

Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access)

PROGRAM SOLICITATION

NSF 19-510



National Science Foundation

Direktorate for Computer & Information Science & Engineering
Division of Computing and Communication Foundations
Division of Information & Intelligent Systems
Division of Computer and Network Systems
Office of Advanced Cyberinfrastructure

Preliminary Proposal Due Date(s) (required) (due by 5 p.m. submitter's local time):

December 20, 2018

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

February 19, 2019

IMPORTANT INFORMATION AND REVISION NOTES

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 18-1](#)), which is effective for proposals submitted, or due, on or after January 29, 2018.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access)

Synopsis of Program:

Increasingly, data- and compute-intensive research and education efforts are benefiting from access to cloud computing platforms, which provide robust, agile, reliable, and scalable infrastructure. To better support this growing use of cloud computing resources, the National Science Foundation's (NSF) Directorate for Computer and Information Science and Engineering (CISE) seeks to fund an entity that can serve as a principal interface between the CISE research and education community and public cloud computing providers. Through this solicitation, NSF will support an entity that will have multiple responsibilities, including: 1) establishing partnerships with the various public cloud computing providers; 2) assisting NSF in allocating cloud computing resources to qualifying CISE-funded projects; 3) managing cloud computing accounts and resources allocated to individual CISE projects; 4) providing user training and other support to CISE researchers and educators using cloud computing in their work; and 5) providing strategic technical guidance for CISE researchers and educators interested in using public cloud computing platforms.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Deepankar (Deep) Medhi, telephone: (703) 292-8950, email: dmedhi@nsf.gov
- Kevin Thompson, telephone: (703) 292-4220, email: kthomps@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Cooperative Agreement

Estimated Number of Awards: 1

Anticipated Funding Amount: \$5,000,000

The maximum award amount is \$5,000,000 via a Cooperative Agreement, pending the availability of funds and quality of proposals received. The annual project operating costs are not expected to exceed \$850,000 per year for five years, for a total of \$4,250,000. The proposed budget may also include a request, not to exceed \$750,000, for initial cloud computing resources, as part of the maximum \$5,000,000 award amount (see section II, Program Description). Future cloud computing resources may be supported through supplemental funding requests by the awardee organization.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization: 1

An organization may participate in no more than one proposal submitted in response to this solicitation.

Collaborative proposals should be submitted from one organization. If awarded, a single award would be made to the submitting organization, with any collaborators listed as subawards. Collaborative proposals submitted from multiple organizations are not allowed.

See PAPPG Chapter II.D.3.a for additional information.

Limit on Number of Proposals per PI or Co-PI: 1

An individual may appear as PI, co-PI, or Senior Personnel on **no more than one proposal** submitted in response to this solicitation.

In the event that an individual exceeds this limit, any proposal submitted to this solicitation with this individual listed after the first proposal is received at NSF will be returned without review. This limitation includes proposals submitted by an organization and any collaborators listed as subawards. **No exceptions will be made.**

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposals:** Submission of Preliminary Proposals is required. Please see the full text of this solicitation for further information.
- **Full Proposals:**
 - Full Proposals submitted via FastLane: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

Recovery of indirect costs (F&A) is prohibited on cloud computing expenditures in awards made in response to this solicitation. This prohibition will apply to any subsequent supplemental funding requests submitted by the awardee organization.

- **Other Budgetary Limitations:**

Not Applicable

C. Due Dates

- **Preliminary Proposal Due Date(s) (required)** (due by 5 p.m. submitter's local time):

December 20, 2018

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

February 19, 2019

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Standard NSF reporting requirements apply.

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I. INTRODUCTION

Data- and compute-intensive research and education are at the forefront of addressing many national and societal challenges. These research and education activities benefit from access to cloud computing platforms, which provide robust, agile, reliable, and scalable computing infrastructure. For example, since 2012, NSF's [Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering](#) (BIGDATA) program has further developed data science as a transdisciplinary field of research enabling understanding through analytics and massive computation on vast amounts of empirical data. Beginning in 2017, NSF's BIGDATA program has included support in the form of access to cloud computing resources ("cloud credits") from Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure; IBM signed on in early 2018. Each cloud computing provider has committed up to [\\$3 million in cloud computing resources](#) for BIGDATA projects over a three- or four-year period, beginning with awards in 2017. Key goals of this public-private collaboration have been to encourage research projects to focus on large-scale experimentation and scalability studies, and to provide researchers access to cutting-edge, scalable platforms for developing new methods and solutions for today's most pressing data challenges.

