



EXASCALE  
COMPUTING  
PROJECT

Accelerating Delivery of a Capable  
Exascale Computing Ecosystem

## Exascale Computing Project: Addressing a National Imperative

To maintain leadership and to address future challenges in national security, cyber security, science, energy, and health, the United States must make a strategic move in high-performance computing (HPC). A grand convergence of advances in modeling and simulation, data analytics, machine learning, and artificial intelligence will facilitate new approaches to predictive analysis for scientific discovery and stockpile stewardship, new means of addressing the sobering threats posed by growing capabilities of potential adversaries, and new solutions to complex data-driven engineering problems.

## About Exascale and ECP Impacts

The Exascale Computing Project (ECP) is focused on accelerating the delivery of a capable exascale computing ecosystem that delivers 50 times more computational science and data analytic application power than possible with DOE HPC systems such as Titan (ORNL) and Sequoia (LLNL). With the goal to launch a US exascale ecosystem by 2021, the ECP will have profound effects on the American people and the world.



### Advancing Scientific Discovery

ECP aims to ensure the exascale computing ecosystem necessary for developing clean energy systems, improving the resilience of our infrastructure, designing new materials that can perform in extreme environments, adapting to changes in the water cycle, developing smaller and more powerful accelerators for use in medicine and industry, and much more. Several projects focus on data-intensive problems to enable effective use of the data streams from powerful scientific facilities, complex environmental genomes, and cancer research (patient genetics, tumor genomes, molecular simulations, and clinical data).



### Strengthening National Security

ECP teams are also developing new applications for supporting the NNSA Stockpile Stewardship Program, which is responsible for maintaining the readiness and reliability of our nuclear weapons systems—without underground testing. Assessing the performance of weapons systems subject to hostile environments and potential threat scenarios exceeds the capabilities of current HPC systems and codes. NNSA application projects are focused on providing the sophisticated modeling and analysis tools needed to sustain the U.S. nuclear deterrence.



### Improving Industrial Competitiveness

Exascale systems will be used to accelerate research that leads to innovative products and speeds commercialization, creating jobs and driving US competitiveness across industrial sectors such as the emerging energy economy. To ensure alignment with US industry needs, ECP is engaging senior technology decision makers from among the country's most prominent private sector companies.

# ECP is structured on the principles of co-design and integration, with three key focus areas



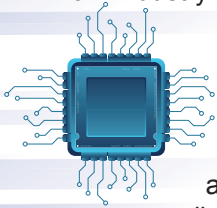
## Application Development (AD):

Capable exascale applications are a foundational element of the ECP and will be the vehicle for delivery of solutions and insights to key national challenges. Problems heretofore intractable will be accessible with ECP applications.



## Software Technology (ST):

Applications are built on underlying software technologies. As a result, software technologies play an essential supporting role in application efficacy on computing systems. ECP's ST effort spans low-level system software to high-level applications development environments, including the software infrastructure to support large-scale data management and data science for science and national security applications. ST efforts complement and integrate into the broader scientific software ecosystem that includes capabilities from industry and the broader HPC R&D community.



## Hardware and Integration (HI):

HI ensures a capable exascale computing ecosystem made possible by integrating ECP applications, software, and hardware innovations within DOE facilities. It supports US vendor R&D focused on innovative architectures for competitive exascale system designs, accelerated application readiness through collaboration with ECP partners, a well-integrated and continuously tested exascale software ecosystem deployed at DOE facilities, and training on key ECP technologies to accelerate the software development cycle and optimize productivity of application and software developers.

ECP is focused on accelerating the delivery of a capable exascale computing ecosystem to provide breakthrough solutions that can address our most critical challenges in scientific discovery, energy assurance, economic competitiveness, and national security. The project is a joint effort of two US Department of Energy (DOE) organizations: the Office of Science and the National Nuclear Security Administration (NNSA).



*ECP is led by a team of senior scientists, project management experts and engineers from six of the largest DOE national laboratories. Working together, this leadership team has established an extensive network to deliver a capable exascale computing ecosystem for the nation.*



[exascaleproject.org](http://exascaleproject.org)

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