Assessing HPCS Productivity with Purpose-Based Benchmarks at MHPCC

A Proposal to:

**Advancing University Research
with High Performance Computing (HPC) through Increased Student Engagement**

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University of Hawaii

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2004 Application for Advancing University Research
with High Performance Computing (HPC) through Increased Student Engagement

Instructions: Please complete the fields below. Mail, fax or email a signed and scanned copy as an attachment, to Dr. Susan T. Brown, 2532 Correa Rd., Building 37, Honolulu, HI 96822, stbrown@hawaii.edu, along with the 2-page project summary. (Summary may be an electronic attachment.)

Faculty Sponsor (Proposer):
Name: **Philip Johnson**
Dept.   **Information and Computer Sciences**
Campus: **Manoa**
Phone: **808 956-3489**
Email: **johnson@hawaii.edu**

Student:
Name: **Michael Paulding**
Undergraduate ___   Graduate **X**
Dept: **Information and Computer Sciences**
Campus: **Manoa**
Email: **mpauldin@hawaii.edu**
Academic Year 2004-5 **X**___   Summer 2005____

Title of Project: **Assessing HPCS productivity with Purpose-Based Benchmarks at MHPCC**

Amount Requested: **$20,928** (**$18,198 salary + $2,730 fringe)**

Basis of amount requested for direct student support, with reference to University student employment guidelines and pay schedules (e.g., undergraduate student at step A4-1 with payrate X for Y hrs/wk for Z week): **Graduate research assistantship GA-5 for one year at 20 hours/wee**k

Description of any non-financial resources requested to execute the project (expected usage of HPC resources, software licenses, technical help): **Expected usage of HPC resources includes access to clusters for development of Truss Optimizer PBB and reasonable level of tech support for hardware/software issues encountered.**

How project will use the MHPCC resources:
Development of Truss Optimizer PBB as described in the project proposal.

Signatures:

Faculty Sponsor – I agree to supervise this student in the execution of the proposed project proposed.

Signature:_____   Date:_____

Student: I agree to work under the supervision of the faculty sponsor in the execution of the proposed project.

Signature:_____   Date:_____

Fiscal Officer - I have reviewed the amount requested and agree that it is the appropriate amount required for student employment according to standard University of Hawaii administrative procedures. I further agree to administer the student employment and any other activities proposed.

Signature:_____   Date:_____

Please refer any questions to Sue Brown at 956-2808 or email stbrown@hawaii.edu.

Summary of Project (maximum 2 pages) describing technical background, work to be done, relevant qualifications of the faculty sponsor and proposed student to execute the work, background on any additional assistance requested. Attachments may be included (student resume, faculty CV, related publications) but are not required.

Assessing HPCS productivity with Purpose-Based Benchmarks at MHPCC

Motivation

High performance computing systems are being applied to an increasingly wide variety of domains, including nuclear physics, crash simulation, satellite data processing, fluid dynamics, climate modeling, bioinformatics, and financial modeling. They are also becoming radically less expensive: the recently announced $5.8 million dollar MACH-5 supercomputer based upon the Apple G-5 will execute 24 teraflops per second. In comparison, the current fastest supercomputer, Japan's Earth Simulator, executes 36 teraflops per second but costs over $350 million dollars.

Unfortunately, these numbers do not tell the whole story. The DARPA High Productivity Computing Systems Program [1] and the Workshop on the Roadmap for the Revitalization of High-End Computing [2] note that dramatic increases in low-level HPCS benchmarks of processor speed, memory access, and dollars/flop do not necessarily translate into increased development productivity. In other words, while the hardware is clearly getting faster and cheaper, the developer effort required to exploit these advances is becoming prohibitive.   Software engineering, not hardware engineering, is becoming the limiting factor in the advance of HPCS.

To complicate matters further, the design, implementation, development, and maintenance of HPCS software systems can differ in significant ways from the systems and development processes more typically studied by the software engineering community:

- The requirements often include conformance to sophisticated mathematical models. Indeed, requirements may often take the form of an executable model in a system such as Mathematica, and the implementation involves porting to the HPCS.

- The software development process, or "workflow" for HPCS application development may differ profoundly from traditional software engineering processes. For example, one scientific computing workflow, dubbed the "lone researcher", involves a single scientist developing a system to test a hypothesis. Once the system runs correctly once and returns its results, the scientist has no further need of the system. This contrasts with standard software engineering lifecycle models, in which the useful life of the software is expected to begin, not end, after the first correct execution.

- "Usability" in the context of HPCS application development may revolve around optimization to the machine architecture so that computations complete in a reasonable amount of time. The effort and resources involved in such optimization may exceed those required for initial development of the algorithm.

