

## *New Computing Technologies for the New Millennium*

At Argonne National Laboratory, world-class computational resources and technology enable diverse and powerful innovations in computing science. Computer scientists and mathematicians team with computational chemists, biologists, materials scientists, and others to advance the frontiers of science and engineering in many different areas.

Petascale computing systems promise new frontiers for research and computing applications. Argonne currently operates a 2,048-processor IBM Blue Gene/L system for systems and applications research. Our driving goal is to carry out research that will make petaflop performance widespread as soon as hardware is available.

Sophisticated new computer models simulate an increasingly wide range of complex phenomena, including climate modeling, nanosciences, and nuclear physics. Argonne is a world leader in designing robust algorithms, multiscale solvers, and scalable numerical libraries that make these simulations possible on the most advanced computer hardware. Argonne also spearheads critical developments in systems software—including parallel programming tools, programming models, operating runtime systems, and high-performance input/output and data-management tools—that enable effective use of petascale systems.

Through the Computation Institute at The University of Chicago, Argonne leads the Grid Infrastructure Group for the TeraGrid. This National Science Foundation-funded project provides extraordinarily large and fast distributed infrastructure for open scientific research, spanning eight partner sites that together provide more than 40 teraflops of computing capability and mass storage capability in the petabytes, linked by networks operating at tens of gigabits per second.



*During the 2003 SARS outbreak, Argonne's Access Grid technology helped radiologists across Taiwan to review SARS patients' daily X-rays without risk of infection.*

Advances in communications, collaboration, and visualization technologies provide new ways for scientists and engineers to share and analyze complex data. Argonne's Globus Alliance devises fundamental mechanisms that integrate geographically distributed computers, scientific instruments, and data. The Globus Toolkit is the backbone for numerous computational science projects. Our multimedia display, presentation, and interaction environment – the Access Grid – supports large-scale distributed meetings, collaborative work sessions, seminars, lectures, tutorials, and training. Wall-sized display technology with 10 million pixels allows visualization of simulations and other digital information in great detail.

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