MSI-CIEC: MSI Cyberinfrastructure Empowerment Coalition and the TeraGrid

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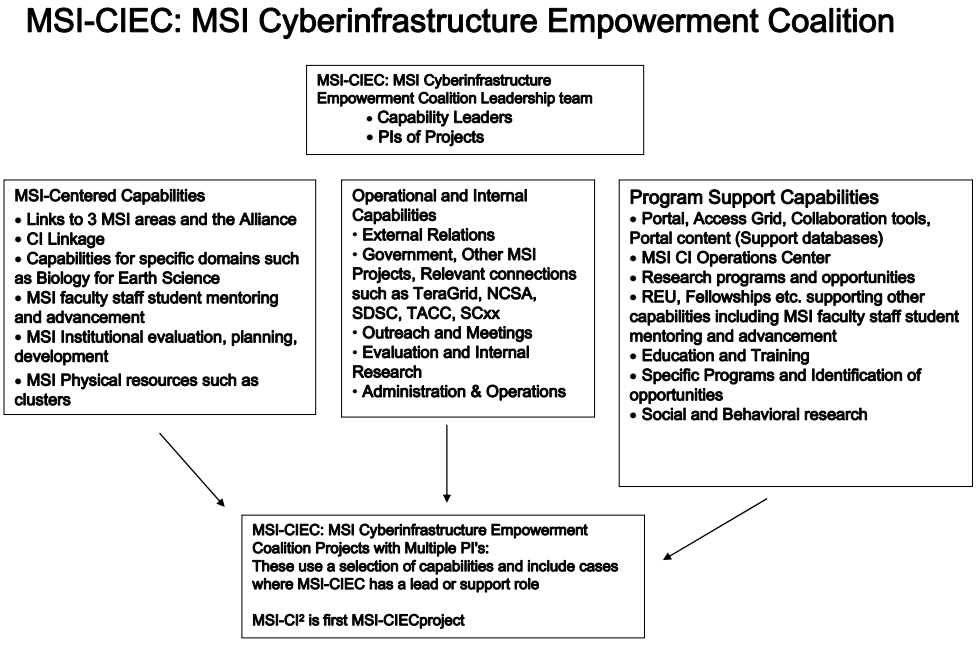
Abstract
We discuss some of the challenges and opportunities for Minority Serving Institutions (MSI) with the emergence of Cyberinfrastructure for science and engineering. We discuss the approach of MSI-CIEC (Cyberinfrastructure Empowerment Coalition) and pay particular attention to the TeraGrid.

Introduction

Cyberinfrastructure (CI) is enormously promising for the nation's science and engineering enterprise and offers the opportunity of democratically benefiting all participants [2,3,6,8].



The Minority-Serving Institution (MSI) Cyberinfrastructure (CI) Empowerment Coalition, MSI-CIEC, is established to accelerate the advancement of e-science and CI, the development of a diverse CI-related science and engineering workforce, and to broaden access, participation, and appreciation for CI and e-science, particularly among traditionally underrepresented minority populations. The vision of MSI-CIEC is to advance science, technology, engineering and mathematics (STEM) and the participation of the nation's underrepresented minorities in STEM, particularly e-science, and in the global STEM workforce through minority-serving institutions (MSI's) and the emerging Cyberinfrastructure (CI). This defines a mission to build and enhance the social and technological mechanisms for meaningful engagement of MSI's in

cyberinfrastructure (CI). That is, to develop the CI "middleware" resource to encourage, broker, enable and manage meaningful CI initiative and MSI collaborations of mutual benefit for the use, support, deployment, development, and design of CI to enable the advancement of e-science research and education unlike ever before, and the development of the nation's diverse science, technology, engineering and mathematics (STEM) workforce, including the current and next generation of the STEM professoriate in an increasingly diverse society. MSI-CIEC exploits the virtualization and global integration features of CI as a democratizing force that can offer leading edge STEM involvement to all.

MSI-CIEC is a virtual organization (using Grid terminology) shown in the figure b and organized under the Alliance for Equity in Higher Education. This ensures its work will have systemic impact on at least 335 Minority Serving Institutions covered by the Hispanic Association of Colleges and Universities, the National Association for Equal Opportunity in Higher Education, and the American Indian Higher Education Consortium). MSI-CIEC is envisaged as largely aimed at supporting the community interested in CI-involvement of MSI's and that it will lead just a few projects but also provide a scalable implementation of its mission by leveraging and advising many relevant projects led by others. The MSI-CIEC initial project is the Minority-Serving Institutions Cyberinfrastructure Institute (MSI CI^2) funded by the NSF CI-Team program as an initial planning and information dissemination activity. This has worked with MSI and CI leaders to identify challenges, opportunities and success stories so as to prepare a pathway forward. We have identified some critical features of our future work including:

- Institutional activities: executive presentations and campus visits to plan CI
- Funding of faculty release time and students
- Linkage of MSI and National CI research projects
- Curriculum enhancement
- Education and Training of faculty, students and CI support staff
- CI installation at MSI sites for both local capability and access to International CI. We suggest the formation of a MSI CI Operations Center to support this.

We will present details of our current and planned activities and how they interact with TeraGrid.

MSICI^2

MSICI^2 was a one-year CI-Team demonstration project that began fall 2005 [13]. Lessons learned have been incorporated into our current plans, most important of which are that there is huge opportunity for leveraging of many related activities among our partners, and we should focus on identifying and exploiting these opportunities. We also found that planning and discussion meetings are essential, and that a systemic approach involving all of the technical and policy aspects of CI at an institution is required. This includes obtaining of faculty and administrative buy-in; acquiring the needed local resources and access to the (inter)national CI; integration of CI into curricula; and providing MSI's the opportunity for equal collaboration on the large national projects.

