

# A 100-Day Advanced Computing Action Plan for the Next Administration



## Advanced Computing

An ecosystem of high performance hardware, software, application models, co-design capabilities, visualization tools and the talented people who know how to leverage them.

Advanced computing is and must remain a bedrock of the United States' current and future competitive advantage in technology. The economic and national security potential of technologies like artificial intelligence, biosciences materials science, the internet of things, additive manufacturing, digital manufacturing, robotics, big data and cyber security highlight the need for U.S. leadership in these fields and the importance of leveraging the full advanced computing ecosystem across the country. These technologies share a common denominator: reliance upon a robust ecosystem of creative and knowledgeable people expertly developing and applying powerful hardware, sophisticated software, and computational methods. Advanced computing is the foundation.

The Advanced Computing Roundtable (ACR) of the Council on Competitiveness convened American computing leaders from industry, academia and the national laboratories. Together, they have identified key bottlenecks and proposed solutions presented here as a **100-day Action Plan for the Next Administration**. To out-compete, the United States must out-compute.

## The United States must:

- 1. Increase federal investment to compete at the high end of advanced computing.** Beyond investments in hardware and software applications related to exascale computing (10<sup>18</sup> floating point operations per second), the United States must leverage its higher performance computing assets to lead in related strategic areas like microelectronics, AI/machine learning, and quantum computing. Only the federal government has the resources to continually press the frontiers of advanced computing through research and engineering, and those expenditures must be maintained and expanded.

The federal government has significant responsibility for critical infrastructure, where leadership at the cutting edge of computing is synonymous with achieving the mission. The U.S. Department of Homeland Security has identified 19 such areas that benefit from investment and progress in advanced computing. These achievements migrate rapidly into economic strength in the commercial sphere, contributing to further innovations.

Global competitors explicitly state the strategic necessity of computational dominance through data, computational modeling and AI, consequently investing aggressively in advanced computing R&D and infrastructure. National security and economic competitiveness will rely upon a computing-augmented workforce for productivity and capability in a world ever-more exhibiting volatility, uncertainty, complexity and ambiguity.

**2. Encourage more software partnerships to fully realize the potential of advanced computing.** The U.S. Department of Energy and the National Science Foundation (NSF) should coordinate a multi-agency effort to create incentives and eliminate technical and legal barriers to software partnerships between private sector users, commercial software vendors (CSVs), national laboratories, and academia.

- Industry end users bring market-based problems and field data to the table. They can gain exclusive rights to their solutions and output data.
- CSVs bring specific software expertise, validation experience and knowledge of data cleansing. They can develop enhanced code to resell.
- Laboratories and university centers bring scientific and computing expertise. They can train the next generation work force, while gaining experience and use rights to enhanced code.

The NSF's Software Infrastructure for Sustained Innovation (SI2) Program is a strategic tool to support software research. In 2016, the SI2 program launched two software institutes, one centered on molecular science and another on science gateways. They enable greater collaboration among researchers and greater access to computing resources. The software institutes could be expanded or serve as models for public-private partnerships to collaborate on pre-competitive software development for advanced industry applications.

**3. Continue support for and expansion of strategic advanced computing federal programs.** Targeted efforts to leverage federal or federally funded advanced computing technology and expertise to advance America's economic competitiveness are critical to U.S. competitiveness. The national lab HPC4 model of competitive bids for partnership projects (in manufacturing, materials and mobility) at reduced cost is one example. In addition, the Manufacturing Extension Partnership (MEP) program of the National Institute of Standards and Technology is partnering with Manufacturing USA, a network of 14 public-private research institutes. Building on a backbone of advanced computing capacity at the institutes, especially the Digital Manufacturing and Design Innovation Institute, MEP centers across the country are working to help U.S. manufacturers enhance their competitiveness by adopting digital technologies.

**4. Develop and fund public-private partnerships (PPPs) to support existing market needs and offer economic incentives to rebuild the technology manufacturing sector.** The PPPs should (1) promote the development of a broad portfolio of specialized hardware to extend the ability of existing semiconductor manufacturing facilities to fuel widespread American productivity gains, (2) facilitate the co-design of computing technology development with heavy industry involvement and improve the ability to scale promising technology to de-risk industry involvement, and (3) advance America's energy and manufacturing agenda through infrastructure for data and high performance computing-driven modeling, simulation and machine learning capabilities across industry.

These private-public hybrid models can be highly effective by leveraging the funding and research capabilities of the federal government, technology accelerator programs and startups from academia, and market and scalability knowledge from industry to continually prioritize promising candidate technologies. One current success in this model is the COVID-19 HPC Consortium, which has produced several projects regarding contact tracing, drug repurposing, outbreak modeling, and more by combining public and private expertise. As of today, the consortium has 43 members and is still expanding.