# *OSTP Convening: Pioneering the Future Advanced Computing Ecosystem*

August 17-18, 2020

## Agenda

**Day 1: August 17, 2020**

(All times in ET)

| | | |
|---|---|---|
| **10:30 AM – 11:00 AM** | **Welcome & Opening Statement** | OSTP Leadership/SC FACE Co-chairs |
| **11:00 AM – 12:00 PM** | **Keynote Session I**<br>**Realizing the Future Advanced Computing Ecosystem** | Chair: Frank Indiviglio, NOAA<br>Speakers:<br>○ Dario Gil, IBM<br>○ Mary Hall, University of Utah |
| **12:00 PM – 12:30 PM** | **Break** | |
| **12:30 PM – 02:00 PM** | **Panel I: Future Advanced Computing Ecosystem** | Moderator: Zachary Goldstein, NOAA<br>Panelists:<br>○ Ilkay Altintas, SDSC/UCSD<br>○ Katie Antypas, NERSC<br>○ Michael Farrar, USAF<br>○ Ashley Korzun, NASA<br>○ Dan Stanzione, TACC |
| **2:00 PM – 3:00 PM** | **Break** | |
| **3:00 PM – 4:30 PM** | **Panel II: Foundational & Translational Research** | Moderator: Margaret Martonosi, NSF<br>Panelists:<br>○ Steve Keckler, NVIDIA<br>○ Raymond Richards, DARPA<br>○ Vivienne Sze, MIT<br>○ Kathy Yelick, UC Berkeley/LBL |
| **4:30 PM – 4:45 PM** | **Day 1 wrap up** | FACE Co-chairs |

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**Day 2: August 18, 2020**
(All times in ET)

| | | |
|---|---|---|
| **10:30 AM – 11:30 AM** | **Keynote Session II**<br>**Realizing the Future Advanced Computing Ecosystem** | Chair: Erwin Gianchandani, NSF<br>Speakers:<br>○ Neil Jacobs, NOAA<br>○ Valerie Taylor, ANL |
| **11:30 AM – 12:00 PM** | **Break** | |
| **12:00 PM – 01:30 PM** | **Panel III: Robust, Sustainable Software and Data Ecosystem** | Moderator: Barbara Helland, DOE<br>Panelists:<br>○ Mike Heroux, Sandia<br>○ James Howison, UT Austin<br>○ Kerstin Kleese Van Dam, BNL<br>○ David Michaud, NOAA<br>○ Fernando Pérez, UC Berkeley |
| **1:30 PM – 1:45 PM** | **Break** | |
| **1:45 PM – 3:15 PM** | **Panel IV: Fostering a Diverse, Capable & Flexible Workforce** | Moderator: Amy Friedlander, NSF<br>Panelists:<br>○ Damian Clarke, AAMU<br>○ Ana Hunsinger, Internet2<br>○ Tsengdar Lee, NASA<br>○ Henry Neeman, U of Oklahoma<br>○ Shelly Olsan, Krell Institute |
| **3:15 PM – 3:30 PM** | **Break** | |
| **3:30 PM – 5:00 PM** | **Summary, Next Steps** | Moderator: Manish Parashar, OSTP<br>Panelists:<br>○ Zachary Goldstein, NOAA<br>○ Margaret Martonosi, NSF<br>○ Barbara Helland, DOE<br>○ Amy Friedlander, NSF |
| **5:00 PM – 5:15 PM** | **Closing** | SC FACE Co-chairs |

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## Panel I: Future Advanced Computing Ecosystems

Moderator: Zachary Goldstein, NOAA

Panelists:

Ilkay Altintas, SDSC/UCSD

Michael Farrar, USAF

Dan Stanzione, TACC

Katie Antypas, NERSC

Ashley Korzun, NASA

Scribe: Bill Cushman, NOAA

Strategic investments by government, academia, and industry in computing infrastructure have resulted in a spectrum of capabilities ranging from extreme scale systems to clouds and edge computing systems. At the same time, emerging applications, including those underlying the Industries of the Future (IotF) bring a growing diversity of computing requirements and have natural affinities to technologies, system architectures, and use cases. These data-driven, AI-enhanced workflows will necessitate the further integration of heterogeneous platforms, including those within a given architecture as well as the composition of different resources types (including HPC, cloud, network-centric and edge) and usage models. An integrated computing ecosystem can accelerate access to new/emerging/future paradigms, technologies and capabilities (for example, Neuromorphic and Quantum), while at the same time enable agencies to leverage crosscutting synergies and efficiencies across government, industry and academia.