Several recent studies have also documented the opportunity that cloud computing presents to advancing research and education. For example, a 2016 National Academies of Sciences, Engineering, and Medicine (NASEM) study, [Future Directions for NSF Advanced Computing Infrastructure to Support U.S. Science and Engineering in 2017-2020](#), discussed how cloud computing democratizes the use of complex systems. This study recommended various strategies for making cloud computing more accessible to the research and education community at large, including reducing or eliminating indirect cost recovery for acquiring or using cloud computing resources, bulk purchasing of cloud computing resources, and/or partnering with public cloud computing providers. Additionally, cloud computing facilitates reproducible research through improved sharing, consistent with a recent [NSF Dear Colleague Letter, Encouraging Reproducibility in Computing and Communications Research](#).

A 2018 NSF-funded conference on [Enabling Computer and Information Science and Engineering Research and Education in the Cloud](#) also highlighted the cloud computing needs of the CISE research and education community, with access to cloud computing resources being identified as an "equalizer" for a variety of institutions. CISE researchers and educators are increasingly using these resources in their work – and access to resources at scale as well as to contemporary hardware and software stacks offers clear benefits to research as well as education. However, conference participants also identified several challenges to rapid cloud computing adoption, including an inability to accurately estimate and monitor costs; complex and evolving cloud pricing models; rapidly evolving sets of cloud computing software services; inadequate access to training and support for cloud computing usage; and the sustainability of the "pay-as-you-go" model. A recommendation to overcome these challenges included devising support structures for academic researchers and educators to transition to cloud computing usage, such as the creation of an entity to serve as a principal interface between public cloud computing providers and the CISE research and education community.

Similarly, discussions at a 2018 NSF-funded conference on [Future Cyberinfrastructure: Rethinking NSF's Computational Ecosystem for 21st Century Science and Engineering](#) highlighted the need for exploring models and mechanisms for integrating cloud services as part of the NSF research cyberinfrastructure ecosystem.

II. PROGRAM DESCRIPTION

The goal of the Cloud Access program is to enable, enrich, and democratize the use of public cloud computing resources by the CISE research and education community. Cloud Access seeks to support an entity to serve as a liaison, linking the CISE community with public cloud computing providers. The Cloud Access entity will primarily serve PIs of participating CISE programs by providing access to cloud resources and other services, and all CISE researchers and educators with strategic technical guidance and training in using the cloud. CISE will note which programs are offering participation in Cloud Access in the corresponding solicitations and on the Cloud Access program webpage. NSF acknowledges that the community served by Cloud Access and its functions may evolve over time.

The entity would encompass two sets of functions, one that is "cloud-facing" and another that is "community-facing." The cloud-facing functions include establishing relationships with public cloud computing providers; establishing a structure for account management and resource allocations; and engaging in strategic planning for use of public cloud computing resources by the CISE community. The community-facing functions include providing user support specifically related to the use of cloud computing resources; providing training and education support related to cloud usage; and providing advice and strategic technical guidance about the use of cloud computing resources in research and education projects.

NSF seeks proposals from organizations capable of fulfilling the Cloud Access vision: managing the use of cloud computing resources; providing computing resources and related support services to user communities; and providing training on the use of state-of-the-art computing resources.

The Cloud Access entity is expected to engage proactively with the CISE community to ensure responsiveness to the community's needs. As part of this proactive engagement, the entity must begin establishing an advisory committee to advise the project on its operational activities and strategic directions. The membership of such an advisory committee should reflect the interests of the various stakeholders in cloud computing, including industry experts, academic researchers, campus chief information officers, and educators. The role of an advisory committee may include advising the Cloud Access entity in developing the cloud-facing and community-facing functions, as well as in its associated operations.

