Towards a Generic Layout Composition Framework for Domain Specific Models

Jendrik Johannes
Karsten Gaul

26/10/2009, DSM’09, Orlando, Florida
Model Composition in MDSD

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Model Composition in MDSD
Viewpoints on Models

Jendrik Johannes and Karsten Gaul: *Towards a Generic Layout Composition Framework for Domain Specific Models*
Viewpoints on Models

(E)MOF

Instance-of

CIM

Instance-of

UML

...
Viewpoints on Models

(E)MOF

CIM

Instance-of

Tool View

User View

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Viewpoints on Models

(E)MOF

CIM

Instance-of

CIM Model
- Logical Module BuiltInHub
- Ethernet Port EthernetPort0
- Ethernet Port EthernetPort1
- Ethernet Port EthernetPort2
- Ethernet Port EthernetPort3
- IP Protocol Endpoint IP

Tool View

User View

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Viewpoints on Models

(E)MOF

CIM

Instance-of

Instance-of

User View

mental map

Tool View

reuseware composition framework

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Viewpoints on Models

(E)MOF

Instance-of

CIM

Instance-of

GMF

Tool View

+ Layout Composition

User View

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Viewpoints on Models

(E)MOF

Instance-of

CIM

Instance-of

GMF

Diagram
- Node true
- Node true
- Edge true

Diagram
- Node true
- Edge true

CIM Model
- Logical Module BuiltInHub
- Ethernet Port EthernetPort0
- Ethernet Port EthernetPort1
- Ethernet Port EthernetPort2
- Ethernet Port EthernetPort3
- IP Protocol Endpoint IP

Tool View

User View

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
• **Layout composition in addition** to semantic composition

• **Setting**
  – DSMLs (defined in EMOF/Ecore) with graphical syntax
  – Graphical composition scripts
  – Composition tool needs to expose relations between composition scripts and input models
Layout Gathering & Merge

Model Composition (MC) -> Layout Composition (LC)

- Layout format dependent (e.g. GMF)
- Input Model (Source Layout)
  - Width and height of bounding box
- Composition Script (Target Layout)
  - Position of model in script

- Source width = ?
- Source height = ?
- Target x = ?
- Target y = ?

Source Information Provider
Target Information Provider
Comparator
Arranger
Materialiser
Layout Gathering & Merge

Model Composition (MC)

(a) Model Composition Engine → Layout Information Gathering (LC1) → Layout Merge (LC2) → Overlap Elimination (LC3) → Layout Persisting (LC4)

(b) Source Information Provider → Target Information Provider → Comparator → Arranger → Materialiser

- Layout format dependent (e.g. GMF)
- Input Model (Source Layout)
  - Width and height of bounding box
- Composition Script (Target Layout)
  - Position of model in script

Source
width = 30
height = 20

Target
x = ?
y = ?
Layout Gathering & Merge

Model Composition (MC) → Layout Composition (LC)

(a) Model Composition Engine
   → Layout Information Gathering (LC1)
   → Layout Merge (LC2)
   → Overlap Elimination (LC3)
   → Layout Persisting (LC4)

(b) Source Information Provider
    → Target Information Provider
    → Comparator
    → Arranger
    → Materialiser

- Layout format dependent (e.g. GMF)
- Input Model (Source Layout)
  - Width and height of bounding box
- Composition Script (Target Layout)
  - Position of model in script

Source width = 30
height = 20

Target
x = 5
y = 5
Layout Gathering & Merge

(a) Model Composition (MC)

Model Composition Engine → Layout Information Gathering (LC1) → Layout Merge (LC2) → Overlap Elimination (LC3) → Layout Persisting (LC4)

(b) Layout Composition (LC)

Source Information Provider → Target Information Provider → Comparator → Arranger → Materialiser

- Layout format dependent (e.g. GMF)
- Input Model (Source Layout)
  - Width and height of bounding box
- Composition Script (Target Layout)
  - Position of model in script

Source
width = 20
height = 10

Target
x = ?
y = ?
Layout Gathering & Merge

(a) Model Composition (MC)

- Model Composition Engine
- Layout Information Gathering (LC1)
- Layout Composition (LC)
- Layout Merge (LC2)
- Overlap Elimination (LC3)
- Layout Persisting (LC4)

(b) Source Information Provider

Source width = 20
height = 10

Target
x = 40
y = 5

- Layout format dependent (e.g. GMF)
- Input Model (Source Layout)
  - Width and height of bounding box
- Composition Script (Target Layout)
  - Position of model in script
Simple Layout Composition

(E)MOF

Instance-of

CIM

Instance-of

GMF

Tool View

+ Layout Composition

User View

mental map

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Simple Layout Composition

(E)MOF
Instance-of

CIM
Instance-of

GMF

+ Layout Composition

Tool View

User View

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
• **Layout adjustment algorithms**
  – Always apply on input model element sets
  – Horizontal sorting
    • May destroy layout by moving elements too far
  – Uniform Scaling
    • May move elements too far out
    • Danger of loosing compactness
(E)MOF

Instance-of

CIM

Instance-of

GMF

Tool View

Reuseware composition framework

+ Layout Composition

User View

mental map

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Implementation

(a) Model Composition Engine ➔ Layout Information Gathering (LC1) ➔ Layout Merge (LC2) ➔ Overlap Elimination (LC3) ➔ Layout Persisting (LC4)

(b) Source Information Provider ➔ Target Information Provider ➔ Comparator ➔ Arranger ➔ Materialiser

- Source Information Provider
  - GMF: all GMF-based DSMLs
  - TOPCASED: all TOPCASED-based DSMLs

- Target Information Provider
  - GMF: Reuseware Composition Programs

- Comparator
  - XYComparator

- Arranger
  - Horizontal Sorting
  - Uniform Scaling

- Materialiser
  - GMF: all GMF-based DSMLs
  - TOPCASED: all TOPCASED-based DSMLs

Jendrik Johannes and Karsten Gaul: Towards a Generic Layout Composition Framework for Domain Specific Models
Evaluation

• Experimented with different modelling languages
  – Common Interface Model (CIM) DSML
  – UML Activity Diagrams

• Tried out different layout adjustment algorithms

• Combined different strategies in staged composition
Summary & Future Work

• We showed
  – Systematic approach to preserve as much layout information as possible in model composition
  – Adjustment algorithms to improve layout without destroying mental map
  – Applicable to different modelling languages

• Future work
  – Did not look at less free layouts (e.g. Sequence Diagrams)
  – Did not consider compositions where elements are replaced (layout of replaced or replacing element(s)?)
  – Did not test with other composition (or transformation) tools/frameworks
  – Do require graphical composition script language

• We are looking for interesting case studies
Thank You!

Questions?

http://reuseware.org