# *Campus Cyberinfrastructure (CC*) and an Update on Selected NSF Program Areas*

## *Quilt 2019 Meeting*

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# Outline

- Brief Material on CISE/OAC background
- Brief Update on NSF Selected Topics
- CC*

# Disruptive Pulls, Pushes / New Opportunities & Challenges

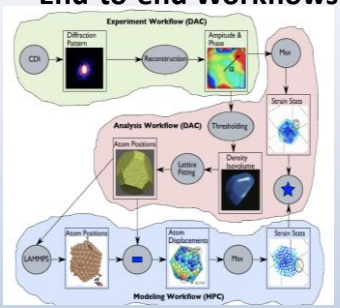
## Evolving Science/Engineering Landscape

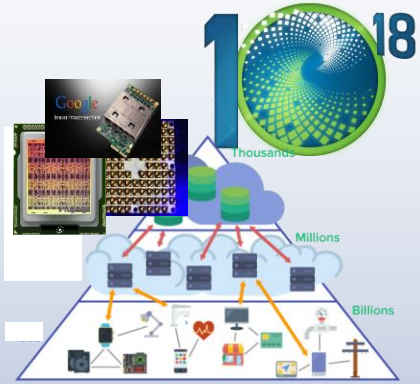
- Large scales / Complex, dynamic workflows
- Data-driven and data intensive
  - Streaming data from observatories, instruments
  - Increasing use of ML
- Heightened emphasis on robust results

## Evolving Technology Landscape

- Diverse / disruptive technologies
- Role of (non-traditional) software in taming complexity
- Novel paradigms / Increasing role of clouds / Growing capabilities & capacities at the edges

**End-to-end Workflows**




**Instrument, Observatories, Experimental Facilities**


# Disruptive Pulls, Pushes – NSF's Large Facilities

Success depends on robust, reliable, and highly connective cyberinfrastructure

# CISE/OAC – Transforming the Frontiers of Science & Society

| | |
|---|---|
| Computing | Advanced resources and services at all scales – MRI (clusters); Innovative HPC; Leadership Class; XSEDE coordination and user services; Research |
| Data | Data Building Blocks (DIBBS) Program |
| Software | Software Infrastructure for Sustained Innovation (SI2) |
| Networking & Cybersecurity | Campus Cyberinfrastructure (CC*), International Research Network Connections (IRNC), Cybersecurity Innovation for CI (CICI) |
| Learning & Workforce Dev. | Training-based Workforce Development for Advanced Cyberinfrastructure (CyberTraining), CAREER, CRII |
| Emerging Opportunities | Cyberinfrastructure for Emerging Science and Engineering Research (CESER), Public Access, Big Data Hubs |

Cyberinfrastructure for Sustained Scientific Innovation (CSSI)

OAC Core Research Program
NSF 18-567; Due 11/15/18

# NSF Selected Topics

- Topic #1:  Current appropriations up to Feb. 15
  - NSF Director is prioritizing agency activities during these 3 weeks
- Topic #2: Impact from the recent lapse in appropriations
  - Many scheduled panels canceled/delayed across NSF
  - Some solicitations and DCLs have been delayed in their release
  - Some Proposal deadlines have been pushed back

# Updated Schedule of Deadlines

- https://nsf.gov/bfa/dias/policy/postshutdown.jsp
- Note that those of most immediate interest from CISE/OAC are
  - DCL for leadership class computing allocations (NSF 19-030) and
  - CyberTraining (NSF 19-524);
  - both have revised deadlines of 2/14/2019.
- Preliminary proposals for Quantum Leap are now due 2/22/2019. Guidance is also available on which version of the PAPPG is applicable.

