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I N S T I T U T F Ü R I N F O R M A T I K

ECOOP'97 Workshop on Precise Semantics for Object-Oriented Modeling Techniques

(Extract and Summary)

Haim Kilov Bernhard Rumpe

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T E C H N I S C H E U N I V E R S I T Ä T M Ü N C H E N

The complete workshop proceedings are not available online. Please contact one of the workshop organizers to receive a copy.

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Call for Papers ECOOP'97 Workshop on

Precise Semantics for Object-Oriented Modeling Techniques

Tuesday 10. June 1997 at Jyväskylä, Finland

The Workshop on Precise Semantics for Object-Oriented Modeling Techniques will be held in conjunction with ECOOP'97.

Rationale:

Currently there is an ongoing standardization process for object-oriented modeling techniques (OOMT) initiated by the OMG. Standardization of OOMTs does not only include a precise syntax, but a precise semantics as well. This is essential for unambiguous understanding of business and system specifications modeled with OOMT.

A precise semantics allows us to detect inconsistencies and inaccuracies both in OOMTs themselves (meta-modeling), and in specifications written using these OOMTs (modeling). It is essential if we want to compare (and use) different OOMTs, with perhaps quite different syntaxes (notations), based on their meaning (semantics). This not only may improve the notations and make them more convenient, but also will enable interoperability between different OOMT. Moreover, precise semantics also allows us to use a notation in a more standardized way, thus leading to better and unambiguous understanding and therefore supporting true reuse of specifications and design, a more accurate definition of context conditions or (code) generators. Furthermore, requirement decisions could be traced more precisely to produced code.

Topics:

The scope of the workshop includes, but is not limited to:

- Precise semantics for OOMT
- Integration of semantics for a heterogeneous set of OOMT
- Formal development and refinement techniques for OOMT
- Comparisons of existing semantics models
- Ways to achieve preciseness
- Concurrency and OOMT
- Tool support
- Existing standards (e.g. ISO) and OOMT

Organizers:

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Important Dates:

Deadline for submission:	April 4, 1997
Notification of acceptance:	May 5, 1997

Proceedings: will be printed as technical report of the Munich University of Technology and will be available at the conference.

Further Information: will be available at http://www.forsoft.de/~rumpe/ecoop-ws/.

Submissions:

Workshop proposals should be about 5 pages and highlight the main contributions of the author. Interesting papers will be selected by the organizers and their authors will have the possibility to present them in about 20 minutes. Furthermore, each author is encouraged to present open questions and one or two main statements that shall be discussed.

Workshop participants are invited to submit their contribution as standard Postscript per email to *both* workshop organizers. Submission deadline is April 4, 1997.

Summary of ECOOP'97 Workshop #5 on „Precise Semantics for Object-Oriented Modeling Techniques“

He had bought a large map representing the sea,
Without the least vestige of land:
And the crew were much pleased when they found it to be
A map they could all understand.

"What's the good of Mercator's North Poles and Equators,
Tropics, Zones, and Meridian Lines?"
So the Bellman would cry: and the crew would reply
"They are merely conventional signs!

"Other maps are such shapes, with their islands and capes!
But we've got our brave Captain to thank:
(So the crew would protest) "that he's bought us the best--
A perfect and absolute blank!"

This was charming, no doubt; but they shortly found out
That the Captain they trusted so well
Had only one notion for crossing the ocean,
And that was to tingle his bell.
(Lewis Carroll. The Hunting of the Snark.)

The first ECOOP workshop on "Precise Semantics for Object-Oriented Modeling Techniques" can be regarded as a success. With 22 accepted submissions of high quality a variety of opinions has been represented and discussed among the 24 participants. During the workshop a set of conclusions has been drawn, which is included later within this summary. It probably serves as a good starting point for the next workshop.

The articles following this summary have been selected for the LNCS Workshop Reader. They are revised versions from the workshop submissions, which have been collected in the workshop proceedings [1]. We thank the department of computer science of the Technische Universität München for their kind permission to reuse the earlier versions of the contributions published in [1].

Scope of the Workshop

Object-oriented modeling techniques (OOMTs) are a way to produce various specifications. Business specifications (the "what"s) are refined into business designs (the "how"s), from where refinements into various information system (software) specifications and implementations are possible.

