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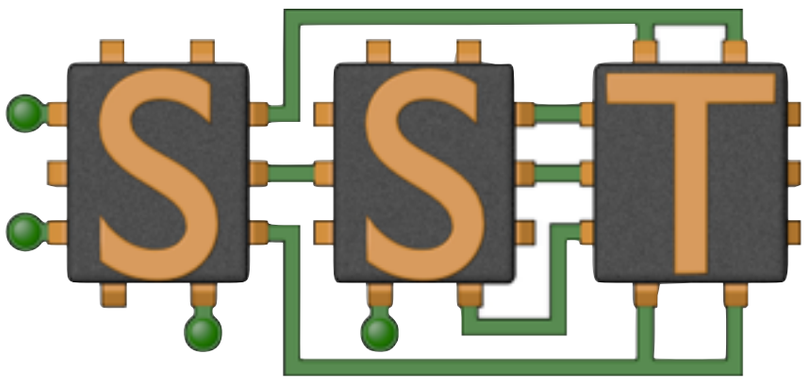

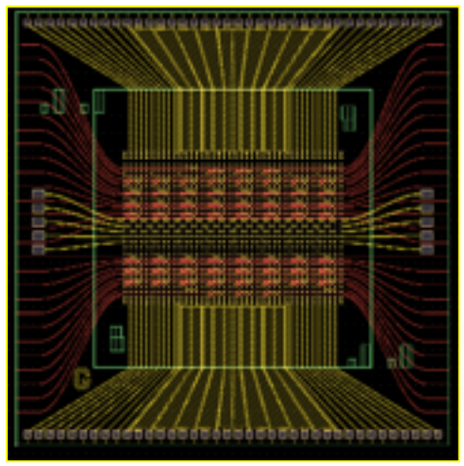

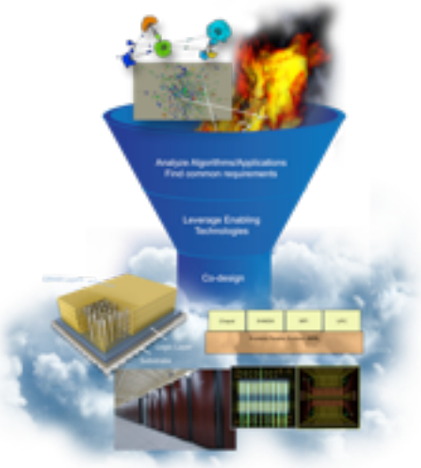

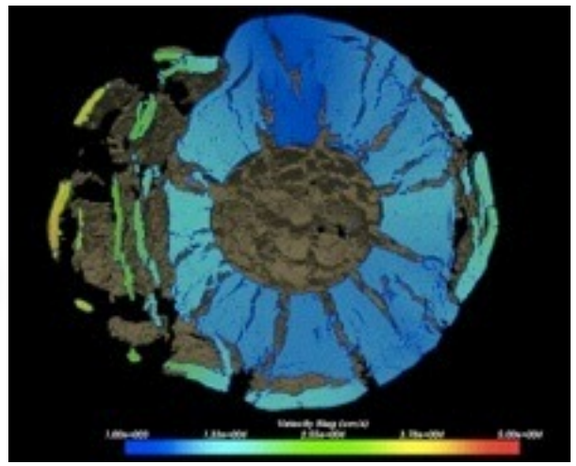

The Structural Simulation Toolkit (SST)

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U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

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SST Simulation Project Overview

Goals

- Become the standard architectural simulation framework for HPC
- Be able to evaluate future systems on DOE/DOD workloads
- Use supercomputers to design supercomputers

Status

- Parallel Core, basic components
- Current Release (3.1)
  - Improved set of components
  - Improved portability

Technical Approach

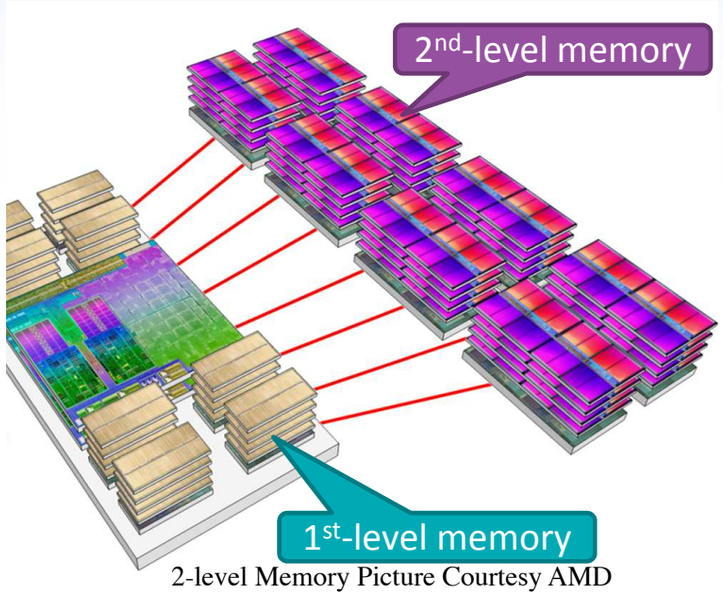
- Parallel
  - Parallel Discrete Event core with conservative optimization over MPI
- Multiscale
  - Detailed and simple models for processor, network, and memory
- Interoperability
  - gem5, DRAMSim, cache models
  - routers, NICs, schedulers, GPGPU
- Open
  - Open Core, non viral, modular