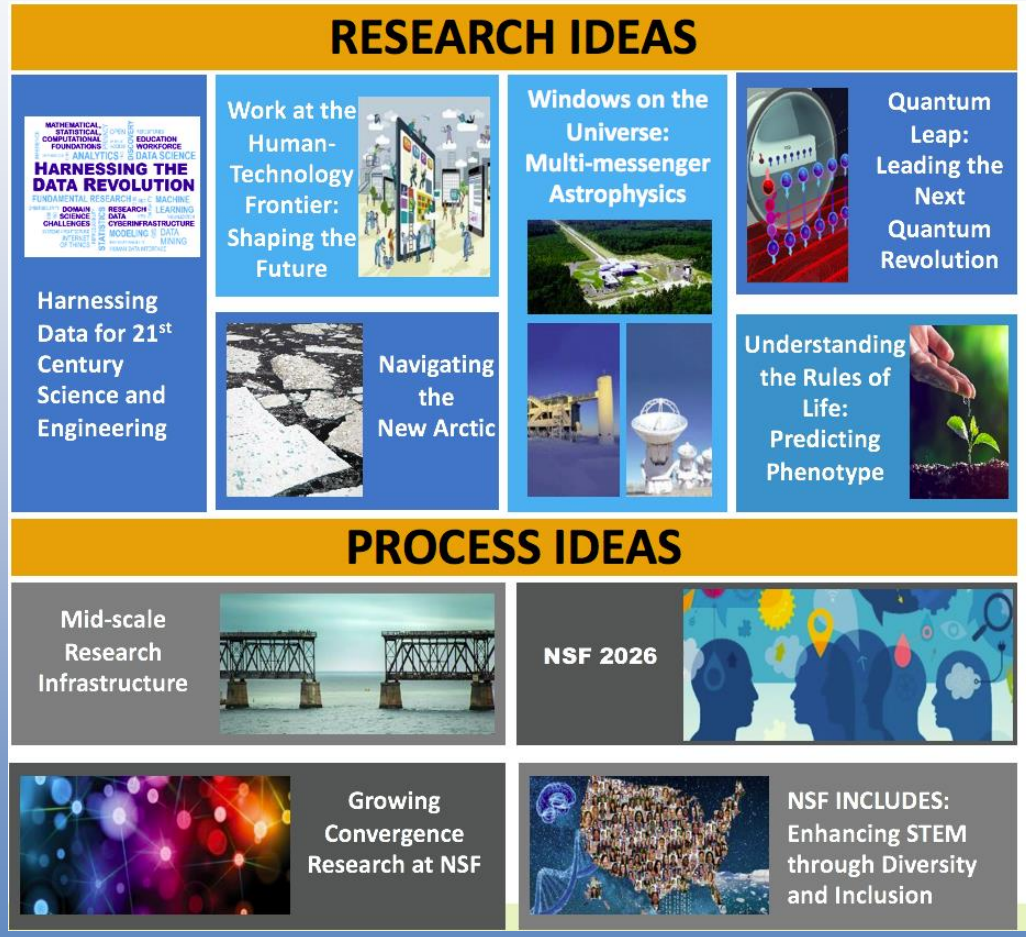
# NSF Selected Topics cont'd – Topic #4 - "Mid-Scale Research Solicitations

- Both solicitations comprising the FY 2019 implementation of the NSF-wide Mid-Scale Research Infrastructure Big Idea have now been published.
  - Mid-scale RI-1 19-537, https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505602
    - projects from $6M-$20M, development track and an implementation track. Projects funded in FY 2019.
    - CISE POC is Deep Medhi, CNS, dmedhi@nsf.gov.
  - Mid-Scale-RI-2 (19-542, https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505550
    - projects from $20 to $70 million, implementation track only. Projects funded in FY 2020.
    - CISE POC is Bill Miller, OAC, WLMiller@nsf.gov.
- Note – LoI deadline for RI-2 is pushed back to Feb. 14
- Note – Webinars today and tomorrow

# Selected Topic #5 - Cloud

- 2 active (and1 just expired) opportunities for NSF supported exploration and engagement in scientific cloud computing:
  - Cloud Access NSF 19-510.
    - Focused on supporting CISE research
    - Deadline for pre-proposals has passed
    - Full proposal deadline remains Feb. 19 - ACTIVE
  - Exploring Clouds for Acceleration of Science (E-CAS) NSF Award# 190444 to Internet2
    - Phase I of the project will support up to six one-year projects, each of which will perform scientific research using commercial cloud resources and corresponding development work.
    - website https://internet2.edu/ecas
    - Deadline was Feb. 1
  - CC* Area#4 – ACTIVE

