Annual Merit Report for 2001

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1 Research

1.1 Summary

I conduct research on program design and modularity mechanisms in programming languages, with special focus on aspect-oriented programming. Our work is about turning a tangled and scattered implementation of a concern into a well-modularized implementation of a concern.

This was a good year for the aspect-oriented programming movement in which I take some leadership. I am on the steering committee for the new series of AOSD (Aspect-Oriented Software Development) conferences. The first conference will be in April 2002 and the second will be at Northeastern University in Boston in 2003. I volunteered to be organizing chair for the Northeastern conference.

The visibility of AOSD has been greatly improved through a special issue of the Communications of the ACM on Aspect-Oriented Programming (AOP). I was one of the 4 panelists featured in the issue with Gregor Kiczales, Harold Ossher and Mehmet Aksit. We are the four fathers of AOP with Crista Lopes, one of our PhD students, being the mother. The visibility of AOSD was also improved by an MIT Technology Review article that mentions the Demeter work at Northeastern University and that labels AOP as one of the top ten most promissing tecnologies at the beginning of the millenium (Jan/Feb 2001).

Our main thrust is on exploring the space of AOP languages and their implementations. Our flagship vehicles are DemeterJ and DJ which live in the Adaptive Programming space. They offer concern-specific languages for traversal-related concerns. We had two papers on DJ this year, one at the Reflection conference in Japan and the other in the Communications of the ACM special issue. Doug Orleans developed Fred, an extension of MzScheme, to demonstrate his new approach to AOP to be presented at AOSD 2002. Johan Ovlinger developed acc, a compiler for aspectual collaborations which offer a form of modular AOP.

Pengcheng Wu added several enhancements to DJ (methods not only on nodes but also on edges) and around methods for nodes. This was subsequently improved by Doug Orleans.

We spent significant work on generating Java code from XML schemas to have a prototype implementation of JSR 31, the JAXB package.

1.2 Books in Print

My book on Adaptive Object-Oriented Software Development continues to be available on the web. Published 1996.

1.3 Journal Articles (Published)

"Discussing Aspects of AOP" with Tzilla Elrad and Mehmet Aksit and Gregor Kiczales and Harold Ossher, *Communications of the ACM*, October 2001, Special Issue on Aspect-Oriented Programming, Tzilla Elrad and Robert Filman, editors, 5 pages.

This was a collaborative effort which required many revisions because four subgroups had to cooperate together and come up with unified concepts and terminology.

"Aspect-Oriented Programming with Adaptive Methods" with Doug Orleans and Johan Ovlinger, *Communications of the ACM*, October 2001, Special Issue on Aspect-Oriented Programming, Tzilla Elrad and Robert Filman, editors, 3 pages.

1.4 Journal Articles (Submitted)

“Traversals of Object Structures: Specification and Efficient Implementation”, with Boaz Patt-Shamir and Doug Orleans. This paper was rejected in 2001 by IEEE Transactions on Software Engineering, was revised based on our experience with using the algorithms in DJ and submitted to ACM Transactions on Programming Languages.

Doug Orleans maintains an implementation of this algorithm in the AP Library which is distributed on the Demeter web page. This library has been used at the Free University of Brussels in a 2001 Ph.D. thesis with good results. The AP library has been improved in 2001 and is used intensively in my undergraduate and graduate courses.

1.5 Refereed Conference Papers Published

“DJ: Dynamic Adaptive Programming in Java” with Doug Orleans, *Reflection 2001: Meta-level Architectures and Separation of Crosscutting Concerns*, Kyoto, Japan, Springer Verlag, Akinori Yonezawa, editor, 8 pages.

NSF workshop position paper (by invitation): ”Coupling Mechanisms in Aspect-Oriented Software”, www.isis.vanderbilt.edu/sdp, ”NSF workshop: Software Design and Productivity (SDP) Coordinating Group”, November 2001.

1.6 Refereed Conference Papers Accepted

By Doug Orleans (I am not a coauthor but I advised Doug):

”Incremental Programming with Extensible Decisions”, First International Conference on Aspect-Oriented Software Development, April 2002, Enschede, The Netherlands, ACM Press,
http://www.ccs.neu.edu/home/dougo/papers/aosd02/

1.7 Invited Conference Presentations

OOPSLA 2001 Poster on ”Demeter Aspects”, invited by Peri Tarr. Doug Orleans and David Lorenz presented it.

1.8 Technical Reports

Mitch found a very elegant formulation of the semantics of traversal specifications which I have immediately integrated into my teaching of traversals both at the undergraduate and graduate level. The paper currently exists as a technical report but will soon be submitted to a journal. It was submitted to AOSD 2002 but rejected.

Mitchell Wand and Karl Lieberherr, Traversal Semantics in Object Graphs, Northeastern University, 2001, May, NU-CCS-2001-05.

Two additional reports on "Aspectual Collaborations" were produced and submitted to conferences (ECOOP and OOPSLA) but rejected. We hope that revisions will be accepted in 2002.