This panel will explore the opportunities and challenges and key actions necessary for realizing the future advanced computing ecosystem spanning government, academia, industry that can serve as an important catalyst for the IotF and accelerating other applications and will lay the foundation for American leadership in science and engineering, economic competitiveness, and national security preparedness.

### Panel Questions:

1. What opportunities for synergies between government, industry, and academia to advance scientific research and mission priorities do you think exist? What is your view on pathways for implementing these synergies?
2. What challenges exist in developing a more integrated ecosystem between HPC, Cloud, network centric and edge computing that directly advance scientific research and mission priorities? How can these be brought into a tighter alignment?
3. What barriers exist in evolving towards an AI-enhanced ecosystem? What are the key actions needed to overcome these barriers?
4. What additional investments are needed beyond the technologies that support Industries of the Future (AI, Quantum, Communications) to develop the future ecosystem for scientific advancement?
5. What is needed to ensure the developing ecosystem remains focused on addressing the needs of agencies from science and technology research to operational practice and back to research?

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## Panel II: Foundational & Translational Research and Development

Moderator: Margaret Martonosi, NSF
Panelists:
Steve Keckler, NVIDIA
Vivienne Sze, MIT
Raymond Richards, DARPA
Kathy Yelick, UC Berkeley/LBL
Scribe: Faisal D'Souza, NITRD

The computational landscape is rapidly evolving as a consequence of the slowing progression of technology advances within Moore's law, the end of Dennard scaling, and the unsustainable power requirements of current technology systems. Computing systems are already multicore and heterogeneous. Future computing systems will require increasingly innovative explorations into all levels of the system, from hardware devices to system architectures and software stacks, and the abstractions and tool flows by which they interconnect. Significant advances from emerging technologies and paradigms are needed in heterogeneous processors, heterogeneous memories and models, new interconnect technologies, special-purpose and energy-efficient architectures, and non-von Neumann computing elements such as those based on neuromorphic and quantum technologies. Simultaneously, advances in applications, algorithms and workflows are needed to scale performance and facilitate the integration of heterogeneous platforms, including those within a given architecture as well as network-centric and edge computing. Finally, a sustained investment into the exploration of new materials, devices, paradigms, technologies, and infrastructure in the form of foundries, testbeds, experimental systems prototypes, and the supply chain is necessary.

This panel will explore the foundational and translational research and development opportunities and challenges, along with key actions to address these. The panel will also explore the essential cross-agency and public-private partnerships.

### Panelist Questions:

1. What are the most promising hardware and software research trends toward these goals?
2. What are the application drivers that can best inform foundational and translational research and development for future computing systems?
3. How can researchers advancing novel computing elements best interface with algorithms and applications researchers in order to explore and advance full-stack approaches?
4. How can government, industry, and academic researchers work together on these issues?

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## Panel III: Robust, Trusted, Sustainable Software and Data Ecosystem

Moderator: Barbara Helland, DOE

Panelists:

Mike Heroux, Sandia
Kerstin Kleese Van Dam, BNL
Fernando Perez, UC Berkeley
James Howison, UT Austin
David Michaud, NOAA

Scribe: Radhika Subramanian, NOAA

An innovative, trusted, verified, usable, sustainable software and data ecosystem and sustainable software ecosystem is essential for translating innovation in science and technology into national science and engineering and economic leadership. Software and data services must balance the following attributes while ensuring robustness and correctness: efficiency of development, debugging, verification, and validation; usability, reproducibility, manageability, extensibility, and sustainability; and performance and scalability.

Furthermore, future computing technologies present new opportunities (e.g., real-time response, embedded processing of data from sensors or actuators, and steering of models and experiments) requiring new algorithms, models of computation and data analysis, programming environments, and software stacks. At the same time, the development for software and data services, including migrating (often legacy) applications to new systems, continues to be a challenge preventing the community from taking advantage of existing and emerging capabilities and necessitating new approaches for balancing stability with innovation and evolution.

