

Red Storm System Raises Bar on Supercomputer Scalability

NNSA's Advanced Simulation and Computing program provides powerful simulation capabilities for defense programs.

Commissioned by the U.S. Department of Energy and National Nuclear Security Administration (NNSA) to address computing and simulation requirements, Cray and Sandia National Laboratories jointly produced the Red Storm supercomputer system. Red Storm is a massively parallel processing (MPP) supercomputer with a distributed memory, multiple instruction, and multiple data (MIMD) architecture to provide exceptional computational power. Not only one of the world's fastest supercomputers, it offers ease of use, system balance, sustained performance, and reliability. The Cray commercial versions of Red Storm (XT3/XT4) are very successful in the high performance computing market with over 25 systems sold.

Unique Architecture

Red Storm can scale from a single cabinet to hundreds of cabinets—ranging up to tens of thousands of processors. The system combines:

- High-volume commodity processors (AMD Dual-core and Quad-core Opteron™);
- A custom high-performance, 3D-mesh interconnect system;
- Linux/Catamount software engineered to produce high parallel efficiency on a wide variety of scientific and engineering applications.





Red Storm leverages knowledge gained from years of supercomputing experience with successful Sandia and Cray systems, such as the ASCI Red and the Cray T3E™ supercomputers.

Performance Goals

In addition to meeting system scalability, reliability, and resiliency requirements, one of Red Storm's main goals is achieving performance balance among the:

- Processor speed;
- Communications bandwidth between processors and memory;
- Communications bandwidth between processors;
- Communications I/O bandwidth to file systems and external network.



Red Storm switch allows flexible reconfiguration between classified and unclassified partitions.

Key features

The Red Storm system at Sandia includes the following features:

- 284 teraOPS (theoretical peak performance);
- Minimum aggregate system memory bandwidth of 83 TB/s;
- High-speed, high-bandwidth, 3D, mesh-based Cray interconnect with minimum sustained aggregate interconnect bandwidth of 120 TB/s;
- High-performance I/O subsystem (minimum sustained file system bandwidth of 100 GB/s to 1159 TB of parallel disk storage and sustained external network bandwidth of 50 GB/s);
- Flexible partitioning for classified and unclassified computing;
- Air-cooled; small footprint/low power (relative to comparably performing systems).



The home of Red Storm, The Supercomputing Annex at Sandia National Laboratories.

New Red Storm Facility

The Supercomputing Annex (SCA) facility at Sandia supports the Red Storm system. The 135 ft. x 150 ft. (20,250 ft²) computer room has a large clear span of expandability to meet future requirements. The computer floor consists of a 36 in. raised floor, providing a large cooling air supply plenum to support the system. The facility has 3.6 MW of available power via 24 installed 150 KW power-distribution units and two 1,000-ton chillers with up to 40 air handlers for system cooling. The SCA can support doubling both the power and chiller capacity for future expansion.



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