1.9 Invited Talks, Colloquia, etc.

Brown University November 2001 on Aspectual Collaborations. Invited Speaker for their Industrial Liason Day.

ABB Corporate Research Center November 2001 on AOP.

1.10 Technology Transfer Activities

XML and Demeter: a MS thesis was completed that integrates XML and Demeter.

DemeterJ is used by Verizon Inc. in a mission critical application that runs 24 hours 7 days per week. See:
http://www.ccs.neu.edu/research/demeter/evaluation/gte-labs/

Luis Blando from Verizon will give an invited presentation at AOSD 2002 about Verizon's successful use of AOSD technology, i.e. DemeterJ.

1.11 Grants

NSF Grant with David Lorenz on Collaboration-oriented Aspects: NSF CCR 0098643 $100 000 (August 2001 - July 2002).

With Mitch: BBN/DARPA: Aspects in Real-Time Embedded Systems, 5/18/2000 - 5/17/2004, approx. $750,000, 1-2 graduate students.

Industrial grant from ABB: $60000, supporting one PhD student (Theo Skotiniotis), Oct. 2001 - Oct. 2002.

Industrial Grant from SKYVA for Ovlinger ($60 000 for 12 months), September 2000 - September 2001.

Industrial Grant from SKYVA for Pengcheng Wu ($12000 June 2001 - September 2001).

1.12 Grant Proposals

Gretag Imaging, Regensdorf, Switzerland. I visited them, gave a talk (in 2000) all in preparation for a grant but then their stock price collapsed and the agreement that was already made orally was terminated.

1.13 Conferences Attended

Nashville: NSF workshop on Software Development Productivity, December 2001.

St. Louis, DARPA PI meeting, May 2001.

ECOOP 2001, Budapest, Hungary.

Trip to Reflection 2001 was all booked but then Sep. 11 made us cancel everything.

2 Teaching

2.1 Courses

COM 1205 Winter 2001 23 students

COM 3360 Fall 2001 10 students

COM 3360 was adapted to incorporate more on Aspect-Oriented Programming.

COM 1205 started to make many connections to XML.

Both courses use tools that we developed in our research program several years ago. Features of those tools are now available in XML and Java but not in such a clean and elegant form as in Demeter.

2.2 Ph.D. Students

Doug Orleans, Johan Ovlinger, Pengcheng Wu and Theo Skotiniotis. Doug is in his seventh year finalizing his PhD proposal. Johan is in his sixth year working on his thesis proposal. But his area has been selected.

Pengcheng is a second year PhD student now writing his research paper. And Theo is a first year PhD student supported by ABB.

2.3 Ph.D. Committees

I serve on the Ph.D. committees of Doug Orleans and Johan Ovlinger. I also served on the PhD commitee of Bart Wydaeghe at the Free University in Brussels, Belgium. He used the AP Library that Doug Orleans developed to automatically generate glue code for software components. I attended Bart's defense in Brussels in November.

At http://ssel.vub.ac.be/Members/BartWydaeghe/Phd/member_phd.htm is Bart Wydaeghe PhD thesis on component composition.

On pages 102 to 116 is a description on how traversal strategies and Doug Orleans Adaptive Programming Library are used to generate adapters to compose software components. The adapter generation is needed when there is a mismatch between two components.

2.4 Reading and Project Courses

I was Huichan He's master's thesis advisor on "XML Data-Binding in Java Applications". Winter and Spring Quarter. The thesis was done in the college of engineering.
http://www1.coe.neu.edu/ hche//JSR31/

Prasenjit Adak and Huichan He and Karl Lieberherr, Adaptive XML/Java Data-Binding . Summary of Master's Thesis by Huichan He in the College of Engineering, 10 pages.

COM 1800 with Ed McCormick. Spring 2001.

COM 1800 with Jon Kelley. Spring 2001.

COM 1800 with Michael Schenk. Spring 2001.

COM 1800 with Jean Traverse. Fall 2001.

All four projects were on using and improving aspect-oriented programming.

I worked with John Sung to get his MS thesis proposal approved. Topic: Integrating AspectJ and Demeter.

2.5 Other

I organize the Demeter seminar. About 20 meetings per year.

3 Service

3.1 Summary

3.2 College Committees

Chair of tenure committee: three year reviews for David and Raj, annual reviews for non-tenured faculty, tenure for Matthias Felleisen.

Graduate committee: Semester conversion: chair of software engineering subcommittee, chair of prerequisites subcommittee (exploring certificate options). Member of PhD committee.

Merit Review committee.

Sabbatical committee.

3.3 University Committees

School of entrepreneurship, starting June 2001, monthly 90 minute meetings.

3.4 Professional Service

Program committee of ECOOP 2001 and Reflection 2001 and AOSD 2002. Attended PC meetings (Aarhus and Chicago), except for Reflection 2001.

Editorial board of Concurrency and Computation.

3.5 Other Service

I maintain the popular Demeter website that offers attractive information about Aspect-Oriented Programming, including our software packages: DemeterJ, DJ and the AP Library. Maintaining the website and software on it could in itself be a full-time job.