COMPARING ATOM3 AND XTEXT – CASE: TRAFFIC SIMULATION

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Content

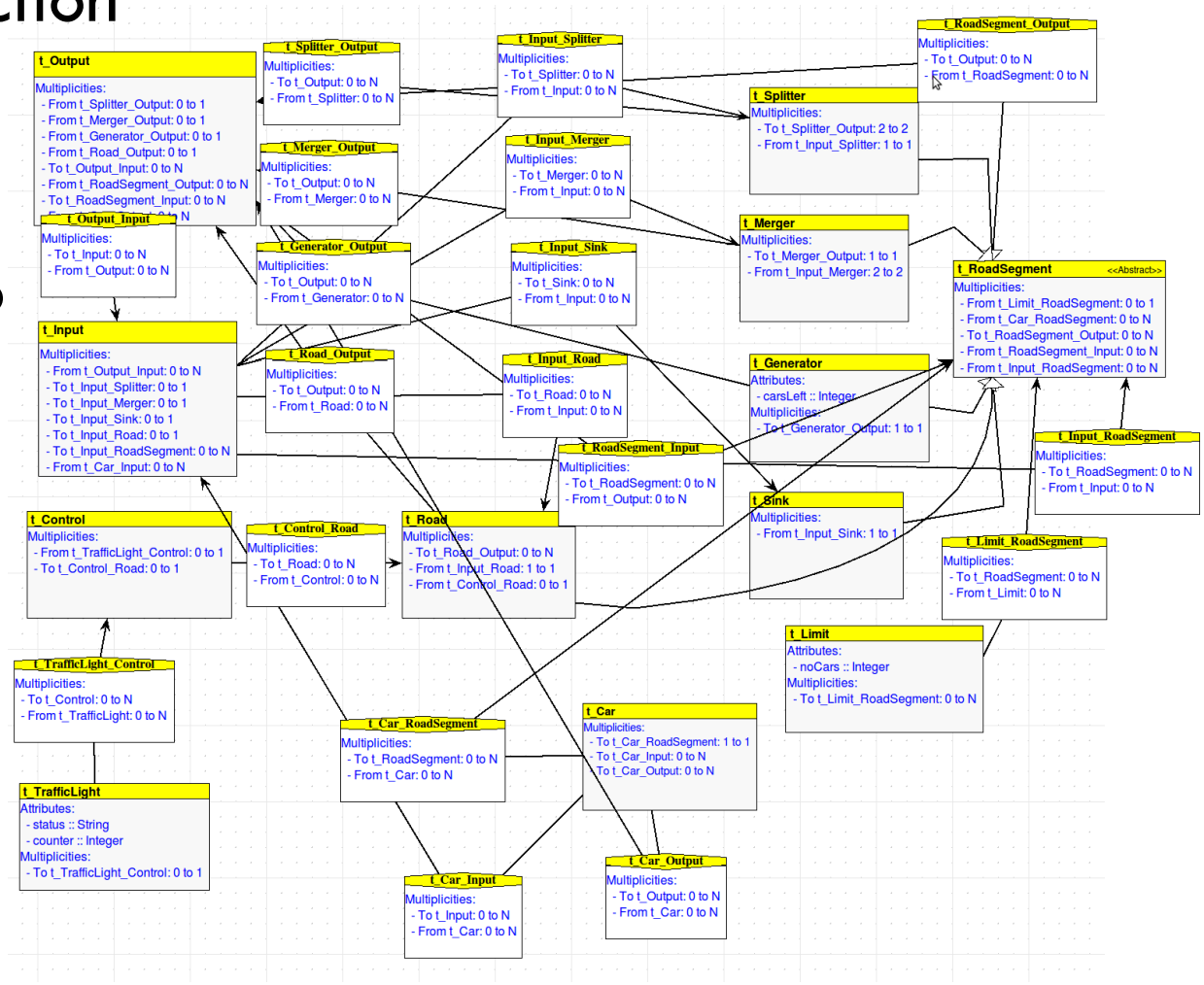
- Comparing which characteristics?
- ATOM3 Model
- Xtext Model
- ATOM3 vs Xtext
- Conclusion

Comparing which characteristics?

