INNOVATIVE COMPUTING LABORATORY

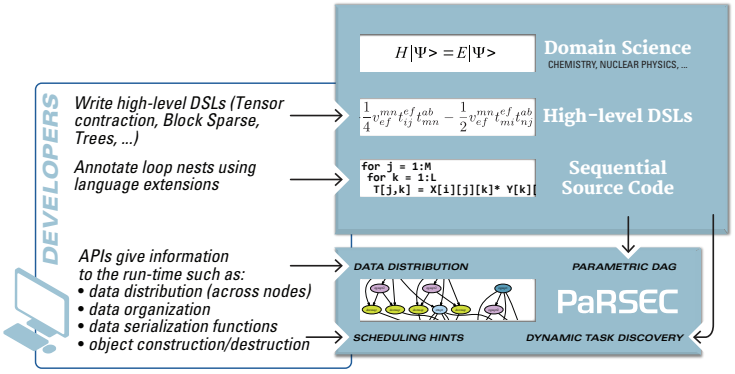
PaRSEC

PaRSEC is a generic framework for architecture aware scheduling and management of micro-tasks on distributed many-core heterogeneous architectures. Applications we consider can be expressed as a Direct Acyclic Graph of tasks with labeled edges designating data dependencies. DAGs are represented in a compact problem-size independent format that can be queried on-demand to discover data dependencies in a totally distributed fashion. PaRSEC assigns computation threads to the cores, overlaps communications and computations and uses a dynamic, fully-distributed scheduler based on architectural features such as NUMA nodes and algorithmic features such as data reuse.

FEATURES

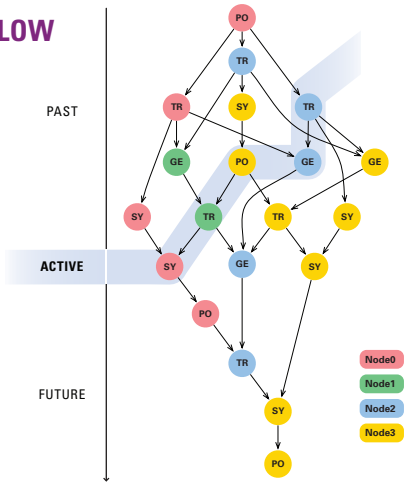
- Supports Distributed Heterogeneous Platforms
- Sustained Performance
- NUMA & Cache Aware Scheduling
- State-of-the-art Algorithms
- Capacity Level Scalability
- Performance Portability
- Implicit Communication
- Communication Overlapping

PaRSEC TOOLCHAIN



Input serial codes are converted automatically by the **PaRSEC compiler** into the task **Dataflow representation** which can also be edited by the programmer. The **Dataflow compiler** generates the stubs that, along with the **Data distribution** provided by the programmer via **Domain Specific Extensions**, the **Application code & Codelets**, the **Runtime** and relevant libraries are linked by the system compiler to generate the executable that will run on a heterogeneous distributed memory supercomputer.

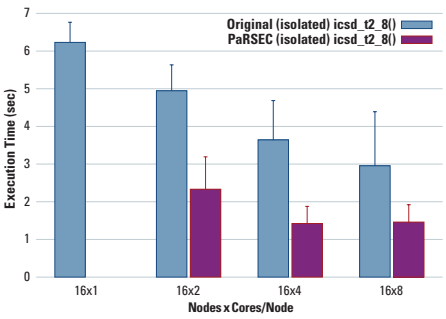
EFFICIENT DATA FLOW REPRESENTATION



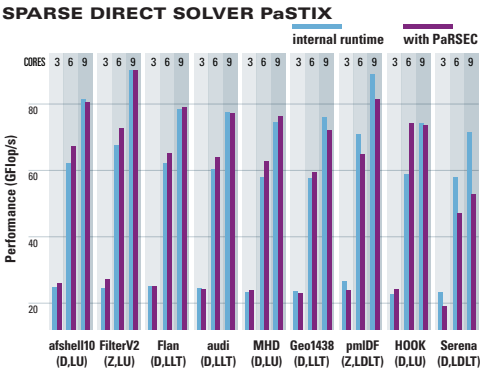
PaRSEC uses a **symbolic**, **problem size independent** representation to express the Directed Acyclic Graph (DAG) of the Dataflow of a program. As a result, at runtime, successors and predecessors of any given task can be evaluated independently, without exploring portions of the DAG pertaining to tasks localized on other nodes. Furthermore, the whole DAG is never **unfolded**, and only the set of locally active tasks resides in the memory at any given time.

APPLICABILITY DOMAINS

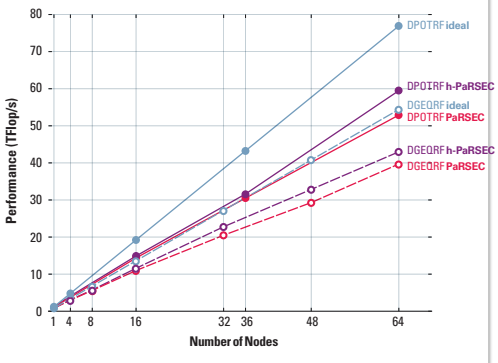
NWCHEM (EXECUTION OF ICSD_T2_8())



SPARSE DIRECT SOLVER PaSTIX



DENSE LINEAR ALGEBRA (192 GPU CLUSTER)



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IN COLLABORATION WITH Inria

WITH SUPPORT FROM Microsoft

SPONSORED BY U.S. DEPARTMENT OF ENERGY, National Science Foundation

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