

High Performance Embedded Computing Workshop

15 – 16 September 2010

AGENDA

15 – 16 September

Workshop at a Glance

Day 1
15 September

Check-in / Setup: 0730
Welcome: 0830

Keynote Address: Dr. Peter Lee / DARPA TCTO

Opening Remarks

Sessions: **Session 1:** GPU
Focus 1: Novel Technologies
(Session 1 and Focus 1 run in parallel)

Poster / Demo A: GPU Technologies and Applications

Session 2: Many Core Processors
Focus 2: Networked Computing
(Session 2 and Focus 2 run in parallel)

Adjourn: 1730
1800 **Reception & 2010 Awards**
1830 **Banquet Speaker:** Prof. Rahul Sarpeshkar / MIT
1900 **Banquet**

Day 2
16 September

Check-in / Setup: 0730
Announcements: 0830

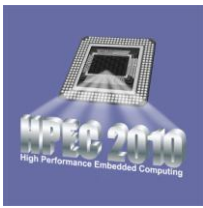
Sessions: **Keynote Address:** Mr. Robert Bond / MIT Lincoln Laboratory

Session 3: Cloud Computing
Focus 3: GPU Frameworks
(Session 3 and Focus 3 run in parallel)

Poster / Demo B: Cloud Technologies and Applications

Session 4: Awards Session
Panel: Embedded Clouds

Adjourn: 1700



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15 September

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

0830 **Welcome**

Dr. Marc Bernstein / MIT Lincoln Laboratory

0835 **Mission Keynote**

Dr. Peter Lee / DARPA TCTO

0905 **Opening Remarks**

Mr. Robert Bond / MIT Lincoln Laboratory

0910

Session 1: GPU

Chair : Miriam Leeser / Northeastern University
Auditorium

0910

Focus 1: Novel Technologies

Chair : Michael Vai / MIT Lincoln Laboratory
S2-180

0920 **INVITED: Accelerating MCAE with GPUs**

Robert Lucas / USC ISI

0920

Bio-Inspired Vision Processor for Ultra-Fast Object Categorization

Clément Farabet / New York University and Yale University
Berin Martini and Polina Akselrod / Yale University
Benoit Corda / New York University
Selçuk Talay / Yale University
Yann LeCun / New York University
Eugenio Culurciello / Yale University

0950 **INVITED: Thinking outside the Tera-Scale box**

Piotr Luszczek / University of Tennessee at Knoxville

0950

Hardware Acceleration of Electromagnetic Field Profile Computation: A Case Study Using the PO-SBR Method

Eric Dunn and Nathan Smith / SAIC
Ray Hoare / Concurrent EDA
Huan-Ting Meng and Jianming Jin / University of Illinois at Urbana-Champaign

1020 **Break**

1020

Break

1035 **Sparse Matrix Algorithms on GPUs and their Integration into SCIRun**

Devon Yablonski, Miriam Leeser and Dana Brooks / Northeastern University

1035 **Scalable Image Graph Matching and Analysis: (SIGMA)**

Karl Ni, Zachary Sun and Nadya Bliss / MIT Lincoln Laboratory

1105 **Benchmark Evaluation of Radar Processing Algorithms on Graphics Processor Units (GPUs)**

Scott Sawyer, Rick Pancoast, Mike Iaquinto, Rathin Putatunda, Rex Bennett, John Broadbent, Scott Harrington and Edward Dunne / Lockheed Martin

1105

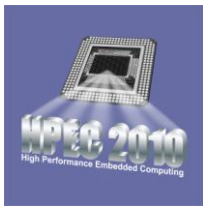
Flexible Filters for High-Performance Embedded Computing

Rebecca Collins and Luca Carloni / Columbia University

1135 **Failing In Place for Low-Serviceability Infrastructure Using High-Parity GPU-Based RAID**

Matthew Curry / University of Alabama at Birmingham and Sandia National Laboratories
Lee Ward / Sandia National Laboratories
Anthony Skjellum / University of Alabama at Birmingham