Currently there is an ongoing standardization process for object-oriented modeling techniques (OOMT) initiated by the OMG. Standardization of OOMTs does not only include a precise syntax, but a precise semantics as well. This is essential for unambiguous understanding of business and system specifications modeled with OOMTs.

Precise specification of semantics – as opposed to just signatures – is required not only for business specifications, but also for business designs and system specifications. In particular, it is needed for appropriate handling of viewpoints which exist both horizontally – within the same frame of reference, such as within a business specification – and vertically – within different frames of reference. In order to handle the complexity of a (new or existing) large system, it must be considered, on the one hand, as a composition of separate viewpoints, and on the other hand, as an integrated whole, probably at a different abstraction level.

A precise semantics allows us to detect inconsistencies and inaccuracies both in OOMTs themselves (meta-modeling), and in specifications written using these OOMTs (modeling). It is essential if we want to compare (and use) different OOMTs, with perhaps quite different syntaxes (notations), based on their meaning (semantics). This not only may improve the notations and make them more convenient, but also will enable interoperability between different OOMTs.

Moreover, precise semantics allows us to use a notation in a more standardized way, thus leading to better and unambiguous understanding and therefore supporting true reuse of specifications and design, including a more accurate definition of context conditions or (code) generators. And precise semantics provide the only way to trace requirement decisions, often through several intermediate steps, to produced code.

The scope of the workshop includes, but is not limited to:

- Precise semantics for OOMT
- Integration of semantics for a heterogeneous set of OOMT
- Formal development and refinement techniques for OOMT
- Comparisons of existing semantics models
- Ways to achieve preciseness
- Concurrency and OOMT
- Tool support
- Existing standards (e.g., ISO) and OOMT

The workshop is intended to contribute to an infrastructure that supports both desirable practice and future research and should document progress made.

This is not the first semantics workshop at OO conferences. The five OOPSLA workshops (with Proceedings, 1992-96) on behavioral semantics are reasonably well-known; and led to the publication of a book [2]. In addition, conclusions of these OOPSLA workshops have been published in the OOPSLA Addenda to the Proceedings. We hope to establish a similar tradition at ECOOP.

The submissions to this workshop represent a productive mix of academia and industry, and have a clearly international flavor. This statement is also applicable to the organizers of the workshop (we have done everything electronically!). We want to note, with great pleasure, that many if not most of the submissions emphasize the need to specify semantics in an abstract and precise manner, and use various rigorous and formal approaches to do just that. Important practical (and hopefully reusable) results have been achieved. Finally, we want to stress that the workshop is not about any particular product or methodology, but about concepts and constructs needed for better understanding and for building better systems. Thus, we will avoid situations described by Lewis Carroll above, “for avoydance of scandall is Divine law” (John Donne).

The workshop proceedings have been published as technical report by the Faculty of Computer Science of the Munich University of Technology [1]. The technical report is provided by the SysLab project, which is chaired by Manfred Broy, under grant of the DFG (German Research Community) under the Leibnizprogramme and by Siemens-Nixdorf.

Conclusions drawn during the workshop

The following list of conclusions has been drawn during the workshop by collecting statements from the participants. These statements have been discussed at the workshop and widely agreed upon. The list should be seen more as a good starting point for future workshop discussions, and less as final conclusions.

Some items below may be perceived as being “trivial”, “obscure”, or “contentious”.

The trivial stuff is well-known, but too many projects (in industry) fail just because this “trivial” stuff has not been taken into consideration (e.g., “no time”, “this is abstract crap, and we need to get the code out”, and so on).

The obscure stuff needs refinement and is especially suited to form the starting point for future workshop discussions.

And we tried to delete all contentious points if anyone at all tried to reject them in Jyväskylä.

- Simplicity (with correctness) is the most important aspect of human communication.
- Scalability and abstraction are explicitly needed.

- You may get insights from a picture.
- Precision:
    - Precision and ease of understanding are needed for a specification. Two approaches are possible for precise specification of semantics:
        - formalize OO modeling techniques [make more precise], or
        - add “warm” features to formal specification languages [make easier to understand].