Objectives and Suggested Operational Activities

Proposers should consider the following objectives and potential operational activities of the Cloud Access entity when preparing submissions:

Managing cloud computing resources:

The Cloud Access entity will establish partnerships with various public cloud computing providers, including exploring novel pricing models; this may include interactions with organizations specializing in engagements with public cloud computing providers.

The Cloud Access entity will also enable account creation and provide account management services for CISE PIs who receive cloud computing resource allocations via NSF awards in participating programs.

As part of the initial award through this solicitation, the Cloud Access entity will manage an allocation of up to \$750,000 in cloud computing resources to establish mechanisms for acquiring cloud computing resources from multiple providers and allocating these resources to users. At most 25% of the requested amount of cloud computing resources should be utilized by the Cloud Access entity for community support activities including, for example, for use during education and training, hosting shared data and software resources, etc. Within this 25%, it may be possible for the Cloud Access entity to use some of the initial cloud computing resources (not to exceed 10% of \$750,000) at its discretion for strategic use, as described in "Strategic technical guidance and training" and "Outreach and trends." The entity should provide a breakdown of the anticipated use of these funds in the Budget Justification. At least 75% of the initial \$750,000 allocation should be readily available to be allocated to PIs of participating NSF programs, as described above. Supplemental funding may be requested to support additional cloud computing resources following initial award. Indirect cost recovery will not be permitted on the costs associated with cloud computing resources.

Strategic technical guidance and training:

The Cloud Access entity will provide logistical and technical support to the CISE PI community across all phases of research and education activities. For example, the Cloud Access entity may assist in exploring the use of cloud computing resources, gaining access to cloud computing platforms, and enabling alignment of research and education activities with available cloud computing services and allocations. The logistical and technical support may span online training modules, webinars, conferences, frequently-asked questions, and other innovative approaches, which will be maintained on an up-to-date education/training website. The Cloud Access entity may partner with public cloud computing providers and "local" campus technical support staff to offer such education/training.

Outreach and trends:

The Cloud Access entity will conduct outreach to the broader CISE community about cloud computing platforms and their associated capabilities. As part of this outreach, Cloud Access may focus on broadening participation of cloud computing users across demographics, regions, and organization types. Activities may include conducting conferences at different types of organizations to help increase adoption across the broader community.

Importantly, the Cloud Access entity will gather and publish cloud computing usage and trend data regarding CISE research and education.

The Cloud Access entity will also keep the CISE community updated about lessons learned via the activities and conferences that it leads.

Logistics and Staffing

The successful operation of the Cloud Access entity will require a dedicated, collaborative project staff with expertise and demonstrated success in the functions and responsibilities described above.

A principal task of the Cloud Access entity will be to manage allocations of cloud computing resources for participating NSF programs. Certain CISE-led programs will provide PIs with the option to include cloud computing resources, provided through the Cloud Access entity, as part of their research proposals. This option will be stated in the corresponding NSF solicitations and on the Cloud Access program webpage, along with guidance for requesting cloud computing resources. NSF anticipates that when proposals submitted to such programs are selected for funding, CISE will verify the funding for cloud computing resources and communicate this information (i.e., the level of funding) to the Cloud Access entity. In parallel, CISE will ask PIs of funded projects to directly contact the entity to obtain their cloud computing accounts and allocations. This process may be refined in coordination with the Cloud Access entity.

Proposers must have an established track record of leadership and management of teams and projects of this scale and scope, and are expected to be engaged in day-to-day operations. The project team should have experience in developing partnerships with public cloud computing providers.

The team members should also have experience in areas related to cloud computing-based education and training, user support, and community outreach. Proposers are encouraged to engage with public cloud computing providers in preparing their proposals.

To successfully manage cloud computing resources, the project team should not only demonstrate experience with the technical aspects of managing the resources but also experience with business aspects such as management of contracts and accounting.

Proposals submitted in response to this solicitation should demonstrate the ability to adapt to the evolving needs and trends of the CISE PI community and the cloud computing ecosystem.

III. AWARD INFORMATION

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited

- in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
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Who May Serve as PI:

There are no restrictions or limits.

