Final report on accomplishments of a Task Force on Campus Bridging sponsored workshop: Campus Leadership Engagement in Building a Coherent Campus Cyberinfrastructure

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1. Introduction

In 2010, the National Science Foundation (NSF) awarded a grant of $49,840 to the University of North Carolina Chapel Hill to organize a workshop on the topic of campus cyberinfrastructure with the title "Campus Bridging Taskforce Sponsored Workshop: Campus Leadership Engagement in Building a Coherent Campus Cyberinfrastructure."

The abstract for this proposal stated the following:

> *The integration of cyberinfrastructure resources from the campus perspective is critical to the support for the ever-increasing level of cross-disciplinary and cross-organizational aspects of scientific research. To assist in this goal, the Campus Bridging Task Force has been organizing a series of workshops focused on key areas that are critical to a successful campus cyberinfrastructure implementation. Previous workshops have been held in April and August, 2010 and have focused on Networking and Data-centric issues and Software and Services.*
>
> *Senior campus leaders are a critical component in the development and successful implementation of campus cyberinfrastructure and the task force has planned a workshop that will be focused on this area. The meeting will provide a forum and opportunity for senior university administrators to offer their perspectives as to what issues must be solved to build a coherent campus cyberinfrastructure at their institution.*
>
> *The workshop participants will also have an opportunity to provide feedback, input, and suggestions on the draft document and recommendations of the Campus Bridging Taskforce of the NSF Advisory Committee on Cyberinfrastructure. This information will be valuable to developers, deployers, other campus administrators, and to the NSF itself in helping the organization plan future NSF programs that will merge with campus cyberinfrastructure and to provide the best cyberinfrastructure support to scientific and engineering researchers.*

This workshop was held in October 2010. A full report on this workshop – including information on the agenda, participants, discussion, and conclusions, is available online at:

> Dreher, P., S.C. Ahalt, G. Almes, M. Mundrane, J. Pepin and C.A. Stewart, (eds.), 2011. Campus Bridging: Campus Leadership Engagement in Building a Coherent Campus Cyberinfrastructure Workshop Report. 2011. http://hdl.handle.net/2022/13194

This report discusses the contents of the full workshop report to the NSF as well as the accomplishments and outcomes reported via the NSF's online reporting system.

2. Activities and findings

2.1. Research and education activities

The major research and education activities of this workshop focused on gathering, compiling, and sharing the ideas, perspectives, and best practices of campus cyberinfrastructure (CI) from senior university administrators, especially campus CIOs and vice presidents for research. The workshop served as a focal lens for discussions centering on the necessary campus cyberinfrastructure needed to support research and teaching on campuses today as seen through the perspectives of senior university administrators. These discussions included:

- The current state of campus bridging from the perspectives of the CIO and VP for research
- Challenges and opportunities at the campus leader level for enablement of campus bridging in the university community
- The senior campus leadership advocacy role for promoting campus bridging

These senior university administrators considered CI resources to include all computing, storage, and data resources that a research or education community creates and consumes to accomplish and publish their research and scholarship. The administrators recognized that the information that they were compiling through this workshop would serve as a reference for other senior campus administrators. The old model of the campus as an island is being replaced by a community interconnected through cyberinfrastructure and will have profound implications on how campuses design, build, support, and use campus networks and other resources in the future.

The workshop participants also highlighted the issue of the four-year college campus as compared to the university research-based institutions. Although the four-year comprehensive campuses are primarily teaching and learning based, they also participate in the research space. The participants advocated that terminal degree level education must include access to creative inquiry research to prepare BS/BA level students for success after graduation.

Faculty at four-year institutions of higher education are often active members of the academic research community, and they typically need access on par with their peers at research institutions in order to be equal partners. Workshop participants concluded that a large set of choices among missions and governance models in this heterogeneous environment is a classic example of what bridging means. It is not one simple structure. Advocates in any one part of the environment need to be aware of the complex diversity in the whole system.

2.2. Findings

At the conclusion of the workshop, the campus CIOs and vice presidents for research who attended the workshop developed four major recommendations to the NSF and to other universities, four-year colleges, and community colleges. The major findings and recommendations are included in this report as Appendix 1, and expanded upon and explained in the full-length report cited above.

