High Performance Embedded Computing Workshop

22 – 23 September 2009

AGENDA

22 – 23 September

Workshop at a Glance

Day 1	Check-in / Setup:	0730
22 September	Welcome:	0830
		Keynote Address
		Opening Remarks
	Sessions:	**Session 1**: HPC Landscape
		Focus 1: Space Technologies
		(Session 1 and Focus 1 run in parallel)
		Poster / Demo A: Advanced Algorithms and Hardware
		Session 2: Decision Support
		Focus 2: Networks and Communications
		(Session 2 and Focus 2 run in parallel)
	Closing Remarks / Adjourn:	1700
		1745 **Reception and Awards**
		1830 **Banquet Speaker**
		1900 **Banquet**

Day 2	Check-in / Setup:	0730
23 September	Announcements:	0830
		Keynote Address
	Sessions:	**Session 3**: GPU
		Focus 3: Multicore Programming
		(Session 3 and Focus 3 run in parallel)
		Poster / Demo B: FPGA Technologies and Applications
		Session 4: Awards Session
		Panel: Survivor: Computer Architecture
	Closing Remarks / Adjourn:	1715

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0730 **Check-in / Poster Setup / Continental Breakfast**

0830 **Welcome**
Mr. David Martinez / MIT Lincoln Laboratory

0835 **Mission Keynote: Technology's Impact on Warfighting and Intelligence**
Dr. Robert H. Latiff / Major General, USAF (RET)

0905 **Opening Remarks**
Mr. Robert Bond / MIT Lincoln Laboratory

0915 **Session 1: HPC Landscape**
Chair: Anthony Skjellum / University of Alabama at Birmingham
Auditorium

0925 **Invited: Application Accelerators: Deus ex machina?**
Jeffrey Vetter / Oak Ridge National Laboratory and Georgia Institute of Technology

0955 **Invited: Exascale Computing: Embedded Style**
Peter Kogge / University of Notre Dame

1025 **Break**

1040 **Invited: The Challenges of Cloud Computing**
Dennis Gannon / Microsoft Research

1110 **Cloud Computing—Where ISR Data Will Go for Exploitation**
Albert Reuther, Jeremy Kepner, Peter Michaleas and William Smith / MIT Lincoln Laboratory

0915 **Focus 1: Space Technologies**
Chair: Frank Pietryka / Raytheon Company
Room S2-180

0925 **Intentionally left blank**

0955 **Intentionally left blank**

1025 **Invited: The Future of FPGAs**
Rajit Manohar / Cornell University and Achronix Semiconductor Corp.

1055 **Break**

1105 **Invited: Bringing the Vision of Plug-and-play to High-Performance Computing on Orbit**
James Lyke / AFRL

1135 **High-performance Heterogeneous and Flexible Computing Architecture for Spacecraft Internet Protocol Communication and Payload**
Ian Troxel, Steve Vaillancourt, Paul Murray and Matthew Fehringer / SEAKR Engineering, Inc.

Transition to the Auditorium

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22 September *(Continued)*

1140 **Poster / Demo A: Advanced Algorithms and Hardware**
Chair: Anthony Skjellum / University of Alabama at Birmingham

1145 **Poster / Demo A Précis**

Poster A.1 **An Interactive Tool for Analyzing Kronecker Graphs**
Huy Nguyen and Alan Edelman / Massachusetts Institute of Technology
Jeremy Kepner / MIT Lincoln Laboratory

Poster A.2 **Automated Parallelization of Non-uniform Convolutions on Chip Multiprocessors**
Yuanrui Zhang and Mahmut Kandemir / Pennsylvania State University
Nikos Pitsianis and Xiaobai Sun / Duke University

Poster A.3 **Checking Model Specifications with CrossCheck**
Jonathan Springer and James Ezick / Reservoir Labs, Inc.
Matthew Craven and Rick Buskens / Lockheed Martin

