Eric M. Heien

Contact Information

Computational Infrastructure for Geodynamics (CIG)
Department of Geology
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University of California, Davis
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http://www.heien.org/research/

Citizenship

USA

Research Interests

parallel computing, high performance computing, parallel simulation of biological/chemical/physical systems, task scheduling and computing on desktop grids

Education

University of California, Davis, Davis, California, USA

Postdoctoral Studies, Department of Geology, March 2010 - September 2010, June 2011 - present

- Area of study: Large scale parallel simulation of earthquakes, mantle convection
- Advisors: Prof. Donald Turcotte, Prof. John Rundle, Prof. Louise Kellogg

INRIA, Grenoble Rhône-Alpes, France

Postdoctoral Studies, INRIA, September 2010 - May 2011

- Area of study: Modeling and utilization of Internet oriented cloud computing, fault tolerance
- Advisor: Dr. Derrick Kondo

Osaka University, Osaka, Japan

Ph. D., Graduate School of Information Science and Technology, March 2010

- Thesis Topic: Parallel Simulation of Large Scale Heterogeneous Biophysical Systems
- Advisor: Prof. Kenichi Hagihara
- Area of Study: Parallel and distributed computing

Doshisha University, Kyoto, Japan

Japanese Language Course Level VI (8000 words, 1500 kanji), September 2006

Independent Research in Evolutionary Algorithms, Advisor: Prof. Tomo Hiroyasu

University of California, Berkeley, Berkeley, California USA

B.A., Computer Science, May 2002

Awards and Grants

Japan Society for the Promotion of Science

- Research Fellowship for Young Scientists, 2007-2010
- Grant-in-Aid for Scientific Research, 2007-2010

Global Center of Excellence for Predictive Medicine (*in silico* medicine) Infrastructure
- Grant for Young Researchers, 2007-2008

Space Sciences Laboratory
- Summer Student Research Fellowship, 2001

Academic Experience

Osaka University, Osaka, Japan

Graduate Student **April 2007 to March 2010**

- Japan Society for the Promotion of Science - Research Fellow (November 2007 to March 2010)

Teaching Assistant **Spring 2007 and Fall 2008**

- Assisted Prof. Fujimoto in Parallel Programming course and Prof. Hagihara in Theory of Parallel Algorithms course.
- Provided in-class support to professor and students in Theory of Parallel Algorithms.
- Maintained and administered parallel computing cluster for Parallel Programming course.

Student Research Advisor **May 2008 to March 2010**

- Developed research topics for undergraduate and masters students
- Met weekly with students to assess progress and make suggestions

UCBerkeley Space Sciences Laboratory, Berkeley, California USA

Student Engineering Aide **September 1999 to March 2002**

- Developed, programmed and tested radio signal analysis algorithms (triplet, FFT, fast folding).
- Rewrote key sections of database code to significantly increase speed.
- Developed science features on web site, coded CGI to show computation results.
- Developed telescope automation program.
- Operated Optical SETI search program during summer 2000 and summer 2001.
- Supervised undergraduate students in development of SETI@home client.

Programmer/Analyst I **April 2002 to August 2003**

- Key developer of global distributed computing application BOINC.
- Designed and implemented client-application API, client-master communication protocol.
- Responsible for beta testing phase of client development.
- Supervised undergraduate students in development of BOINC volunteer computing system.

University of California, Berkeley, Berkeley, California USA

Undergraduate Researcher **December 1998 to March 2002**

- Worked with Prof. Richard Fateman to develop mathematical equation interpreter and online graphing calculator in Java.
- Interfaced calculator to be front-end to a symbolic integration engine.
- Researched equation input systems and developed tree based GUI equation input and manipulation program.