Further, at our training meetings we found that planning and organizational discussions between MSI-CI^2 PI's and the MSI attendees were very fruitful. We also identified several CI training programs that we have incorporated into our MSI Institute which we will augment with MSI-focused planning and training sessions. Sources of additional CI training that we encourage our MSI participants to attend include SCxx, SDSC, NCSA, TACC and the Open Science Grid. We found the current GGF sessions not well targeted to our audience but we will work with the new GGF Training, Outreach & Education Community Group that will identify and promote curricula development and delivery activities that we can leverage. This new activity is coordinated by the EU ICEAGE project on Grid training and education which is led by Malcolm Atkinson from our advisory group [10]. The need for education and awareness activities is illustrated by MSI

Elizabeth City State University that is building CI supporting the CReSIS center for ice-sheet remote sensing [4]. The original idea was developed following a MSICI^2 training and planning session but we found the need to involve all members of CReSIS (MSI and non-MSI) in a similar process as there is a broad need to disseminate the best practice in the use of CI.

Activities of EPIC [7] and Global CyberBridges [5] are synergistic with MSI-CIEC and will aim at leveraging them. SDSC and MSI-CIEC are collaborating on a separate project that will link in community colleges and enhance the education pipeline. The SCxx series of conferences are an important opportunity for MSI's and MSI-CIEC project team members are involved with the planning activities for the education and proposed new broadening of participation components. We see sessions such that on "Cyberinfrastructure: Changing the Face of Science and Engineering" at SACNAS (Society for Advancement of Chicanos and Native Americans in Science [13]) this October as illustrative of required broad awareness activities and are working with SACNAS who attended our January planning session. We will also be collaborating with the newly formed BPC Computing Alliance of HSIs who also will attend.

We found an interesting spectrum of issues surrounding access to and provision of CI at MSI's. We found MSI's with large scale systems (including Bowie State and the University of New Mexico) who were natural providers of CI but there is currently no clear methodology for such systems to be made part of a Grid and in particular part of TeraGrid. The universality of CI requires that we have MSI and non-MSI providers just as we have those from MSI's and those from non-MSI's that "just" access it. We hope that the new effort to better define what it takes to be part of the TeraGrid will be successful and will involve MSI's. Many institutions possess access to the TeraGrid based on network performance but lacked either an understanding of how to link to the TeraGrid or to deploy the needed local infrastructure. This local infrastructure should often want to run a similar software stack to the TeraGrid and so installation of a local institutional cluster would often face similar challenges to those of a potential provider. It would be useful to quantify this and provide the needed national training and support. One interesting possibility discussed with Keahey and Foster from Argonne is the use of VM (virtual machine) technology to allow remote resources to be dynamically configured to support local needs [11]; this is interesting for small groups and institutions who may not wish to invest in system administration needed to support local CI. We hope to identify with the TeraGrid, the institutional requirements for CI access which at its simplest is a Science Gateway portal linked to remote resources; however, personal data, visualization and local development and training requires some institutional resources. Note that even after we quantify the CI access and provision issues, it is difficult to see how many institutions will be able to provide the local systems and operational support. The skills needed are still evolving and not many existing systems staff have the needed experience and training. One can see this in the use of the Access Grid; this important system is much simpler than the TeraGrid but many groups find it very difficult to provide needed support and so its use is limited compared to its potential. We have suggested providing a National CI Operations Center similar to that pioneered for the Open Science Grid [9] but broader in scope. Such a center could be focused on MSI users or cover all of CI. The deployment of remote VM-based resources as one's local CI would certainly benefit from such a Grid Operations Center. Note that the clarification of the technical details of CI access/provision discussed here is different from and in addition to the domain specific questions as to how to use CI in a particular application. This involves understanding how to deploy computing, data, sensors and instruments as CI, how to build a portal, how to federate resources and simply how to collaborate in and run a virtual organization. These important issues are covered in the education discussion above,

It became clear early on that it was essential to provide opportunities for MSI faculty and students to participate in the best CI research projects. Many of the presentations at our January meeting prompted interest in participation in the projects that were described, and in general our strategy is to make the appropriate contacts between MSI and other researchers where our other activities have given the MSI's the needed knowledge and infrastructure for full participation. We do not intend to develop our own research agenda but rather to use our distinguished advisory group to identify opportunities for MSI's, and, of course, foster the research agendas at MSI's. As part of our attention to the complete process, we also are adding campus visits based on earlier experience with AN-MSI [1], so that we can identify all the opportunities for and impediments to adoption of CI at an MSI and follow-up with technical assistance. We will try to identify opportunities for additional support by encouraging MSI students to apply to relevant REU (Research Experience for Undergraduates) programs. There is a need for REU programs targeted at CI, and we will encourage their formation.

The lessons and sample activities described above are generalized and built into the proposed MSI-CIEC, which fills a major requirement in CI as a virtual organization emphasizing bi-directional links to MSI's and CI activities and participating in additional projects in either a lead or support role. MSI-CIEC emphasizes leverage either by interacting with existing activities/organizations and/or by specific projects. This strategy helps us scale the activity in a sustainable manner – potentially to all institutions in the Alliance and to many national and international CI/e-Science activities.

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