Transition to the Auditorium



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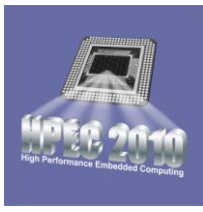
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AGENDA

15 September (Continued)

- 1205 **Poster / Demo A: GPU Technologies and Applications**
Chair: Miriam Leeser / Northeastern University
- 1215 **Poster / Demo A Précis**
- Poster A.1** **VSIPRO®-GPU: Commercial VSIPL Support for Single and Multikernel GP-GPU Accelerated Signal and Image Processing based on CUDA and Fermi**
Anthony Skjellum and Jennifer Skjellum / RunTime Computing Solutions, LLC
- Poster A.2** **An FPGA Implementation of Incremental Clustering for Radar Pulse Deinterleaving**
Scott Bailie / MIT Lincoln Laboratory
Miriam Leeser / Northeastern University
- Poster A.3** **Particle Filter Speed Up Using a GPU**
John Sacha and Andrew Shaffer / Applied Research Laboratory
- Poster A.4** **Sidcar Network Adapters: Open Architectures for ISR Data Sources**
Craig McNally, Chuck Yee and Larry Barbieri / MIT Lincoln Laboratory
- Poster A.5** **Fast Extraction of Feature Saliency Maps for Rapid Video Data Analysis**
Nikos Pitsianis and Xiaobai Sun / Duke University
- Poster A.6** **A 25 GFLOPS/Watt Software Programmable Floating Point Accelerator**
Andreas Olofsson, Roman Trogan and Oleg Raikhman / Adapteva Inc.
- Poster A.7** **Large Matrix-Matrix Multiply on PS3 clusters**
Dennis Fitzgerald / ITT
Mark Barnell / AFRL
- Poster A.8** **GeAccKL: Toward a GPU numerical kernels library for geosciences**
Alan Richardson and Chris Hill / MIT
- Poster A.9** **Motion Saliency Map Generations for Video Data Analysis: Spatio-temporal Signatures in the Array Operations**
Jun Hu, Nikos Pitsianis and Xiaobai Sun / Duke University
- Poster A.10** **Queuing Theory Modeling of a CPU-GPU System**
Lindsay May and Robert Voigt / Northrop Grumman Corporation
- Poster A.11** **Dense Wavelength Division Multiplexed Interconnects for High Performance Embedded Computing Architectures**
Aaron Cordes and Rick Stevens / Lockheed Martin
- Poster A.12** **A Prototype FPGA Tile for Subthreshold-Optimized CMOS**
Peter Grossmann and Miriam Leeser / Northeastern University
- 1255 **Lunch** (View Posters)

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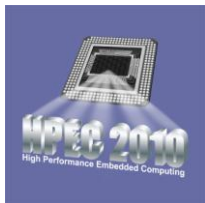
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15 September (Continued)

