Object-Oriented Modeling: A Roadmap

Gregor Engels
University of Paderborn

Luuk Groenewegen
Leiden University

Software Development: Traditional (?) Approach

problem domain

implementation

program
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Software Development: Reality

- Problem domain
- Program

Software Development: Model-centered Approach

- Problem domain
- Model
- Code
- Program

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Requirements for a Model and the Modeling Language

Requirements for a Model

- user-friendly, understandable
- expressive
- correct, precise

Requirements for a Modeling Language

- visual, diagrammatic
- structure & behavior
- syntax & semantics

History of Modeling Languages

Historical Development

~ 70 Data Flow Diagrams (DFD) + Entity-Relationship Diagrams = Structured Analysis (SA)

~ 80 abstract data type: object-orientation

~ 90 > 50 object-oriented modeling languages

~ 00 standardization: Unified Modeling Language
Unified Modeling Language (UML)

**Unified Modeling Language (UML)**

**union of > 9 diagram types**

- **structure**: class / object diagram
- **behavior**: use case diagram, statechart diagram, activity diagram, sequence diagram, collaboration diagram
- **implementation**: component diagram, deployment diagram
- **constraints**: object constraint language (OCL)

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**Unified Process (RUP)**

- **pushed by Rational**
  - “three amigos”: Grady Booch, Jim Rumbaugh, Ivar Jacobson
- **standardized by OMG (Object Management Group)**
  - version 1.1: November 1997
  - version 1.3: Autumn 1999
  - version 2.0: under discussion

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This is not a talk about UML!
Object-Oriented Modeling: A Roadmap

Perspectives - Open Issues

regions of the object-oriented modeling landscape

- modeling process (in the small)
- model review
- model composition
- model constituents
- language structure

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Layered Language Structure

- Language Structure
  - application-specific extensions
  - domain-specific extensions
  - modeling language
  - core language

Open Issues (1)

Open issues in the Language Structure region:

- language architecture (core vs. profiles)
- hybrid notations (textual vs. graphical)
- completeness, expressiveness
- semantics
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Perspectives - Open Issues

regions of the object-oriented modeling landscape

modeling process (in the small)

modeling process (in the large)

model review

model composition

model constituents

language structure

Model Constituents (1)

what are the basic building blocks of a model?

model domain

view integration of structural and behavioral views

view 1

view 2

view 3

view 4

model
Model Constituents (2)

what are the basic building blocks of a model?

- problem domain
- code
- program
- model
- aspects (e.g., concurrency)
- aspect weaver
- core model
- pattern repository

Model Constituents (3)

what are the basic building blocks of a model?

- problem domain
- code
- program
- model
- pattern repository
- modeling by using patterns
what are the basic building blocks of a model?

- modeling units and their interdependencies
  - views
  - aspects, features
  - patterns
  - frameworks
Perspectives - Open Issues

regions of the object-oriented modeling landscape

- modeling process (in the large)
- model composition
- model constituents
- language structure
- model review
- modeling process (in the small)

Model Composition

what are the means to compose models?

- horizontal composition
  - adding/removing model parts

- vertical composition
  - refinement
    - subsystems
    - class-like descriptions
Open Issues (3)

Open issues in the Model Composition region:

- scalability
- horizontal / vertical composition techniques

Perspectives - Open Issues

regions of the object-oriented modeling landscape
what are the tasks during composing a model?

- managing consistency between model parts
- determining model architecture

Model-View-Controller (MVC) Architecture

Controller ➔ View ➔ Model

Communication

Model-View-Communication-Controller (MVCC)

Controller ➔ View ➔ Communication ➔ Model
Open Issues (4)

Open issues in the Modeling Process (in-the-Small) region:

• consistency within the model
• modeling of coordination and communication

Perspectives - Open Issues

regions of the object-oriented modeling landscape

modeling process (in the small) → modeling process (in the large)

model composition → model constituents → language structure

model review
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Open Issues (5)

Open issues in the Model Review region:

- animation / simulation techniques
- analytical techniques

Perspectives - Open Issues

regions of the object-oriented modeling landscape
Open Issues (6)

Open issues in the **Modeling Process (in-the-Large)** region:

- front-end / back-end transformations
- round-trip engineering
- process models
- support tools

Conclusions (1)

**regions of the object-oriented modeling landscape**

- modeling process (in the small)
- modeling process (in the large)
- model review
- model composition
- model constituents
- language structure
Conclusions (2)

Summary
- drawn a structured landscape
- identified a list of open issues

Note:
- a lot of individual solutions exist

Challenge for the Future
- Adaption and Integration of Solutions *

*Footnote: UML might be a good platform!

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