Undergraduate Student **August 1998 to May 2002**

International Journal Articles

A Correlated Resource Model of Internet End Hosts
E. Heien, D. Kondo, D. Anderson
IEEE Transactions on Parallel and Distributed Computing, (under revision)

Computing Low Latency Batches with Unreliable Workers in Volunteer Computing Environments
E. Heien, D. Anderson, K. Hagihara
Journal of Grid Computing, December 2009 Vol. 7, No. 4, pp. 501-518

Optimization Techniques for Parallel Biophysical Simulations Generated by *insilico*IDE
E. Heien, Y. Asai, T. Nomura, K. Hagihara
IPSJ Transactions on Advanced Computing Systems July 2009, vol. 2 (2) pp. 131-143

Specifications of insilicoML 1.0: A Multilevel Biophysical Model Description Language
Y. Asai, Y. Suzuki, Y. Kido, H. Oka, **E. Heien**, M. Nakanishi, T. Urai, K. Hagihara, Y. Kurachi, T. Nomura
The Journal of Physiological Sciences : JPS 2008 vol. 58 (7) pp. 447-58

Refereed International Conference Papers (acceptance rates in parentheses)

Modeling and Tolerating Heterogeneous Failures in Large Parallel Systems
E. Heien, D. Kondo, A. Gainaru, D. LaPine, B. Kramer, F. Cappello
Supercomputing 2011, Seattle, USA
(21.0% acceptance rate, 74/352)

Correlated Resource Models of Internet End Hosts
E. Heien, D. Kondo, D. Anderson
31st International Conference on Distributed Computing Systems, 2011, Minneapolis, USA
(15.4% acceptance rate, 87/565)

A Multi-GPU Spectrometer System for Real-time Wide Bandwidth Radio Signal Analysis
H. Kondo, **E. Heien**, M. Okita, D. Werthimer, and K. Hagihara
8th International Symposium on Parallel and Distributed Processing with Applications, 2010, Taipei, Taiwan

insilicoSim: an Extendable Engine for Parallel Heterogeneous Biophysical Simulations
E. Heien, M. Okita, Y. Asai, T. Nomura, K. Hagihara
3rd International ICST Conference on Simulation Tools and Techniques, 2010, Torremolinos, Spain

PyMW: a Python Module for Parallel Master Worker Computing
E. Heien, A. Kornafeld, Y. Takata, K. Hagihara
1st International Conference on Parallel, Distributed and Grid Computing for Engineering, 2009, Pécs, Hungary

Static Load Distribution for Communication Intensive Parallel Computing in Multiclusters
E. Heien, N. Fujimoto, K. Hagihara
16th Euromicro Conference on Parallel, Distributed and Network-Based Processing, 2008, Toulouse, France

A Platform for in silico Modeling of Physiological Systems II. CellML Compatibility and Other Extended Capabilities
Y. Suzuki, Y. Asai, T. Kawazu, M. Nakanishi, Y. Taniguchi, **E. Heien**, K. Hagihara, Y. Kurachi, Y. Nomura

30th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 2008, Vancouver, Canada

International Workshop Papers

PyMW - a Python Module for Desktop Grid and Volunteer Computing
E. Heien, A. Kornafeld, Y. Takata, K. Hagihara
3rd Workshop on Desktop Grids and Volunteer Computing Systems, 2009, Rome, Italy (invited)

Computing Low Latency Batches with Unreliable Workers in Volunteer Computing Environments
E. Heien, N. Fujimoto, K. Hagihara
2nd Workshop on Desktop Grids and Volunteer Computing Systems, 2008, Miami, Florida

Refereed National Conference Papers

Optimization Techniques for Parallel Biophysical Simulations Generated by insilicoIDE
E. Heien, Y. Asai, T. Nomura, K. Hagihara
Information Processing Society of Japan (IPSJ) High Performance Computing Symposium, 2009, Tokyo, Japan

