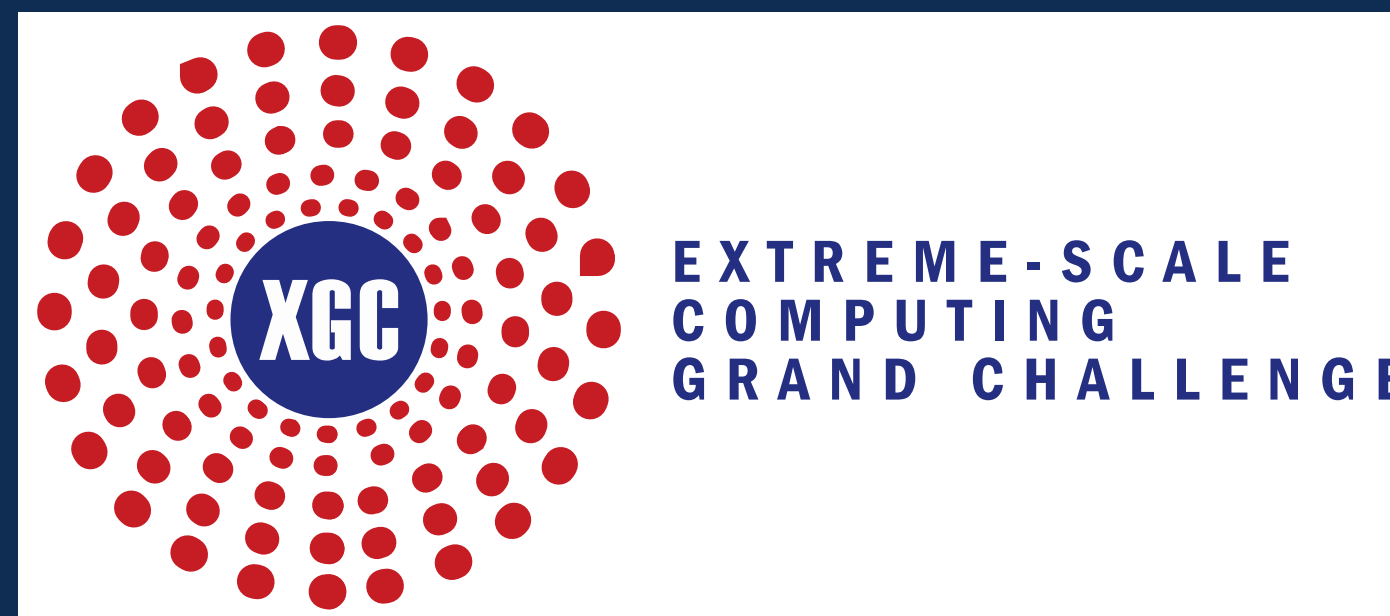


Extreme-Scale Computing Grand Challenge LDRD (XGC)

