Xtext-based Tool Support for ABS

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Outline

• History of this Talk
• Xtext-Technology
• Wrestling with ABS
  - Language Description
• Examples/Demo
  - Focus on Visualization
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History of this Talk

• Oct. 2017
  - two students and me take part at KeY-workshop, Rastatt
    ▪ They present Xtext-Technology

• Winter term 2017/18
  - The two students work on Xtext-support for ABS as a semester project
    ▪ Results were rather disappointing

• Summer term 2018
  - I work on Xtext support for ABS
    - Result: Prototypical tool for a FRAGMENT of ABS
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Xtext

• Language Engineering Framework
  - Home: https://www.eclipse.org/Xtext/
  - Not only for Eclipse, but also Web-Browsers, LSP* - Editors

• Focus of Textual Languages
  - Syntax is defined by a grammar + validators
  - Easy access to Abstract Syntax Tree (AST)
    ▪ AST can be programatically traversed and analyzed
    ▪ From the AST, other artefacts can be generated

LSP* – Language Server Protocol
Xtext Overview

Language Designer

ABS required a much deeper understanding than usual languages

«authors»

ANTLR 3.x

Validator

«xtend»

Code Generator

Editor Configurations
- Outline-Provider
- Scope-Provider
- Quickfix-Provider
- ...

«xtex» Grammar

T.Baar: ABS Workshop, May 2018
Xtext in Action

Defining the grammar

```
grammar exa.sc1.SC1 with org.eclipse.xtext.common.Terminals

generate sC1 "http://www.sc1.exa/SC1"

// TODO: split this language in two formally different languages:
// The first one without inv-support, the second with inv-support.

StateDiag:
  vd=VarDecl
  sd=StateDecl
  ed=EventDecl
  td=TransDecl
  id=InvDecl;

VarDecl:
  'vars' ':' vars=Var*;

// first state is considered to be start state

StateDecl:
```

T.Baar: ABS Workshop, May 2018
Xtext in Action

Rich editor for my DSL

Outline

T.Baar: ABS Workshop, May 2018
Xtext in a Web-Browser

- Technology provided by dslforge

![Image of a web browser window showing Xtext and a Petri net example with a syntax error message: "10: mismatched input '}' expecting RULE_ID. Mismatched input '}' expecting ID"]
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ABS Language Description

- My sources:
  - docs.abs-models.org
  - Some input-files
Problems when Encoding ABS with Xtext

- Documentation has some (minor) inconsistencies
  - e.g. Same rule under different names

- ABS is not always Java-like
  - e.g. Import clauses

Is it also possible to write

import Drinks::*;

???
Problems when Encoding ABS with Xtext

- Sheer size of language definition
Problems when Encoding ABS with Xtext

- Documented Grammar Rules allow Ambiguous Parsing
  - Requires a lot of effort for Left-Factoring
### Exp

- PureExp | EffExp  
- PureExp ::= SimpleIdentifier  
- this . SimpleIdentifier  
- this  
- null  
- Literal  
- LetExp  
- DataConstrExp  
- FnAppExp  
- FnAppListExp  
- ParFnAppExp  
- IfExp  
- CaseExp  
- OperatorExp  
- ( PureExp )  

### IfExp

- if PureExp then PureExp else PureExp

---

### Statement

- SkipStmt  
- VarDeclStmt  
- AssignStmt  
- ExpStmt  
- AssertStmt  
- AwaitStmt  
- SuspendStmt  
- ThrowStmt  
- ReturnStmt  
- Block  
- IfStmt  

### IfStmt

- if ( PureExp ) Stmt [ else PureExp ]
Problems when Encoding ABS with Xtext

• Grammar rule reveal only coarsely, what can be referenced
  - Distinction only between Type-/NonType-Identifier
  - Uniqueness-/Scope-rules for identifiers not found

AssignStmt ::= [ this . ] SimpleIdentifier = Exp ;

PureExp ::= SimpleIdentifier
           | this
           | null
           | Literal

Also Method-Arg allowed?
Rather access to Field?
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Demo

Focus on Visualization

• My Code-Generator generates .dot-Files (input for Graphviz)

• Visualization at 3 Levels:
  - Abstract Syntax Tree (AST)
  - Program Structure (e.g. Class Diagram)
  - Domain-Specific Visualization
    ▪ Example of meta-programming
    ▪ Works without graphics-library in ABS