

RECAST: Evolution of Object-Oriented Applications

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The goal of the Recast project is to support the evolution of object-oriented applications by focusing on three main directions: reverse engineering and reengineering, versions analysis, and migration towards components. As we are part of the Software Composition Group of the University of Bern, we worked on topics related to the Recast project but also on topics related to the project “Tools and Techniques for Decomposing and Composing Software”¹(TTDCS in the rest of this document). Therefore this report also lists the results obtained in the context of language design. Note that they are listed here to show that we got other results but they will be described in the detail in the TTDCS scientific report.

1 Results

The current results of the Recast project are:

- the identification of the key infrastructural design variations that have to be taken into account when developing reengineering environments. Indeed, most of the time reengineering environments are built without a clear analysis of the impact of the representation choices. The analysis we elaborate will serve as a basis to understand the concerns that have to be taken into account when designing new reengineering environments [5] [2].
- the development of a reengineering environment. We have extended MOOSE, our reengineering environment to support the analysis of versions. We are working on the analysis of new languages such as Java.
- the definition of new visualizations techniques for both system-wide and class-based understanding [1], [4], [6]. The work developed in [1], [6], and [4] while offering different solutions focuses on the same problem: how to support the understanding of classes. The first one uses Formal Concept Analysis to identify semantical clusters while the second presents how a visualization of a call-flow enriched with semantical information offers views which support the oppor-

¹(SNF Project No. 2000-067855.02, Oct. 2002 - Sept. 2004)

tunistic reading of the code. Finally in [4] we present how simple but scalable visualization techniques enriched with metric information support the perception of large systems. Note that Software-Tomography a professional environment started to use this idea.

We are currently working on the identification of trends in evolution, the definition of techniques to support the modularization of software, the use of formal techniques such as clustering analysis to support the understanding and clustering of object-oriented applications. We expect to have some significant publications on these topics within a year.

Contributions of Collaborators.

Mr. Girba developed the HisMo model to analyze evolution trends in large object-oriented systems. We are in a bootstrap phase (we collected case studies, designed a suitable meta-model for history analysis, and submitted a first paper) and we are now ready to perform a lot of experiments to validate our hypotheses.

Mr. Gälli is working on the analysis of tests. The idea is to prioritize failed tests in terms of their relevance to a given problems based on their coverage to offer to the developers the tests that are the most important to fix first.

Important Events.

- Organization of two workshops at the European Conference on Object-Oriented Programming ECOOP'2003: Object - Oriented Language Engineering in Post - Java Era and Object - Oriented Reengineering.
- Organization of the Annual European Smalltalk User Group Conference. Chair of the Academic Track, editor of the special issue of the journal Computer Languages from Elsevier.
- Michele Lanza whose PhD was co-supervised with O. Nierstrasz received the Denert Software-Engineering prize 2003 for his PhD.

Workshop Proceedings.

Wolfgang Demeuter and Stéphane Ducasse, Theo D'hondt and Ole Lehrmann Madsen, Report of the ECOOP'03 Workshop on Object - Oriented Language Engineering in Post - Java Era, *In Object - Oriented Technology (ECOOP'03 Workshop Reader)*, LNCS (Lecture Notes in Computer Science), Springer - Verlag, 2003.

Serge Demeyer and Stéphane Ducasse and Kim Mens, Adrian Trifu and Rajesh Vasa, Report of the ECOOP'03 Workshop on Object - Oriented Reengineering, *In Object - Oriented Technology (ECOOP'03 Workshop Reader)*, LNCS (Lecture Notes in Computer Science), Springer - Verlag, 2003.

2 Publications

As we are part of the Software Composition Group of the University of Berne, we worked on topics that are related to the evolution of object-oriented applications but also on topics related to the project “Tools and Techniques for Decomposing and Composing Software” (SNF Project No. 2000-067855.02, Oct. 2002 - Sept. 2004) (TTDCS).

To avoid discriminating one or other of the projects, we decided to clearly separate the publications. We selected as RECAST publications results related to reengineering and evolution publications and we selected as TTDCS results related to language design to TTDCS. For these papers we only list them here and they will be joined to the TTDCS report.

2.1 Recast Publications

- [1] Gabriela Arévalo, Stéphane Ducasse and Oscar Nierstrasz, XRay Views: Understanding the Internals of Classes, *In Proceedings of ASE'03 (Automated Software Engineering)*, 2003, short paper.
- [2] Michele Lanza, CodeCrawler - Lessons Learned in Building a Software Visualization Tool, *Proceedings of CSMR 2003*, IEEE Press, 2003, pp. 409-418.
- [3] Michele Lanza, Object-Oriented Reverse Engineering - Coarse-grained, Fine-grained, and Evolutionary Software Visualization, Ph.D. thesis, University of Berne, May 2003.