Poster A.4 **The PetaFlops Router: Harnessing FPGAs and Accelerators for High Performance Computing**
Zachary Baker, Tanmoy Bhattacharya, Mark Dunham, Paul Graham, Rajan Gupta, Jeff Inman,
Andreas Klein, Gerd Kunde, Al McPherson, Matt Stettler and *Justin Tripp* / Los Alamos National Laboratory

Poster A.5 **Modeling Singular Valued Decomposition (SVD) Techniques using the Parallel MATLAB Toolbox**
Inerys Otero, Carlos González, *Miguel Goenaga* and Domingo Rodriguez / University of Puerto Rico

Poster A.6 **Thermal-Aware Scheduling for Real-Time Applications in Embedded Systems**
Adam Lewis, *Soumik Ghosh* and Nian-Feng Tzeng / University of Louisiana at Lafayette

Poster A.7 **High-Speed Parallel Processing of Protocol-Aware Signatures**
Jordi Ros-Giralt, James Ezick, Peter Szilagyi and Richard Lethin / Reservoir Labs, Inc.

Poster A.8 **Signal/Data Processor Implementation and Algorithms for Realtime Wide-Angle Ultra-Wideband SAR Image Formation**
Jeff Isenman and Eric Jones / Lockheed Martin IS&GS
David Caliga / SRC Computers, LLC

Poster A.9 **Parallel Processing in ROSA II**
Sara Siegal and *Glenn Schrader* / MIT Lincoln Laboratory

Poster A.10 **Dependable Multiprocessor (DM) Support for Diverse and Heterogeneous Processing**
John Samson, *Mathew Clark*, Eric Grobelny and Susan Van Portfliiet / Honeywell Aerospace, Defense and Space Systems

Poster A.11 **Resource-aware Distributed Split Radix FFT on Wireless Sensor Networks**
Sherine Abdelhak, Jared Tessier, Soumik Ghosh, Magdy Bayoumi and Nian-Feng Tzeng / University of Louisiana at Lafayette

Poster A.12 **High Bandwidth Data Collection and Processing Using OpenMPI on a LINUX Cluster**
David MacPherson and Greg Kliss / SRC Inc.

Poster A.13 **Very High Level Languages (VHLL) for No Pain Scalable Computing on High Performance Systems**
Bracy Elton, Siddharth Samsi, Harrison Ben Smith, Laura Humphrey, Stanley Ahalt and
Alan Chalker / Ohio Supercomputer Center
Niraj Srivastava and Roope Astala / Interactive Supercomputing

Poster A.14 **Adapting the USRP as an Underwater Acoustic Modem**
Paul Ozog, Miriam Leeser and Milica Stojanovic / Northeastern University

1235 **Lunch** (View Posters)

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22 September *(Continued)*

1335 **Session 2: Decision Support**
Chair: Nadya Bliss / MIT Lincoln Laboratory
Auditorium

1345 **Invited: Cross-Domain ISR Maritime Awareness Demonstration**
Kenneth Gregson / MIT Lincoln Laboratory

1415 **Stochastic Digital Circuits for Probabilistic Inference**
Vikash Mansinghka, Eric Jonas and Josh Tenenbaum / Massachusetts Institute of Technology

1445 **Multi-objective Optimization of Sparse Array Computations**
Una-May O'Reilly / Massachusetts Institute of Technology
Nadya Travinin Bliss, Sanjeev Mohindra, Julie Mullen and Eric Robinson / MIT Lincoln Laboratory

1515 **Break** (View Posters)

1530 **3D Exploitation of Large 2D Urban Photo Archives**
Peter Cho and Ross Anderson / MIT Lincoln Laboratory
Noah Snavely / Cornell University

1600 **Optimizing an Innovative SAR Post-Processing Algorithm for Multi-Core Processors: A Case Study**
Peter Carlston / Intel Corporation
Dave Murray / N.A. Software Ltd.