To address these issues, I have begun collaborative research with SUN Microsystems over the past year with two broad goals: (1) The study of HPCS development from a software engineering perspective, with the goal of identifying key HPCS productivity bottlenecks and subsequent development of new tools or techniques to overcome them; and (2) The development of more comprehensive measures of HPCS productivity for use in evaluating new and existing HPCS architectures, which take into account not only the low-level hardware components, but the higher-level development costs associated with producing usable HPCS applications using the architecture. Our work together so far has included the development of a framework for HPCS productivity evaluation that uses "Purpose-Based Benchmarks" [3], and the organization of a workshop on HPCS and Software Engineering [4].

Assessing HPCS productivity with Purpose-Based Benchmarks at MHPCC

Proposed research and contributions

To accelerate the pace of this research, and to create new opportunities for UH and MHPCC participation, I request graduate assistant funding for Michael Paulding, an ICS Ph.D. student, for the 2004-2005 academic year. Michael enrolled in EE 603, Understanding and Utilizing Parallel Computation, taught by Professor David Yun during Spring 2004, which gave him a comprehensive introduction to HPCS software development using the Engineering Department's LIPS-240 cluster as well as experience with MPI programming in C and Fortran. As part of this class, Michael began implementation of a Purpose-Based Benchmark (PBB) called the "Truss Optimizer". Briefly, given a wall with three attachment points and a load at a distance from the wall, the Truss Optimizer finds the pin-connected structure that uses the least amount of steel and therefore has the least mass. Each PBB, such as the Truss Optimizer, is designed to be complex enough to exercise HPCS resources, yet simple enough that it can be implemented on multiple platforms for comparative purposes. Unlike traditional HPC benchmarks like Linpack, PBBs measure not only run-time performance but also development time measures such as the time required to implement the software.

During the 2004-2005 academic year, the proposed funding will support the following research activities:

- Implementation of the Truss Optimizer PBB on an MHPCC platform such as HuiNalu using C, Fortran, and MPI libraries.
- Acquisition of PBB measurements for HuiNalu, including traditional HPC execution time metrics like speedup, as well as traditional software engineering metrics like developer effort, defect density, code size, and code complexity.
- Extension of my research system, the Hackystat automated software measurement framework [5], to support HPCS measurement.
- Possible porting/reimplementation of the Truss Optimizer PBB on a different MHPCC platform (such as Squall) or to a different software language/distributed computing infrastructure (such as JavaParty).

This proposed research is designed to make technical contributions to our understanding of the software engineering of high performance computing systems. It will result in the first complete implementation of the Truss Optimizer PBB, which will provide valuable insight into the utility and effectiveness of PBBs in general, the Truss PBB in particular, and the kinds of measures that can and should be collected. The research is also designed to create new opportunities for UH and MHPCC. It will provide new visibility for MHPCC as the site in which these measures were created. The data collected should be helpful in improving the developer productivity of MHPCC users. Finally, the research could lead to new collaborations between UH, MHPCC, SUN Microsystems, and the DARPA High Productivity Computing Systems program.

References

[1] DARPA High Productivity Computing Systems Program, http://www.highproductivity.org/

[2] The Roadmap for the Revitalization of High-End Computing, http://www.cra.org/Activities/workshops/nitrd/

[3] S. Faulk, J. Gustafson, P. Johnson, A. Porter, W. Tichy, and L. Votta, *Measuring HPCS Productivity*, International Journal of High Performance Computing and Applications, vol. 18, no. 4, Winter 2004.

[4] International Workshop on Software Engineering for High Performance Computing System Applications, http://csdl.ics.hawaii.edu/se-hpcs/

[5] Hackystat, A Framework for Automated Software Engineering Measurement, http://hackydev.ics.hawaii.edu

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Degrees

Ph.D. in Computer Science, University of Massachusetts, Amherst. 1990

M.S. in Computer Science, University of Massachusetts, Amherst. 1985

B.S. in Computer Science, University of Michigan, Ann Arbor. 1980

B.S. in Biology, University of Michigan, Ann Arbor. 1980

Research and Teaching Experience

Professor   2001—present
Associate Professor   1995—2001
Assistant Professor   1990—1995
Department of Information and Computer Sciences, University of Hawaii.

- Director, Collaborative Software Development Laboratory
- Graduate Chair, Information and Computer Sciences, 1998-2001

Senior Research Fellow   1997
Distributed Systems Technology Centre, University of Queensland, Brisbane, Australia.

- Research on computer-supported cooperative work technologies

Research Assistant   1984—1986, 1987—1990
Department of Computer Science, University of Massachusetts.

- Ph.D. thesis on structural evolution in software development
- Research on automated Ada package restructuring
- Research on natural language processing tools.

Teaching Assistant   1983—1984
Department of Computer Science, University of Massachusetts.

- Coursework support in software engineering.

Lecturer   1981—1982
Department of Computer and Communication Sciences, University of Michigan.

- Taught introductory programming course.

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Industry Experience

Member, Board of Directors   2003-present
Tiki Technologies, Inc., Honolulu, Hawaii.

- Tiki Technologies develops internet software such as spam detection systems.

Member, Board of Directors   2002-present
Lavanet, Inc., Honolulu, Hawaii.

- Lavanet is an Internet Service Provider, Network Engineering, and Web Development Services company.

