

Advancing Minority Institutions' Cyberinfrastructure Through the AN-MSI Program

A report prepared for the National Science Foundation by the external evaluator
of the Advanced Networking with Minority Serving Institutions program

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1. Introduction to the problem

In January of 2003, the National Science Foundation Blue-Ribbon Advisory Panel on Cyberinfrastructure released its report on the cyberinfrastructure improvements necessary to keep our nation at the forefront of scientific and technological development.¹ In this report, Atkins et al. recommended that the NSF set aside \$1 billion in funding per year to establish a program that would “create, deploy, and apply cyberinfrastructure in ways that radically empower all scientific and engineering research and allied education” (ES p.1). However, the panel's recommendations went beyond increasing the speed and sophistication of high performance computing tools. Like numerous others at NSF, Atkins et al. also recognized the importance of making sure that all universities and colleges—regardless of size, budget, and student demographics—have an opportunity to participate in and benefit from cyberinfrastructure developments so that no class of institutions, no group of faculty researchers, and no population of students is left behind. Indeed, in section 2.9 of their report, they emphasized:

“An important goal of the Advanced Cyberinfrastructure Program (ACP) must be to more effectively include Minority Serving Institutions (MSIs)...Few of these institutions were involved in discussions leading to the original NSF supercomputing centers, and collaboration efforts to date, though well intentioned...have for the most part fallen short of their goals for a variety of reasons...One of the most important barriers to engaging MSIs in research using cyberinfrastructure is the lack of adequate network connectivity—a problem especially acute for the Tribal Colleges because of their largely rural location and frequently impoverished localities...Further, such institutions lack the tools and infrastructure needed to participate in mainstream research...These and other limitations have perpetuated the so-called digital divide, reflected by a 20+ year gap in capability between mainstream institutions and many MSIs...The PITAC emphasized the importance of reaching MSIs, and we underscore it again here. *The ACP therefore must support strategic IT planning for underserved communities...Significant efforts must be directed toward engaging underserved communities directly, rather than as programmatic add-ons*” (p.28, italics added).

In the report that follows, I will show how the barriers to MSI participation raised in the Atkins report are being successfully addressed by the Advanced Networking with Minority Serving Institutions (AN-MSI) program, now in its final year of NSF funding. A three-year external evaluation of the AN-MSI program by the University of Wisconsin-Madison's LEAD Center supports the argument that continued funding for AN-MSI's efforts should be included in the budget for NSF's new Cyberinfrastructure program or a related technology initiative. Sections 3 and 4 of this paper present evaluation data demonstrating the effectiveness of the 4-year-old, \$6-

¹ Atkins et al. (2003). [Revolutionizing Science and Engineering Through Cyberinfrastructure: Report of the Blue-Ribbon Advisory Panel on Cyberinfrastructure.](#)

million AN-MSI program in working directly with the three communities of minority institutions to:

- develop strategic IT plans for their campuses
- improve their network connectivity
- increase the training and professional development of their IT staff
- increase the IT awareness of their presidents
- provide their faculty with opportunities for training and research collaborations in IT

In the four years of the AN-MSI program, 40 Historically Black Colleges and Universities (HBCUs), 47 Hispanic Serving Institutions (HSIs), and 37 Tribal (or Native American/Native Hawaiian serving) Colleges and Universities (TCUs) have participated in one or more AN-MSI sponsored events or initiatives. After reviewing the results of annual surveys and interviews with program participants, it is clear that the 40-some institutions most consistently involved with AN-MSI have greatly benefited from the program and have developed a collaborative network of minority researchers, IT staff, and faculty that can eventually expand to all of the nation's nearly 380 MSIs. Because this is the first time anyone has attempted such a collaboration across all three minority communities, the evaluators and administrators of the AN-MSI program are in a unique position to educate others about how to make such efforts succeed. The lessons we have learned, summarized in Section 4 of this paper, should be of value to the NSF and others who want to be effective in addressing the "digital divide" and working with MSIs on future collaborations. We are concerned that without the assistance of pioneering, cross-community efforts like AN-MSI, the NSF's attempts to reach the MSIs that serve the bulk of our nation's minority students will continue to fall short. If an effort is not made to explicitly address the needs of the nation's technologically-strapped MSIs, ambitious IT programs like Cyberinfrastructure will only wind up *increasing* the disparities in technological development that already exist.

2. History and evolution of the AN-MSI program

In September 1999, the NSF awarded EDUCAUSE, the nation's leading higher education technology association, a special \$6-million grant to encourage advanced networking opportunities for minority serving institutions. One million dollars of this amount was subcontracted to the Education Outreach and Training Partnership for Advanced Computational Infrastructure (EOT-PACI) to work with the comparatively few MSIs who were already interested in and ready to take advantage of high performance computing applications. EDUCAUSE proposed that the remainder of the grant be used as seed money to establish a collaborative infrastructure across all three minority communities that, over time, would enable all of the nation's MSIs to take advantage of training, networking, and funding opportunities in IT. Given the nearly 380 MSIs that the NSF eventually hoped to reach, the modest IT budgets of most participants, the relatively low-bandwidth and less-than-adequate networking infrastructure of smaller MSIs, and the difficulties that financially-strapped MSIs face in attracting and retaining qualified IT staff, the administrators of the new AN-MSI program had their work cut out for them.