1630 **Effective Floating Point Applications on FPGAs: Examples from Molecular Modeling**
Bharat Sukhwani, Matt Chiu, Md. Ashfaq Khan and *Martin Herbordt* / Boston University

1700 **Closing Remarks / Adjourn**
Jeremy Kepner / MIT Lincoln Laboratory

1745 **Reception and 2008 Awards**

1830 **Banquet Speaker:**
Dr. Sigrid Close / Los Alamos National Laboratory

1900 **Banquet**

1335 **Focus 2: Networks and Communications**
Chair: Vladimir Stojanović / Massachusetts Institute of Technology
Room S2-180

1345 **Silicon-Photonic Clos Networks for Global On-Chip Communication**
Ajay Joshi and Christopher Batten / Massachusetts Institute of Technology
Yong-Jin Kwon and Scott Beamer / University of California
Imran Shamim / Massachusetts Institute of Technology
Krste Asanović / University of California
Vladimir Stojanović / Massachusetts Institute of Technology

1415 **Photonic On-Chip Networks for Performance-Energy Optimized Off-Chip Memory Access**
Gilbert Hendry, Daniel Brunina, Johnnie Chan, Luca Carloni and Keren Bergman / Columbia University

1445 **Low Power Silicon Microphotonic Communications for Embedded Systems**
Michael Watts, Anthony Lentine, Douglas Trotter, William Zortman, Ralph Young, David Campbell and Subhash Shinde / Sandia National Laboratories

1515 **Break** (View Posters)

1530 **A Special-Purpose Processor System with Software-Defined Connectivity**
Benjamin Miller, Sara Siegal, James Haupt, Huy Nguyen and Michael Vai / MIT Lincoln Laboratory

1600 **OpenVPX: Architectures for High-Performance Embedded Computing**
Robert Cooper / Mercury Computer Systems
Mark Littlefield / Curtiss-Wright Controls Embedded Computing

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0730 **Check-in / Poster Setup / Continental Breakfast**

0830 **Announcements**
Mr. Robert Bond / MIT Lincoln Laboratory

0835 **Technology Keynote: Air Force Science and Technology Issues and Opportunities Regarding High Performance Embedded Computing**
Dr. Richard Linderman / AFRL

0905 **Session 3: GPU**
Chair: James Lebak / Mathworks
Auditorium

0915 **Invited: Data Intensive Computing on Heterogeneous Platforms**
Norman Rubin / Advanced Micro Devices, Inc.

0945 **Fast Pattern Matching in 3D Images on GPUs**
Patrick Eibl and Dennis Healy / Duke University
Nikos Pitsianis / Duke University / Aristotle University
Xiaobai Sun / Duke University

1015 **Hierarchical Parallelization of a Radio Frequency Tomography Application via Multiple GPUs**
Dana Schaa / Northeastern University
Mark Barnell / AFRL
Roope Astala, *Steve Reinhardt* and Viral Shah / Interactive Supercomputing

1045 **Break**

1100 **GPU Accelerated Decoding of High Performance Error Correcting Codes**
Andrew Copeland, Nicholas Chang and Stephen Leung / MIT Lincoln Laboratory

1130 **Accelerating a MATLAB Application with Nvidia GPUs: a Case Study for GPU Library Construction**
Nicholas Moore and Miriam Leeser / Northeastern University

0905 **Focus 3: Multicore Programming**
Chair: Craig Lund / Local Knowledge
Room S2-180

0915 **High Performance Linear Transform Program Generation for the Cell BE**
Srinivas Chellappa, Franz Franchetti and Markus Püschel / Carnegie Mellon University

0945 **Implementation of 2-D FFT on the Cell Broadband Engine Architecture**
Kerry Barnes, *William Lundgren* and James Steed / Gedae, Inc.

1015 **Remote Store Programming: Reflective Memory for Multicore**
Henry Hoffmann, David Wentzlaff and Anant Agarwal / Massachusetts Institute of Technology

1045 **Break**

1100 **A Multi-Paradigm Programming Model for Heterogeneous Architectures**
Michael Champigny / Mercury Computer Systems

1130 **Runtime Verification and Validation for Multi-Core Based On-Board Computing**
Hans Zima and Mark James / Jet Propulsion Laboratory

1200 **The "State" and "Future" of Middleware for HPEC**
Anthony Skjellum / RunTime Computing Solutions, LLC and University of Alabama at Birmingham