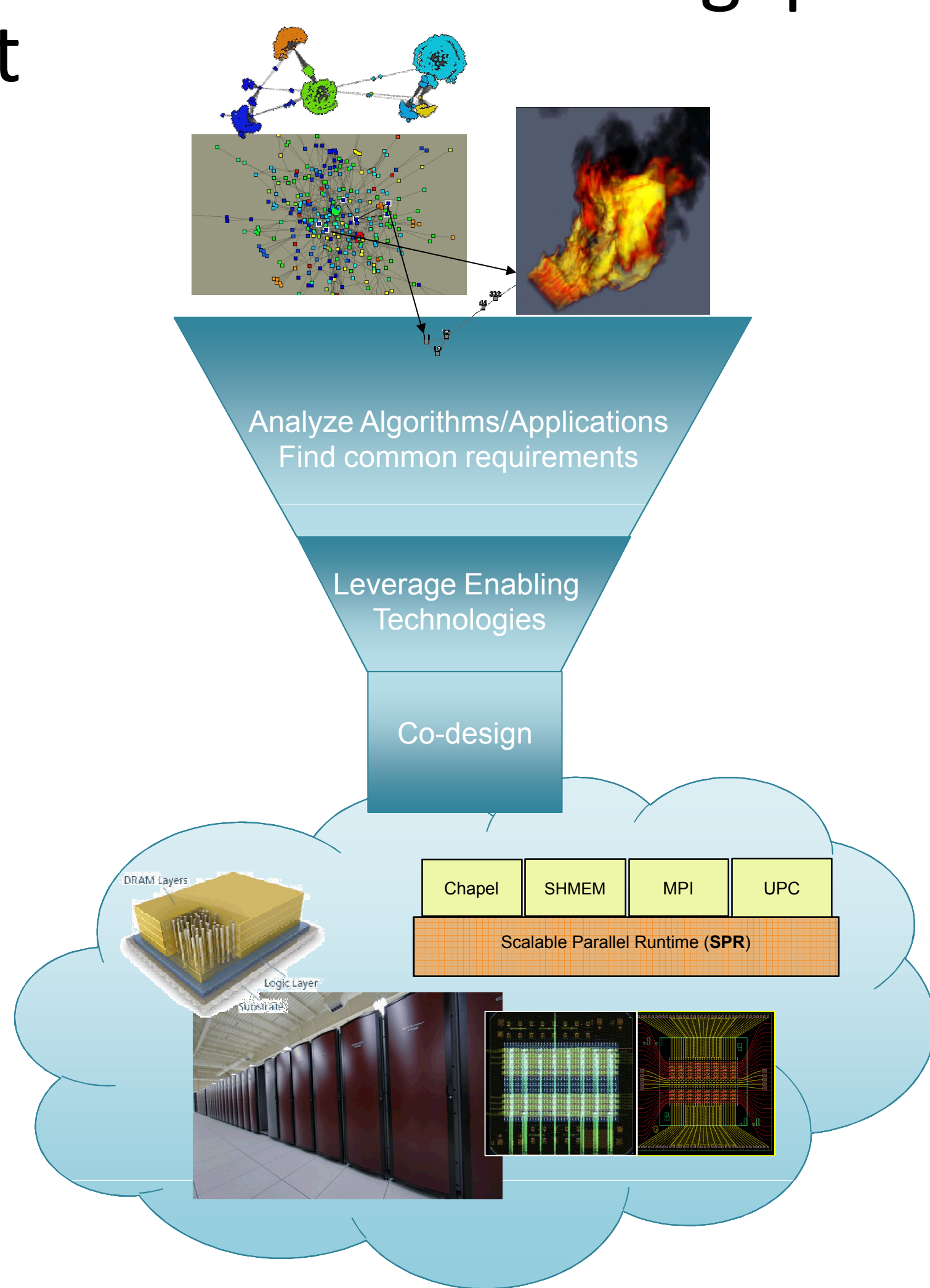


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Challenge

Develop the key system architecture concepts that will enable a unified physics/data analytics computing platform or determine what gaps prevent it



Key Contributions

Full system approach allows each level of the system architecture to inform the others. Advances at each level are directed at improving system efficiency. Key contributions to the system architecture development from each area follow:

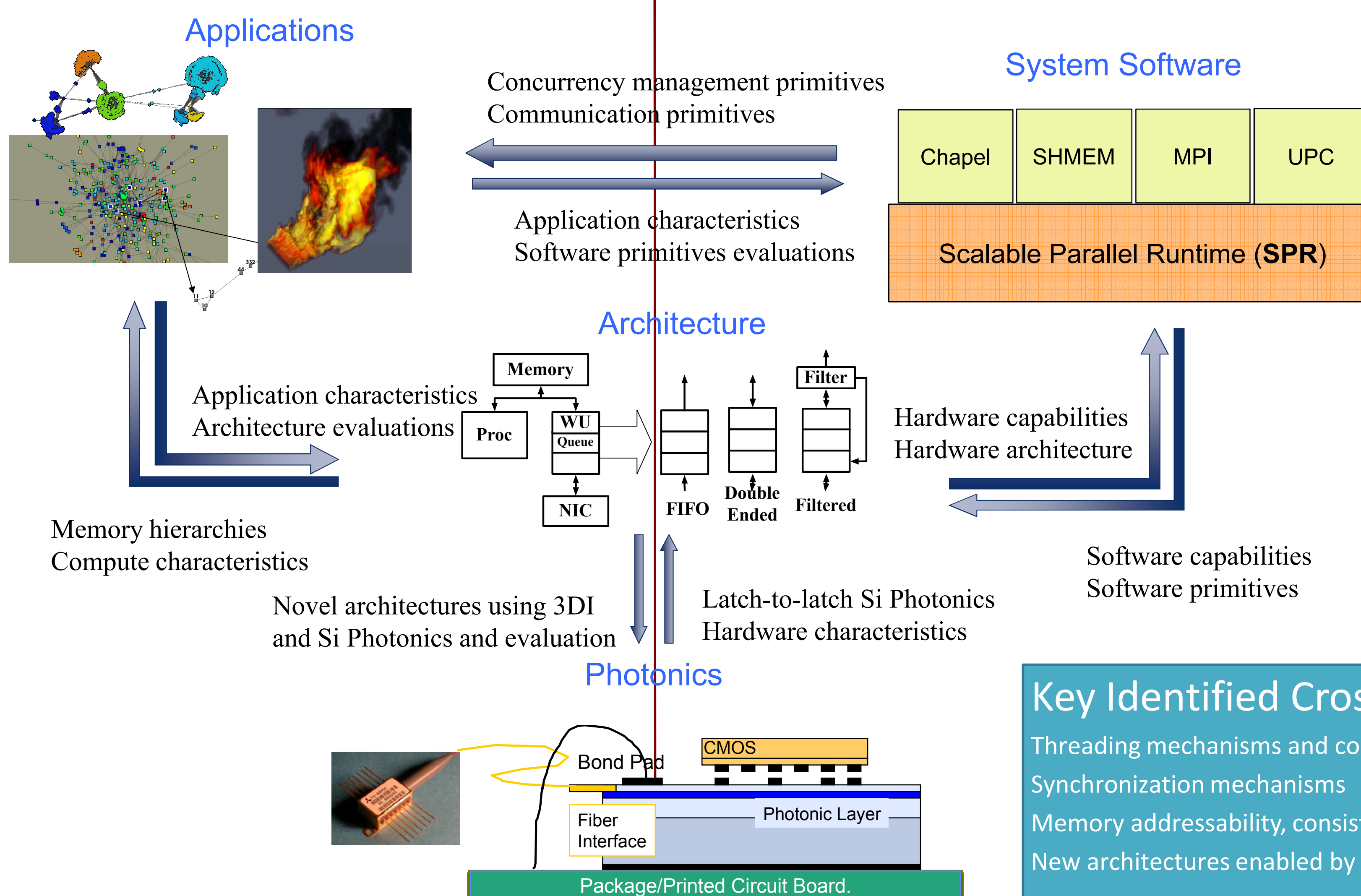
Applications: Development of a suite of miniapps, representative of key performance issues in full applications, that are being used to evaluate system architecture and to understand computations common to data analytics and physics. Miniapps concretely inform co-design toward a unified computing environment.

System Software: Co-design of a run-time infrastructure which supports both physics and informatics workloads on current and future hardware, including heterogeneous platforms. The run-time is informed by architectural simulations and developed in coordination with the miniapps.

Architecture: Co-design of key architectural mechanisms to alleviate data movement bottlenecks in support of a unified physics/informatics system architecture. Availability of an open source simulation framework/toolkit for exploring system architectures...

Silicon Photonics: Photonic/electronic integration with 'intimate' flip-chip bonding, experimentally demonstrating: 1) 5 fJ/bit optical receiver (~100 fJ/bit link energy); 2) reduced energy for phase alignment; and 3) optical modulator and filter (optical demux) resonant wavelength stability.

Full System Approach



Key Identified Crosscut Areas:

- Threading mechanisms and control
- Synchronization mechanisms
- Memory addressability, consistency & architecture
- New architectures enabled by silicon photonics