DASH - Hierarchical Arrays for Efficient and Productive Data-Intensive Exascale Computing

DASH is a collaborative research project funded initially for 3 years by the German Research Foundation (DFG) as part of the priority programme „Software for Exascale Computing - SPPEXA“ (2013-2015). Duration: 36 months, starting May 2013

Objective

DASH aims to ease the efficient programming of future supercomputing systems for data-intensive applications. These systems will be characterized by their extreme scale and a multi-level hierarchical organization. DASH adopts the concept of Partitioned Global Address Space (PGAS) and provides a C++ template library for distributed containers as multidimensional arrays, lists, hash tables, etc. Unlike other PGAS approaches, DASH does not only distinguish local and remote data, but allows different grades of remoteness taking into account the hierarchical nature of future [and to a lesser degree, current] systems as for instance NUMA domain, socket, node, rack, island, full system. DASH will furthermore allow a developer to control [and explicitly take advantage of] the hierarchical data layout of global data structures. The global address space semantics is realized by operator overloading and other advanced C++ features based on a runtime system with one-sided messaging primitives provided by MPI or GASNet. As such DASH can co-exist with other parallel programming models and allows to parallelize existing codes incrementally. DASH is complemented by an efficient I/O system directly to and from the hierarchical structures.

HLRS contribution to the project is twofold. Firstly, we will participate in the development of the core runtime system, in particular the communication backend. On the other side, HLRS will port a Molecular Dynamics application to the DASH model in order to validate the approach with realistic data-intensive use-cases.

Project Partners:
- LMU Munich, MNM Team [coordination, C++ template library]
- KIT Karlsruhe [runtime, application liaison]
- TU-Dresden, ZIH [parallel I/O, integration]
- HLRS, University of Stuttgart [runtime, application]
- CEODE, Chinese Academy of Science [associated partner, application]

Resources:
- www.hlrs.de/organization/av/spmt/research/dash/
- www.dash-project.org
- www.sppexa.de

Contact: Dr. José Gracia
Höchstleistungsrechenzentrum Universität Stuttgart
Nobelstraße 19, 70569 Stuttgart, Germany
Phone: +49-711-685-87208
Fax: +49-711-685-65832
E-Mail: gracia@hlrs.de