- Model Construction
- Model Validation
- Model Simulation and/or Transformation.

ATOM3 Model

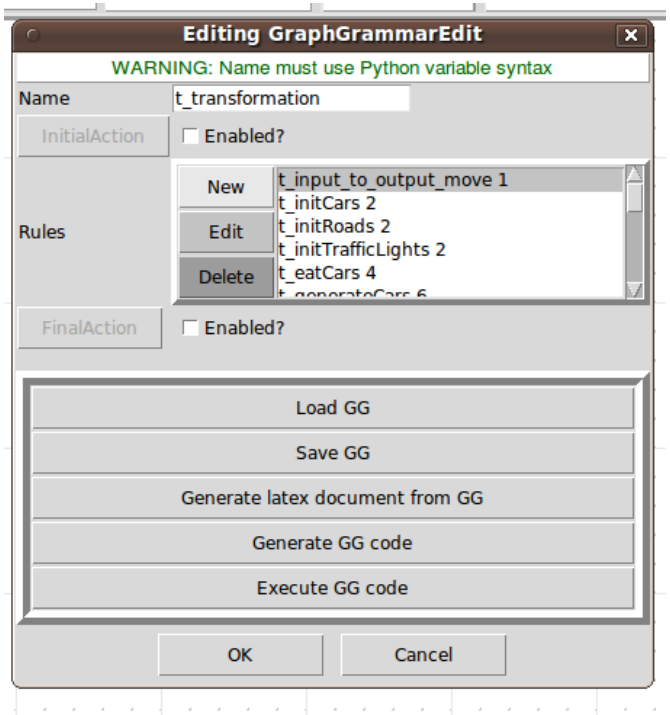
- Model Construction
  - Metamodel
  - Model Env.
  - Graphical Rep

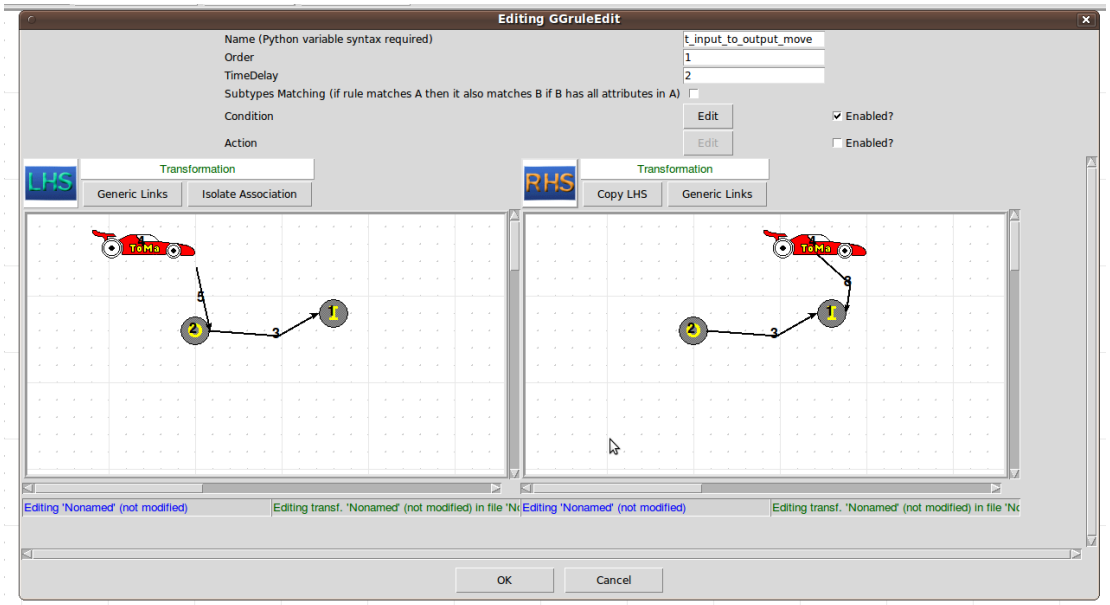


ATOM3 Model

- Model Validation
  - Connecting elements:
    - Multiplicities
    - Assocations
  - Invalid semantics:
    - E.g. Create model with to many cars on RoadSegment compared to associated Limit
    - Checks trigger upon creation/deletion/alteration.

