Transforming Science in the 21st Century: A Vision for a National Cyberinfrastructure Ecosystem

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Cyberinfrastructure is Central NSF’s Mission & Priorities

“To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense...”
Foster a cyberinfrastructure ecosystem to transform science and engineering research... through Research CI and CI research

Rapid (disruptive) changes in S&E and CI landscapes → Our cyberinfrastructure ecosystem must evolve!
Transforming Science Through Cyberinfrastructure

NSF’s Blueprint for a National Cyberinfrastructure Ecosystem for Science and Engineering in the 21st Century

“.... an agile, integrated, robust, trustworthy and sustainable CI ecosystem that drives new thinking and transformative discoveries in all areas of S&E research and education”

Community-informed blueprints focused on different elements of the CI ecosystem

http://go.usa.gov/xm8bU
A new vision…

An agile, integrated, robust, trustworthy and sustainable CI ecosystem that drives new thinking and transformative discoveries in all areas of S&E research and education.

Overarching principles:

- View CI more holistically
- Support translational research
- Balance innovation with stability
- Couple discovery and CI innovation cycles
- Improve usability
Computational blueprint.

Implement extensions and enhancements to current investments and new programs and opportunities in 2019 and beyond.

Two strategies

Deploy a balanced computational ecosystem that supports broad and diverse requirements, users and usage modes

Achieve maximal impact from the array of computational capabilities and expertise

First of several blueprints focused on different elements of the CI ecosystem
Computational Blueprint: Elements of a balanced computational ecosystem

- **Petascale Facility**
  - Blue Waters (UIUC)

- **Leadership Class Computing Facility**
  - LCCF Phase 1: Frontera (UT-Austin)
  - LCCF Phase 2 (MREFC)

- **Innovative HPC Systems**
  - Bridges, Comet, Jetstream, Stampede2, Wrangler

- **Innovative Capacity Systems**
  - FY20; FY21; 5+5 years; NSF 19-534

- **Innovative Prototypes/testbeds**
  - FY20; FY21; 5 years; NSF 19-534

- **XSEDE, XMS, OS**
  - Community-driven planning
  - Next Generation CI Services (alloc., coordination, user-support)

- **Advanced Computing Systems & Services**

- **CI Services**

Computation for the Endless Frontier

Frontera will be:

- A leadership-class computational instrument with the **broadest utility for all of S&E applications**
- The **largest CPU system** on a **US academic campus**
- A national asset that **complements** other leadership-class computing investments in the US research ecosystem

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Early user access started in May 2019

#5 on Top500 (06/19)

https://www.tacc.utexas.edu/systems/frontera
Advanced Computing Systems & Services (ACSS): FY19 Awards

Category I

Computing without Boundaries: Cyberinfrastructure for the Long Tail of Science
- Increased capacity and performance for users of batch-oriented and science gateway computing; integration with the public cloud and the Open Science Grid
- PI: Michael Norman, University of California-San Diego

Bridges-2: Scalable Converged Computing, Data, and Analytics for Rapidly Evolving Science and Engineering Research
- High capacity, large memory system targeting high-performance data driven analytics with machine learning / deep learning / artificial intelligence applications
- PI: Nicholas Nystrom, Carnegie-Mellon University

Category II

Ookami: A high-productivity path to frontiers of scientific discovery enabled by exascale system technologies
- Explores the Fujitsu A64fx processor with ultra-high memory bandwidth to better support memory-intensive applications
- PI: Robert Harrison, SUNY at Stony Brook
Advanced Computing Systems & Services (ACSS): FY20 Solicitation

OAC encourages the community to take advantage of this opportunity to consider novel and innovative services that are aligned with goals of the blueprint and the ACSS program solicitation, complement currently available (and planned) resources and services, and respond to current and emerging technologies and S&E needs. For example, Category I capacity systems that federate and leverage distributed resources and/or integrated cloud computing services are relevant. Likewise, Category II systems that explore novel technologies, architectures, and/or access models are also relevant. Across both categories of investment, the overarching goal of the solicitation remains to provision the resources and services that enable discoveries and innovation across S&E while also advancing the state of the art of the CI ecosystem consistent with NSF’s mission to support discovery and innovation.
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Clouds and the NSF CI Ecosystem

- CISE CloudAccess Solicitation
  - Explore models for providing (CISE) researchers access to Cloud services

- Exploring Clouds for Acceleration of Science (ECAS)
  - Explore clouds as platforms for leading edge science

- CC*: Clouds and Campus Computing
  - Integrated Cloud services/expertise into campus CI
Request for Information (RFI): WH OSTP-led Update to Strategic Computing Objectives

- The NITRD Fast-Track Action Committee (FTAC) on Strategic Computing is requesting input from all interested parties on the goals and necessary approaches for sustaining and enhancing U.S. scientific, technological, and economic leadership in strategic computing.
- The results will be used to reevaluate the objectives of strategic computing, including those defined within the NSCI, in light of significant (and even disruptive changes) in the computing landscape.

**Details**
- **How to respond:** Send an email to StrategicComputing@nitrd.gov
- **Deadline:** 11:59 p.m. (ET) on August 23, 2019
Conclusion

- Science and society are being transformed by compute and data – a connected, robust and secure cyberinfrastructure ecosystem is essential.

- Rapidly changing application requirements; resource and technology landscapes
  - Our cyberinfrastructure ecosystem must evolve in response.

- NSF/OAC strives to build a cyberinfrastructure ecosystem aimed at transforming science.
Join the conversation

- OAC Webinar Series
  - 3rd Thursday @ 2PM ET
- OAC Newsletter
- Follow us on Twitter @NSF_CISE

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  - Learn about NSF events, programs, webinars, etc.
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  - cise-announce-subscribe-request@listserv.nsf.gov

Get involved

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NSF Office of Advanced Cyberinfrastructure (OAC) Newsletter

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Exploring the frontiers of computing
Arlington, Virginia - nsf.gov/dir/index.jsp...
“Make no little plans; They have no magic to stir men's blood ...”
Daniel H. Burnham, Architect and City Planner Extraordinaire, 1907.

“If you want to travel fast, travel alone; if you want to travel far, travel together”
African Proverb.

THANKS!

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