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Collaborative proposals should be submitted from one organization. If awarded, a single award would be made to the submitting organization, with any collaborators listed as subawards. Collaborative proposals submitted from multiple organizations are not allowed.

See PAPPG Chapter II.D.3.a for additional information.

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In the event that an individual exceeds this limit, any proposal submitted to this solicitation with this individual listed after the first proposal is received at NSF will be returned without review. This limitation includes proposals submitted by an organization and any collaborators listed as subawards. **No exceptions will be made.**

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals (required): Preliminary proposals are required and must be submitted via the NSF FastLane system, even if full proposals will be submitted via Grants.gov.

Submitters will receive feedback from NSF within 6 weeks indicating either encourage or discourage submission of a Full Proposal. An encourage finding generally indicates that the proposal appears to be responsive to the program guidelines and is a candidate for further development. A discourage finding generally indicates that the project is not responsive to this solicitation, or has serious conceptual flaws that would not benefit from further development as a full proposal submission. The feedback provided pursuant to the preliminary proposal is advisory only; submitters of both "encouraged" and "discouraged" preliminary proposals are eligible to submit full proposals.

Submission of a Preliminary Proposal is required to be eligible to submit a Full Proposal. Preliminary proposals must be submitted, via FastLane, by 5 p.m. submitter's local time on the due date for preliminary proposals.

Preliminary proposals are started in the same way in Fastlane as new full proposals. Proposers must be sure to check the box "If this is a preliminary proposal then check here" in the middle of the Cover Sheet. This box appears on the Cover Sheet just under the section labeled "Previous NSF Award."

Required components of the preliminary proposal are given below. Page limitations given here will be strictly enforced. Proposers should review the most current *Proposal & Award Policies and Procedures Guide (PAPPG)* for specific information on signatures and format for the required sections. The preliminary proposal should consist of three elements: Cover Sheet, project description, and biographical sketch (described below). No other sections are required, nor should they be included in the preliminary proposal.

1. Cover Sheet. The PI and any co-PIs should be indicated. The budget indicated on the Cover Sheet should be the total budget for the project. A proposal title on the Cover Sheet must begin with "**Cloud Access Preliminary:**" followed by the project title. For example, titles should take the form, **Cloud Access Preliminary: Title**.
2. Project Description (4-page limit). The Project Description should have the following clearly labeled sections:
 - a. Investigator information: All PIs, co-PIs, and Senior Personnel with their institutional and departmental affiliations should be listed.
 - b. A concise description of the scope of work for the entity, including cloud-facing and community-facing functions necessary for the operation of the entity.
 - c. Team experience aligning with scope of work.
 - d. Project schedule of activities showing the sequence of anticipated goals and milestones.
3. Biographical Sketch (2-page limit per individual). Biographical sketches are required for the PI, co-PIs, and Senior Personnel.

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal & Award Policies & Procedures Guide*

(PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

See PAPPG Chapter II.C.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

Submission of a Preliminary Proposal is required to be eligible to submit a Full Proposal.

1. **Proposal Title.** A proposal title must begin with “**Cloud Access Full proposal:**” followed by the project title. For example, titles should take the form, **Cloud Access Full proposal: Title**.
2. **Project Summary (1-page limit).** In the Overview text box, enter the title of the Cloud Access project, the name of the PI, and the institution, and then provide a summary description of the Cloud Access project. In the separate text boxes, provide succinct summaries of the intellectual merit and broader impacts of the proposed project.
3. **Project Description.**

The Project Description section must not exceed **20 pages** including figures, charts, graphs, maps, photographs, and other pictorial representations. **Proposals exceeding this length will be returned without review.**

The Project Description should include the sections described below.

I. Scope of work

Describe in detail the entity's scope of work, including the “cloud-facing” and “community-facing” functions. As described above in the Program Description section of this solicitation, these functions include establishing relationships with public cloud computing providers; staffing the entity in preparation for activities related to acquiring cloud computing resources; establishing cloud computing accounts; providing strategic technical guidance; providing training opportunities for use of cloud computing platforms for research and education; performing cloud computing-related outreach activities; and providing the CISE community with updates on trends in cloud usage by CISE Pls.

