LSU Releases First Open Source ParalleX Runtime Software System

Louisiana State University's Center for Computation & Technology (CCT) has delivered the first freely available open-source runtime system implementation of the ParalleX execution model. The HPX, or High Performance Parallex, runtime software package is a modular, feature-complete, and performance oriented representation of the ParalleX execution model targeted at conventional parallel computing architectures such as SMP nodes and commodity clusters.

HPX is being provided to the open community for experimentation and application to achieve high efficiency and scalability for dynamic adaptive and irregular computational problems. HPX is a library of C++ functions that supports a set of critical mechanisms for dynamic adaptive resource management and lightweight task scheduling within the context of a global address space. It is solidly based on many years of experience in writing highly parallel applications for HPC systems.

The two-decade success of the communicating sequential processes (CSP) execution model and its message passing interface (MPI) programming model has been seriously eroded by challenges of power, processor core complexity, multi-core sockets, and heterogeneous structures of GPUs. Both efficiency and scalability for some current (strong scaled) applications and future Exascale applications demand new techniques to expose new sources of algorithm parallelism and exploit unused resources through adaptive use of runtime information.

The ParalleX execution model replaces CSP to provide a new computing paradigm embodying the governing principles for organizing and conducting highly efficient scalable computations greatly exceeding the capabilities of today's problems. HPX is the first practical, reliable, and performance-oriented runtime system incorporating the principal concepts of ParalleX model publicly provided in open source release form.

HPX is designed by the CCT STE||AR Group (STE||AR: Systems Technology, Emergent Parallelism, and Algorithm Research) to enable developers to exploit the full processing power of many-core systems with an unprecedented degree of parallelism. STE||AR is a research group focusing on system software solutions and scientific application development for hybrid and many-core hardware architectures.

"This technology has the potential to transform the way we program and run applications

today, and to massively increase the possible parallelism and thus the efficiency of our codes," said Hartmut Kaiser, lead of the STE||AR group and adjunct associate research professor of LSU's Department of Computer Science. "The highly modular structure of HPX guarantees a smooth migration path from today's systems towards future architectures, which provides a stable implementation platform for application developers over the next years. We are very proud to to enable scientists to achieve results today that they couldn't achieve purely using conventional programming models."

HPX incorporates routines to manage lightweight user-threads; it provides an active global address space and a dynamic hierarchy of ParalleX processes that provide context for code execution and data protection, the threads that operate upon the data, and child processes. HPX supports a special form of active messages, Parcels, for message-driven computation to move work to data or to GPU resources. Lastly, HPX implements a set of powerful synchronization objects to eliminate global barriers and permit overlap of successive phases of computation as well as communication. Together these runtime techniques of the HPX system provide a new means of constructing, coordinating, and conducting new generations of parallel applications at unprecedented performance.

"HPX provides an early reference implementation and first open source version of ParalleX to drive towards the next paradigm shift for high performance systems and computing," said Thomas Sterling, professor at Indiana University and creator of the ParalleX execution model. "It will address many of the problems currently challenging HPC and permit many more applications to benefit from HPC in this decade," he said.

HPX development has been sponsored, in part, by the National Security Agency, National Science Foundation, DARPA (Defense Advanced Research Projects Agency), and Microsoft as well as by the LSU CCT. It is central to the X-Caliber Project led by Sandia National Laboratories. More information and means for accessing the HPX libraries may be found at http://stellar.cct.lsu.edu.

Pats on the Back:

Steven Brandt received an award from the Board of Regents titled "Beowulf Bootcamp 2012." This award is for $3,000 to cover one year and will be used to support students for the Beowulf Bootcamp.

CCT in the News:
LSMS/LSU Joint-Study Details Lack of EMR Adoption By La. Physicians
Source: Quality Insider

LSU Releases First Open Source ParalleX Runtime Software System
Source: HPCwire

Please Note:

- Last call for registration for SCALA 2012- Scientific Computing Around Louisiana, January 20-21, 2012 on LSU Campus. FREE to participate, but you must register by January 13, 2012. For more information and to register, visit http://www.cct.lsu.edu/scala2012

- The University will be closed on Monday, January 16th in observance of Martin Luther King Day.

- Submissions for the 2012 Red Stick International Animation Festival have been extended thru January 31st. Visit http://www.redstickfestival.org/competition/submissions/ for details.

- CCT is now compiling its 2012 events calendar. If you are planning any workshops, conferences, camps, trainings etc. needing AV or Events Support, please email Karen Jones (kjones@lsu.edu) with the dates and services required.

- If you or your group is interested in showcasing at the 2012 TechPawLooza Event on March 14th, which is held on campus in the Union Ballroom, please contact Karen Jones (kjones@lsu.edu). If you wish to reserve a space, submit a small summary of your display, and any electrical and/or internet needs by January 13th.

- On February 9th from 3:00pm-4:30pm in the LSU Student Union Capital Chamber Room, Equity, Diversity & Community Outreach and the Office of the Ombudsperson is pleased to announce the 6th Annual Spring Faculty Enrichment Series on: "Workplace Harmony: Creating Civil and Appreciative Cultures in Stressful Times," which will feature experts speaking on the importance of creating civil work environments, working through differences and conflicts, and managing internal and external stressors from both an individual and collective perspective. This session is recommended for all faculty, staff, and graduate assistants and highly recommended for faculty and administrators with supervisory and/or human resource functions. For early registration, please visit: http://www.surveymonkey.com/s/SFES2012.

- Prior approval is required for Special Meal Requests. Employees who make meal purchases without prior approvals may find that they must cover the cost of any monies spent for an unapproved event out of pocket. Dine-in restaurant meals are not allowed on LaCarte credit cards. Please contact Susie McGlone (susie@cct.lsu.edu) prior to any special meal with visitor(s) to file the appropriate request for approval. Prior approval could take up to two weeks, so please plan accordingly.

- Please remember to send your news concerning grants, awards, conferences, or other pertinent information to CCT Event Coordinator Jennifer Fontenot at jennifer@cct.lsu.edu

- Follow CCT with social media to access photos and see news, events or updated information. These pages are public; you do not need an account to view the information.
    - Facebook group : LSU Center for Computation & Technology
    - Twitter : LSUCCT
    - YouTube channel : LSUCCT

Interest groups:
- **MAG (Mobile App-Art-Action Group)**: Everyone interested in the potential for Mobile Apps is invited to come and add their vision for these revolutionary devices. Meetings are scheduled January 30th, February 27th, March 26th and April 23rd, 5:00-6:00 pm For more information visit: http://www.cct.lsu.edu/MAG
    - Contact: Jesse Allison (jtallison@lsu.edu)

- **GPU**: meets weekly (Wednesdays @ 2:30 pm in 338 Johnston) and encourages participation from anyone who would like to join in the discussions. Join the mailing list: lasigma-gpu@loni.org
    - Contact: Bhupender Thakur (bthakur@cct.lsu.edu)

Upcoming events:
January 20-21: Scientific Computing Around Louisiana Workshop
Thru January 31: Red Stick International Animation Festival "Best of the Fest" accepting entries
February 16-17: Mardi Gras Conference: Computational Materials & Biosystems Conference
February 25-29: Symposium on Principles & Practice of Parallel Programming
February 25-29: Symposium on High Performance Computer Architecture
Thru March 1: REU-Computational Sciences accepting entries
Thru March 1: REU-Materials science accepting entries
April 15-17: Symposium on Laptop Ensembles & Orchestras

Upcoming Grant Deadlines:
Note: Please check the CCT deadline Web site, since it is updated daily.