



## Infrastructure for Innovation - Canada's Advanced Research Computing Platform

Canadian private sector and SME R&D / innovation investments have not resulted in the desired economic outcomes. Today, our potential success in genomics, advanced manufacturing, green technology, and natural resources are directly linked to access to supercomputing and big data resources -- infrastructure that is generally termed *Advanced Research Computing (ARC)*.

Canadian companies are poor adopters of ARC technology and methods and frequently miss opportunities to use those technologies to innovate and improve their competitiveness. This productivity gap means that our economy is slow to diversify and provide growth and jobs. Worse, without access to advanced data services in Canada, these companies will be left behind their competitors.

A number of programs have been developed to improve SME adoption elsewhere (e.g. NDEMC and iForge at the NCSA in the US, SHAPE and Fortissimo in Europe). Canada needs to catch up. In order to increase our global competitiveness and to diversify and grow the Canadian economy, we need to treat this infrastructure as essential national infrastructure, the way advanced networking (CANARIE) was recognized a generation ago, with both public investment and public access -- for academia, government and business researchers and innovators -- to supercomputing resources and big data management systems. A robust advanced computing environment is as essential to our economic growth as the Trans-Canada Highway or broadband connectivity.

This is advantageous for a several reasons:

- Supercomputing and big data infrastructure are essential infrastructure for innovation in Canada and support important economic drivers.
- Larger systems are very costly and sharing resources allows for investment in leadership class systems that will compete globally. This is a growing global trend. We have the opportunity to lead early.
- Leveraging ARC expertise to support a broader community will accelerate skills develop in government and economic development.

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- Fee for service or infrastructure as a service enables efficient cost recovery and solves current funding model issues.

This new approach to advanced research computing would be publicly funded, with extensive cost recovery. It will be a shared provider of advanced research computing with open access and robust structures for governance and accountability. By providing a common platform for academic, government and industry research, it will promote labour force mobility, encouraging seamless transitions from academia to industry and government.

When fully implemented, the annual federal investment (capital plus operating) required to support this approach would be approximately \$350M/year, augmented by funds from provinces, institutions and industry. This total includes roughly equal capital investment in the three supported sectors - academic, government and industry. This level of investment would be competitive to that made by comparator countries on a per-researcher basis.

*“We need Infrastructure that supports change”*  
– PM Trudeau, Davos, January 20, 2016

### **There is potential for tremendous impact:**

- Canada’s best research programs would be strengthened through the retention of the 200 experts currently working with Compute Canada. This best-in-class work would be expanded to serve the increasing demands of industry and government and assist in broader workforce development through training and internship opportunities.
- We could potentially serve an estimated 4,000 academic research groups, 3,000 private sector firms and 3,000 government projects.
- Based on ROI numbers published by IDC, a \$100 million investment to provide additional capacity for private sector firms can be expected to generate returns of \$48 billion in additional revenues and \$4 billion in incremental profits for those firms.



Canada has committed to playing a leading role in the knowledge economy and Industrial Revolution 4.0.

Advanced Research Computing will be the critical infrastructure needed for developing a data-savvy workforce, growing firms at the forefront of technologies such as “big data”, the Internet of Things, cloud computing, smart materials and advanced manufacturing, personalized precision medicine, promoting open government, and making decisions based on the best available evidence.

These goals require a robust national strategy for advanced research computing (ARC) and research data management (RDM). The strategy should take advantage of economies of scale and scope made possible by a national system while incenting investment at local and regional levels. It should ensure that government investments in science and technology are supported by an enabling infrastructure that allows those projects to thrive. Establishing a common carrier, with the scope and mandate proposed in this document, that can implement such a strategy would be an exceptional step forward. Canada has committed to playing a leading role in the knowledge economy and Industrial

## **About Compute Canada**

Compute Canada's mandate is to serve advanced research computing (ARC) and research data storage needs at any scale, for any discipline, for all of Canada. Compute Canada supports projects ranging from a single faculty member, up to the largest "Big Science" projects in the country. The facility enables world-leading research in many disciplines, including digital humanities, engineering, computer science, physics, astronomy, chemistry, neuroscience, bioinformatics, and mathematics. The national platform also supports researchers from large and small research institutions from coast-to-coast, across many sectors. The diverse community needs are met through Compute Canada's delivery of services, which include traditional tightly coupled High Performance Computing (HPC), serial High Throughput Computing (HTC), cloud computing and storage, visualization and other technology solutions as required.

Compute Canada is the national advanced research computing (ARC) facility of Canada. We are a not-for-profit corporation and a federation of 37 member universities



and research institutions. The 37 institutions collectively own the infrastructure and employ the 200 experts that serve researchers across the country. Compute Canada's skilled team members are themselves an essential resource for Canada, working together to help Compute Canada's users accelerate and amplify their own research achievements. The federated Compute Canada team has been assembled from long-standing institutional consortia that now participate in Compute Canada as partner Regional Organizations: ACENET, Calcul Québec, Compute Ontario and WestGrid. Together, we support more than 10,000 researchers including more than 3,000 faculty.