# Selected Topic #6 – NSF Big Ideas



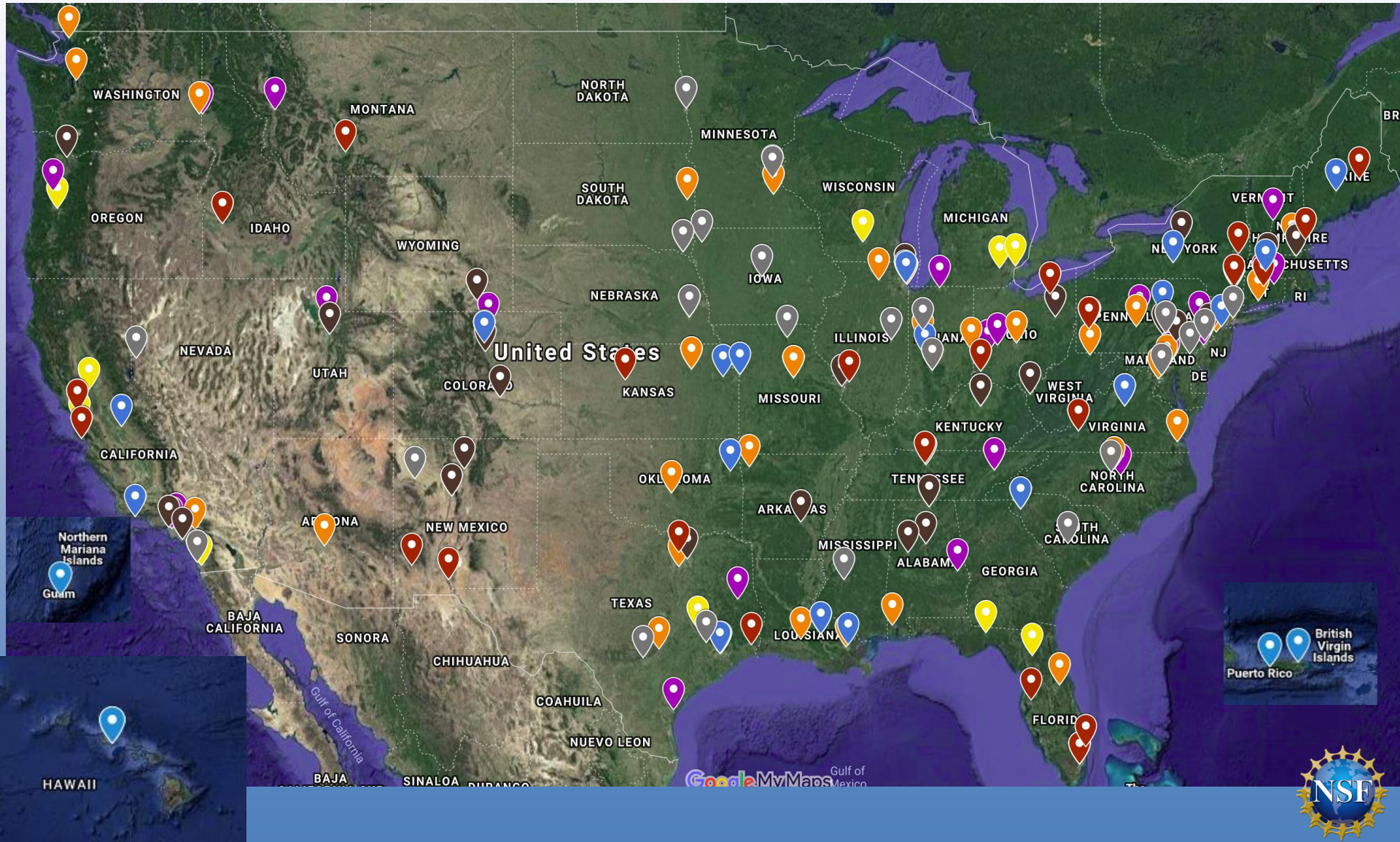

"Bold questions that will drive NSF's long-term research agenda …" -- F. Cordova

FY 2019

- Research Ideas: $30 million each
- Process Ideas: Midscale infrastructure: $60 million
- Convergence Accelerators: HDR, FW-HTF: $30 million each

*All present CI Challenges & Opportunities*

# Campus Cyberinfrastructure (CC*) Program awards 2012-2018: ~250 awards



# Summary #s for NSF's Campus CI Program 2012-2018

- ~250 awards (not including workshops, EAGER)
- $100M+ invested over 7 years (FY12-FY18)
- 49 states and jurisdictions represented on award map
- Award categories aggregate(FY18):
  - Campus Networking Upgrades: 130 (9)
  - Network Integration/Innovation: 47 (5)
  - Network Design (small institutions): 29 (7)
  - CI Engineer/Cyberteam: 25 (n/a)
  - Other: 27 (2)