Even among the 100 MSIs that were the initial partners in the AN-MSI program, it was clear that \$6 million over four years was not going to go very far. Indeed, as the interviews I performed as an evaluator made clear, some MSI participants were concerned from the outset that the relatively low amount of funding and short time frame for such a large and complicated task

would doom the program to failure.² The effort was further complicated by the fact that most of the participating institutions had rarely collaborated with institutions within their own minority community, much less with schools from other minority communities. Hence, before the program could even delineate its goals and strategies, it would be necessary to build trust and a sense of common purpose among schools that had often seen each other as competitors in the past. The participants would have to reach consensus, leverage resources, and develop cross-cultural partnerships that, at times, subsumed the needs of their individual institutions and communities to the needs of the larger group.

It is important to recognize the risk of such an undertaking for financially-strapped institutions: For many of the participants, volunteering the time and effort of their small, over-committed IT staffs to community-wide projects whose largest payoffs were in the future was no easy sacrifice. However, it was a sacrifice that those MSIs who signed onto the program were willing to make. The dozens of individuals who regularly attended program meetings and who volunteered for program committees and consulting teams trusted that, in the end, the benefit to their campuses and their communities would be more than worth the time and effort invested. As the conversations about the new program's priorities and structure began to unfold, it became clear to all those involved that this was a historic and ambitious undertaking.

Prior to the kickoff meeting in January 2000, the EDUCAUSE-based Project Director David Staudt had already begun hiring project consultants to provide technical expertise and Community Leaders to serve as project liaisons within the three minority communities. Working closely with organizations that represent the interests of particular minority communities in higher education, including the American Indian Higher Education Consortium (AIHEC), the Hispanic Association of Colleges and Universities (HACU), the National Association for Equal Opportunities in Higher Education (NAFEO), and the Executive Leadership Foundation, Staudt selected individuals who could commit a substantial portion of their time to the program (generally 50%) and who were in recognized leadership or advocacy positions within their communities. Community Leaders were given the bulk of responsibility within their communities for encouraging program participation, fostering proposal development, identifying areas of particular need or desired emphasis, and representing their community's interests at AN-MSI meetings. The LEAD Center was brought on as the evaluator for both the EDUCAUSE and EOT-PACI portions of the AN-MSI program in June 2000. My first introduction to the larger community of AN-MSI was at a Project Action Committee meeting that July, where I gave a presentation on formative and summative evaluation, addressed participants concerns about how evaluation data is collected and used, and sought buy-in from the MSIs in each community to participate in the evaluation.

On the following page is a time line for the program that shows how the program developed and evolved over the four years of the grant. From my perspective as the evaluator, I saw the program as having four distinct phases of development, as described in Table 1.

Table 1: Time-line for the AN-MSI program

Sept 1999: NSF awards EDUCAUSE a \$6-million grant (with a \$1-million EOT-PACI subcontract) for the AN-MSI program.

² Foertsch, J. & Clifton, C. (2002). Annual Evaluation Report for the AN-MSI Project, 2001-02. UW-Madison: LEAD Center. (available at <http://www.cae.wisc.edu/~lead>)

Phase I: Sept 1999 - Dec 1999: Preparation

- Community Leaders & project consultants were hired.
- Buy-in was obtained from national organizations representing minorities in higher education.
- Kickoff-meeting was planned.

Phase II: Jan 2000 – Jan 2001: Activity planning and community building

- Initial meetings were held within communities and across communities to explain the program's goals, engage MSI participants, form Project Action Committees, discuss common ground, build trust, share knowledge of IT problems and solutions, and reach consensus on the program's priorities and processes.
- Participants were funded to attend AN-MSI meetings and IT conferences like EDUCAUSE.
- Intra- and intercommunity collaborative proposals for outside funding were written by some participants.

Phase III: Feb 2001 – April 2002: Implementation of activities and services

- Program focus shifted from planning and consensus-building to implementation of activities and services: Tribal Colleges Wireless Project was implemented, final draft of AN-MSI's Network Model was circulated, IT training workshops began, Campus Visits by AN-MSI consultants began, AN-MSI videoconference series on distance learning occurred, executive leadership workshops were held, and a collaborative Title V proposal on security written by the participating California HSIs was funded.
- Participants continued to be funded by AN-MSI to attend meetings and IT conferences.
- Some MSIs began to receive AN-MSI funding for small-scale pilot projects on their campuses.
- Program administration broadened with the formation of an 18-member caucus that held monthly conference calls to update others on program activities and plan meetings.
- Additional consultants were hired to help with writing proposals and promotional materials and organizing Campus Visits.