Member, Board of Directors   1999-present
Hawaii Strategic Development Corporation, Honolulu, Hawaii.

- HSDC is a State-sponsored organization whose mission is to support the growth of the venture capital industry in Hawaii.

Member, Professional Advisory Board   2000-present
BreastCancer.org, Philadelphia, PA.

- BreastCancer.org is a non-profit organization dedicated to helping those living with breast cancer.

Member, Board of Directors   2000-2004
High Technology Development Corporation, Honolulu, Hawaii.

- HTDC is a State-sponsored organization whose mission is to support the growth of the high technology industry in Hawaii.

Co-Founder   2000
hotU, Inc., Honolulu, Hawaii.

- Served as interim Chief Technology Officer during initial formation of company to provide Internet-based services to college student market. Currently serve on Technology Advisory Board.

Consulting Software Engineer   1994—present
Honolulu, Hawaii.

- Providing project management and software engineering services to local and national companies.

Member, Professional Advisory Board   2000-2002
Referentia, Inc., Honolulu, HI.

- Referentia develops E-learning multimedia packages.

Programmer   1986—1987
Department of Computer Science, University of Massachusetts.

- Developed control shell for GBB, an AI knowledge base and inference environment.

Systems Programmer   1982—1983
Software Services Corporation, Ann Arbor, MI.

- Developed software quality assurance and validation tools for Ford Motor Company.

Systems Analyst   1981—1983

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Veterans Hospital, Ann Arbor, MI.

- Developed real-time data acquisition and signal processing software to control hardware for psychophysiological experimentation.

Programmer   1978
Great Lakes Software Systems, Ann Arbor, MI.

- Implemented an accounts receivable package in COBOL.

Journal Publications

S. Faulk and J. Gustafson and P. Johnson and A. Porter and W. Tichy and L. Votta, *Measuring HPC Productivity*, International Journal of High Performance Computing Applications, December 2004.

P. M. Johnson and M. L. Moffett and B. T. Pentland, *Lessons learned from VCommerce: A virtual environment for interdisciplinary learning about software entrepreneurship.* Communications of the ACM, Vol. 46, No. 12, December, 2003.

P. M. Johnson and C. A. Moore and J. A. Dane and R. S. Brewer, *Empirically Guided Software Effort Guesstimation.* IEEE Software, Vol. 17, No. 6, December 2000.

P. M. Johnson and A. M. Disney, *A Critical Analysis of PSP Data Quality: Results from a Case Study.* Journal of Empirical Software Engineering, Volume 4, December, 1999.

P. M. Johnson and A. M. Disney, *The Personal Software Process: A Cautionary Case Study.* In IEEE Software, Volume 15, No. 6, November, 1998.

P. M. Johnson, *Reengineering Inspection.* In Communications of the ACM, Volume 41, No. 2, February, 1998.

P. M. Johnson and D. Tjahjono, *Does Every Inspection Really Need A Meeting?*, In Journal of Empirical Software Engineering, Volume 4, No. 1, January 1998.

A. A. Porter and P. M. Johnson, *Assessing Software Review Meetings: Results of a Comparative Analysis of Two Experimental Studies.* In IEEE Transactions on Software Engineering, vol. 23, no. 3, March 1997.

P. M. Johnson, *Design for Instrumentation: High Quality Measurement of Formal Technical Review.* Software Quality Journal, Volume 5, March, 1996.

D. Wan and P. M. Johnson, *Experiences with CLARE: a Computer-Supported Collaborative Learning Environment.* In the International Journal of Human-Computer Studies, Volume 41, December, 1994.

P. M. Johnson, *Experiences with EGRET: An Exploratory Group Work Environment.* In Collaborative Computing 1(1), March, 1994.

B. Walker, M. Walker, S. Achem, P. Johnson, and R. Gregg. *The Clinical Significance of Electrogastrography.* In Psychophysiology 20: 1983.

Book Chapters

P. M. Johnson, *An Instrumented Approach to Improving Software Quality through Formal Technical Review*. In Software Inspection: An Industry Best Practice. David A. Wheeler, Bill Brykczyn-ski, and Reginald N. Meeson, Jr., Editors. IEEE Computer Society Press. 1996

Also appearing in the Proceedings of the 16th International Conference on Software Engineering, Sorrento, Italy. 1994.

P. M. Johnson and W. G. Lehnert, *Beyond Exploratory Programming: A Methodology and Environment for Natural Language Processing*. In Artificial Intelligence and Software Engineering, D. Partridge, editor. Ablex, 1990.

Also appearing in Proceedings of the Fifth National Conference on Artificial Intelligence (AAAI-86), Philadelphia, PA.

D. Corkill, K. Gallagher, and P. M. Johnson, *Achieving Flexibility, Efficiency, and Generality in Blackboard Architectures*. In Readings in Distributed Artificial Intelligence, A. Bond and L. Gasser, editors. Morgan-Kaufman, 1988.

