Scalable Eigensolver for Many-Fermion Dynamics - nuclear (MFDn)

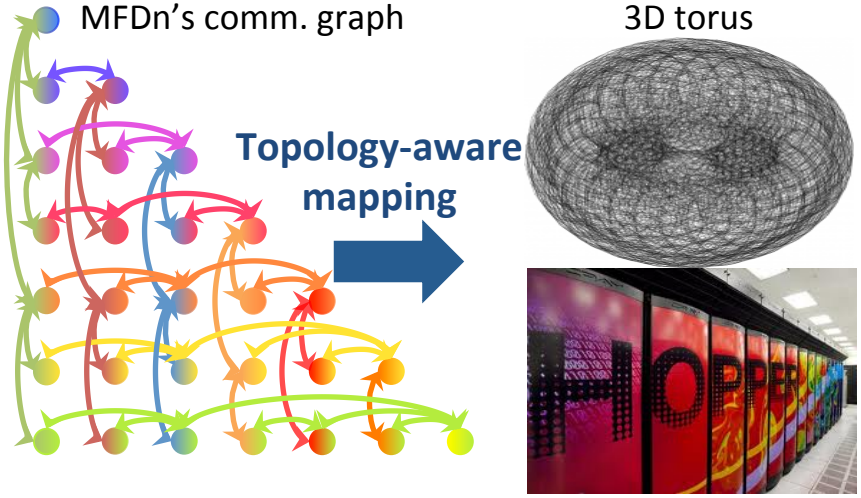
ASCR/NP – Applied Math/Computer Science Highlight

Objective

- Efficient and scalable iterative solvers for extreme-scale eigenvalue problems arising in nuclear physics (MFDn code)

Impact

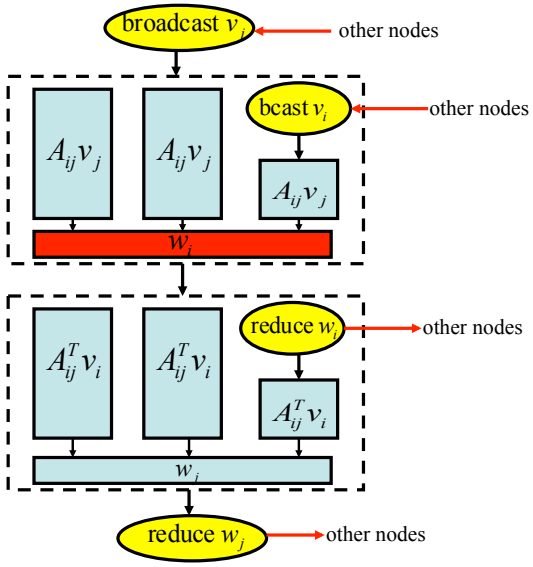
- Drastically reduced communication overheads
- Significant speed-ups over earlier version of MFDn (up to 6x on 18,000 cores)
- Almost perfect strong scaling on up to 260,000 cores on Jaguar



Topology-aware mapping of processes to the physical processors becomes more important as the gap between computational power and bandwidth widens. Communication groups are optimized through a column-major ordering of processes on the triangular grid [1].

Communication Hiding

Flow-chart for multi-threaded SpMV computations during the eigensolve phase of MFDn. Expensive communications are overlapped with computations. Explicit communications are carried out over topology-optimized groups [2].



[1] H.M. Aktulga,C. Yang,P. Maris,J.P. Vary,E.G. Ng, "Topology-Aware Mappings for Large-Scale Eigenvalue Problems", Euro-Par 2012 Conference

[2] H.M. Aktulga,C. Yang,E.G. Ng,P. Maris,J.P. Vary, "Improving the Scalability of a Symmetric Iterative Eigensolver for Multi-core Platforms", CCP&E 25 (2013)

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