In Print. We got accepted articles that are in print or that have been published after the 1st of September 2003. They will be joined in the 2003-2004 report. Still we want to show that we got some results therefore we join as physical copies [4] and [5] as they are in print.

- [4] Michele Lanza and Stéphane Ducasse, Polymetric Views - A Lightweight Visual Approach to Reverse Engineering, *IEEE Transactions on Software Engineering*, vol. 29, no. 9, September 2003, pp. 782-795.
- [5] Stéphane Ducasse and Sander Tichelaar, Dimensions of Reengineering Environment Infrastructures, *International Journal on Software Maintenance: Research and Practice*, pp. 345-373, Vol 15, Oct, 2003.
- [6] Stéphane Ducasse and Michele Lanza, The Class Blueprint: a Visual Way of Understanding Classes, Accepted with major revision to *IEEE Transactions on Software Engineering*, 2003.
- [7] Roel Wuyts and Stéphane Ducasse, Unanticipated Integration of Development Tools using the Classification Model, 2003, To appear in *Elsevier Journal on Computer Languages, Special Issues on Smalltalk*.
- [8] Michele Lanza, Program Visualization Support for Highly Iterative Development Environments, *Proceedings of VisSoft 2003 International Workshop on Visualizing Software for Understanding and Analysis*, IEEE Press, 2003.

Recast Related Publications

Here are the publications that are related to RECAST but are part of the TTDCS report.

- [9] Gabriela Arévalo, Understanding Behavioral Dependencies in Class Hierarchies using Concept Analysis, Proceedings of LMO 2003: Langages et Modeles à Objets, Hermes, Paris, 2003, pp. 47-59.
- [10] Roland Bertuli and Stéphane Ducasse and Michele Lanza, *Understanding Object-Oriented Software Systems Using Condensed Run-Time Information*, Proceedings of WOOR 2003 (4th International Workshop on Object-Oriented Reengineering), University of Antwerp, 10-19, 2003.

2.2 Other publications

Here are the publications that we obtain in the context of the TTDCS project. They are mainly related to new language features.

- [11] Stéphane Ducasse and Philippe Mougín, Power to Collections: Generalizing Polymorphism by Unifying Array Programming and Object-Oriented Programming, *Proceedings of the ECOOP '03 Workshop on Object-oriented Language Engineering for the Post-Java Era*, 2003.
- [12] Alexandre Bergel, Stéphane Ducasse and Roel Wuyts, Classboxes: A Minimal Module Model Supporting Local Rebinding, *In Proceedings of the Joint Modular Languages Conference 2003*, LNCS (Lecture Notes in Computer Science), N 2789, Springer - Verlag, 2003, Best award paper.
- [13] Nathanael Schärli, Stéphane Ducasse, Oscar Nierstrasz and Andrew Black, Traits: Composable Units of Behavior, *In Proceedings ECOOP 2003*, LNCS, Springer Verlag, Juillet, 2003.
- [14] Stéphane Ducasse, Oscar Nierstrasz and Roel Wuyts, Composing Embedded Real-Time Software Components: the PECOS Data-Centric Approach, *ERCIM News*, 52, 2003.
- [15] Stéphane Ducasse Nathanael Schärli and Roel Wuyts, Controlled Right Accesses based on Uniform and Open Surfaces, *Proceedings of the ECOOP '03 Workshop on Object-oriented Language Engineering for the Post-Java Era*, 2003.

In print

- [16] Philippe Mougín and Stéphane Ducasse, OOPAL: Integrating Array Programming in Object - Oriented Programming, *In OOPSLA'2003 (International Conference on Object - Oriented Programming Systems Languages and Applications)*, 2003, 26 accepted papers on 142 = 18 %.
- [17] Andrew P. Black, Nathanael Schärli and Stéphane Ducasse, Applying Traits to the Smalltalk Collection Hierarchy, *Proceedings OOPSLA 2003*, 2003, 26 accepted papers on 142 = 18 %

- [18] Roel Wuyts, Stéphane Ducasse and Oscar Nierstrasz, A Data-centric Approach to Composing Embedded, Real-time Software Components, To appear in *Elsevier Journal of Systems and Software — Special Issue on Automated Component-Based Software Engineering*, 2003.