Cyberinfrastructure Research, Learning and Workforce Development (LWD) Programs at NSF

Office of Advanced Cyberinfrastructure (OAC)

Computer and Information Science & Engineering (CISE)

National Science Foundation

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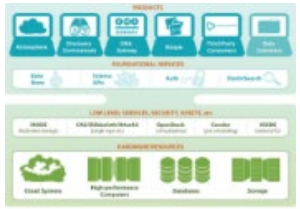
MUG Workshop, 2022

NSF Office of Advanced Cyberinfrastructure (OAC)

Foster a cyberinfrastructure ecosystem to transform science and engineering research… through Research CI and CI research

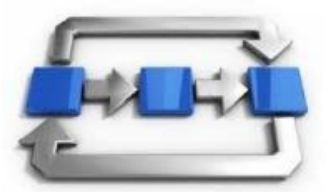
People, organizations, and communities

Coordination & User support



Gateways, Hubs, and Services

Data Infrastructure



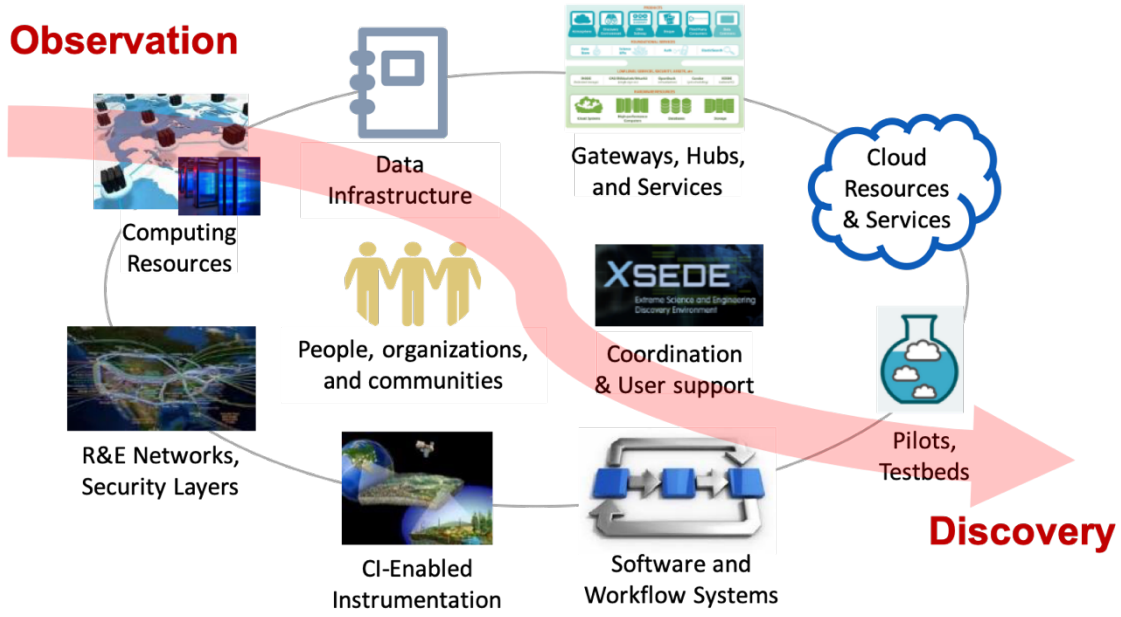
Software and Workflow Systems

CI-Enabled Instrumentation

Pilots, Testbeds

Computing Resources

R&E Networks, Security Layers



Rapid (disruptive) changes in S&E and CI landscapes → *Cyberinfrastructure ecosystem must evolve!*

CI and the Missing/Invisible Millions

Learning and Workforce Development: Communities of Concern

NSF Workshop on Building the Research Innovation Workforce, Sept. 2020
https://www.rcac.purdue.edu/ciworkforce2020/report/