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1200 **Poster / Demo B: FPGA Technologies and Applications**
Chair: James Lebak / Mathworks

1205 **Poster / Demo B Précis**

Poster B.1 **UAV Video Image Stabilization on the SRC MAP Processor**
William Turri / University of Dayton Research Institute
David Pointer / SRC Computers, LLC

Poster B.2 **GPU VSIPL: Core and Beyond**
Andrew Kerr, Dan Campbell and Mark Richards / Georgia Institute of Technology

Poster B.3 **RAPID—A Rapid Prototyping Methodology for Embedded Systems**
Huy Nguyen, Michael Vai, Andrew Heckerling, Michael Eskowitz, Ford Ennis,
Thomas Anderson, Larry Retherford and George Lambert / MIT Lincoln Laboratory

Poster B.4 **Floating Point Synthesis from Model-Based Design**
Mark Jervis, Martin Langhammer, *Mark Santoro* and Graham Griffiths / Altera Europe

Poster B.5 **Heterogeneous Processing Solutions for the IBM BladeCenter**
Patrick Stover and *Paul Letourneau* / Annapolis Micro Systems

Poster B.6 **Disruptive Applications of GPGPU Technology**
Matthew Curry and Anthony Skjellum / University of Alabama at Birmingham

Poster B.7 **Performance of Graph and Biological Analytics on the Cell Broadband Engine Processor**
Tan Tran and David Bader / Georgia Institute of Technology

Poster B.8 **DAPR: Design Automation for Partially Reconfigurable FPGAs**
Shaon Yousuf and Ann Gordon-Ross / NSF Center for High-Performance Reconfigurable Computing (CHREC)

Poster B.9 **A Fault Tolerant Gaussian Elimination Solver for the Cell Broadband Engine**
James Geraci / Square-Enix Research and Development

Poster B.10 **QR Decomposition: Demonstration of Distributed Computing on Wireless Sensor Networks**
Sherine Abdelhak, Soumik Ghosh, Rabi Chaudhuri and Magdy Bayoumi / University of Louisiana at Lafayette

Poster B.11 **Developing Fast DSP Libraries for Advanced Processors**
David Murray and Mike Delves / N.A. Software Ltd.

Poster B.12 **Kronecker Products-based Regularized Image Interpolation Techniques**
Blas Trigueros, Ricardo Castañeyra and Domingo Rodriguez / University of Puerto Rico

1250 **Lunch** (View Posters)

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23 September *(Continued)*

1355

Session 4: Awards Session
Chair: Jeremy Kepner / MIT Lincoln Laboratory
Auditorium

1405 ★ **Nonlinear Equalization Processor IC for Wideband Receivers and Sensors**
William Song, Joshua Kramer, James Mann, Karen Gettings, Joel Goodman, Benjamin Miller, Matthew Herman, Thomas Emberley, Larry Retherford and Albert Horst / MIT Lincoln Laboratory
Gil Raz / GMR Research & Technology, Inc.

1435 ★ **Sourcery VSIPL++ for NVIDIA CUDA GPUs**
Don McCoy, *Brooks Moses,* Stefan Seefeld, Mike LeBlanc and Jules Bergmann / CodeSourcery, Inc.

1505 ★ **Automatic Generation of Vectorized FastFourier Transform Libraries for the Larrabee and AVX Instruction SetExtension**
Daniel McFarlin, Franz Franchetti and Markus Püschel / Carnegie Mellon University

1535 **Break** (View Posters)

1550 **Panel: Survivor: Computer Architecture**
Moderator: Dr. Richard Linderman / AFRL

Distinguished Panelists:
Prof. Rajit Manohar / Cornell University and Achronix Semiconductor Corporation
Mr. Andreas Olofsson / Adapteva, Inc.
Dr. Norman Rubin / Advanced Micro Devices, Inc.
Dr. David Scott / Intel Corporation

1700 **IARPA and Its Mission**
Edward Baranoski / IARPA

1715 **Closing Remarks / Adjourn**

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★ **Denotes outstanding submission**