Provide a comprehensive description of project management activities, aligning these activities with specific goals and milestones. If multiple participating organizations are involved, describe project management plans across institutions, and also with external stakeholders including with public cloud computing providers or others.

Identify the metrics and key performance indicators that will be used to evaluate the entity's effectiveness in realizing its goals and milestones. Proposers should describe the processes they will employ to identify, prioritize, and support necessary training, outreach, and other activities.

Describe plans for use of the initial allocation of cloud computing resources (see above in the Program Description section of this solicitation).

II. Team experience aligning with scope of work

Discuss the team experience as it aligns with the activities in the scope of work, including who will lead, facilitate, and participate in the varied activities (the proposal may specify backgrounds, disciplines, sectors, etc., rather than specific participant names). Highlight how the team aligns with the key objectives outlined in the solicitation and brings forth experiences relevant to these objectives.

III. Project schedule

The proposal should outline a detailed schedule of activities to show the sequencing of all major activities and key milestones, such as when will the training activities be conducted; how many such activities are planned; how strategic technical guidance and support will be set up; and how often interactions with the public cloud computing providers will take place. Provide sufficient detail and the personnel involved to justify the proposed budget.

IV. Contingency plan

Discuss any contingencies associated with completing project activities, including technical and organizational contingencies, such as continuity of staffing and operations.

V. Longer-term vision and sustainability

Provide a short statement to discuss how the Cloud Access entity envisions the cloud computing landscape beyond the initial five years of support. What would be the role of the entity beyond the duration of the proposed project? What types of financial models or support mechanisms would be needed beyond the duration of the proposed project to continue to sustainably support the PI community?

4. Proposal Budget.

Proposals may request up to \$5,000,000 over five years.

The annual project operating costs are not expected to exceed \$850,000 per year for five years, for a total of \$4,250,000.

The proposed budget may also include a request, not to exceed \$750,000, for initial cloud computing resources, as part of the maximum \$5,000,000 award amount (see section II, Program Description). Future cloud computing resources may be supported through supplemental funding requests by the awardee organization.

Recovery of indirect costs (F&A) is prohibited on cloud computing expenditures in awards made in response to this solicitation. This prohibition will apply to any subsequent supplemental funding requests submitted by the awardee organization.

Proposal budgets should include funds to support travel for at least one PI or co-PI to the annual PI meeting for certain CISE-led programs (to be held in the Washington, DC, area).

5. Supplementary Documents.

- a. **Data Management Plan (required).** Proposals must include a Supplementary Document of no more than two pages labeled "Data Management Plan." This Supplementary Document should describe how the proposal will conform to NSF policy on the dissemination and sharing of research results.

See Chapter II.C.2.j of the PAPPG for full policy implementation.

For additional information on the Dissemination and Sharing of Research Results, see:
<https://www.nsf.gov/bfa/dias/policy/dmp.jsp>.

For specific guidance for Data Management Plans submitted to the Directorate for Computer and Information Science and Engineering (CISE) see: https://www.nsf.gov/cise/cise_dmp.jsp.

- b. **Documentation of collaborative arrangements of significance to the proposal through Letters of Collaboration.** The Project Description must fully detail any substantial collaborations and engagements (included or not included in the budget) with partner institutions, including public cloud computing providers. PIs are encouraged to engage with public cloud computing providers in preparing the proposals, and letters of collaboration from public cloud computing providers may be used to demonstrate support for proposed work.
- c. Letters of collaboration should be provided in the Supplementary Documents section of the proposal and follow the format instructions specified in the NSF PAPPG. Letters of collaboration should not contain endorsements or evaluation of the proposed project. Specifically, as per the NSF PAPPG (See PAPPG Chapter II.C.2.j), letters of collaboration should be limited to stating the intent to collaborate and should not contain endorsements or evaluation of the proposed project. The recommended format for letters of collaboration is as follows: "If the proposal submitted by Dr. [insert the full name of the Principal Investigator] entitled [insert the proposal title] is selected for funding by NSF, it is my intent to collaborate and/or commit resources as detailed in the Project Description or the Facilities, Equipment or Other Resources section of the proposal."