ATOM3 Model


Editing GraphGrammarEdit
WARNING: Name must use Python variable syntax
Name
t_transformation
InitialAction
Enabled?
Rules
New
Edit
Delete
t_input_to_output_move 1
t_initCars 2
t_initRoads 2
t_initTrafficLights 2
t_eatCars 4
FinalAction
Enabled?
Load GG
Save GG
Generate latex document from GG
Generate GG code
Execute GG code
OK
Cancel


Editing GGruleEdit
Name (Python variable syntax required)
t_input_to_output_move
Order
1
TimeDelay
2
Subtypes Matching (if rule matches A then it also matches B if B has all attributes in A)
Condition
Edit
Enabled?
Action
Edit
Enabled?
LHS
Transformation
Generic Links
Isolate Association
RHS
Transformation
Copy LHS
Generic Links
Editing 'Nonamed' (not modified)
Editing transf. 'Nonamed' (not modified) in file 'Nc
Editing 'Nonamed' (not modified)
Editing transf. 'Nonamed' (not modified) in file 'Nc
OK
Cancel

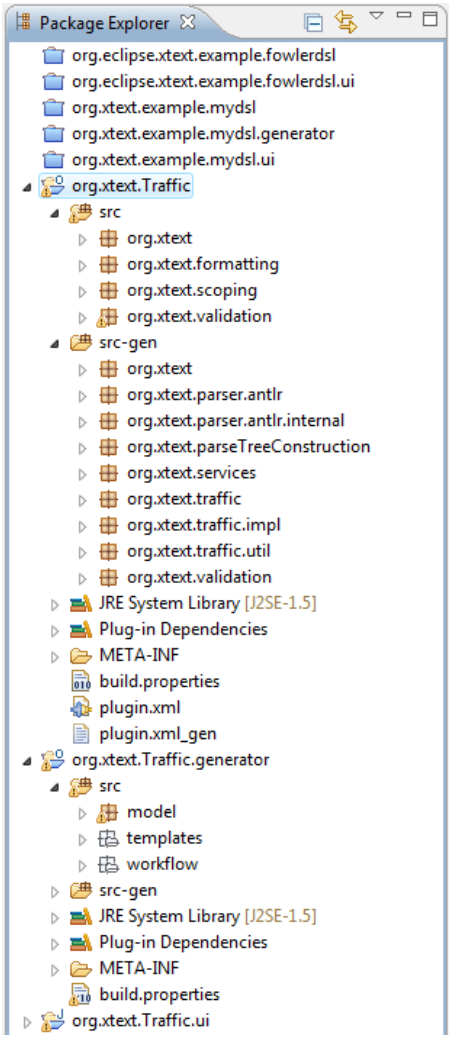
ATOM3 Model

- Model Transformation
  - Graph Transformations
    - LHS / RHS
    - Priorities
    - Additional Applicability Checks
  - Rule Based
    - Priorities
    - Random/Choice/Parallel