Also appearing in Proceedings of the Sixth National Conference on Artificial Intelligence (AAAI-87), Seattle, WA.

Conference Publications

P. M. Johnson, H. Kou, J. Agustin, Q. Zhang, A. Kagawa, T. Yamashita, *Practical automated process and product metric collection and analysis in a classroom setting: Lessons learned from Hackystat-UH*, In Proceedings of the 2004 Symposium on Empirical Software Engineering, Los Angeles, CA., August 2004.

P. M. Johnson, H. Kou, J. Agustin, C. Chan, C. Moore, J. Miglani, S. Zhen, and W. Doane, *Beyond the Personal Software Process: Metrics collection and analysis for the differently disciplined*, In Proceedings of the 2003 International Conference on Software Engineering, Portland, OR., May, 2003.

P. M. Johnson, *Leap: A "Personal Information Environment" for Software Engineers*. In Proceedings of the 1999 International Conference on Software Engineering, Los Angeles, CA., May 1999.

A. M. Disney, P. M. Johnson, *Investigating Data Quality Problems in the PSP*. In Proceedings of the Sixth International Symposium on the Foundations of Software Engineering, Orlando, FL., November, 1998.

P. M. Johnson, D. Tjahjono, *Assessing software review meetings: A controlled experimental study using CSRS*. In Proceedings of the 1997 International Conference on Software Engineering, Boston, MA., May 1997.

D. Wan and P. M. Johnson, *Computer Supported Collaborative Learning using CLARE: the Approach and Experimental Findings*. In Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work, Chapel Hill, NC. 1994.

P. M. Johnson, *Supporting Technology Transfer of Formal Technical Review through a Computer Supported Collaborative Review System*. In Proceedings of the Fourth International Conference on Software Quality, Reston, VA. 1994

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P. M. Johnson, *An Instrumented Approach to Improving Software Quality through Formal Technical Review*. In Proceedings of the 16th International Conference on Software Engineering, Sorrento, Italy. 1994.

P. M. Johnson, D. Tjahjono, D. Wan, R. Brewer, *Experiences with CSRS: An Instrumented Software Review Environment*. In Proceedings of the 11th Annual Pacific Northwest Software Quality Conference, Portland, OR. 1993.

P. M. Johnson, D. Tjahjono, *Improving Software Quality through Computer Supported Collaborative Review*. In Proceedings of the Third European Conference on Computer Supported Cooperative Work, Milan, Italy. 1993.

P. M. Johnson, *Supporting Exploratory CSCW with the EGRET Framework*. In Proceedings of the ACM 1992 Conference on Computer Supported Cooperative Work, Toronto, Canada. 1992.

P. M. Johnson, D. Hildum, A. Kaplan, C. Kay, and J. Wileden, *An Ada Restructuring Assistant*. In Proceedings of the Fourth Annual Conference on Artificial Intelligence and Ada, Fairfax, VA. 1988.

D. Corkill, K. Gallagher, and P. M. Johnson, *Achieving Flexibility, Efficiency, and Generality in Blackboard Architectures*. In Proceedings of the Sixth National Conference on Artificial Intelligence (AAAI-87), Seattle, WA.

P. M. Johnson and W. G. Lehnert, *Beyond Exploratory Programming: A Methodology and Environment for Natural Language Processing*. In Proceedings of the Fifth National Conference on Artificial Intelligence (AAAI-86), Philadelphia, PA.

Workshop Publications

P. M. Johnson, *You can't even ask them to push a button: Toward ubiquitous, developer-centric, empirical software engineering*, Proceedings of the Workshop on New Visions for Software Design and Productivity: Research and Applications, December, 2001.

P. M. Johnson, *Project LEAP, Lightweight, Empirical, Anti-measurement dysfunction, and Portable Software Developer Improvement*, Software Engineering Notes, Volume 24, Number 6, December 1999.

P. M. Johnson, *Egret: A Framework for Advanced CSCW Applications*, Software Engineering Notes, Volume 21, Number 5, September 1996.

P. M. Johnson, *Assessing software review meetings: An empirical study using CSRS*, Appearing in the 1996 International Software Engineering Research Network Meeting (ISERN'96), Sydney, Australia, August, 1996.

P. M. Johnson and Carleton Moore, *Investigating Strong Collaboration with the Annotated Egret Navigator*, Appearing in the Fourth IEEE Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises (WET ICE 95), April, 1995.

P. M. Johnson, *Computer Supported Formal Technical Review with CSRS*, Software Inspection and Review Organization Newsletter, Volume 5, Number 3, December, 1994.

P. M. Johnson, *Collaboration-in-the-large vs. Collaboration-in-the-small*. Appearing in Proceedings of the 1994 CSCW Workshop on Software Architectures for Cooperative Systems, Chapel Hill, VA. October, 1994.

P. M. Johnson, *From Principle-centered to Organization-centered Design: A Case Study of Evolution in a Computer-Supported Formal Technical Review Environment*. Appearing in the Proceedings of the 15th Interdisciplinary Workshop on Informatics and Psychology, Scharding, Austria, 1994.