The growing complexity of applications and computing environments is also leading to the exploration of automated approaches to the development and testing of software and data services and new opportunities for "smarter" software and data services (including applications) and processes through the integration of AI.

This panel will explore opportunities and challenges in realizing a robust, trusted, and sustainable software and data ecosystem, along with key actions to address them. The panel will also address crosscutting structures and partnerships that are essential to fostering and supporting such an ecosystem.

### Panelist Questions

1. What opportunities exist from the rapid growth of data from "smart" sensors, detectors or actuators coupled with artificial intelligence and machine learning to revolutionize software and computing? How can we develop software, algorithms and methods that will ensure that the results are reproducible, understandable and robust?
2. With future computer architectures becoming more complex and the increasing availability of data, software is key to hiding complexity while providing ease of use. What lessons have we learned over decades of software development that can inform the design and implementation of a trusted, robust software? How do we convince application developers to use new programming environments, tools and libraries instead of "growing their own?
3. What challenges exist in developing smart, agile software that is also trusted and robust? Is it even possible?

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4. The software ecosystem is part of a much larger advanced computing ecosystem. What new partnerships do we need to encourage to foster co-design between hardware, software and the growing user community?
5. What new partnerships, opportunities or structures do we need to institute to ensure that innovative, trusted, verified, usable software is sustained and maintained for emerging architectures?

## Panel IV: Fostering a Diverse, Capable & Flexible Workforce

Moderator: Amy Friedlander, NSF
Panelists:
Damian Clarke, AAMU
Tsengdar Lee, NASA
Shelly Olsan, Krell Institute
Ana Hunsinger, Internet2
Henry Neeman, NASA
Scribe: Joyce Lee, NITRD

Effectively leveraging advanced computing capabilities requires both turning them into practical and usable forms (that is, making the advanced computing, software and data systems and services more intuitive and easier to use) and developing the skilled workforce that can build the tools, operate the systems, and enable a broad range of users to employ these capabilities to do their work. This is especially true in the case new and potentially disruptive technologies and paradigms. The essential, skilled -- and future – workforce should be trained in the current state of the art and be able to anticipate and exploit future technologies and solutions and communicate effectively across a variety of stakeholders and end users. This involves a wide range of training and skills, from cable laying to power and heat management to research and development to organizational management, marketing and communication. In a rapidly evolving landscape, developing and sustaining a strong, diverse, and adaptive workforce involves not only training within educational institutions or on the job, but refreshing skills throughout a career as technologies, platforms, and applications evolve. Developing the necessary curricula and tools for workforce training, re-skilling, productivity, and collaboration is equally important. Finally, establishing synergies across government, academic, and industry stakeholders and developing creative incentives and rewards mechanisms are essential to sustain this workforce.

This panel will explore opportunities and challenges related to ensuring a skilled workforce and develop key actions necessary. The panel will also explore the essential cross-agency as well as public-private partnerships.

### Panelist Questions

1. What are the issues? That is, where are the gaps in research or in the current landscape of services?
2. Who are the stakeholders? That is, who is already engaged in this discussion or who should be in the discussion but is not? And why? What are the barriers to access and participation? What are the stakeholders' respective roles and responsibilities?
3. What engagements and partnerships across the stakeholders are essential to achieve the goal of a skilled workforce?
4. What questions should we ask? That is, what steps are possible in the near term and goals for the long term? What interventions and incentives are possible?

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## How to Submit Questions

- By WebEx
  Use the Q&A box, on the right side of your WebEx window, to send your question to the panelists. Please ensure you address your question to **"All Panelists"** from the dropdown option.
- By Email
  Send an email to the appropriate email alias:
  - For questions to Keynote and Summary, Next Steps sessions: WHC-FACE@nitrd.gov
  - For questions to Panel 1: FACE-Panel1@nitrd.gov
  - For questions to Panel 2: FACE-Panel2@nitrd.gov
  - For questions to Panel 3: FACE-Panel3@nitrd.gov
  - For questions to Panel 4: FACE-Panel4@nitrd.gov

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