=> In place transformation

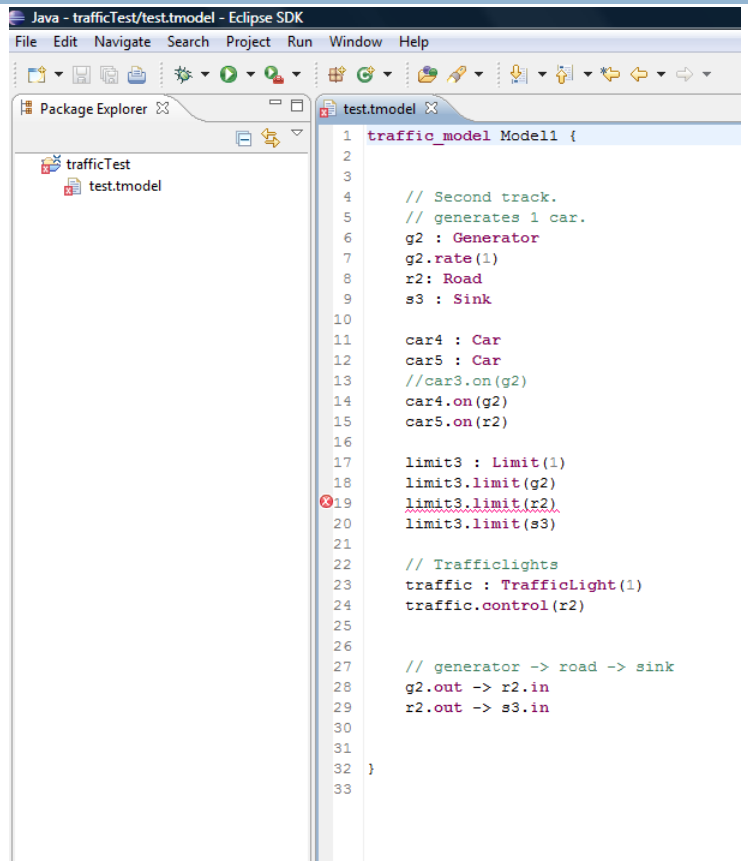
XText Model

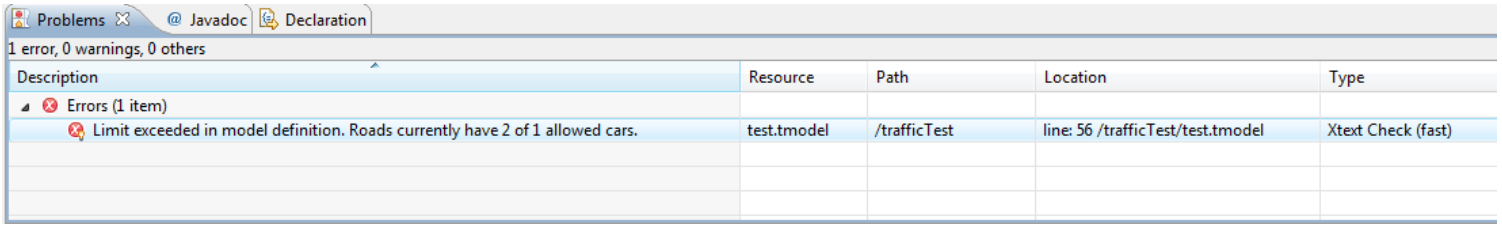
- Model Construction
  - Eclipse Xtext Plugin
  - Textual
  - Separate Environment for model creation
    - Syntax Highlighting
    - Validation
    - Syntax 'Completion'



```
grammar org.xtext.Traffic with org.eclipse.xtext.common.Terminals

generate traffic "http://www.xtext.org/Traffic"

Model:
    'traffic_model' name=ID '{'
        (elements+=RoadSegmentDecl
        | generatorRates+=GeneratorRate
        | links+=RoadLink
        | cars+=CarDeclaration
        | carPlacements+=CarPlacement
        | limits += LimitDeclaration
        | roadLimits += LimitOnRoad
        | trafficLights += TrafficLight
        | trafficLPlaces += TrafficLPlace
        | SL_COMMENT
        | ML_COMMENT
        )+
    '}';

TrafficLPlace:
    light=[TrafficLight] '.' 'control' '(' road=[RoadSegmentDecl] ')';

TrafficLight:
    name=ID ':' 'TrafficLight' (hasState?='(' state=INT ')')?;

LimitOnRoad:
    limit=[LimitDeclaration] '.' 'limit' '(' road=[RoadSegmentDecl] ')';

LimitDeclaration:
    name=ID ':' 'Limit' '(' limit=INT ')';

GeneratorRate:
    generator=[RoadSegmentDecl] '.' 'rate' '(' rate=INT ')';

CarDeclaration:
    name=ID ':' 'Car';

CarPlacement:
    (car=[CarDeclaration|ID] '.' 'on' '(' onRoad=[RoadSegmentDecl] ')')
    ;

RoadSegmentDecl:
```

