



# Supercomputing at Berkeley Lab

- The National Energy Research Scientific Computing Center (NERSC), located in Shyh Wang Hall at Lawrence Berkeley National Laboratory, is the primary scientific computing facility for the DOE Office of Science. It has been in operation for more than 40 years.
- NERSC systems enable the work of more than 7,000 researchers in 47 countries.
- NERSC has supported the work of six Nobel Prize winners.
- NERSC is more than a supercomputing center — it is part of an HPC ecosystem that is dealing with an explosion of scientific data being generated at experimental facilities such as telescopes and advanced light sources. NERSC resources — including supercomputers, storage archives and data scientists — enable researchers from all over the world to process, analyze, simulate and store this data.
- NERSC users publish about 2,000 refereed research papers per year involving supercomputing at NERSC.

## Unique Features of Wang Hall

### Energy Efficiency

- In addition to water-based cooling towers, Shyh Wang Hall employs an innovative “free” cooling mechanism that takes advantage of the Bay Area environment to cool the systems.
- There are no mechanical chillers (AC), so less than 10% of power goes to cooling, compared to 25-50% in conventional data centers.
- Waste heat from the machine room (note the clear plastic “chimneys” on servers throughout the machine room) is reused to heat offices on upper floors of Wang Hall.

### Seismic Isolation Floor

- The Hayward fault runs through the nearby UC Berkeley campus. The NERSC machine room thus features seismically isolated floors designed to withstand a magnitude 7.5 earthquake.
- The steel floor substructure rolls on casters; blue “moat plates” allow the floor to move up to 18 inches (anything below magnitude 5.1 will only move the floor <1 inch).
- Each of the springs in the floor has 20,000 lbs. of pull (80,000 lbs. total) to return the floor to static position following an event.

## NERSC Supercomputers

NERSC currently hosts two supercomputers for its users — Cori and Edison — running day and night all year long. We typically replace our supercomputers every 5 years to provide our 7,000 users with the newest technology to create detailed scientific simulations and analyze increasingly large datasets from scientific experiments.

## Cori

- All NERSC systems are named in honor of scientists, mathematicians or engineers. Cori is named for Gerty Cori, a Czech-born, American biochemist and first American woman to win a science Nobel prize.
- Cori is a 30 petaflop Cray XC40 system that can run 30 million-million calculations per second. It does this by computing on more than 650,000 processor cores.
- Cori comprises 68 cabinets, with about 10K processor cores per cabinet.
- Cori's file system can store 28 petabytes of data. A single petabyte is enough to store the DNA of the entire U.S. population — and then clone them, twice.
- The visualization depicted in the front panels of Cori is a fluid dynamics simulation using CHOMBO, a code developed at Berkeley Lab.

## Edison

- Edison, named after U.S. inventor and businessman Thomas Alva Edison, is a Cray XC30 supercomputer with a peak performance of 2.57 petaflops/sec.
- Edison has 134,064 compute cores for running scientific applications, 357 terabytes of memory and 7.56 petabytes of online disk storage with a peak I/O bandwidth of 168 gigabytes per second.

## ESnet

- ESnet is the DOE's high-performance science network, which links more than 50 DOE sites, including all U.S. national labs, supercomputing centers and major scientific experiment facilities.
- It is the world's fastest network for science.
- ESnet's transcontinental "backbone" transfers data at up to 100 gigabits per second, (over 2,000 times faster than the average home Internet connection).
- ESnet links to 140 other research and education networks around the world and has four 100 Gbps links across the Atlantic.

## Control Room

- Control room staff are the first line of support for NERSC, ensuring accessibility, reliability and security of supercomputers, data storage systems, the facility environment and ESnet.
- Staff monitor operation of the building, computer systems, data storage systems and ESnet's world-wide network on a 24x7 basis.
- The monitors on the wall above the windows in the control room display Thruk, which provides system alerts; HPSS, which provides alerts for tape libraries, servers and networking; ESnet, which provides alerts on all routers and switches; and environmental sensors, which monitor water flow, temperature and humidity, as well as the building itself.



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