P. M. Johnson, *Report from the 1993 ECSCW Workshop on Tools and Technologies*. SIGOIS Bulletin, April, 1994.

P. M. Johnson, *Methodological Issues in CSCW Research*. Position paper for the 1993 European Conference on Computer Supported Cooperative Work, Workshop on Tools and Technologies, Milan, Italy. 1993.

P. M. Johnson, *An Architectural Perspective on EGRET*. In Proceedings of the ACM 1992 Conference on Computer Supported Cooperative Work, Workshop on Tools and Technologies, Toronto, Canada. 1992.

P. M. Johnson, *Collaborative Software Review for Capturing Design Rationale*. In Proceedings of the 1992 AAAI Workshop on AI and Design Rationale, San Jose, CA. 1992.

D. Wan and P. M. Johnson, *Supporting Scientific Learning and Research Review using CORE-VIEW*. In Proceedings of the 1992 AAAI Workshop on Communicating Scientific and Technical Knowledge, San Jose, CA. 1992.

P. M. Johnson, *EGRET: Exploring Open, Evolutionary, and Emergent Collaborative Systems*. In Proceedings of the 1991 European Conference on Computer Supported Cooperative Work, Tools and Technologies Workshop, Amsterdam, The Netherlands. 1991.

P. M. Johnson, *Structural Evolution in Exploratory Software Development*. In Proceedings of the 1989 AAAI Spring Symposium on AI and Software Engineering, Stanford University, CA. 1989.

S. Founds and P. M. Johnson, *A Knowledge-based Rhythm Composition Tool*. In Proceedings of the 1989 IJCAI Workshop on Artificial Intelligence and Music, Detroit, MI. 1989.

P. M. Johnson, *Integrating BB1-style Control into the Generic Blackboard System*. In Proceedings of the 1987 AAAI Workshop on Blackboard Systems, Seattle, WA. 1987.

P. M. Johnson, *Combining Software Engineering and Artificial Intelligence*. In Proceedings of the First International Workshop on Computer-Aided Software Engineering, Cambridge, MA. 1987.

D. Corkill, K. Gallagher, and P. M. Johnson, *From Prototype to Product: Evolutionary Development from within the Blackboard Paradigm*. In Proceedings of the Workshop on High-level Tools for Knowledge-based Systems, Columbus, OH. 1986.

P. M. Johnson, *Requirements Definition for a PLUMber's Apprentice*. In Proceedings of the Second Annual Workshop on Theoretical Issues in Conceptual Information Processing, New Haven, CT. 1985.

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Tutorial Presentations

Java: What's it all about? Half-day tutorial presented at the Pacific New Media Center, Honolulu, HI, November, 1997.

The TekInspect Software Review Method: Reviewer Training and *The TekInspect Software Review Method: Moderator Training*. Two day tutorial presented at Tektronix, Inc, Beaverton, OR. July, 1996.

Inspection Quick Start: An accelerated, pragmatic introduction for software engineers and managers. Full-day tutorial presented at Tektronix, Inc, Beaverton, OR. May, 1996.

Improved Formal Technical Reviews: Beyond Fagan Code Inspections. Half-day tutorial presented at the 17th International Conference on Software Engineering, Seattle, WA. April, 1995.

Formal Technical Review: Theory and Practice — Past, Present, and Future. Half-day tutorial presented at the Fourth International Conference on Software Quality, Reston, VA. 1994

UNIX and Trends in Next Generation Operating Systems. Half-day tutorial presented at the Japan-America Institute for Management Science. Honolulu, HI. 1992, 1993, 1994.

Invited Talks

Tool Support for Experimentation. Panel chair and member, presented at the 2003 meeting of the International Software Engineering Research Network, Rome, Italy, 2004.

e-World Experimentation. Panel chair and member, presented at the 2001 meeting of the International Software Engineering Research Network, Strathclyde, Scotland, August, 2001.

Experimental Software Engineering in Internet Startups: An oxymoron? Talk presented at the 2000 meeting of the International Software Engineering Research Network, Honolulu, HI. October, 2000.

Process improvement is dead! Long live the rising tide! Talk presented at Microsoft Corporation, Seattle, Washington. November, 1999.

Questioning assumptions in the PSP, Part II. Talk presented at the 1999 meeting of the International Software Engineering Research Network, Oulu, Finland. June, 1999.

Introduction to Software Engineering in the Collaborative Software Development Laboratory. Talk presented at "A presentation of leading-edge scientific projects and programs for the Honorable Benjamin J. Cayetano, Governor, State of Hawaii". University of Hawaii, April, 1999.

Investigating Data Quality Problems in the PSP. Talk presented at the Sixth International Symposium on the Foundations of Software Engineering, Orlando, FL, November, 1998.

From the PSP to Project LEAP. Talk presented at the 1998 Meeting of the International Software Engineering Research Network, Naperville, IL, October, 1998.