Xtext Model


Java - trafficTest/test.tmodel - Eclipse SDK
File Edit Navigate Search Project Run Window Help
Package Explorer
trafficTest
test.tmodel
test.tmodel
1 traffic_model Model1 {
2
3
4 // Second track.
5 // generates 1 car.
6 g2 : Generator
7 g2.rate(1)
8 r2: Road
9 s3 : Sink
10
11 car4 : Car
12 car5 : Car
13 //car3.on(g2)
14 car4.on(g2)
15 car5.on(r2)
16
17 limit3 : Limit(1)
18 limit3.limit(g2)
19 limit3.limit(r2)
20 limit3.limit(s3)
21
22 // Trafficlights
23 traffic : TrafficLight(1)
24 traffic.control(r2)
25
26
27 // generator -> road -> sink
28 g2.out -> r2.in
29 r2.out -> s3.in
30
31
32 }
33


Problems
Javadoc
Declaration
1 error, 0 warnings, 0 others
Description
Resource
Path
Location
Type
Errors (1 item)
Limit exceeded in model definition. Roads currently have 2 of 1 allowed cars.
test.tmodel
/trafficTest
line: 56 /trafficTest/test.tmodel
Xtext Check (fast)

XText Model

- Model Validation
  - Cross Referencing of model elements
  - OCL constraints
    - context TrafficLight ERROR "TrafficLight state must be an integer between 1 and 6 (inclusive). Where Green=[0,1]; Orange[2]; Red[3,5]":

      !hasState || (state >= 0 && state <= 5);
  - Java code checks based on inner representation of model

XText Model

- Model Transformation
  - Based on template
  - Outputs to JAVA representation of model
  - Textual

=> No in-place transformations

XText Model

```
«DEFINE main FOR Model»
«FILE name+"_simulator.java"»
import model.*;
public class «name»_simulator {
public static void main(String[] args) {
// Create model elements & add to model if needed.
Model m = new Model("«name»");
«EXPAND model_elements FOREACH elements-»
// Set generator rates
«EXPAND model_generators FOREACH generatorRates-»
// Create cars in model.
«EXPAND model_cars FOREACH cars-»
// Link the model elements to one another.
«EXPAND link_model FOREACH links-»
….
// Simulate the model.
// Simulation ends when no more cars can be moved and/or generated.
while(m.hasMoreSteps()){
m.simulateStep();
}
}
}
«ENDFILE»
«ENDDEFINE»
```

XText Model

```
«DEFINE model_elements FOR RoadSegmentDecl-»
«IF type.compareTo("Sink") == 0-»
Sink «name» = new Sink("«name»");
m.addSink(«name»);
«ELSEIF type.compareTo("Generator") == 0-»
Generator «name» = new Generator("«name»");
m.addGenerator(«name»);
«ELSEIF type.compareTo("Merger") == 0-»


Merger «name» = new Merger("«name»");
«ELSEIF type.compareTo("Splitter") == 0-»
Splitter «name» = new Splitter("«name»");
«ELSEIF type.compareTo("Road") == 0-»
Road «name» = new Road("«name»");
«ENDIF-»
«ENDDEFINE»
```

Comparisson

- Model Construction
  - ATOM3: Visual - Class/Assocation based meta-meta-model
  - XText: Textual – Grammar based meta-meta-model

Comparisson

- Model Validation
  - ATOM3: Two types of checks
    - Multiplicity
    - On creation/deletion/alteration
  - XText: Three types of checks
    - Cross-referencing
    - OCL
    - Java based extensive checks

Comparisson

- Model Transformation
  - ATOM3:
    - Visual
    - In-place transformation
    - Graph transformations
  - XText:
    - Textual
    - Original model remain unchanged
    - Template based transformation

Comparisson

- Biggest distinctions:
  - Visual vs Textual
  - In-place transformation vs leaving original model unchanged