      Merging as the result would be great.
        - Semantics of basic generic concepts should be made precise. To use terms like “aggregation” and “subtyping”, they have to be formally defined
    - Any notation (textual or graphical or ...) has to have a precisely defined semantics.
    - Precise semantics of a graphical notation (e.g., in Z) is used:
        - to rely upon in cases of doubt
        - to provide feedback to the (more or less) rigorous specifications using the notation
        - to detect inconsistencies and incompletenesses
        - and to acquire much better (analyst’s and client’s) understanding, not just a “warm and fuzzy feeling”.
- Explicitness:
    - Decisions have to be made explicit (and explicitly).
    - Explicit extraction of evidence of conflicts:
        - articulation of business specifications, including defaults and hidden information
        - notation must allow that
    - Extensibility has to be dealt with explicitly
    - Appropriate aspects of the environment have to be specified explicitly
    - How to combine different components of “OO” specifications should be stated explicitly. This is not trivial.
- Composition:
    - Composition is not an operator, it is an intellectual act (emergent properties appear here)
    - Composing different viewpoints is possible and often required
    - Abstraction is a result of composition
    - Implementation is composition (of specification and platform) [composing a given specification with an implementation-oriented context]
    - Objects (components) to be composed often belong to different layers (not only different frames of reference at the same layer)
- A tool (for specifications) may comprise a word processor and hypertext facility.
- Approaches have to be used in their frame of reference, and not everywhere

The gap between the semantics of the models and the semantics of the code has to be recognized and filled in. It is relatively easy if the semantics are explicitly specified and impossible otherwise.

- For precise (informal) specification notations, how do we achieve that
    - the users have a mutually consistent intuitive understanding of symbology (can't be resolved without a rigorous specification)
    - the users' intuitive understanding of semantics is the same as provided by the formally specified semantics.
- Trying to localize behavior in objects leads to pathological results and is difficult to understand; global description is very useful. Objects (and components) do not exist in isolation: collective state and behavior is essential. Closed system = isolated component.
- What to show the user?
    - Different levels of detail
    - Abbreviations
    - Different presentations for different users (e.g., graphical vs. linear)
    - Explicit conflicts should be shown
    - How to deal with the learning curve?
- Appropriate education and reward systems are needed to solve many of these problems.

Literature

[1] ECOOP'97 Workshop on Precise Semantics for Object-Oriented Modeling Techniques. Editors: Haim Kilov, Bernhard Rumpe. Technical report TUM-I9725, Institut für Informatik, Technische Universität München, 1997.

[2] Haim Kilov and William Harvey. *Object-oriented behavioral specifications*. Kluwer Academic Publishers, 1996. ISBN 0-7923-9778-9.

Organizers

Haim Kilov (haim_kilov@ml.com)

has been involved in all stages of information management system specification, design, and development. His approach to information modeling, widely used in telecommunications, financial, document management, and insurance areas, has contributed clarity and understandability to enterprise and application modeling, leading to business (and system) specifications that are demonstrably better than traditional ones. It has been described in *Information modeling: an object-oriented approach* (Prentice-Hall, 1994). Haim Kilov is using and extending his approach in customer engagements, and does research and consulting in the areas of business specifications and information modeling. He is a member of and active contributor to several international standardization technical committees, as well as an invited speaker at OMG task force meetings. He co-chaired five OOPSLA

workshops on object-oriented behavioral specifications, and co-edited their Proceedings. He also co-edited a book (recently published by Kluwer) based on the first four of these workshops. He has been a speaker and a program committee member at numerous national and international conferences. He has a significant number of publications in journals and conference proceedings. His interests are in the areas of information modeling, business specifications (including business patterns), and formal methods.

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is working in his research group to narrow the gap between formal methods and practical modeling techniques. In his Ph.D. thesis he has developed an approach for an integrated formalization of object-oriented modeling techniques that capture structure as well as behavior. He contributed to several papers on related topics, including a submission to the ECOOP´97, that contains an analysis of the UML description concepts. He also contributed to several workshops about similar themes, and recently organized a workshop with a similar theme within the working group ``Foundations of Object-Oriented Modeling" (GROOM), organized in the German Computer Science Community (GI, FG 2.1.9). Within the SysLab project he contributes to the development of a tool, that focuses less on simple editing functions, but more on the concrete use of the refinement and composition techniques for object-oriented description notations like class diagrams, state transition diagrams, and sequence diagrams.