Learning and Workforce Development

RESEARCH TRAINING AND WORKFORCE DEVELOPMENT

- REU sites – NSF 22-601
- CyberTraining – NSF 22-574

FACULTY EARLY CAREER RESEARCH

- CRII – NSF 22-598
- CAREER – NSF 22-586

RESEARCH AND DEVELOPMENT

- OAC Core – NSF 21-616
- CSSI – NSF 21-617

CyberTraining Solicitation Goals

- Long-term vision: Computational and Data-driven Science for All scientists and engineers.
  - Prepare, nurture, and grow the scientific research workforce.
- Ensure broad adoption of CI tools, methods, and resources.
- Integrate CI and CDS&E skills into undergraduate and graduate curriculum.
- Build communities of CIPs and establish career paths for them.
  - Deeper incorporation of CIPs into the research enterprise.
- Broaden CI access and adoption by varied institutions, scientific communities, and underrepresented groups.

More guidance can be found at ***https://www.nsf.gov/pubs/2022/nsf22574/nsf22574.htm***

CI Professional Track

FUNDING

- Support for research CI professionals
- 2 FTEs **per year** per institution; 4 FTE total over all institutions in a project per year
- 5 years maximum
- NSF directorates involved: CISE, ENG, GEO, MPS, EHR, SBE

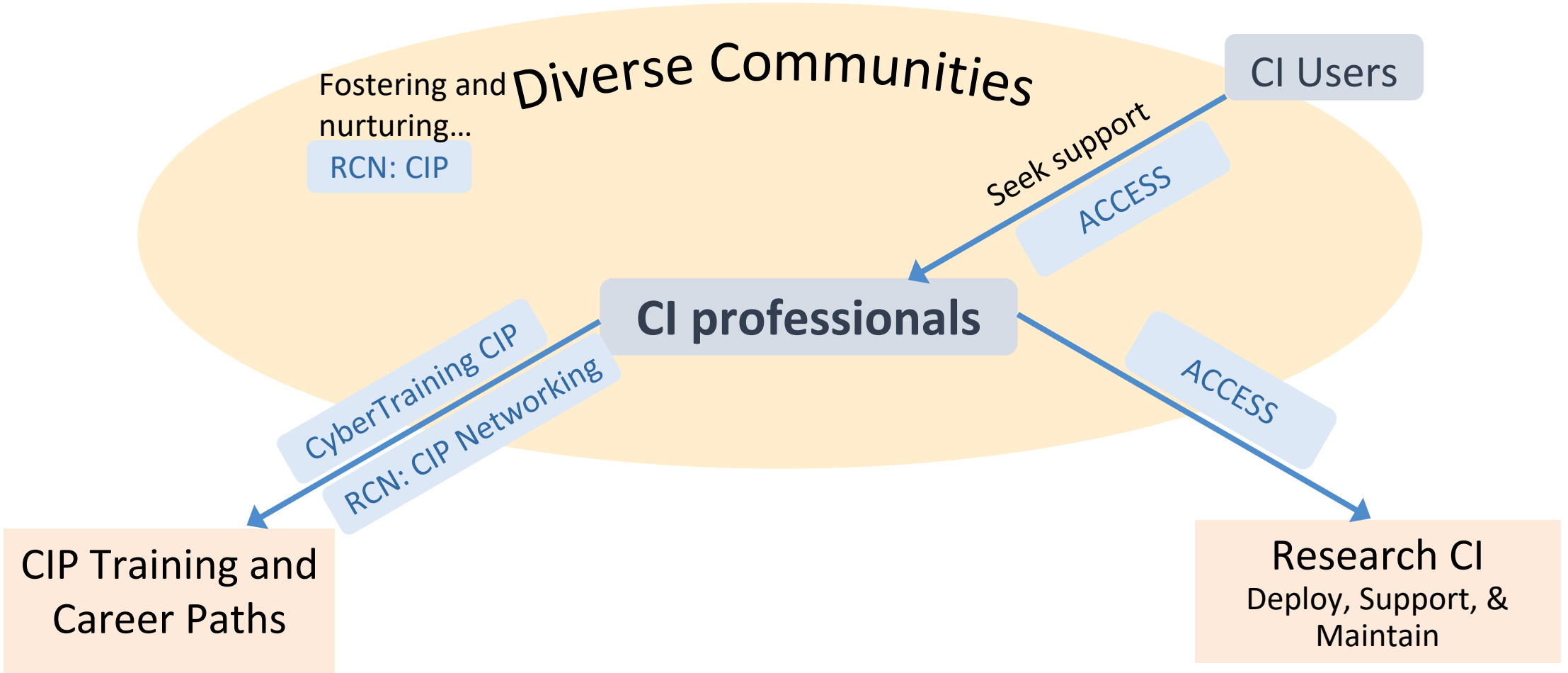
WHO IS A CIP?