(in Japanese) Development of insilicoML 1.0: A Language for Multilevel Physiological Models
Y. Asai, Y. Suzuki, Y. Kido, H. Oka, **E. Heien**, M. Nakanishi, T. Urai, K. Hagihara, Y. Kurachi, T. Nomura
Biology Medicine and Engineering Symposium 2008, Osaka, Japan

(in Japanese) insilicoIDE: An Integrated Development Environment for Physiological Modeling
Y. Suzuki, Y. Asai, **E. Heien**, M. Nakanishi, T. Urai, H. Oka, K. Hagihara, Y. Kurachi, T. Nomura
Biology Medicine and Engineering Symposium 2008, Osaka, Japan

(in Japanese) The Massive Simulation of the Spinal Neural Network Dynamics using Biodynamics Modeling Integration Platform (insilico IDE)
M. Nakanishi, Y. Asai, **E. Heien**, K. Hagihara, T. Nomura
The 47th Annual Conference of Japanese Society for Medical and Biological Engineering, 2008, Kobe, Japan

(in Japanese) The insilicoIDE Integrated Platform and Architecture for Multilayer Object Oriented Biodynamics Modeling
Y. Asai, T. Kawazu, M. Nakanishi, Y. Suzuki, **E. Heien**, K. Hagihara, Y. Kurachi, T. Nomura
The 47th Annual Conference of Japanese Society for Medical and Biological Engineering, 2008, Kobe, Japan

Other

Parallelization of the Virtual California Earthquake Simulator
E. Heien, B. Yikilmaz, M. Sachs, D. Turcotte, J. Rundle, L. Kellogg
SCEC (Southern California Earthquake Center) Annual Meeting, September 2011, Palm Springs CA, USA

Comparisons Among Earthquake Simulator Results for UCERF2 Fault Model of California and Observed Seismicity
T. Tullis, K. Richards-Dinger, M. Barall, J. Dieterich, E. Field, **E. Heien**, L. Kellogg, F. Pollitz, J. Rundle, M. Sachs, D. Turcotte, S. Ward, B. Yikilmaz, O. Zielke
SCEC (Southern California Earthquake Center) Annual Meeting, September 2011, Palm Springs CA, USA

The Future of Virtual California Earthquake Simulations
B. Yikilmaz, J. Rundle, D. Turcotte, **E. Heien**, M. Sachs, L. Kellogg
SCEC (Southern California Earthquake Center) Annual Meeting, September 2011, Palm Springs CA, USA

Understanding Earthquake Dynamics with Numerical Simulations
J. B. Rundle, **E. Heien**, M. B. Yikilmaz, M. K. Sachs, D. Turcotte, L. Kellogg, A. Donnellan, K. Tiampo
AOGS (Asia Oceania Geosciences Society) Meeting, August 2011, Taipei, Taiwan

Re-evaluation of Event Correlations in Virtual California Using Statistical Analysis
M. Glasscoe, M. Heflin, R. Granat, M. Yikilmaz, **E. Heien**, J. Rundle, A. Donnellan
AGU (American Geophysical Union) Fall Meeting, December 2010, San Francisco, CA, USA

Preliminary Results from SCEC Earthquake Simulator Comparison Project
T. Tullis, M. Barall , K. Richards-Dinger, S. Ward, **E. Heien**, O. Zielke, F. Pollitz, J. Dieterich, J. Rundle, B. Yikilmaz, D. Turcotte, L. Kellogg, E. Field
AGU (American Geophysical Union) Fall Meeting, December 2010, San Francisco, CA, USA

Correlated Resource Models of Internet End Hosts
E. Heien, D. Kondo, D. Anderson
INRIA Research Report, November 2010

SCEC Earthquake Simulator Comparison Project
T.E. Tullis, M. Barall , K. Richards-Dinger, S.N. Ward, **E. Heien**, O. Zielke, F. Pollitz, J. Dieterich, J. Rundle, B. Yikilmaz, D. Turcotte, L. Kellogg, E.H. Field
APEC Cooperation for Earthquake Simulation International Workshop, October 2010, Hokkaido, Japan

