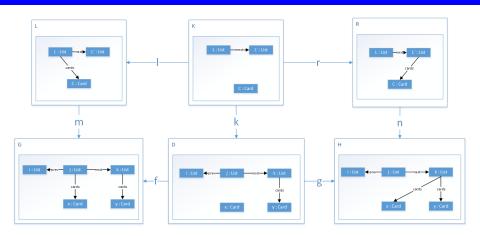
### Introduction

Constraint Example: Each List J with a card X has a previous list K



### Introduction

Rule Example: Moving Card C from List L to  $L^\prime$ 



#### Introduction

Why do we want to construct application conditions from constraints?

- model transformation system containing sets of rules and constraints
- need to ensure: graph after rule application does not violate a constraint
- idea: construct application conditions to check this before rule application
- regeneration after changes in rules / constraints necessary
   ⇒ construction needs to be automatized

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1 Introduction

**2** Construction of Right Application Conditions from Constraints

**3** Construction of Left from Right Application Conditions

**4** Conclusion

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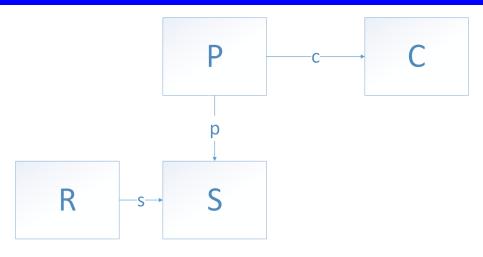
Introduction

**2** Construction of Right Application Conditions from Constraints

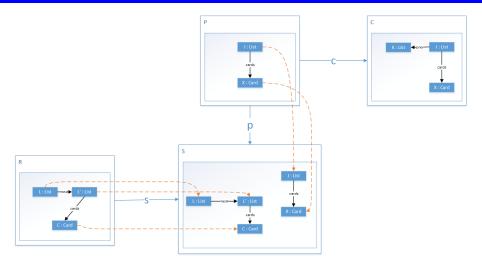
**3** Construction of Left from Right Application Conditions

4 Conclusion

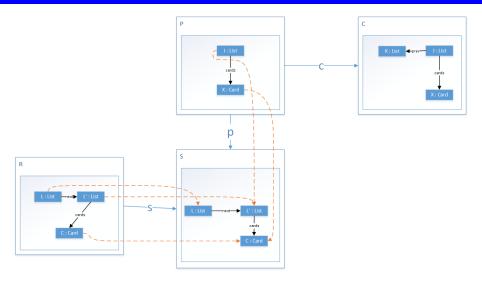
Construct possible epimorphic gluings S – Schema



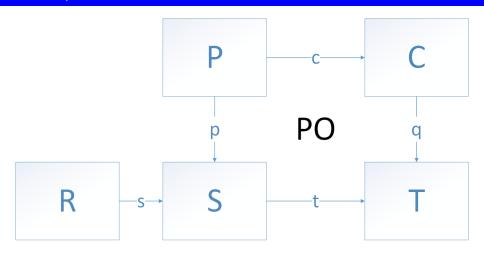
Construct possible epimorphic gluings S – Example Step 1



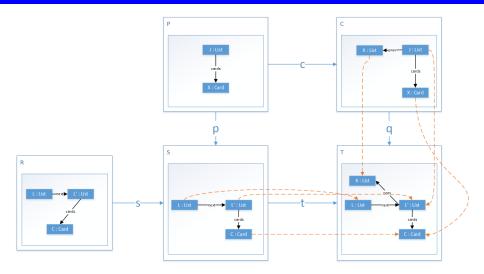
Construct possible epimorphic gluings S – Example Step 2



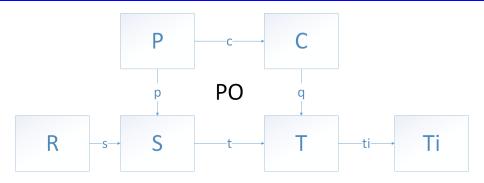
# Construction of Application Conditions from Constraints Construct pushout T – Schema



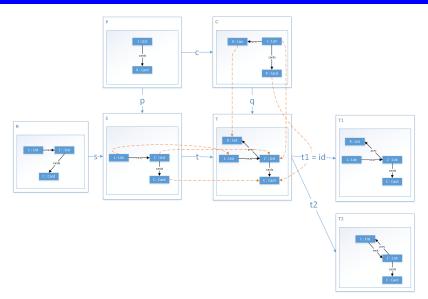
Construct pushout T – Example



Construct epimorphic gluings  $T_i$  – Schema



Construct epimorphic gluings  $T_i$  – Example



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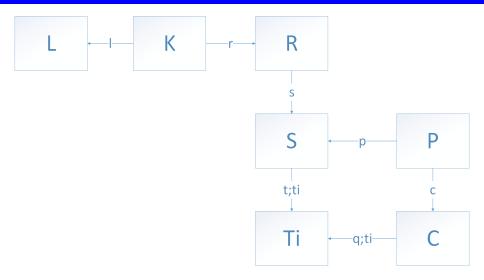
Introduction

