1st Variability Expeditions All Hands Meeting

- CECS Staff

The first Variability All-Hands Meeting was held at the University of California Irvine campus on November 19th and November 20th, 2010. All the Variability PIs and their students and collaborators were invited and required to attend. The meeting started on the eve-

Variability Expeditions

ning of Friday November 19th and then continued throughout the day on Saturday November 20th. The AHM started with the PIs of the project giving an overview of the entire project, providing the vision, the co-ordination plans and the meeting agenda. The rest of the AHM was structured as a series of exciting talks by our various Variability Co-PIs with Question and Answer sessions at the end of each session. On Saturday we had several Breakout sessions with a summary towards the end of the day for each of those breakout sessions. The goal of this All-Hands Meeting is for all the PIs and their students to get to know each other well and form small collaborative

teams targeting specific projects towards the overall vision of the Variability Expeditions.

About the Variability Expeditions:
As semiconductor manufacturers build ever smaller components, circuits and chips at the nano scale become less reliable and more expensive to produce – no longer behaving like precisely chiseled machines with tight tolerances. Modern computing tends to ignore the variability in behavior of underlying system components from device to device, their wear-out over time, or the environment in which the computing system is placed. This makes them expensive, fragile and vulnerable to even the smallest changes in the environment or component failures. The Variability Expedition envisions a computing world where system components -- led by proactive software -- routinely monitor, predict and adapt to the variability of manufactured systems. Changing the way software interacts with hardware offers the best hope for perpetuating the funda-

VISITOR & STUDENT PROFILES

Visitor Profile: Dr. Yuko Hara-Azumi

- CECS Staff

Dr. Yuko Hara-Azumi is a visiting scholar at UC Irvine, hosted by Professor Nikil Dutt from July through December 2010.

She received her Ph.D. degree in information science from Nagoya University, Japan in 2010. Currently she is a research fellow of the Japan Society for the Promotion of Science at Nagoya University. Also, she serves as a visiting researcher at Ritsumeikan University, Japan. Her research interests include high-level synthesis and compiler techniques. Especially, she has been working on system-level design methodologies, targeting high-level synthesis from large behavioral descriptions. She developed a suite of benchmark programs for C-based high-level synthesis, CHStone (http://www.ertl.jp/chstone/), which is getting prevalent in the community of high-level synthesis. Currently she is engaged in some research projects including fault tolerant embedded system designs.

Her husband, Takuya Azumi, who is an assistant professor at Ritsumeikan University, Japan, will visit UC Irvine as a visiting scholar, hosted by Professor Rainer Doemer from September 2011 through March 2012.

Student Profile: David Dali Zhao

- David Dali Zhao

I was born in the city of Shenyang in northeastern China and went to school there. I received my BS in Computer Science and Technology from Northeastern University in China. In 2008, I moved to the US and became a graduate student at UCI.

I have been conducting research under the supervision of Prof. Veidenbaum. My research interest lies in computer system architecture, specifically the memory hierarchy of multi-core processors. We worked on a project to study cache allocation algorithms for shared-cache multi-core systems. Most multi-core processor design uses a shared cache, in which several processor cores will compete for the limited resources in the cache. Since different program has different behavior in memory access, we can moderate
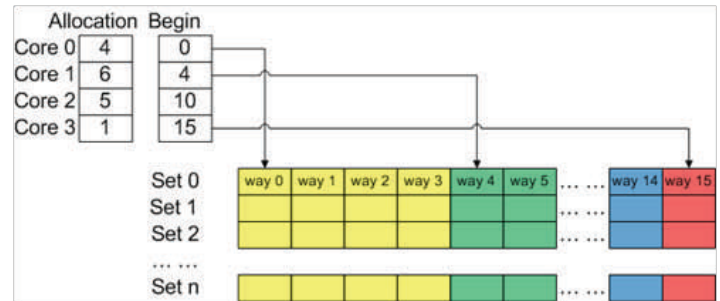
PROFILES & ANNOUNCEMENTS

Student Profile: David Dali Zhao (continued from page 2)

- David Dali Zhao

this competition and achieve cooperation.