- Deploy, manage, and support effect use of research CI
- Includes scientists, information technology professionals, and engineers who research and develop new CI capabilities, approaches, and methods
- Examples: CI system administrators, CI research staff, research software engineers, CI facilitators

IDEAL FOR PIs WHO …

- Want to leverage CIPs for a variety of research projects
- Are prepared to train and mentor CIPs
- Will develop sustainable long-term career paths for CIPs

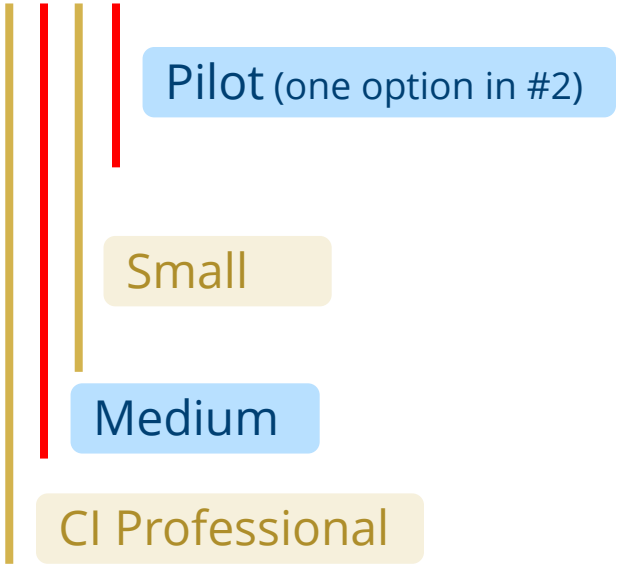
CyberTraining CIP Program Context



Other CyberTraining Tracks

- Pilot: Exploratory projects, $300K over 2 years.
- Small implementation: $500K over 4 years.
- Medium implementation: $1M over 4 years.

1. Identify challenges in research workforce development
2. (a) Broaden use of CI resources, (b) CI skills training, (c) build a community of CI professionals
3. Scalability and sustainability of the training program
4. Recruitment and evaluation plans
5. Collective impact strategy
6. Fostering a suitable community
7. Integrate with Computational Science Support Network



Faculty Early Career Development Program (CAREER)

- Supports junior faculty as a teacher-scholar
  - Outstanding research, education, and integration of education and research
  - Future leaders in their research fields and organizations
  - Presidential early career awards (PECASE)

- Minimum $400K/5 years in CISE
  - ~$500K typical in CISE

More guidance can be found at ***https://www.nsf.gov/pubs/2022/nsf22586/nsf22586.htm***

CAREER GUIDANCE

- OAC encourages proposals that are either
  - of primary interest to OAC, or
  - secondary interest to OAC (add OAC on cover page)
  - OAC contact: Juan Jenny Li at jjli@nsf.gov

- OAC interests
  - Relevance to cyberinfrastructure
  - Application of cyberinfrastructure to science need evidence of support from the target science domain

- CAREER resources
  - Program page: https://www.nsf.gov/career
  - CISE CAREER workshops: https://www.nsf.gov/cise/workshops/career/

CISE Research Initiation Initiative (CRII)

- Independent research for faculty or research scientists or educator in their first three years
  - Non-R1 institutions or non-profit, non-academic institutions
  - No more than 6 years after receipt of PhD (for 2022 only)
  - See solicitation for other requirements and recommendations