Limitations and Tradeoffs in Large Scale Earthquake Simulation
E. Heien, B. Yikilmaz, D. Turcotte, J. Rundle, L. Kellogg
SCEC (Southern California Earthquake Center) Annual Meeting, September 2010, Palm Springs CA, USA

Preliminary Results for N CA from Earthquake Simulator Comparison Project
T.E. Tullis, M. Barall , K. Richards-Dinger, S.N. Ward, **E. Heien**, O. Zielke, F. Pollitz, J. Dieterich, J. Rundle, B. Yikilmaz, D. Turcotte, L. Kellogg, E.H. Field
SCEC (Southern California Earthquake Center) Annual Meeting, September 2010, Palm Springs CA, USA

(in Japanese) MapReduce Implementation in Python for Multiple Parallel Computing Environments
Y. Takata, **E. Heien**, M. Okita, K. Hagihara
Research Report of the IPSJ, 2009-ARC-185, (2009-10). 7 pages

Techniques for Automatic Parallelization and Optimization of Biological Simulations from insilicoIDE
E. Heien, Y. Asai, T. Nomura, K. Hagihara
3rd MEI International Symposium, December 2008, San Francisco, CA, USA

Automatic Parallelization of Biological Simulations from the in Silico IDE for Execution in Cluster Environments
E. Heien, M. Nakanishi, Y. Asai, T. Nomura, K. Hagihara
2nd MEI International Symposium, December 2007, Osaka, Japan

Investigation of Mutation Operators for the Bayesian Optimization Algorithm
E. Heien, T. Hiroyasu, N. Fujimoto
9th Conference on Genetic and Evolutionary Computation, 2007, London England

Latest Results of the SETHI Survey at Arecibo
E. J. Korpela, **E. M. Heien**, D. Werthimer
How Does the Galaxy Work? A Galactic Tertulia with Don Cox and Ron Reynolds, 2004 vol. 315 pp. 97

Three Years of SETI@home: A Status Report
E. J. Korpela, J. Cobb, S. Fulton, M. Lebofsky, **E. Heien**, E. Person, P. Demorest, R. Bankay, D. Anderson, D. Werthimer
Bioastronomy 2002: Life Among the Stars 2004 vol. 213 pp. 419

SETHI@Berkeley- A Piggyback 21-cm Sky Survey at Arecibo
E. J. Korpela, **E. M. Heien**, D. Werthimer
Seeing Through the Dust: The Detection of HI and the Exploration of the ISM in Galaxies 2002 vol. 276 pp. 100

Berkeley radio and optical SETI programs: SETI@home, SERENDIP, and SEVENDIP
D. Werthimer, D. Anderson, C. S. Bowyer, J. Cobb, **E. Heien**, E. J. Korpela, M. L. Lampton, M. Lebofsky, G. W. Marcy, M. McGarry, D. Treffers
Proc. SPIE Vol. 4273 2001 vol. 4273 pp. 104

Pulse Detection Algorithms for Use in SETI@home
E. J. Korpela, **E. M. Heien**, D. Werthimer
American Astronomical Society 2000 vol. 197 pp. 1492

Visits

- Dr. Dan Werthimer and Dr. David P. Anderson, UC Berkeley, Dr. David Skinner, NERSC, December 2010. Worked on GPU based radio signal analysis system, discussed Internet host resource model.
- Adam Kornafeld, SZTAKI Institute, April 2009. Discussed techniques for improving Python based parallel volunteer computing. Discussed task scheduling for improved energy efficiency in volunteer computing systems.
- Dr. Dan Werthimer and Dr. David P. Anderson, UC Berkeley, March 2009. Discussed feasibility of GPU based radio signal analysis system.
- Dr. Derrick Kondo, INRIA Grenoble - Rhône Alps, February 2008. Discussed scheduling for volunteer computing systems and fairness in terms of task scheduling.