The algorithm samples the cache behavior and dynamically allocates a certain number of blocks within each cache set to each processor core. Using this scheme, we see 5.51% improvement in IPC compared with traditional LRU policy. Our current work involves extending this scheme with different cache replacement algorithms. We plan to combine other cache optimization techniques, such as prefetching with this scheme.

CECS moves to Engineering Hall

CECS has recently relocated to the 3rd floor of Engineering Hall on the UCI Campus. Please be sure to direct all future correspondence to 3011 Engineering Hall.

http://www.classroom.uci.edu/

1st Variability Expeditions All Hands Meeting (continued from front page)

mental gains in computing performance at lower cost of the past 40 years.

The Variability Expedition fundamentally rethinks the rigid, deterministic hardware-software interface, to propose a new class of computing machines that are not only adaptive but also highly energy efficient. These machines will be able to discover the nature and extent of variations in hardware, develop abstractions to capture these variations, and drive adaptations in the software stack from compilers, run-time to applications. The resulting computer systems will work and continue working while using components that vary in performance or grow less reliable over time and across technology generations. A fluid software-hardware interface will thus mitigate the variability of manufactured systems and make machines robust, reliable and responsive to changing operating conditions.

For more details, please visit the Variability website: www.variability.org

PUBLICATIONS

The following papers were published by CECS affiliates between
July 2010 to December 2010 (and unreported papers from previous eNews).

Focus	Title, Author, Publication
Energy Efficiency	Jinsik Kim and Pai H. Chou, "**Energy-Efficient Progressive Remote Update for Flash-Based Firmware of Networked Embedded Systems**," to appear, in *ACM Transactions on Design Automation of Electronics Systems* (TODAES).
Power and Size Management	Houman Homayoun, Avesta Sasan, Jean-Luc Gaudiot, and Alex Veidenbaum, "**Reducing Power in All Major CAM and SRAM-Based Processor Units via Centralized, Dynamic Resource Size Management,**" IEEE Transactions on Very Large Scale Integration Systems, in press
Prediction on GPU	Shaoshan Liu, Christine Eisenbeis, and Jean-Luc Gaudiot, "**Value Prediction and Speculative Execution on GPU,**" International Journal of Parallel Programming, DOI: 10.1007/s10766-010-0155-0, December, 2010
Out-of-Order Instruction Commit	Nam Duong and Alex Veidenbaum, "**Compiler Assisted Out-Of-Order Instruction Commit,**" TR 10-11, November 18, 2010. Posted December 07, 2010. download pdf
Garbage Collection	Jie Tang, Shaoshan Liu, Zhimin Gu, Xiao-Feng Li and Jean-Luc Gaudiot, "**Achieving Middleware Execution Efficiency: Hardware-Assisted Garbage Collection Operations,**" Journal of Supercomputing, DOI: 10.1007/s11227-010-0493-0, November, 2010
Enix	Yu-Ting Chen, Ting-Chou Chien, and Pai H. Chou, "**Enix: A Lightweight Dynamic Operating System for Tightly Constrained Wireless Sensor Platforms,**" in *Proceedings of the 8th ACM Conference on Embedded Networked Sensor Systems* (SenSys 2010), Zurich, Switzerland, November 3-5, 2010. [sourceforge] (25/145 papers accepted = 17% acceptance rate)
Parallel Garbage Collector	Shaoshan Liu, Ligang Wang, Xiao-Feng Li, and Jean-Luc Gaudiot, "**Space-and-Time Efficient Parallel Garbage Collector for Data-Intensive Applications,**" International Journal of Parallel Programming, DOI: 10.1007/s10766-010-0151-4, October, 2010
Virtualization in Cloud Security	W/ M. Cesarano, C. Badea, A. Veidenbaum, M. Furnari, G. Tsudik, "**Leveraging Virtualization Towards Improving Cloud Security for Compute-Intensive Applications,**" Accepted for publication in the Proceedings of the 2nd International ICST Conference on Cloud Computing (CloudComp 2010), October 2010.
Program Multithreading	W/ A. Kejariwal, "**How Many Threads to Spawn During Program Multithreading,**" Accepted for publication in the Proceedings of the 23rd International Workshop on Languages and Compilers for Parallel Computing (LCPC2010). October 2010.
TeleScribe	Min-Hua Chen and Pai H. Chou, "**TeleScribe: A Scalable, Resumable Wireless Programmable Approach,**" to appear, in *Proc. International Conference on Embedded Software* (EMSOFT, part of ESWEEK), Scottsdale, AZ, USA, October 24-29, 2010. (29/89 papers accepted) [YouTube video]
Nucleos	Jiwon Hahn and Pai H. Chou, "**Nucleos: a Runtime System for Ultra-Compact Wireless Sensor Nodes,**" to appear, in *Proc. International Conference on Embedded Software* (EMSOFT, part of ESWEEK), Scottsdale, AZ, USA, October 24-29, 2010. (29/89 papers accepted)
Multithreading Processors	Kyueun Yi and Jean-Luc Gaudiot , "**Network Applications on Simultaneous Multithreading Processors,**" IEEE Transactions on Computers, Vol. 59, No. 9, pp.1200-1209, September 2010.
Energy Efficiency	Xiaodong Wu, Yuan Lin, Jian-Jun Han and Jean-Luc Gaudiot , "**Energy-Efficient Scheduling of Real-Time Periodic Tasks in Multicore Systems,**" Proceedings of the 2010 IFIP International Conference on Networks and Parallel Computing (NPC 2010), Zhengzhou, P. R. China, September 13-15, 2010.

