International Exascale Software Project Meetings

Overall goal:

• Bring together the international community to explore plans and identify gaps for producing a software infrastructure capable of supporting exascale applications

Meeting history:

1. Santa Fe, NM, US, April 2009
2. Paris, France, June 2009
3. Tsukuba, Japan, October 2009
5. Maui, HI, US, October 2010
7. Cologne, Germany, October 2011
8. Kobe, Japan, April 2012

SC08 (Austin), SC09 (Portland), ISC09, SC10 (NOLA), ISC10, SC11 (Seattle)

www.exascale.org: White Papers and Slides
IESP Roadmap (2009 – 2012)

The IESP Roadmap presented a multidimensional analysis of the major challenges to be overcome in order to create a software infrastructure capable of supporting exaflop performance on next generation systems, and made a cogent case for the urgency of starting that work as soon as possible.

Spurred in some degree by the work of the IESP and its Roadmap, the United States, the European Union, and Japan have, in the past three years, moved aggressively to develop their own plans for achieving exascale computing in the next decade.
IESP Roadmap Components

4.1 Systems Software
   4.1.1 Operating systems
   4.1.2 Runtime Systems
   4.1.3 External Environments
   4.1.4 Systems Management

4.2 Development Environments
   4.2.1 Programming Models
   4.2.2 Frameworks
   4.2.3 Compilers
   4.2.4 Numerical Libraries
   4.2.5 Debugging tools

4.3 Applications
   4.3.1 Application Element: Algorithms
   4.3.2 Application Support: Data Analysis
   4.3.3 Application Support: Scientific Data

4.4 Crosscutting Dimensions
   4.4.1 Resilience
   4.4.2 Power Management
   4.4.3 Performance Optimization
   4.4.4 Programmability

The International Exascale Software Project roadmap


Abstract
Over the last 20 years, the open-source community has provided more and more software on which the world's high performance computing systems depend for performance and productivity. The community has invested millions of dollars and years of effort to build key components. However, although the investments in these separate software elements have been tremendously valuable, a great deal of productivity has also been lost because of the lack of planning, coordination, and key integration of technologies necessary to make them work together smoothly and efficiently, both within individual petascale systems and between different systems. It seems clear that this completely uncoordinated development model will not provide the software needed to support the unprecedented parallelism required for petascale exascale computing, or the flexibility required to exploit new hardware models and features, such as transactional memory, speculative execution, and graphics processing units. This report describes the work of a community to prepare for the challenges of exascale computing, ultimately combining their efforts in a coordinated international effort.
IESP → BDEC (2013 – today)

BDEC derived much of its impetus from the earlier work

• International Exascale Software Project (IESP)
• European Exascale Software Initiative (EESI)
• European Exascale Software Initiative 2 (EESI2)
• European eXtreme Data and Computing Initiative (EXDCI)
Europe-USA-Asia International series of Workshops on Big Data and Extreme Computing

Overarching goal:

1. Create an international collaborative process focused on the co-design of software infrastructure for extreme scale science, addressing the challenges of both extreme scale computing and big data, and supporting a broad spectrum of major research domains,
2. Describe funding structures and strategies of public bodies with Exascale R&D goals worldwide
3. Establishing and maintaining a global network of expertise and funding bodies in the area of Exascale computing

1 – BDEC Workshop, Charleston, SC, USA, April 29-May 1, 2013
2 – BDEC Workshop, Fukuoka, Japan, February 26-28, 2014
3 – BDEC Workshop, Barcelona, Spain, January 28-30, 2015
4 – BDEC Workshop, Frankfurt, Germany, June 15-17, 2016
5 – BDEC Workshop, Wuxi, China, March 9-10, 2017

With BoF’s at SC and ISC meetings

1. BDEC2 (Next Generation) Planning, Chicago, IL, March 26-28, 2018
BDEC Report to be Published in IJHPCA

BIG DATA AND EXTREME-SCALE COMPUTING: PATHWAYS TO CONVERGENCE. Toward a Shaping Strategy for a Future Software and Data Ecosystem for Scientific Inquiry*


Shorten version of the January report:
Scientific Computing is Changing

• In the past, we moved experimental data to the centralized servers, which provided bulk storage and computational resources for analysis and simulation.

• Three things have changed:
  • CPU advances have enabled edge/IoT devices to be small parallel computers with real operating systems and multithreaded programming models (CUDA, OpenMP, TensorFlow, etc.).
  • Machine learning and AI has helped create a new class of algorithms that can sift through massive amounts of experimental data, and then pushing to the data center only the relevant results.
  • Edge devices and scientific instruments are rapidly expanding, creating a new class of “edge software defined instrument” that must connect to cyberinfrastructure.

• These three changes are forcing us to rethink the central services model of HPC and embrace a new model where network infrastructure computes-along-the-way.

• To realize that goal, we need a new conceptual model for programming this new end-to-end infrastructure.