- 1355 **Session 2: Many Core Processors**
Chair: Sharon Sacco / The MITRE Corporation
Auditorium
- 1405 **INVITED: The Processor: Manycore for Embedded and Cloud Computing**
Richard Schooler / Tiler
- 1435 **Micro-op Fission: Hyper-threading Without the Hyper-headache**
Robert Koutsoyannis, Anthony Cartolano and
Daniel McFarlin / Carnegie Mellon University
- 1505 **Automatic Parallelization and Locality Optimization of Beamforming Algorithms**
Albert Hartono, Nicolas Vasilache, Cédric Bastoul, Allen Leung, Benoît Meister and Richard Lethin / Reservoir Labs, Inc.
Peter Vouras / Naval Research Laboratory
- 1535 **Break** (View Posters)
- 1550 **Performance Scalability on Embedded Many-Core Processors**
Michael Champigny / Mercury Computer Systems
- 1620 **CRBLASTER: Benchmarking a Cosmic-Ray Rejection Application on the Tiler 64-core TILE64 Processor**
Kenneth Mighell / National Optical Astronomy Observatory
- 1650 **Toward Mega-Scale Computing with pMatlab**
Chansup Byun and Jeremy Kepner / MIT Lincoln Laboratory
Vipin Sachdeva and Kirk Jordan / IBM
- 1730 **Closing Remarks / Adjourn**
Jeremy Kepner / MIT Lincoln Laboratory
- 1800 **Reception & 2010 Awards**
- 1830 **Banquet Speaker**
Rahul Sarpeshkar / MIT
- 1900 **Banquet**
- 1550 **Focus 2: Networked Computing**
Chair: William Song / MIT Lincoln Laboratory
Room S2-180
- 1600 **DR&E LLGrid Portal: Interactive Supercomputing for DoD**
Albert Reuther, William Arcand, Chansup Byun, Bill Bergeron, Matthew Hubbell, Jeremy Kepner, Andrew McCabe, Peter Michaleas, Julie Mullen and Andrew Prout / MIT Lincoln Laboratory
- 1630 **Performance Migration to Open Solutions: OFED for Embedded Fabrics**
Kenneth Cain / Mercury Computer Systems, Inc.
- 1700 **Large Scale Complex Network Analysis Using the Hybrid Combination of a MapReduce Cluster and a Highly Multithreaded System**
Seunghwa Kang and David Bader / Georgia Institute of Technology
- Transition to the Auditorium**



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

0830 **Announcements**

Mr. Robert Bond / MIT Lincoln Laboratory

0835 **Technology Keynote**

Mr. Robert Bond / MIT Lincoln Laboratory

0905 **Session 3: Cloud Computing**

Chair: Albert Reuther / MIT Lincoln Laboratory
Auditorium

0915 **INVITED: Accelerating Data Intensive Applications with Flash**

Allan Snively / San Diego Supercomputing Center

0945 **INVITED: Cloud Computing for Processing Large Volumes of Data**

Patrick Dreher / Renaissance Computing Institute

1015 **Break**

1030 **Persistent Surveillance Supercomputing in a Can**

Jeremy Kepner, William Arcand, Chansup Byun, Bill Bergeron, Matthew Hubbell, Andrew McCabe, Peter Michaleas, Julie Mullen and Albert Reuther / MIT Lincoln Laboratory

1100 **Toward a Scalable Knowledge Space on the Cloud**

Delsey Sherrill, Jonathan Kurz and Craig McNally / MIT Lincoln Laboratory

0905 **Focus 3: GPU Frameworks**

Chair: James Lebak / The MathWorks
Room S2-180

0915 **Adding support for GPUs to PVTOL: The Parallel Vector Tile Optimizing Library**

Miriam Leeser, *James Brock* and Mark Niedre / Northeastern University

0945 **Comparison of Multicore Processors using Sourcery VSIPL++**

Brooks Moses, Don McCoy, Justin Voo and Stefan Seefeld / CodeSourcery, Inc.

1015 **Break**

1030 **Using GPU VSIPL & CUDA to Accelerate RF Clutter Simulation**

Daniel Campbell and Daniel Cook / Georgia Tech Research Institute

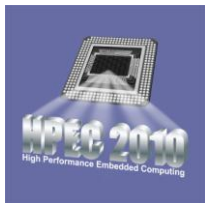
1100 **Adaptable and Efficient Variable Size Template Matching in CUDA**

Nicholas Moore and Miriam Leeser / Northeastern University
Laurie King / College of the Holy Cross

Transition to the Auditorium

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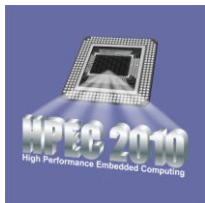
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16 September (Continued)