- OAC research focus
  - Advanced CI research: translational, use-inspired, multi-disciplinary, end-to-end
  - Computational and data intensive scientists in addition to computer scientists

- Award up to $175K/ 2 years

More guidance can be found at ***https://www.nsf.gov/pubs/2022/nsf22598/nsf22598.htm***

CRII GUIDANCE

- Start a research program and career
  - PI need not have significant prior research results or maturity
  - Start a path toward research independence
  - Develop collaborations across research disciplines
  - Undertake exploratory investigations
  - Acquire and test preliminary data

- Broadens the community of researchers
  - Reach underserved communities, under-represented groups, and non-traditional institutions

Cyberinfrastructure for Sustained Scientific Innovations (CSSI)

- Supports the development and deployment of robust, reliable and sustainable data and software cyberinfrastructure
- Brings innovative capabilities towards sustained scientific innovation and discovery
- Provides a cross-directorate opportunity to advance common approaches to sustain and innovate research cyberinfrastructures
- Follows accepted data management and software development practices

More guidance (from last year) at ***https://www.nsf.gov/pubs/2021/nsf21617/nsf21617.htm***

CSSI GUIDING PRINCIPLES

PROJECT MOTIVATION AND IMPACT

- Science-driven
- Innovation

CI PLANS

- Project plans; system and process architecture
- Building on existing, recognized capabilities
- Close collaborations among stakeholders

MEASURABLE OUTCOMES

- Deliverables
- Sustained and sustainable impacts
- Metrics

CSSI Award Classes

Project Class	Description
Elements	Small groups that will create and deploy robust capabilities for which there is a demonstrated need that will advance one or more significant areas of S&E. (Awards <= $600K, up to 3 years)
Framework Implementations	Larger, interdisciplinary teams organized around the development and application of common infrastructure aimed at solving common research problems faced by NSF researchers in one or more areas of S&E, resulting in a sustainable community framework serving a diverse community or communities. (Awards between $600K - $5 Million, between 3-5 years)
Transition to Sustainability	Groups who will execute a well-defined sustainability plan for existing CI with demonstrated impact in one or more areas of S&E supported by NSF. The sustainability plan should enable new avenues of support for the long-term sustained impact of the CI. (Awards <= $1 Million, up to 2 years)

OAC Core Goals

- Advanced Cyberinfrastructure (CI) research to impact the future capabilities of research CI
  - New knowledge in design, development, deployment, experimentation, and application of CI to enable new frontiers of discovery and innovation

- Research career paths of cyber-scientists/engineers
  - Broaden participation from underrepresented groups

More guidance (from last year) at ***https://www.nsf.gov/pubs/2021/nsf21616/nsf21616.htm***

Characteristics of OAC-Core

- Translational research
  - Design, development, deployment, experimentation, and application of CI
  - Spanning design to practice

- Other common characteristics
  - Multi-disciplinary
  - Extreme-scale
  - Science and engineering drivers
  - End-to-end solution or deployable as robust CI

Example Research Areas

- Architecture and middleware for extreme-scale systems
  - Design, benchmarking, and analysis
  - Storage, networks, and I/O
  - Resource monitoring, fault tolerance, and cybersecurity
- Scalable algorithms and applications
  - Numerical and high-performance scientific computing methods
  - Data, software, and visualization
  - Modeling and simulation
- Advanced cyberinfrastructure ecosystem
  - Programming languages, libraries, and environments
  - Tools
  - Sociotechnical aspects

Other LWD Opportunities within OAC

- INTERN DCL
  - Supplements for non-academic graduate student research (~$50K per student)
- EAGER (up to $300K), workshops (up to $50K), RCN
  - Seed exploration of research, training and education, broadening participation
  - Students, post-docs, faculty, CI professionals
- Student travel grants
  - Discuss with OAC program officers
- To subscribe to the OAC mailing list, email: OAC-ANNOUNCE-subscribe-request@listserv.nsf.gov

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