Professional Experience

Japan Exchange and Teaching Program, Kurashiki, Okayama Japan

Assistant Language Teacher **August 2003 to August 2005**

- Taught English conversation, reading and writing to students at Kojima High School and Kojoike High School in Japan.
- Created curricula and supervised over 400 students.

Davis Energy Group, Davis, California USA

Software Engineering Consultant **December 1998 to August 1999**

- Developed and maintained organization website.
- Developed prototype thermostat user interface design in Java.
- Programmed microcontroller LCD based thermostat interface in C.

Schilling Robotics, Davis, California USA

Programmer **May 1999 to August 1999**

- Developed web site organization, HTML code, and Flash web site.
- Developed interactive front-end for company informational CD.
- Supervised other student workers to maintain and develop web site.

Software Engineering Consultant **September 1996 to August 1998**

- Developed web site organization, HTML code, and Flash web site.
- Developed interactive technical manuals for robotic manipulator systems.

Academic Leadership and Service

- Program Chair for the 5th Workshop on Desktop Grids and Volunteer Computing Systems (PCGrid 2011), Anchorage, Alaska
- Program Committee Member for the 17-20th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP2009-PDP2012)
- Reviewer for IEEE Transactions on Parallel and Distributed Computing, Journal of Grid Computing, Future Generation Computer Systems, Euro-Par 2011

Advising

- Hirofumi Kondo, Osaka University, 2009-2010
- Takata Yusuke, Osaka University, 2008-2010
- Jeremy Cowles, Google Summer of Code, 2009, now at Pixar
- Seth Cooper, BOINC summer student 2003, now doing PhD at University of Washington
- Cecile Kim, SETI@home summer student, 2002
- Michael Gary, SETI@home summer student, 2002

Software

CitcomS (http://geodynamics.org/cig/software/citcoms)
Developer for CitcomS, a finite element thermochemical convection simulator for geophysics studies of mantle convection. Worked on conversion and restructuring of code to C++, optimization of particle flow dynamics.

Virtual California (currently not publicly available)
Lead developer of Virtual California (VC), a simulation engine for analyzing long term behavior of strike-slip earthquake faults using a sliding-block model. VC supports both OpenMP and MPI based parallel computing for large scale models on the order of hundreds of thousands of elements requiring hundreds of GB of memory to compute.

PyMW (http://pymw.sourceforge.net/)
Lead developer of PyMW (Python Master Worker), a Python library providing a seamless interface for master worker style computing in multiple environments. This was successfully applied to performing a large computation with donated resources for an academic class, and was used as a base for a generalized MapReduce implementation.

*insilico*Sim/*insilico*IDE (http://physiome.jp/)
Lead developer of *insilico*Sim and co-developer of *insilico*IDE. These are tools for modeling and simulating biophysical systems. *insilico*Sim was successfully applied to performing simulations of small and large scale heterogeneous models on single and multiprocessor systems.

Technical Skills

Extensive hardware and software experience in networking and information technology

Programming: C, C++, Java, MPI, Python, PHP, UNIX shell scripting, SQL, SVN, and others

Applications: TEX, LATEX, BIBTEX, Microsoft Office, and other common productivity packages for Windows, OS X, and Linux platforms

Operating Systems: Microsoft Windows XP/Vista, Apple OS X, Linux, and other UNIX variants

Collaborators

John Rundle, UC Davis, USA.

Louise Kellogg, UC Davis, USA.

Donald Turcotte, UC Davis, USA.

Derrick Kondo, INRIA Grenoble Rhone-Alps, France.

Adam Kornafeld, SZTAKI Institute, Hungary.

Yoshiyuki Asai, Osaka University, Japan.

Taishin Nomura, Osaka University, Japan.

David Anderson, UC Berkeley, USA.

Dan Werthimer, UC Berkeley, USA.

References

Available upon request.