- 1130 **Poster / Demo B: Cloud Technologies and Applications**
Chair: Albert Reuther / MIT Lincoln Laboratory
- 1140 **Poster / Demo B Précis**
- Poster B.1** **Performance Characterization of the Tile Processor Architecture: Lessons Learned**
Matthew Clark, Eric Grobelny, Jim Passwater and Andrew White / Honeywell
- Poster B.2** **The MIST, a local, secure cloud context and 802.11s testbed**
Gregory Dempsey, Ronald Feher and Lindsay Gordon / USMA
Kurt Keville / MIT
- Poster B.3** **Development of a Real-Time Parallel UHF SAR Image Processor**
Matthew Alexander, Michael Vai, Thomas Emberley, Stephen Mooney and Joseph Rizzari / MIT Lincoln Laboratory
- Poster B.4** **Automated Software Cache Management**
William Lundgren, Kerry Barnes and James Steed / Gedae, Inc.
- Poster B.5** **Dependable Multiprocessor (DM) Implementation for Nano-satellite and CubeSat Applications**
Matthew Clark and John Samson, Jr. / Honeywell
- Poster B.6** **Scripting Sourcing VSIPL ++**
Stefan Seefeld, Brooks Moses, Don McCoy and Justin Voo / CodeSourcery, Inc.
- Poster B.7** **Multicore, Multithreaded, and/or Multi-GPU-Kernel VSIPL Standardization, Implementation, and Programming Impacts: Syntax, Semantics, Models**
Anthony Skjellum / RunTime Computing Solutions, LLC
- Poster B.8** **Mnemosyne: A Tool for Temporal Memory Access Analysis in HPC Applications**
Shahrukh Tarapore and Matthew Burkholder / Lockheed Martin
- Poster B.9** **Development of a Component-Based Framework using VSIPL++**
Alan Ward, Roger Winstanley and Mark Hayman / Northrop Grumman
- Poster B.10** **Improving FFTW Benchmark to Measure Multi-core Processor Performance**
William Pilaud / Curtiss Wright Controls Embedded Computing
- Poster B.11** **Evaluating the Performance of DVB-S2 Over Asymmetric Heterogeneous Optical to Radio Frequency Satellite Links Using the LLGrid**
Nancy List, Tommy Royster and Ryan Shoup / MIT Lincoln Laboratory
- 1225 Lunch (View Posters)

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16 September (*Continued*)

- 1325 **Session 4: Awards Session**
Chair: Jeremy Kepner / MIT Lincoln Laboratory
Auditorium
- 1335 ★ **3-D Graph Processor**
William Song, Jeremy Kepner, Huy Nguyen, Joshua Kramer, Vitaliy Gleyzer, James Mann, Albert Horst, Larry Retherford, Robert Bond, Nadya Bliss, Eric Robinson, Sanjeev Mohindra, and Julie Mullen / MIT Lincoln Laboratory
- 1405 ★ **GPU Lessons Learned for High Performance Embedded Computing**
Hahn Kim, Peter Boettcher, Karen Eng and Joshua Kramer / MIT Lincoln Laboratory
- 1435 ★ **Enabling High Performance Embedded Computing through Memory Access via Photonic Interconnects**
Gilbert Hendry / Columbia University
Eric Robinson and Vitaliy Gleyzer / MIT Lincoln Laboratory
Johnnie Chan and Luca Carloni / Columbia University
Nadya Bliss / MIT Lincoln Laboratory
Keren Bergman / Columbia University
- 1505 ★ **Using Graphics Processors to Accelerate Synthetic Aperture Sonar Imaging via Backpropagation**
Dan Campbell, Mark McCans, Mike Davis and Mike Brinkmann / Georgia Tech Research Institute
- 1535 **Break** (View Posters)
- 1550 **Panel: Embedded Clouds**
Moderator: Mr. Craig Lund / Local Knowledge
- Distinguished Panelists:**
Dr. Patrick Dreher / Renaissance Computing Institute
Ms. Diane Gibson / Cray Inc.
Dr. Jeremy Kepner / MIT Lincoln Laboratory
Mr. Chris Rezendes / VDC Research
Dr. Niraj Srivastava / Raytheon
- 1700 **Closing Remarks / Adjourn**

★ Denotes outstanding submission
Denotes Presenting Author