What's Quality Got To Do With It? Talk presented at the School of Information Technology, University of Queensland, St. Lucia, Australia, July, 1997.

Java: What's so Special? Talk presented at the Annual Meeting of the Data Processing Management Association, Western Region. Honolulu, HI, September, 1996.

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Object Oriented Programming: From Scandinavia to the South Pacific, Simula to OO Cobol. Talk presented to the Data Processing Management Association, Honolulu Chapter, April 1996.

Reengineering Inspection: The Future of Formal Technical Review. Talk presented at: Tektronix, Inc, Beaverton, OR; Andersen Consulting, Chicago, IL; Motorola, Inc, Austin, TX. 1996.

Supporting Software Quality through Computer Supported Formal Technical Review. Invited talk for the Distinguished Software Scientists Visiting Speaker Program, Tektronix, Inc. Beaverton, OR. 1994.

Supporting Technology Transfer of Formal Technical Review through a Computer Supported Collaborative Review System. Talk presented at the Fourth International Conference on Software Quality, Reston, VA. 1994

Lessons Learned from Designing Computer-mediated Collaboration for Formal Technical Review. Talk presented at the 15th Interdisciplinary Workshop on Informatics and Psychology, Schärding, Austria, 1994.

An Instrumented Approach to Improving Software Quality through Formal Technical Review. Talk presented at: the 16th International Conference on Software Engineering, Sorrento, Italy; the University of Aalborg, Denmark. 1994.

Experiences with CSRS: An Instrumented Software Review Environment. Talk presented at the Eleventh Annual Pacific Northwest Quality Conference, Portland, OR. October, 1993.

Improving Software Quality through Computer-Supported Formal Technical Review. Invited talk presented at the Naval Command, Control, and Ocean Surveillance Center, San Diego, CA. October, 1993.

Improving Software Quality through Computer-Supported Collaborative Review. Talk presented at the 1993 European Conference on Computer Supported Cooperative Work. Milan, Italy. 1993.

Why CSCW Developers are Bad at CSCW Research. Keynote address presented at the 1993 European Conference on Computer Supported Cooperative Work, Tools and Technologies Workshop. Milan, Italy. 1993.

CSRS: A Collaborative Software Review Environment. Poster session at the 15th International Conference on Software Engineering. Baltimore, MD. 1993.

Working Notes on Collaborative Design of a Collaborative Spreadsheet. Talk presented at the 1992 International Conference on Computer Supported Cooperative Work, Workshop on Tools and Technologies. Toronto, Canada. 1992.

Supporting Exploratory CSCW with the Egret Framework. Talk presented at the 1992 International Conference on Computer Supported Cooperative Work. Toronto, Canada. 1992.

Coordination in the Egret Framework. Talk presented at the 1992 AAAI Workshop on AI and Design Rationale. San Jose, CA. 1992.

International Aspects of Computer Supported Cooperative Work. Talk presented at the Hawaii International Software Conference. Honolulu, HI. 1991

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Type Flow Analysis for Exploratory Software Development. Talk presented at: MITRE Corporation, University of South Carolina at Columbia, Siemens Corporation, University of California at San Diego, MCC, Portland State University, University of Hawaii at Manoa, and the University of Massachusetts at Amherst. 1990.

An Ada Restructuring Assistant. Talk presented at the Fourth Annual Conference on Artificial Intelligence and Ada. Fairfax, VA. 1988.

Integrating BB1-Style Control into the Generic Blackboard System. Talk presented at the 1987 AAAI Workshop on Blackboard Systems. Seattle, WA. 1987.

How can Knowledge-based Approaches Help Computer-Aided Software Engineering? Panel member at the First International Workshop on Computer-Aided Software Engineering. Cambridge, MA. 1987.

Combining Software Engineering and Artificial Intelligence. Talk presented at the First International Workshop on Computer-Aided Software Engineering. Cambridge, MA. 1987.

Beyond Exploratory Programming: A Methodology and Environment for Natural Language Processing. Talk presented at AAAI 1986. Philadelphia, PA. 1986.

An Introduction to the Plumber's Apprentice. Talk presented at General Electric Corporation Research and Development. Schenectady, NY. 1986.

Requirements Definition for a Plumber's Apprentice. Talk presented at the 2nd Annual Workshop on Theoretical Issues in Conceptual Information Processing. New Haven, CT. 1985.

Computers in Psychophysiology: Hardware and Software Considerations. Lecture series presented at the Veterans Hospital, Ann Arbor, MI. 1982.

Awarded Grant Support

Eclipse Innovation Grant Award, P. M. Johnson, Principal Investigator. IBM Corporation. $15,000. 2004.

Supporting development of highly dependable software through continuous, automated, in-process, and individualized software measurement validation. P. M. Johnson, Principal Investigator. Joint NSF/NASA Highly Dependable Computing Program. $638,000. 2002-2006.

Aligning the financial services, fulfillment distribution infrastructure, and small business sectors in Hawaii through B2B technology innovation. P. M. Johnson, Principal Investigator. University of Hawaii New Economy Research Grant Program. $30,000. 2000-2001.