Please ensure that appropriate details are provided in the Project Description, and/or Facilities, Equipment or Other Resources.

A list of Project Personnel and Partner Institutions:

Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list must include all PIs, co-PIs, Senior Personnel, paid/unpaid Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and included (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mary Smith; XYZ University; PI
2. John Jones; University of PQR; Senior Personnel
3. Jane Brown; XYZ University; Postdoc
4. Bob Adams; ABC Inc.; Paid Consultant
5. Mary White; Welldone Institution; Unpaid Collaborator
6. Tim Green; ZZZ University; Subawardee

6. Single Copy Documents.

Collaborators and Other Affiliations Information:

Proposers should follow the guidance specified in Chapter II.C.1.e of the NSF PAPPG. Grants.gov Users: The COA information must be provided through use of the COA template and uploaded as a PDF attachment.

Note the distinction to the list of Project Personnel and Partner Institutions specified above under Supplementary Documents: the listing of all project participants is collected by the project lead and entered as a Supplementary Document. The Collaborators and Other Affiliations are entered for each senior project personnel and, as Single Copy Documents, are available only to NSF staff.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Indirect Cost (F&A) Limitations:

Recovery of indirect costs (F&A) is prohibited on cloud computing expenditures in awards made in response to this solicitation. This prohibition will apply to any subsequent supplemental funding requests submitted by the awardee organization.

Budget Preparation Instructions:

Proposal budgets should include funds to support travel for at least one PI or co-PI to the annual PI meeting for certain CISE-led programs (to be held in the Washington, DC, area).

C. Due Dates

- **Preliminary Proposal Due Date(s) (*required*)** (due by 5 p.m. submitter's local time):

December 20, 2018

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

February 19, 2019

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <http://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-

implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the

proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

In addition to a proposal's Intellectual Merit and Broader Impacts, reviewers will also be asked to consider the extent to which the proposal demonstrates:

1. Cloud computing expertise: expertise and experience in using public cloud computing resources for research and/or education;
2. Managerial, technical, administrative, and financial expertise: expertise and experience in projects similar in scope to the proposed activities, as well as an understanding of how to pursue novel cloud computing pricing models and managing such models;
3. Completeness of the project schedule: goals, milestones, and activities proposed in the project schedule cover all the essential aspects of the entity, and a reasonable plan for contingencies exists; and
4. Longer-term vision and sustainability plan: a compelling vision and longer-term sustainability strategy beyond the duration of the proposed project is presented.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review, Internal NSF Review, Site Visit Review, or Reverse Site Review.

Preliminary proposals are required for each proposal, prior to full proposal submission, as specified in the solicitation. The preliminary proposals are not subject to external merit review, but will go through internal review. Submitting a preliminary proposal does not oblige potential proposers to submit a full proposal. The decision is non-binding.

For Full proposals, based on discussions at panel review, the Program Officers may elect to obtain additional input on aspects of the proposed activities by further review, for example requesting information from the PI or conducting a Site Visit and/or Reverse site visit.

Reviewers will be asked to evaluate full proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the

program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Special Award Conditions:

Recovery of indirect costs (F&A) is prohibited on cloud computing expenditures for proposals submitted in response to this solicitation. This prohibition will apply to any subsequent supplemental funding requests submitted by the awardee organization.

Attribution of support in publications must acknowledge the National Science Foundation, the award number, and the program, by including the phrase, "This material is based upon work supported by NSF under [Award Number], using resources provided as part of the NSF Cloud Access Program."

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Deepankar (Deep) Medhi, telephone: (703) 292-8950, email: dmedhi@nsf.gov
- Kevin Thompson, telephone: (703) 292-4220, email: kthompson@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail:

support@grants.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at <http://www.grants.gov>.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314

- **For General Information
(NSF Information Center):** (703) 292-5111

- **TDD (for the hearing-impaired):** (703) 292-5090

- **To Order Publications or Forms:**

Send an e-mail to: nsfpubs@nsf.gov

or telephone: (703) 292-7827

- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, [NSF-50](#), "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and [NSF-51](#), "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314

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