2 Construction of Right Application Conditions from Constraints

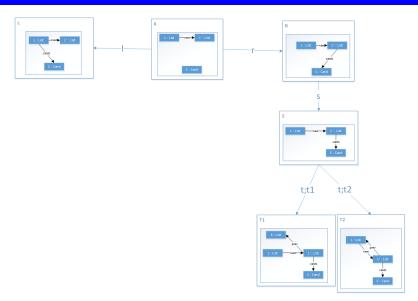
3 Construction of Left from Right Application Conditions

4 Conclusion

What we have done so far: Right Application Conditions



Right Application Condition - Example



Left and Right Application Conditions

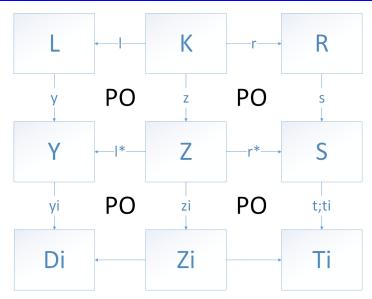
## Right application condition

Rule is applicable if the right application condition holds in H (i. e. after rule application).

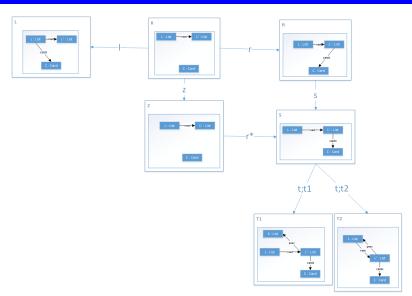
## Left application condition

Rule is applicable if the left application condition holds in G (i. e. before rule application), so the application of the rule doesn't result in a graph violating one of the constraints.

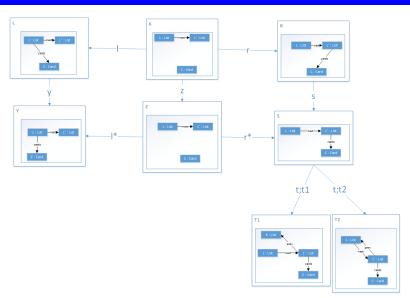
From Right to Left Application Conditions – Schema



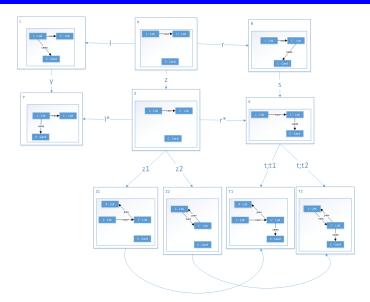
Construct pushout complement Z – Example



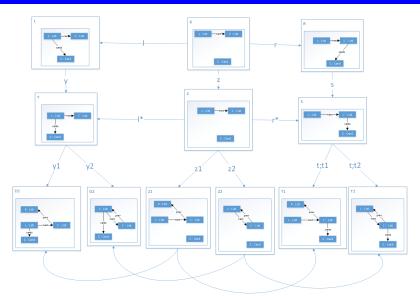
Construct pushout Y – Example



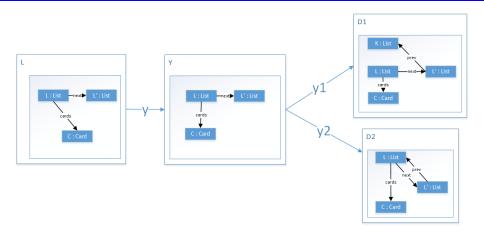
Construct pushout complements  $Z_i$  – Example



Construct pushout  $D_i$  – Example

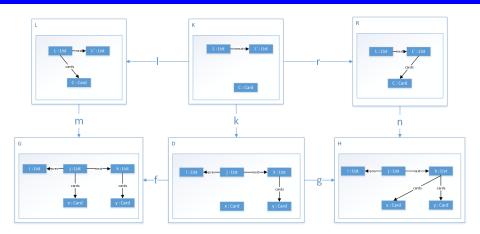


Left Application Condition – Example



## Rule Application allowed?

Rule Example: Moving Card C from List L to  $L^\prime$ 



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### Conclusion

## Our implementation

- interesting topic, worth repeating with focus on current performance limitations on larger examples
- The construction of application conditions can be implemented with the code from the exercises
  - currently only implemented for constraint  $c: P \to C$  (not multiple conclusions)

## Problems during implementation

- difficult to output diagrams in PlantUML as labels are used to identify objects in the diagrams (but there exist multiple objects with the same label) - only limited help for debugging
- choose left or right and first or second in corners/spans? (missing documentation!)
- ⇒ code generation from category diagrams would be great!

#### Literature

Hartmut Ehrig, Karsten Ehrig, Ulrike Prange, and Gabriele Taentzer: Fundamentals of Algebraic Graph Transformation.

Monographs in Theoretical Computer Science. An EATCS Series. Springer, 2006.

Sections 7.2 and 7.3 (pp. 156-164)