3. Training and development

The Task Force on Campus Bridging gathered information in previous workshops documenting what 'we' as a community of CI users 'want and need' to advance our research and educational teaching and learning capabilities for the future. Conspicuously absent from the discussion to date is what we need to do on our campuses to gain the support and backing a key group – the senior campus leaders.

The workshop provided a mechanism and catalyst to address these issues. The workshop attendees each showed a strong commitment to addressing the issue of cyberinfrastructure on their campus and to helping the larger community with these issues. Several invited speakers documented current examples of programs focused on building the campus cyberinfrastructure needed for educational institutions to have their faculty, researchers, and students be successful in the future. Larry Smarr, Director of CalIT^2, presented extensive documentation illustrating opportunities for campus cyberinfrastructure along with the documentation developed by the University of California San Diego titled *UCSD Research Cyberinfrastructure Design Team. Blueprint for the Digital University*. In addition, the Big Ten university CIOs illustrated several options for advocacy to the campus presidents and provosts in their document *A Research Cyberinfrastructure Strategy for the CIC: Advice to the Provosts from the Chief Information Officers* (2010). Both of these documents provide excellent information for training, mentoring, and advocacy for CIOs and VPs for research to present the needs and requirements for a robust campus cyberinfrastructure to the most senior university administrators.

In addition to gathering information from these important CI user communities, the senior campus administrators recognized the key role they played in designing, producing and overseeing any implementation of cyberinfrastructure on their campuses.

The Task Force on Campus Bridging also found that the recommendations from this workshop were critical to development of cyberinfrastructure for higher education institutions. The workshop made a very compelling case that a successful campus CI will be greatly enhanced with the support of senior campus administrators. Senior campus administrators set priorities and control resources on their campuses. Campus CI is but one of numerous resource-needy areas that they must consider for their university funding and support. How should CI be presented to senior university administration officials? It is essential to solicit input, advice, and recommendations as to what they need in order for them to support this cyberinfrastructure and successfully move it forward on their campuses. To this end the task force is interested in assembling a group of senior university officials to meet with some of the task force members, so that we may solicit their input and recommendations as to how best to proceed in the area of CI from the perspective of a senior campus administrator.

4. Outreach activities

The workshop attendees carefully documented the findings, comments and recommendations. From these materials the principal investigator (Patrick Dreher) and the organizing committee assembled this raw data and information into the report cited in the introduction. The Task Force on Campus Bridging has recognized the importance of this work and has cited it numerous times in their final report to the Advisory Committee on Cyberinfrastructure (ACCI) of National Science Foundation.

Individual members of the organizing committee and the workshop attendees in general have continued to play very active roles in the community advocating and supporting the development of a robust campus cyberinfrastructure in the higher education community.

5. Contributions

5.1. Contributions within discipline

There have been many workshops touching upon cyberinfrastructure over the past several years. Our workshop report cites many of these workshops that have addressed the issues of cyberinfrastructure from the aspects of science and engineering, data, software, etc.

This workshop is unique in that its main goals have focused on gathering the thoughts, ideas and perspectives of senior university administrators regarding campus cyberinfrastructure. The workshop specifically focused on the following:

- The current state of campus bridging from the perspectives of the CIO and VP for research
- Challenges and opportunities at the campus leader level for enablement of campus bridging in the university community
- The senior campus leadership advocacy role for promoting campus bridging

The findings, comments, and suggested next steps and recommendations that resulted from the work of the participants has helped to shape the thinking and perspectives of senior campus faculty leaders and administrators nationwide. Senior administrators and faculty at our institutions of higher education are critical players in this process. Without an educated and enlightened senior campus administration and senior campus faculty leaders actively supporting campus cyberinfrastructure and opportunities that can be realized by effectively implementing such technology on their campus, it will be difficult for faculty, researchers, and students at these institutions of higher education to effectively compete worldwide in the years ahead.

5.2. Contributions to other disciplines

Unlike physics, chemistry, biology, chemical engineering, electrical engineering, etc. cyberinfrastructure is not a discipline in the usual sense of the word from the perspectives of the NSF. For the purposes of agreeing on a common terminology, the workshop participants adopted the definition of cyberinfrastructure proposed by the 2008 EDUCAUSE/CASC workshop titled *Developing a Coherent Cyberinfrastructure from Local Campuses to National Facilities: Challenges and Strategies*:

> *Cyberinfrastructure consists of computational systems, data and information management, advanced instruments, visualization environments, and people, all linked together by software and advanced networks to improve scholarly productivity and enable knowledge breakthroughs and discoveries not otherwise possible.*

This workshop has most certainly contributed to the larger discussion and education of all participants in the successful adoption and implementation of best practices and methodologies for campus cyberinfrastructure (in the case of this workshop, the full emphasis was on creating an environment for a dialog among senior administrators of institutions of higher education and the production of recommendations and next steps from their perspective.