Internet Entrepreneurship: Theory and Practice. P. M. Johnson and Glen Taylor, Principal Investigators. University of Hawaii Entrepreneurship Course Development Grant. $10,000. 1999-2000.

Java-based software engineering technology for high quality development in "Internet Time" organizations. P. M. Johnson, Principal Investigator. Sun Microsystems Academic Equipment Grant Program. $39,205. 1999.

Project LEAP: Lightweight, Empirical, Anti-measurement dysfunction, and Portable Software Developer Improvement. P. M. Johnson, Principal Investigator. National Science Foundation. $265,000. 1998-2001.

Internet-enabled Engineering Tool for Dynamically Analyzing and Planning World-Wide Subsea Cable and Array Installations. P. M. Johnson, Principal Investigator. Makai Ocean Engineering, Inc. $83,286. 1998-1999.

Kona: A distributed, collaborative technical review environment. P. M. Johnson, Principal Investigator. Digital Equipment Corporation External Research Program. $101,413. 1997.

Collaborative Software Development Laboratory Industrial Affiliates Program: Makai Ocean Engineering, Inc., P. M. Johnson, Principal Investigator. $10,000. 1997.

Collaborative Software Development Laboratory Industrial Affiliates Program: Tektronix, Inc., P. M. Johnson, Principal Investigator. $45,000. 1996-1998.

Improving Software Quality through Instrumented Formal Technical Review, P. M. Johnson, Principal Investigator. National Science Foundation. $161,754. 1995-1997.

Collaboration Mechanisms for Project HI-TIME: Hawaii Telecommunications Infrastructure Modernization and Expansion: A Model for Statewide Strategic Planning, P. M. Johnson, Principal Investigator. Subcontract with the Pacific International Center for High Technology Research. $30,280. 1995

Three Dimensional Interfaces for Evolving Collaborative Systems. P. Johnson, Principal Investigator. University of Hawaii Research Council Seed Money Grant, $5,000. 1992-1993.

Support for Structural Evolution in Exploratory Software Development. P. M. Johnson, Principal Investigator. National Science Foundation Research Initiation Award Program in Software Engineering. $54,810. 1991-1993.

An Investigation of Software Structure Evolution. P. M. Johnson, Principal Investigator. University of Hawaii Research Council Seed Money Grant, $6,000. 1990-1991.

Professional Activities

Program Committee Member, PROFES 2005, Oulu, Finland, June 2005.

Program Chair, First International Workshop on Software Engineering for High Performance Computing System Applications, Edinburgh, Scotland, May, 2004.

Program Committee Member, XP/Agile Universe, Calgary, CA, August 2004.

Program Committee Member, International Software Metrics Symposium, 2003-2004.

Program Committee Member, International Symposium on Empirical Software Engineering, 2002-2004.

Editorial Board, IEEE Transactions on Software Engineering, 2000-2004.

Program Chair, International Software Engineering Research Network Annual Meeting, Honolulu, HI, 2000.

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Member, State of Hawaii Millenium Workforce Development Initiative, 1999.

Program Committee Member, European Conference on Computer Supported Cooperative Work, Copenhagen, Denmark, 1999.

Judge, Hawaii State Science Fair, Honolulu, Hawaii, 1998-present.

Founder and Chair, Hawaii Java Users Group, Honolulu, Hawaii, 1996-present.

Member, International Software Engineering Research Network (ISERN), 1996-present.

Program Committee Member, European Conference on Computer Supported Cooperative Work, Lancaster, England, 1997.

Advisory Board Member, The International Journal of Computer Supported Cooperative Work, 1997-2004.

Editor, the WWW Formal Technical Review Archive.
http://www.ics.hawaii.edu/~johnson/FTR/.

Editor, the WWW Software Inspection and Review Organization (SIRO) Home Page.
http://www.ics.hawaii.edu/~siro/.

Program Organizer, Software Architectures for Cooperative Systems Workshop, 1994 ACM Conference on Computer Supported Cooperative Work, Chapel Hill, North Carolina.

Program Chair, CSCW Tools and Technologies Workshop, 1993 European Conference on Computer Supported Cooperative Work, Milan, Italy.

Program Organizer, CSCW Tools and Technologies Workshop, 1992 ACM Conference on Computer Supported Cooperative Work, Toronto, Canada.

Reviewer, IEEE Transactions on Software Engineering, IEEE Software, ACM Transactions on Software Engineering and Methodology, Hawaii International Conference on System Sciences, Sixth International Conference on Computing and Information, IEEE Computer, the 1993 Conference on Organizational Computing Systems, the 1993 International Conference on Computer Applications in Industry and Engineering, the Journal of Collaborative Computing, Artificial Intelligence in Engineering, Design, and Manufacturing (AI-EDAM), ACM Transactions on Programming Languages and Systems, The AI Handbook, Volume 4 (Chapter on AI and Software Engineering), the 1991 Conference on Software Maintenance.

