ASCR@40: An Update on the ASCAC Subcommittee Documenting ASCR Impacts

Bruce Hendrickson
Associate Director for Computing

September 23, 2019

Lawrence Livermore National Laboratory

Reminder of the charge

- Steve Binkley charged the ASCAC with producing a report that assesses and documents the historical accomplishments of the Advanced Scientific Computing (ASCR) program and its predecessors over the past four decades.
  - Highlight outstanding examples of major scientific accomplishments that have shaped the fields of ASCR research
  - Identify the lessons learned from these examples to motivate ASCR investment strategies in the future
  - Illuminate the guiding strategies and approaches that will be key to ensuring future U.S. leadership in the full range of disciplines stewarded by ASCR
  - Inform the investment strategy of the Office of Science

- The report should provide technical details as needed for context but should be primarily concerned with the essence of each story as it relates to the larger progress of science

- In Spring of 2019, request expanded to encompass two documents, one more technical and one more broadly accessible

Status of these two documents

- **Detailed history document**
  - All sections have (reasonably) mature drafts
  - Merged into unified document for feedback
  - We are addressing some gaps and inconsistencies
  - Interested in both high-level and low-level feedback from ASCAC and the community
    - What content have we missed?
    - Are the technical and historical details accurate?

- **Accessible document**
  - Most articles are mature
  - Particularly interested in feedback on critical themes we've overlooked
  - Beginning to work on design and layout

Subcommittee members

- Buddy Bland, ORNL
- Jon Bashor, LBL
- Jackie Chen, SNL
- Phil Colella, LBNL
- Tiffani Conner, ORAU
- Jack Dongarra, UT & ORNL
- Thom Dunning, PNNL
- Ian Foster, UC & ANL

- Richard Gerber, LBL
- Bruce Hendrickson, LLNL, Chair
- Wendy Huntoon, KINBER
- Bill Johnston, LBNL (ret.)
- Paul Messina, ANL, Former Chair
- Jim Pool, Caltech (ret.)
- John Sarrao, LANL
- Jeff Vetter, ORNL

Red = new since last ASCAC meting

Proposed history document outline from March

Executive Summary (All)

1. Introduction (Hendrickson, Messina)
2. Criteria for selection of material to include (Hendrickson)

   Combine

3. Accomplishments
   i. Computational science (Chen, Dunning)
   ii. Applied mathematics (Colella, Dongarra)
   iii. Computer science (Reed, Johnston)
   iv. Computer architecture (Messina)
   v. Facilities (Bland, Gerber, ALCF representative)
4. Impact on industry (Bland, Messina)
5. Impact on workforce & education (Hendrickson, Messina)
6. Broader achievements and contributions (Sarrao, Dongarra)
   i. High-impact workshops and reports sponsored by ASCR
7. Lessons learned from different modes of funding and recommendations for the future (Hendrickson)
8. ~~Summary (All)~~
9. Appendices

Final history document outline w/ section owners

Executive Summary (All)

1. Introduction & document description (Hendrickson)
2. Accomplishments
   i. Computational science (Chen, Dunning, Sarrao)
   ii. Applied mathematics (Colella, Dongarra)
   iii. Computer science (Foster)
   iv. Computer architecture (Vetter)
   v. Facilities (Bland, Gerber, w/ Laura Wolf (ANL))
3. Impact on industry (Bashor)
4. Impact on workforce & education (Hendrickson)
5. Broader achievements and contributions (Sarrao, Dongarra)
   i. High-impact workshops and reports sponsored by ASCR
6. Lessons learned and recommendations for the future (Hendrickson)
7. Appendices
   i. Charge letter
   ii. Contributors

Accessible, impact-centric document

- Structured around exemplar impact stories, 3-4 pages each
  - Bill Cannon is overseeing the writing of this document
  - Articles written by professional tech writers
  - "Shepherd" from committee for each article

- Current set includes:
  - Delivering on the promise of computational science (Dunning, Sarrao)
  - Mathematics is the critical enabler (Colella)
  - To out-compute is to out-compete (Bashor)
  - Connectivity changes everything (Johnston)
  - Petaflops for the people (Gerber)
  - When decisions matter (Hendrickson)
  - Knowledge from data (Foster)
  - Developing the nation's computing workforce (Bashor)
  - Rules of the road for HPC (Vetter)

- Are we missing any key stories?

Selected highlights

- Prehistory dates back to creation of math & computing program in late 50s. Encouraged by von Neumann.

- Foundational role in envisioning & navigating transition to massive parallelism

- Critical role in enabling the internet – particularly congestion control

- Facilities model is the gold-standard for the international community

- Recurring cycle of new computers enabling faster science opening new math and CS research questions

- Creation of distributed computing to enable collaborations and scientific data management

- Combination is greater that sum of its parts. Creation of field of computational science. Intimate partnership with other SC offices (e.g. SciDAC)

High-level lessons

1. A compelling and consistent vision can drive scientific revolutions

2. Diverse funding models are required for diverse and impactful outcomes

3. Workforce investments have been critical

4. Partnerships are essential

5. Testbeds and platform access funding models are important

Challenges in the coming years

1. Technology disruptions are inevitable

2. Funding balance is essential for sustained impact

3. Software support model is needed to preserve investments

4. Broader partnerships will be required

5. A sought-after workforce will complicate staffing

Anticipated timeline

- Next two months:
  - Gather input and update documents accordingly
  - Gather appropriate imagery
  - Begin preparing layout of shorter, accessible document

- By end of calendar year:
  - Accessible document final version under review
  - Detailed document writing complete, layout underway

- We will update status at next ASCAC meeting

Questions?