A tool for the convergence of multilevel modelling approaches

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This work

Tool-agnostic metamodel
This work

Tool-agnostic metamodel

Tooling
This work

Tool-agnostic metamodel

Tooling

Experiments and results
Tooling

Flat metamodel $\xrightarrow{\text{Annotator}}$ Smell detection $\xrightarrow{\text{Annotated flat metamodel}}$
Annotator

Heuristics

Flat metamodel

Smell detection

Annotated flat metamodel

JAVA

Extensible by Java interfaces
Tooling

Annotated flat metamodel → Transformer → Annotation-based transformation → Multilevel hierarchy (tool-independent)

Multilevel hierarchy metamodel conforms to Extensible by Java interfaces.
Tooling

Multilevel hierarchy metamodel

conforms to

Transformer

Annotated flat metamodel

Annotation-based transformation

Multilevel hierarchy (tool-independent)
Tooling

Annotated flat metamodel

Transformer

Transformations

Multilevel hierarchy metamodel

conforms to

Multilevel hierarchy (tool-independent)
Multilevel hierarchy metamodel

conforms to

Multilevel hierarchy (tool-independent)

Exporter

Tool-dependent transformation

Multilevel hierarchy (tool-dependent)
Multilevel hierarchy metamodel

conforms to

Multilevel hierarchy (tool-independent)

Exporter

Multilevel hierarchy (tool-dependent)

Tool-dependent transformation

Registered tools

Multilevel hierarchy (tool-independent)

Recommender

Feature- and support-based recommendation

Tool support

MLM concepts

Extensible by Java interfaces
Multilevel hierarchy metamodel

conforms to

Multilevel hierarchy (tool-independent)

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Feature- and support-based recommendation

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Extensible by Java interfaces

Multilevel hierarchy (tool-independent)

Multilevel hierarchy (tool-dependent)
Multilevel hierarchy metamodel

Tool-dependent transformation

Importer

conforms to

Multilevel hierarchy (tool-independent)

Registered tools

Multilevel hierarchy (tool-dependent)

Multilevel hierarchy
(conform to)

Multilevel hierarchy (tool-independent)

Multilevel hierarchy metamodel

Tool-dependent

transformation
Tooling

- Heuristics
- Smell detection
- Annotator
- Annotation-based transformation
- Transformer
- Multilevel hierarchy metamodel

- Flat metamodel
- Annotated flat metamodel
- Transformer
- Annotation-based transformation

- Tool-dependent transformation
- Importer
- Registered tools

- Multilevel hierarchy (tool-dependent)

- Multilevel hierarchy (tool-independent)

- Recommender
  - Feature- and support-based recommendation

- Tool support
- MLM concepts

- Registered tools
- Extensible by Java interfaces
Extensible by Java interfaces
## Experiment 1: Recommender score

<table>
<thead>
<tr>
<th>Size (Multilevel)</th>
<th>Melanee</th>
<th>MetaDepth</th>
<th>MultEcore</th>
</tr>
</thead>
<tbody>
<tr>
<td>#M</td>
<td>#C</td>
<td>#R</td>
<td>#A</td>
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<td>4</td>
<td>5</td>
<td>4</td>
</tr>
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<td>64</td>
<td>118</td>
<td>81</td>
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<td>15</td>
<td>17</td>
<td>26</td>
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<tr>
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<td>21</td>
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<tr>
<td>1</td>
<td>41</td>
<td>15</td>
<td>72</td>
</tr>
</tbody>
</table>
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### Size (Multilevel)

<table>
<thead>
<tr>
<th>#M</th>
<th>#C</th>
<th>#R</th>
<th>#A</th>
<th>Melanee</th>
<th>MetaDepth</th>
<th>MultEcore</th>
</tr>
</thead>
<tbody>
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<td>284</td>
<td>156 284</td>
</tr>
</tbody>
</table>
## Experiment 2: Case study validation

<table>
<thead>
<tr>
<th>Size (Multilevel)</th>
<th>Melanee</th>
<th>MetaDepth</th>
<th>MultiEcore</th>
</tr>
</thead>
<tbody>
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<td>#M</td>
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<td>#R</td>
<td>#A</td>
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</tbody>
</table>
Experiment 3: MultEcore ⇒ MetaDepth

```
x: ext Model configuration@2 {  
x: ext abstract Node  
x:  
x:  ext Node BasicPart@2 :  
x:  ext Node Component@2 :  
x:  ext configuration bicycle {  
x:  ext BasicPart Frame{}  
x:  ext Component Bicycle {  
x:  ext configuration bicycle racing_bike {  
x:  ext Frame RacingFrame{}  
x:  ext Bicycle RacingBike {  
x:  ext Model configuration {  
x:  ext Clobject Composite  
x:  ext Clobject BasicPart {  
x:  ext Clobject Component {  
x:  ext Model bicycle {  
x:  ext Clobject Bicycle  
x:  ext Clobject Frame {  
x:  ext Model racing_bike {  
x:  ext Clobject RacingFrame  
x:  ext bicycle racing_bike {  
x:  ext bicycle {  
x:  ext bicycle {  
x:  ext configuration {  
x: ext Abstract configuration {  
x: ext Abstract configuration {  
x: ext configuration {  
x: ext configuration {  
x: ext configuration {  
x: ext configuration {  
```

MultEcore  Tool-agnostic  MetaDepth
Experiment 4: MultEcore ⇒ MultEcore

- **Hierarchy bicycle**
  - **Model configuration**
    - Clabject Composite
    - Clabject BasicPart
      - Potency 1
    - Clabject Component
      - Potency 1
      - Attribute weight
      - Reference subc
      - Level 1
      - Potency 1
  - Model bicycle
    - Clabject Bicycle
    - Clabject Frame
      - Level 2
      - Potency 1
  - Model racing_bike
    - Clabject RacingFrame
    - Clabject RacingBike
      - Level 3
      - Potency 1

MultEcore Tool-agnostic MultEcore
Tool-supported common representation → Exchange format
Conclusions and future (community?) work

- Tool-supported common representation $\rightarrow$ Exchange format
- Foster discussion towards the convergence of MLM principles
Conclusions and future (community?) work

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- Formal definition of the semantics for the tool-agnostic metamodel
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- Identify key features and improve MLM tools
Conclusions and future (community?) work

- Tool-supported common representation → Exchange format
- Foster discussion towards the convergence of MLM principles
- Formal definition of the semantics for the tool-agnostic metamodel
- Identify key features and improve MLM tools
- Invite contributions to the tool and the metamodel