# CC* status 2018

- CC* 18-508 produced ~23 awards, a few notes:
  - 4 networking-centric areas
  - 4th area added was “Network Performance Engineering and Outreach” (2 awards made)
  - Area#2 “Network Design and Implementation for Small Institutions” – modified text was meant to incentivize proposals addressing r&e network connectivity across groups of under resourced institutions

# CC* 19-533 - Campus Cyberinfrastructure

- **Addresses science-driven CI needs at the campus layer**
- **$10M-$17M in expected award funding**
- **Proposals due February 20, 2019 [Note – unchanged]**
  - **Contact Kevin Thompson kthompso@nsf.gov**
- Area #1 – **Campus Network upgrades**
  - 10/100Gbps inter- and intra-campus networking
  - Re-design of campus border **to prioritize science flows**
- Area #2 – **Regional coordination for Small Institutions**
  - Establishing r&e network connectivity **for under-resourced institutions**
- Area #3 – **Networking Integration and Applied Innovation**
  - **Applied R&D in networking** motivated by science use cases (e.g. SDN on campus)
- Area #4 – **Campus Computing**
  - **Shared cluster and cloud credits (Amazon and Google)** for campus-wide science
- Area #5 – **Cyber Team – R&E CI-based Regional Facilitation**
  - Regionally coordinated **teams of CI practitioners/professionals/experts**

# Program-wide Criteria for CC* proposals

- The extent to which the work provides a needed capability required by science, engineering and education.
- Evidence of partnerships.
- **A Cyberinfrastructure Plan** - To what extent is the planned cyberinfrastructure likely to enhance capacity for discovery, innovation, and education in science and engineering? How well does the plan as presented position the proposing institution(s) for future cyberinfrastructure development? How well does the cyberinfrastructure plan support and integrate with the institutions' science and technology plan? Are IPv6 deployment and InCommon Federation addressed? Are the activities described in the proposal consistent with the institution's cyberinfrastructure plan?
- Where relevant, addressing appropriate cybersecurity issues and challenges
- Represent ongoing opportunities for student engagement

# For this Quilt Audience we'll focus on Area#2

- Area#2 – Regional Coordination for Small Institutions
  - Up to $800k for 2 years
  - Eligibility: "Institutions of Higher Education and Non-profit, Non-academic Organizations are eligible to submit proposals in this program area."
  - Expected number of awards: 3-5
- Program note – Some entities recommended for award may be asked to work with NSF BFA, if BFA deems it necessary to conduct a financial review prior to award

# CC* Area#2

- “This area specifically targets groups of smaller institutions with fundamental challenges in networking infrastructure and resources. This area supports increased research and education (R&E) network connectivity across smaller institutions coordinated and led by an Regional Optical Network (RON) or a leadership institution in R&E networking in the region.”
- “Proposals are required to address campus networking needs spanning multiple under-resourced institutions.”
- “Proposals addressing a single institution are not allowed in this area and will be returned without review.”
- “Proposals may choose to apply an alternative design framework…”

# CC* Area #2 cont'd

- "Proposals submitted to this area must address scientific research and education needs driving the proposed improvements in R&E networking connectivity on campus and/or externally."
- "Proposals may focus on upgrading an institution's connectivity to the national research and education community and/or point to a need to redesign their campus network to better support academic data flows…"
- "Institutions whose missions are primarily education-focused may choose to present their scientific needs in the context of network-enabled education activities and distance education.
- "Proposals are encouraged to discuss research and education drivers with specific descriptions of these drivers."
- "Proposals in this area are not required to present a complete technical solution,…"

# CC* Area#2 cont'd

- "The lead proposing entity is expected to be experienced in high-performance R&E networking and to be well-resourced and capable of actively working with the participating institutions on designing and implementing the proposed networking improvements."
- "The partnering institutions' engagement activities may be supported in the proposal and included as subawards."
- "Proposals are required to include, in the Project Description, a conceptual or functional network diagram of the proposed network upgrades and are encouraged to include the context of end system and user connectivity."
- "Proposals must include, in the Project Description, a Project Plan addressing clear goals and milestones resulting in a working system in the target environment."