Consortium

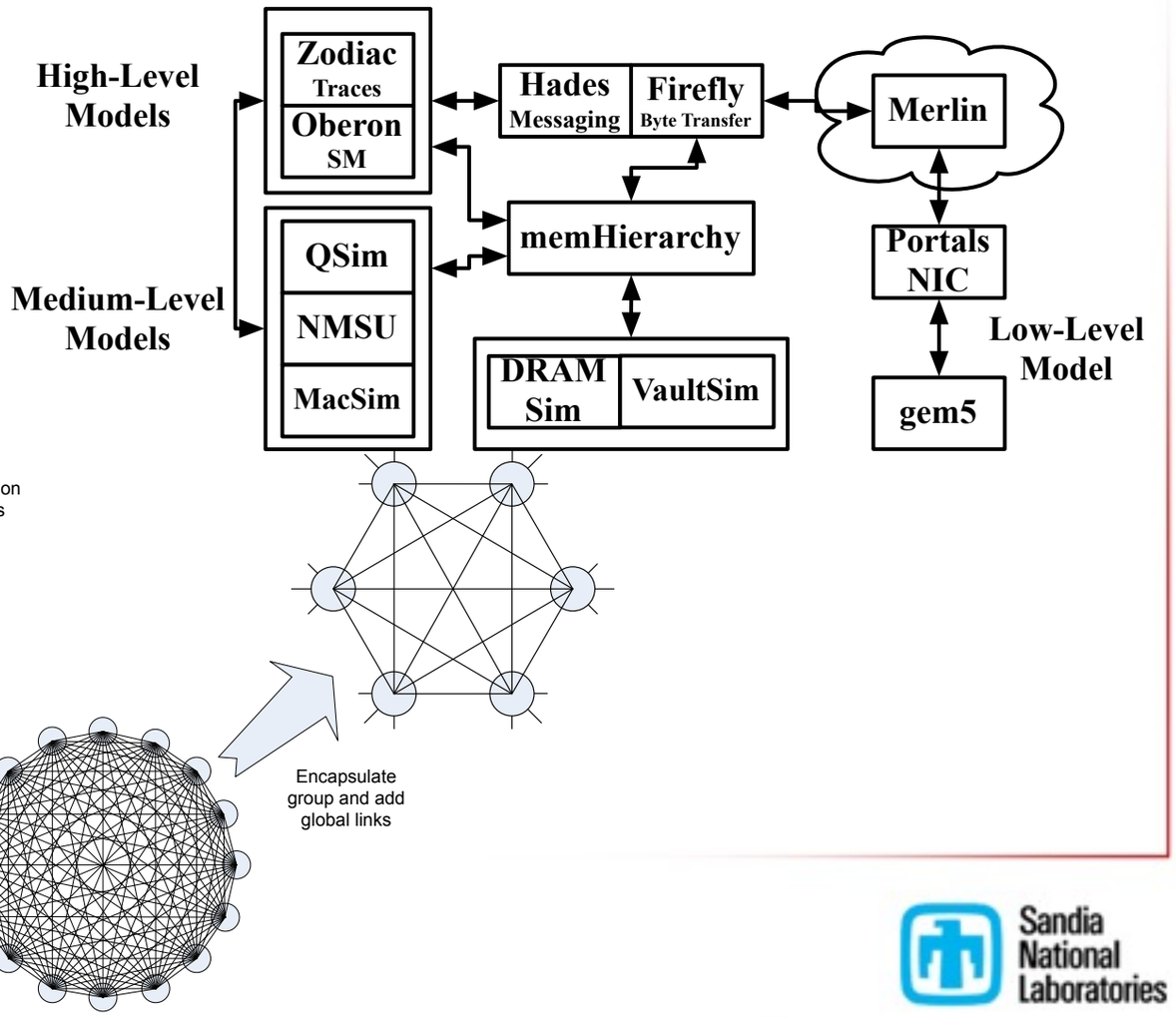
- "Best of Breed" simulation suite
- Combine Lab, academic, & industry