Awards and Honors

Coach of the Year, American Youth Soccer Association, Region 100, 2001.

Honorary member, Golden Key International Honour Society, 2001.

University of Hawaii Presidential Citation for Meritorious Teaching, 1994.

Computer and Information Science Department Fellowship, 1989-1990.

University of Massachusetts Graduate School Fellowship, 1985-1986.

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Michael George Paulding

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EDUCATION: **University of Hawaii at Manoa,** Honolulu, HI
   Degree: Candidate for Ph.D. in Information and Computer Sciences
   Cumulative G.P.A. – 3.94/4.0
Bucknell University, Lewisburg, PA
   Degree: BS in Computer Science and Engineering, Magna Cum Laude, May 2002

Computer Experience: Sun Certified Java Programmer, C/C++, Visual Basic, Perl, Eiffel, LISP, Scheme, Pascal, MIPS, Sun Solaris, Linux and UNIX Workstations, Windows XP/NT, TCP/IP, MS Office Suite

WORK EXPERIENCE: **Graduate Intern,** Sun Microsystems, Inc. (Summer 2004)
- Implementing purpose-based benchmarks to identify key High Performance Computing System (HPCS) productivity bottlenecks and the development of tools and techniques to overcome them.

Research Assistant, Collaborative Software Development Lab, UHM (01/2004 – Present)
- Performing research on measurement and analysis of software telemetry data to improve productivity of high performance and parallel computing systems.

Professional, JP Morgan Chase (08/2002 – 08/2003)
- Developed a real-time programming language to build applications that calculate profit maximizing prices from fixed income brokers.
- Designed a distributed platform to compute financial analytics for bonds and other fixed income instruments, processed in real-time.

Applications Delivery Intern, JP Morgan Chase (05/2001 – 08/2001)
- Developed VB application to verify fixed income broker pages between trader monitoring software and a remote database. Automated log to report discrepancies.
- Converted existing trader application to retrieve real time prices from a Tib publishing backbone. Modified trader application for improved performance.

TEACHING EXPERIENCE: **Teaching Assistant,** Networks and Web Programming courses, UHM (08/2003 – Present)
- Provide face-to-face information and remedial sessions for students enrolled in online courses, with primary instructors based in London and Norway.
- Design grading schema and assess students for programming assignments and exams.

Calculus I, II, III Tutor, Bucknell University (01/2000 – 05/2002)
- Met biweekly with two students in need of Calculus help throughout semesters.
- Underwent extensive training through the Career Development Center for improved communication in mathematics.

Teaching Assistant, Engineering 100, Bucknell University (08/1999 – 12/2001)
- Facilitated a discussion session for students seeking help outside of class.
- Prepared supplementary notes for lecture and drafted answer keys for exams.

ACTIVITIES / : HONORS   "A Bounded Linear Approximation for Multiprocessor Job Scheduling" - Research with Dr. Antonio Miranda, Bucknell University (11/2001-05/2002)
Tau Beta Pi, National Engineering Honor Society (10/2001-Present)
Alpha Lambda Delta, National Honor Society (05/1999-Present)
Phi Eta Sigma, National Academic Fraternity (08/1999-Present)

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June 29, 2004

Dr. Susan Brown
Director, HPC Engagement Program
University of Hawaii
Honolulu, HI 96822

Dear Susan,

I enthusiastically support Professor Philip Johnson's proposal called "Assessing HPCS Productivity with Purpose-Based Benchmarks at MHPCC" to the "Advancing University Research with High Performance Computing (HPC) through Increased Student Engagement" program. Sun Microsystems has become aware that major improvements in high performance computing will require major new research initiatives to understand the software engineering of these systems, and the development of new tools and technologies to address the unique challenges involved with the design, implementation, and maintenance of these systems.

Professor Johnson's research supervision of Mike Paulding will provide important initial findings in this area, and the use of platforms at the Maui High Performance Computing Center will help these results be more useful and relevant in real-world HPCS settings.

Sincerely yours,

Lawrence G. Votta Jr.

Sun Distinguished Engineer
SunCARE (Sun Customer Advocates for Reliability Engineering)

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June 30, 2004

Reference Biography:

   Dr. Lawrence G. Votta Jr. received his B.S. degree in Physics from the University of Maryland, College Park, Maryland in 1973, and his Ph.D. degree in Physics from the Massachusetts Institute of Technology, Cambridge, Massachusetts in 1979. He is a Distinguished Engineer at Sun Microsystems improving the software and system reliability and availability of Sun's products. Larry is the Productivity and Reliability, Availability and Serviceability Principle Investigator for Sun Microsystems' successful DARPA Phase II High Performance/Productivity Computer System project. Larry has authored or coauthored more than 60 papers and chapters of 2 books in Software Engineering (and another 10 papers in Physics) including empirical studies of software development from highly controlled experiments investigating the best methods for design reviews and code inspection to anecdotal studies of a developer's time usage in a large software development. Larry is a member of the IEEE and ACM.