PUBLICATIONS

The following papers were published by CECS affiliates between
July 2010 to December 2010 (and unreported papers from previous eNews).

Focus	Title, Author, Publication
Real-Time Systems	Peter Nistler and Jean-Luc Gaudiot, **"Efficient Scheduling for Hard Real-Time Systems on Multiprocessor Platforms,"** Proceedings of the 2010 IFIP International Conference on Networks and Parallel Computing (NPC 2010), Zhengzhou, P. R. China, September 13-15, 2010.
GPU Exploration	Shaoshan Liu, Christine Eisenbeis and Jean-Luc Gaudiot, **"Speculative Execution on GPU: An Exploratory Study,"** Proceedings of the Thirty Ninth International Conference on Parallel Processing, San Diego, California, September 13-16, 2010.
Parallel Systems	Shaoshan Liu, Christine Eisenbeis and Jean-Luc Gaudiot, **"A Theoretical Framework for Value Prediction in Parallel Systems,"** Proceedings of the Thirty Ninth International Conference on Parallel Processing, San Diego, California, September 13-16, 2010.
DuraCap	Chien-Ying Chen and Pai H. Chou, "DuraCap: a Supercapacitor-Based, Power-Bootstrapping Maximum Power Point Tracking Energy-Harvesting System," *Proc. International Symposium on Low Power Electronics and Design* (ISLPED), August 2010.
Water Distribution Systems	Masanobu Shinozuka, Debasis Karmakar, Pai H. Chou, Sehwan Kim, Hong Rok Kim, Lu Fei, **"Non-Invasive Acceleration-Based Methodology for Damage Detection and Assessment of Water Distribution Systems,"** to appear, in *Smart Structures and Systems*, Vol. 6, No. 6, July-August 2010. .
Fault-Tolerant Systems	Jihoon Lee, Alokika Dash, Sean Tucker, Hyun Kook Khang, and Brian Demsky, **"Distributed Transactional Memory for Fault-Tolerant Systems,"** TR 10-10, August 24, 2010. download pdf
Transactional Memory	Brian Demsky and Navid Farri Tehrany, **"Supporting File Operations in Transactional Memory,"** TR 10-09, August 24, 2010. download pdf
Temperature Sensing	S. Sharifi, T. Simunic Rosing, "Accurate Direct and Indirect On-Chip Temperature Sensing for Efficient Dynamic Thermal Management," IEEE TCAD, July 2010.
Reconfigurable Antennas	H. Eslami, C. P. Sukumar, D. Rodrigo, S. Mopidevi, L. Jofre, B. A. Cetiner and A. M. Eltawil, **"Reduced Overhead Training for Multi Reconfigurable Antennas with Beam-tilting Capability,"** in *IEEE Transactions on Wireless Communications*. (Accepted July 2010)
Defect Cache	Avesta Sasan (Mohammad A Makhzan), Houman Homayoun, Ahmed Eltawil, Fadi Kurdahi, **"Inquisitive Defect Cache: A Means of Combating Manufacturing Induced Process Variation,"** in *IEEE Transactions on Very Large Scale Integration Systems*. (Accepted July 2010)
Silicon Optimization	Amin Khajeh, Ahmed M. Eltawil, and Fadi J. Kurdahi, **"Embedded Memories Fault-Tolerant Pre and Post Silicon Optimization,"** in *IEEE Transactions on Very Large Scale Integration Systems*. (Accepted July 2010)
Reconfigurable Systems	Shaoshan Liu, Richard Neil Pittman, Alessandro Forin, and Jean-Luc Gaudiot, **"On Energy Efficiency of Reconfigurable Systems with Run-Time Partial Reconfiguration,"** Proceedings of the 21st IEEE International Conference on Application-Specific Systems, Architectures and Processors (ASAP 2010), Rennes, France, July 7-9, 2010
Garbage Collection	Jie Tang, Shaoshan Liu, Zhimin Gu, Xiao-Feng Li, and Jean-Luc Gaudiot, **"Hardware-Assisted Middleware: Acceleration of Garbage Collection Operations,"** Proceedings of the 21st IEEE International Conference on Application-Specific Systems, Architectures and Processors (ASAP 2010), Rennes, France, July 7-9, 2010
Multi-Core Validation	W. Chen, X. Han, R. Doemer, *"ESL Design and Multi-Core Validation using the System-on-Chip Environment,"* Proceedings of the International High Level Design Validation and Test Workshop 2010, Anaheim, California, June 2010.