# CC* Area #2 cont'd

- "All proposals in this area must document explicit partnerships or collaborations with the participating campus' IT/networking organizations, as well as one or more domain scientists, research groups, and educators in need of the new network capabilities"
- "Partnership documentation from personnel not included in the proposal as PI, co-PI, or Senior Personnel should be in the form of a letter of collaboration located in the Supplementary Documents section of the proposal."
- "Beyond modest configurations of a Data Transfer Node (DTN) as part of a Science DMZ, proposals in this area are discouraged from budgets reflecting significant investments in storage and computing. This is a networking area and proposal budgets are expected to reflect this simple theme."

# CC* Area#2 cont'd

- "Any budget request for professional services at the campus level, such as IT staff support, must be documented in coordination with the institutions' campus IT or CIO organizations. The proposing entity may choose to include technical staff support required to carry out the work."
- "Proposals are required to include, in the Project Description, a network management plan addressing responsibilities, support, and roles. The plan should spell out how science data flows will be supported."
- "A letter of support from a campus leader at each participating campus is encouraged and should address sustainability and commitment from each participating institution."
- See solicitation for more key text phrases

# Finally

- **Thank you for serving on NSF review panels!**
- **I'm here through Thursday mid-day and happy to meet with you to address any questions on CC*.**

# *Thanks!*

# Backup/additional slides

# CC* Area#1 - Data Driven Networking Infrastructure for the Campus and Researcher

- network infrastructure improvements at the campus level
- network improvements include:
  - Network upgrades within a campus network to support a wide range of science data flows
  - re-architecting a campus network to support large science data flows, for example by designing and building a "science DMZ" (see http://fasterdata.es.net/science-dmz/ for more information on the "science DMZ" approach)
  - Network connection upgrade for the campus connection to a regional optical exchange or point-of-presence that connects to a state/regional/national network aggregation point prioritizing support for research and education

# CC* Area #3 – Network Integration and Applied Innovation

- This program area supports end--to--end network CI through integration of existing and new technologies and applied innovation.
- The goal is to take advantage of research results, prototypes, and emerging innovations to use them to enable specified researchers in a networking context.
- Proposals in this area may leverage new and existing investments in network infrastructure, services, and tools by combining or extending capabilities to work as part of the CI environment used by scientific applications and users.
- Proposals in this area are expected to reflect innovation in advanced networking. As a result, this area is not appropriate for projects whose costs are dominated by equipment purchases.

# CC* Area #4 – Campus Computing and the Computing Continuum

- This program area promotes coordinated approaches in scientific computing at the campus level through three funding options:
  - (a) Campus Cluster Resource, seeding and augmenting shared computing resources at the campus level through investments in capacity computing in campus clusters;
  - (b) Cloud Computing Resources, enabling campuses to explore the potential use of cloud computing services and its analytics platforms in supporting their community's scientific research computing assets and available resources; and
  - (c) Hybrid, a combination of both local computing resources and access to remote cloud computing. For all the three funding options, the program promotes a coordinated approach incentivizing multi-campus and national resource sharing.
- It is expected that campus-wide computing needs are addressed in the proposal; a proposal focusing on a single science domain or project use will not be considered for funding.
- NSF encourages proposals in this program area from under-resourced institutions and preference will be given to proposals demonstrating a compelling need for access to campus/cloud resources, including institutions lacking necessary computing and storage resources on campus.

# CC* Area#5 - Research and Education CI-based Regional Facilitation

- This program area supports facilitation of campus cluster, cloud, and distributed computing resource use by scientists and scientific collaborations.
- Proposals in this area should describe the multi-institutional science-driven needs and enabling impact of long-term access to and engagement with a shared Cyber Team.
- Proposals should describe planned engagement activities in multiple science and engineering projects across campuses, including plans to leverage existing campus CI and how these bridging services can be managed.
- Proposals should describe and justify the structure and make-up of the proposed Cyber Team, including the approach to its engagement, interactions, and partnerships with science and engineering research as well as education and training activities.
- Proposals should address details of the initial planned engagements.
- Proposals are encouraged from multi-institution teams or regional network organizations and consortia representing and serving the cyberinfrastructure needs of academic institutions within a designated region of the U.S. Proposals are also allowed from an individual leadership institution representing a state or region, or group of institutions.
- Proposals may request up to four full-time equivalents for up to three years.