5.3. Contributions to education and human resources

This workshop has addressed the issue of human resource development in science and engineering. It is at the core of the mission of the senior campus administrators, which is to provide a positive and supportive environment for education and the advancement of science and engineering on their respective campuses. Consequently, the senior campus leaders attending the workshop made effective development of a supportive environment for science and engineering their first recommendation.

5.4. Contributions to resources for science and technology

This workshop provided an opportunity and a catalyst for a cross section of higher education senior administrators and faculty serving in the roles of vice presidents for research to focus a spotlight on the challenges and opportunities at the campus leader level regarding enabling campus bridging in the university community. During the workshop senior administrators reported on major ongoing cyberinfrastructure activities and projects that were being conducted in collaboration with multiple universities nationwide. For example, there was a report was from the CIOs representing the campuses within the Committee on Institutional Cooperation (CIC). Their report titled *A Research Cyberinfrastructure Strategy for the CIC: Advice to the Provosts from the Chief Information Officers* summarized initial findings that the CIOs had presented to the provosts at their respective institutions.

The findings and recommendations from the Campus Leadership Engagement in Building a Coherent Campus Cyberinfrastructure workshop report have been disseminated to the CIC members and it has served to reinforce the discussions and planning by the CIC member institutions as to how best to effectively implement campus cyberinfrastructure on each individual campus. Several campus cyberinfrastructure pilot projects and activities have been launched.

Another example showing the impact of this workshop and on the thinking and potential directions for the national campus cyberinfrastructure discussion has been the recognition of the importance of the outcomes from our workshop to the goals of campus bridging by the NSF Task Force on Campus Bridging:

- http://www.nsf.gov/od/oci/taskforces/
- http://www.nsf.gov/od/oci/taskforces/TaskForceReport_CampusBridging.pdf

The Task Force on Campus Bridging has recognized the importance of this workshop for the advancement of research and education. It has embraced our workshop's findings and recommendations

and has included five major citations from our workshop findings and recommendations in its final report to the NSF.

5.5. Contributions beyond science and engineering

This workshop has helped to shape the discussion of the role of cyberinfrastructure in higher education at some of the most senior levels of the campus administration. Many campus administrators have not had the time to focus on this topic because of the demands of so many pressing issues that they must manage.

While positive changes in the strategic thinking and direction of implementing cyberinfrastructure on university campuses will certainly benefit the science and engineering communities, our workshop has also engaged impact on campus in other communities and disciplines outside science and engineering. Our workshop has addressed cyberinfrastructure topics that span a cross section of the higher education environment. For example, our workshop tackled campus cyberinfrastructure issues such as

- Coherent computing and data infrastructure
- Digital curation and data services
- Data networking in research cyberinfrastructure
- Cyberinfrastructure support and expertise
- Relationship of cyberinfrastructure and administrative computing
- Cyberinfrastructure governance models
- Financial structures in academic research

Our final report provides findings, comments, and recommendations from the senior administrator perspective in these areas that impact the overall environment of campuses and higher education. Providing a forum for senior campus leaders to tackle the broad spectrum of higher education cyberinfrastructure will have an impact on the shape and strategic direction of the nation's higher education in the coming years. A healthy, vibrant, and technically savvy cyberinfrastructure at the nation's higher education institutions will positively influence the advancement of science and engineering but will also positively affect the education of the next generation of our citizens.

Appendix 1. Major recommendations from the October 2010 Campus Bridging Workshop

In this section we capture the overall recommendations that arose from the workshop discussions and information exchanges.