CECS—*promoting creativity and pursuing discovery!*

Center for Embedded Computer Systems, University of California, Irvine

CECS *Mission Statement:*

To conduct leading-edge interdisciplinary research in embedded systems emphasizing automotive, communications, and medical applications, and to promote technology and knowledge transfer for the benefit of the individual and society.

Publications continued from page 4...
April July to December 2010 (and unreported papers from previous eNews).

System Level Design	Y. Guo, R. Doemer, *"A Hybrid Instruction Set Simulator for System Level Design,"* Center for Embedded Computer Systems, Technical Report 10-06, June 2010.
SystemC Emulation	S. Sirowy, C. Huang, and F. Vahid, **"Online SystemC Emulation Acceleration,"** IEEE/ACM Design Automation Conference, June 2010. pdf (to appear)
EcoExec	Chih-Hsiang Hsueh, Yi-Hsuan Tu, Yen-Chiu Li, and Pai H. Chou , **"EcoExec: An Interactive Execution Framework for Ultra Compact Wireless Sensor Nodes,"** in *Proceedings of the 7th IEEE Communications Society Conference on Sensor, Mesh and Ad Hoc Communications and Networks* (SECON 2010), Boston, MA, June 21-25, 2010. pp. 190-198. 63/268 = 23% acceptance rate. [sourceforge]
EcoIMU	Yi-Lung Tsai, Ting-Ting Tu, Hyeoungho Bae, and Pai H. Chou , **"EcoIMU: A Dual Triaxial-Accelerometer Inertial Measurement Unit for Wearable Applications,"** in *Proc. International Conference on Body Sensor Networks* (BSN 2010), June 7-9, 2010, Singapore. [YouTube video]
Wireless Embedded Sensing	Vahid Salmani and Pai H. Chou, **"Pushing the Throughput Limit of Low-Complexity Wireless Embedded Sensing Systems,"** in *Proc. 2010 IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing* (SUTC 2010), Newport Beach, CA USA, June 7-9, 2010.
Solar Energy	Pai H. Chou and Sehwan Kim, **"Techniques for Maximizing Efficiency of Solar Energy Harvesting Systems (Invited Paper),"** in *Proceedings of the Fifth Conference on Mobile Computing and Ubiquitous Networking* (ICMU 2010), Seattle, WA, April 26-28, 2010.