SST Capabilities

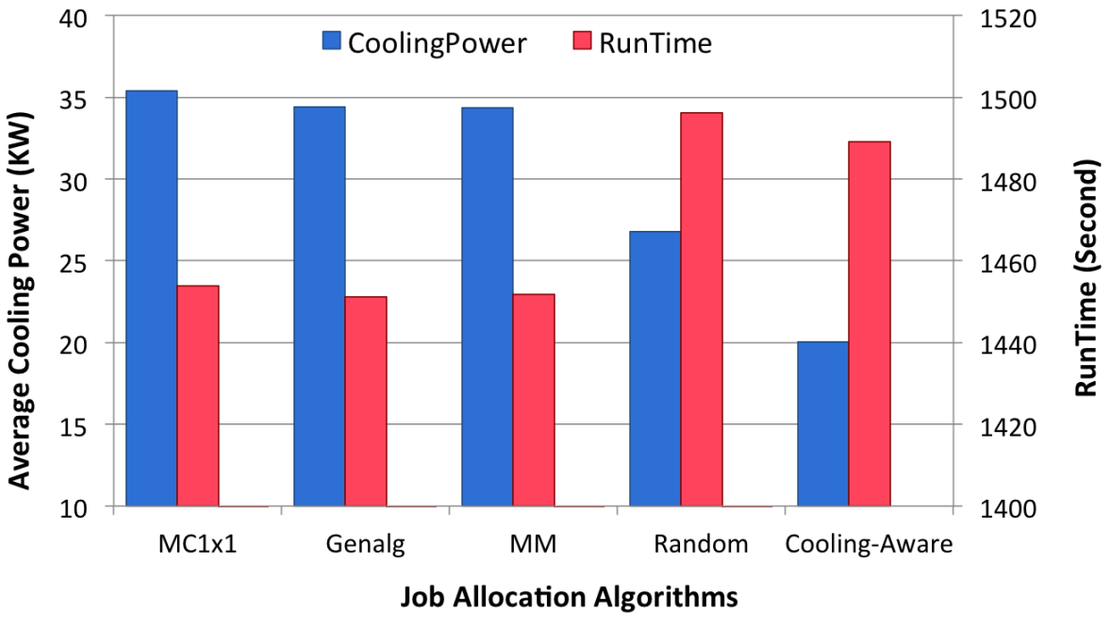
- **Memory Simulations**
  - Extensive cache models
    - Snoopy and Directory-based coherency models
    - Multiple pre-fetcher models
  - Multiple Drivers
    - Execution driven (gem5, pintool, qsim)
    - Trace driven (ariel, oberon)
  - Accurate Memory Simulators
    - DRAMSim, VaultSim, HybridSim
- **Network Simulations**
  - High-performance network topologies
    - N-dim Torus, Fat-tree, Dragonfly, etc.
  - Multi-scale
    - Network-on-chip
    - 100K+ nodes
  - Multiple Drivers
    - Traces
    - State-machines
    - Pattern-based stochastic
- **System-level Simulations**
  - Job scheduling & Allocation

