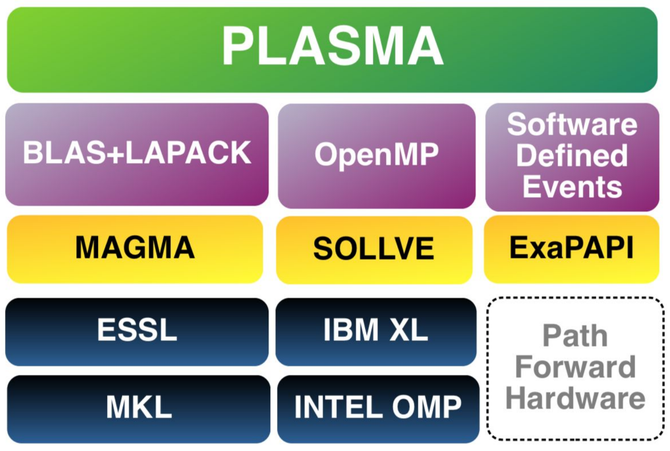
PLASMA

THE PLASMA LIBRARY ON CORAL SYSTEMS AND BEYOND

PLASMA (Parallel Linear Algebra Software for Multicores with Accelerators) is a software package implementing a set of fundamental linear algebra routines using the OpenMP standard. PLASMA includes routines for solving linear systems of equations and linear least square problems, parallel matrix norms, etc. PLASMA has been deployed to systems based on Intel processors (including Xeon Phi family), IBM POWER processors, and ARM processors. For over a decade, PLASMA served as a research vehicle for the design of new dense linear algebra algorithms, and paved the way for new developments in the Exascale program.



LAWN 292
PLASMA 17 Performance Report
Maksims Abalenkovs, Negin Bagherpour, Jack Dongarra, Mark Gates, Azzam Haidar, Jakub Kurzak, Piotr Luszczek, Samuel Relton, Jakub Sistek, David Stevens, Panruo Wu, Ichitaro Yamazaki, Asim YarKhan, and Mawussi Zounon
UT-EECS-17-750 June 2017

LAWN 232
PLASMA 17.1 Functionality Report
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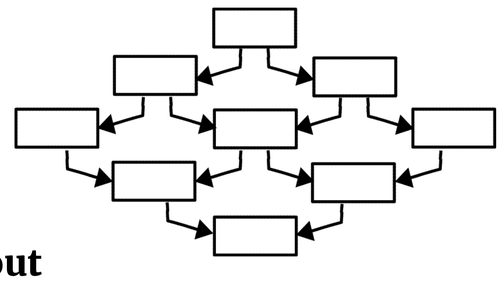
STATE-OF-THE-ART APPROACHES



Tile Matrix Layout

PLASMA lays out matrices in square tiles of relatively small size. Each tile occupies a continuous memory region. Tiles are loaded to the cache memory efficiently with little risk of eviction while being processed. The use of tile layout minimizes conflict cache misses, TLB misses, and false sharing, and maximizes the potential for prefecthing. PLASMA contains parallel and cache efficient routines for converting between the conventional LAPACK layout and the tile layout.

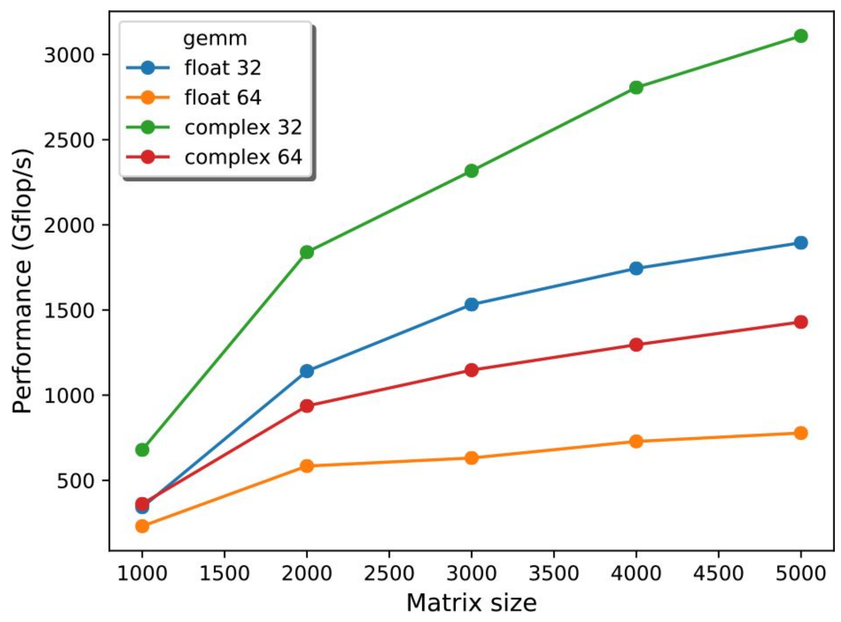
Tile Algorithms

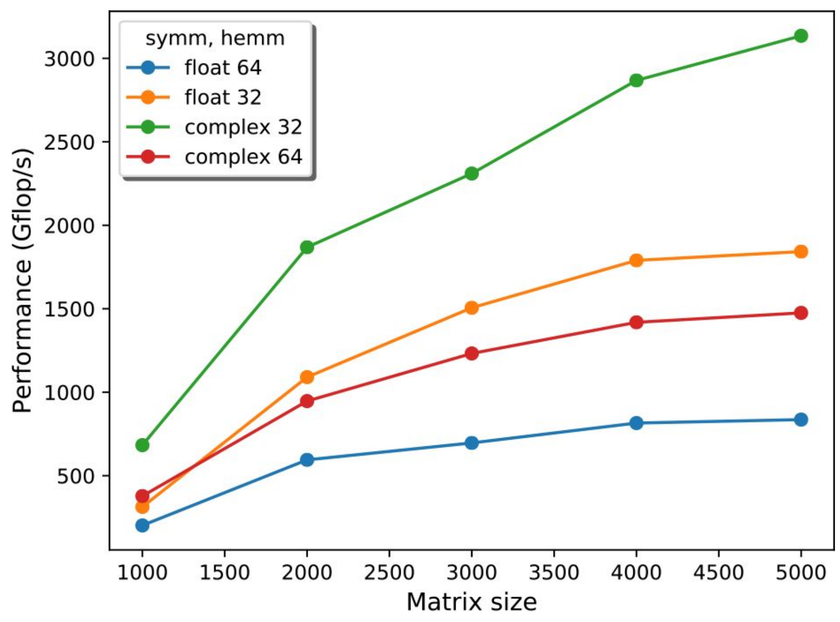
PLASMA introduces new algorithms redesigned to work on tiles, which maximize data reuse in the cache levels of multi-core systems. Tiles are loaded to the cache and processed completely before being evicted back to the main memory. Operations on small tiles create fine-grained parallelism, providing enough work to keep a large number of cores busy.

Dynamic Scheduling

PLASMA relies on runtime scheduling of parallel tasks. Runtime scheduling is based on the idea of assuming work to cores based on availability of data for processing at any given point in time, and thus is also referred to as data-driven scheduling. The concept is related closely to the idea of expressing computation through a tash graph, often referred to as the DAG (Directed Acyclic Graph), and the flexibility of exploring the DAG at runtime. This is in direct opposition to the fork-and-join scheduling, where artifical synchronization points expose serial sections of the code are idle while sequential processing takes place.

PERFORMANCE





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