The first recommendation focuses specifically on the need to consider the new paradigm of collaborative research, while recognizing the critical role of individual-investigator science as a motivator for the need for coherent cyberinfrastructure and campus bridging:

> *Recommendation 1: Campuses should support both individual and collaborative research activities at their individual institution. Towards this end, campuses should cooperate with other campuses and institutions towards the goal of providing their educators and researchers a seamless cyberinfrastructure access and capability in support of collaborative research and education.*

To support collaborative research, our second recommendation is for campuses to develop a plan, with support from the apex of their leadership, for coherent cyberinfrastructure. As stated by the CIC CIOs in their identification of planning as best practice: "Maintaining a viable campus cyberinfrastructure is an ongoing process of responding to the co-evolution of technology and the scholarship it enables." Having coordination of campus cyberinfrastructure represents a significant benefit in terms of that cyberinfrastructure being more effective, both for producing research benefits and cost effectiveness. Hence:

> *Recommendation 2: Campuses should develop and deploy a cyberinfrastructure master plan with the goal of identifying and planning for the changing research infrastructure needs of faculty and researchers.*

The NSF and other federal agencies can inculcate the urgency and need for a coherent approach. When a coherent message is presented by the national funding agencies, senior academic leaders from the president down will take the message seriously. However, if the IT department makes the same argument, it will be regarded as yet another technical fad of the month.

Additionally, the NSF can foster the process by providing the community with best practices for such plans. We have now a set of campuses that have undergone the planning process, and a study of successful strategies for governance, deployment, sustainability, and support approaches would benefit and encourage other institutions to follow.

> *Recommendation 3: The NSF should, to encourage academic institutions to implement a cyberinfrastructure master plan, fund a study and report on successful campus cyberinfrastructure implementations in order to document and disseminate the best practices for strategies, governance, financial models, and cyberinfrastructure deployment.*

Over the last few years, universities have come to recognize the relationship between successful faculty research projects that require cyberinfrastructure resources on campus and the rising costs for universities providing that infrastructure. For universities with strong research in areas requiring substantial cyberinfrastructure, these associated university costs can become quite substantial. This recommendation emphasizes planning cyberinfrastructure in ways similar to planning for the development and implementation of other institutional assets, including buildings, laboratories, and libraries. Findings from the workshop discussion on cyberinfrastructure planning include the following points:

- The cyberinfrastructure master plan should be developed in collaboration among campus intellectual leadership, infrastructure providers, and faculty in order to achieve maximum buy-in and address as broadest set of needs and requirements.

- The senior campus leadership must be involved and committed to the cyberinfrastructure master plan's success with the senior campus officer responsible for campus CI (usually the CIO or equivalent) regarded as part of the campus intellectual leadership rather than just a service provider.
- The cyberinfrastructure master plans must place value on people, in the form of research and professional staff, who deploy, operate and support CI technology and systems.
- The cyberinfrastructure master plan should distinguish and separate funding for research CI as opposed to other IT infrastructure and include an analysis for sustainability of these CI systems.
- Addressing the needs of high-end researchers can change the entire campus. For example, the 2-3 supercomputer users on each campus in 1985 drove campus-wide change.
- We are at a 'once in 20 years' phase transition in CI driven by new data creation capabilities, the exploding growth rates of data and networking capabilities, and the requirement for collaborative science to address the most challenging problems in science and engineering. The new NSF data management policy requirements are symptoms of this change.
- Our current economic challenges are straining IT budgets, along with all other budgets on our campuses. The most obvious path of across-the-board budget reductions is less desirable than focusing on what an organization does best; this requires appropriate planning.
- There are advantages in the economies of scale for CI provisioning and support at the campus, state, national, and international levels that can act to relieve economic problems. Having a plan allows a campus to take advantage of these economies.
- The new emphasis on the NSF data management plan requirement will be a key driver for many cyberinfrastructure master plans.
- A potential mechanism that may help provide better CI support for faculty and researcher needs and requirements, and assist in campus planning for research infrastructure facilities, would be to engage with the researchers at the proposal writing stage.

Recommendation 4: US colleges and universities should strive to include costs for research cyberinfrastructure in negotiated facilities and administration rates. The resulting facilities and administration income from grant awards should be used strategically within the context of a campus cyberinfrastructure master plan.

The key considerations in this matter are as follows:

- Cyberinfrastructure that generally supports research activities of a university may fairly be included in Facility and Administration (F&A) calculations.
- F&A is capped at 26% of direct costs for administration, and the effective rate (the rate universities actually collect as opposed to the negotiated rate) tends to be lower than this.
- In some cases it is possible to fund some computing as direct costs in grant awards (obtained competitively through grant proposals). In this case, 100% of the cost of equipment may be included as direct costs.
- The cost or value of equipment obtained through monies included in F&A calculations cannot also be counted as part of a matching commitment in a grant proposal or grant award budget