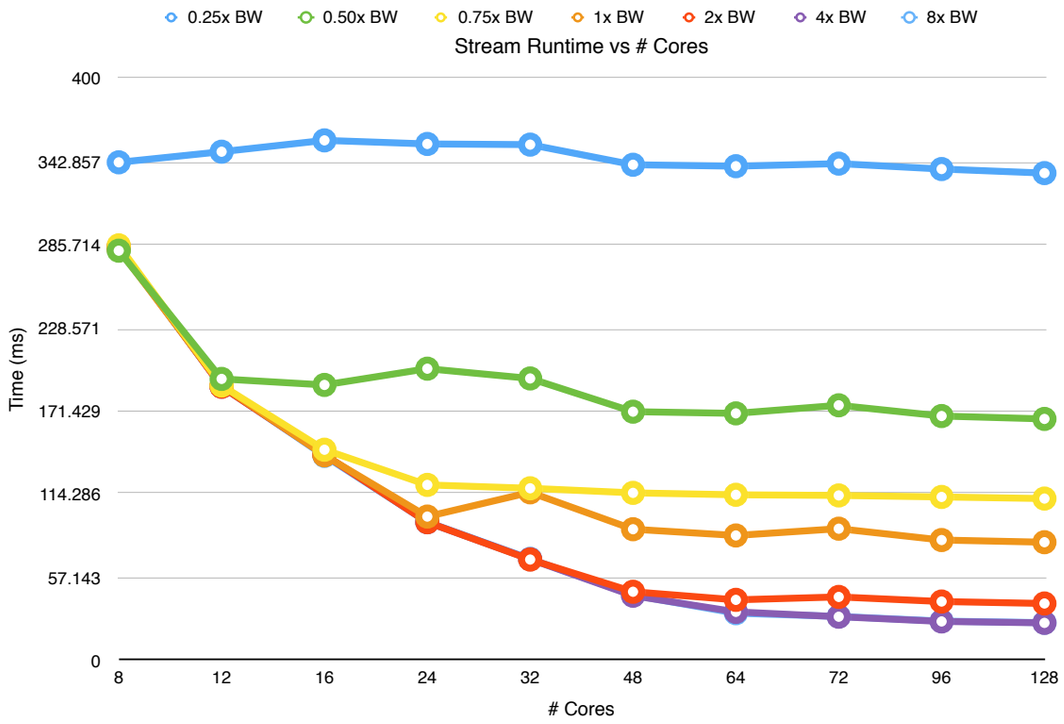


2-level Memory Picture Courtesy AMD



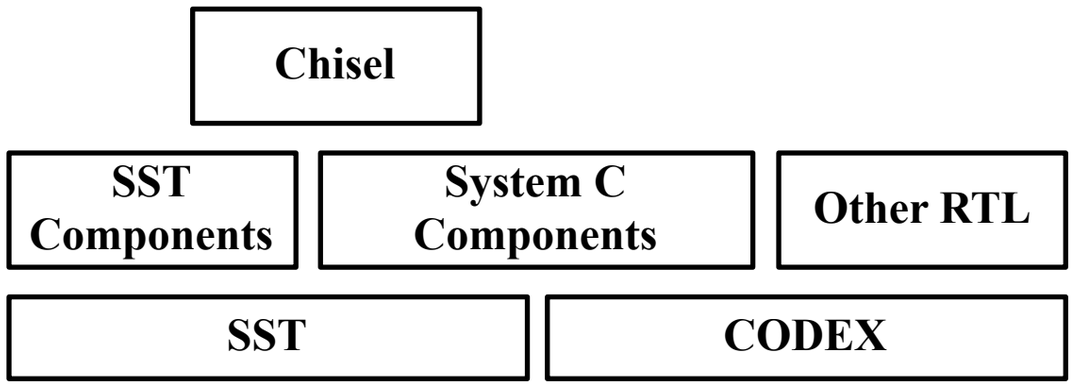
SST Recent Results



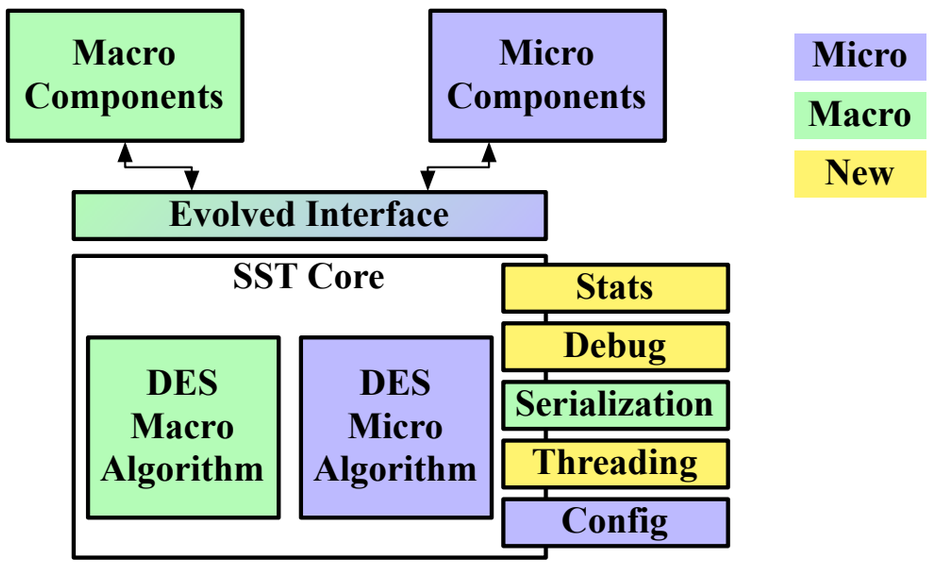


- **Examined different Job allocation algorithms**
  - **Geometry-, cooling-, and power- aware allocation algorithms**
  - **Timescale: Months**
- **Memory Benchmarks**
  - **STREAMS benchmark to indicate we are getting correct memory BW**
  - **Memory contention curves match real systems**
  - **Timescale: Seconds**

Interconnections



- SST is generic framework
- Supports many other simulators
- Planned reuse of Chisel & System C components w/ CODEX



- Planned integration with “SST/Macro” components