Phase IV: May 2002 – August 2003: Looking to the future

- Planning for the future of AN-MSI began, with participants becoming more active in writing collaborative proposals for outside funding.
- Program services like Campus Visits continued at full steam, and more IT pilot projects received AN-MSI funding.
- Demands by some participants for clearer administrative processes and better accountability led AN-MSI administrators to implement more detailed reporting mechanisms and more frequent communication with participants.
- Community Leaders and Caucus members met with greater frequency to develop a proposal for AN-MSI's future.

3. Outcomes of the EDUCAUSE-sponsored portion of the AN-MSI program

In this section, I summarize the outcomes of AN-MSI activities and events funded by EDUCAUSE portion of the NSF grant, which do not include EOT-PACI's subcontracted

activities involving high performance computing. The outcomes from EOT-PACI's subcontract were evaluated separately and will be described in the summative evaluation report they are releasing in September 2003.

Outcomes of the EDUCAUSE-sponsored portion of the AN-MSI program were assessed on two levels. The first, most basic level involves documenting all meetings, conferences, workshops, campus assessments, collaborative proposals, and products that AN-MSI sponsored or produced over the four years of the grant, as well as the number of MSI campuses and representatives that participated in each of these. The second level of assessment involves determining what the impact of these efforts has been on the campuses and individuals who participated in them. This level of assessment was obtained through the following evaluation activities conducted by the LEAD Center:

- Observations and note-taking during AN-MSI Project Action Committee meetings, planning meetings, and conference calls
- Review of all documents and messages on the AN-MSI website and listserves
- Individual interviews with Community Leaders, Committee Chairs, project consultants, and other MSI representatives (conducted annually in January and February)
- Surveys of all AN-MSI meeting participants in a given year (conducted annually in May)

3.1 Key AN-MSI activities and products and their participation levels:

A complete accounting of AN-MSI's activities, products, and participants will be provided by administrators at the conclusion of the program in August 2003. Below I provide a summary of the key efforts to date and the level of participation in each:

3.1.1 IT-focused meetings and conferences:

- AN-MSI sponsored 473 attendees to attend 10 of AN-MSI's Project Action Committee meetings, most of which were held on the campuses of participating MSIs or at the EDUCAUSE annual conference. From January of 2000 to April of 2003, a total of 177 different individuals attended these, with 35% representing TCUs, 32% representing MSIs, 21% representing HSIs, and the rest representing majority institutions or consulting organizations. Participants at these meetings (about 70% of whom were MSI IT staff, 10% MSI faculty, and 10% other MSI administrators) networked with one another; learned about IT problems and solutions on other campuses; heard about opportunities for funding, training, and networking; received updates on AN-MSI activities; and planned future collaborations and grant proposals.
- Nineteen planning & coordination meetings focusing on particular AN-MSI communities, committees, or topics were held at the EDUCAUSE D.C. office or at other sites around the country from April 2000 to February 2003. Attendance at these invitation-only meetings totaled 339.
- AN-MSI sponsored attendance for 341 AN-MSI participants at 18 IT-focused conferences or conference sessions from April 2000 to April 2003. These events included the annual conferences sponsored by EDUCAUSE, National Learning Infrastructure Initiatives (NLII), and Networking. Many participants reported they would not have been able to attend these conferences without the financial support provided by AN-MSI.

- AN-MSI sponsored 65 MSI representatives to participate in IT training and certification workshops in networking, security, and data management. These workshops, beginning in April 2001, were offered to AN-MSI at special rates by providers like Williams, CREN, CERT, SANS, and KnowledgeNet.

3.1.2 On-campus IT consulting and strategic planning:

- AN-MSI conducted 48 Campus Visits from June 2001 through the summer of 2003, including 30 at TCUs and native Hawaiian colleges, 12 at HSIs, and 5 at HBCUs throughout the U.S. and Puerto Rico. During these visits, small teams of IT experts from participating MSIs assessed the IT networks and organizational structures of MSIs that wanted affordable, vendor-neutral advice on how to improve or upgrade their existing systems. AN-MSI paid for the consultants' time, while campuses generally paid for travel and accommodations.
- AN-MSI facilitated IT strategic planning at nine MSIs by bringing experienced facilitators to the campus to lead the institution's IT staff, faculty, and administrators in developing a comprehensive campus IT plan.

3.1.3 Innovative wireless networks and related pilot projects at selected MSIs:

- AN-MSI's Tribal Wireless Project installed state-of-the-art wireless backbone systems at three remote Tribal colleges, setting distance records in the process and enabling some sites to get reliable, permanent Internet connections for the first time.
- Leftover wireless radios and lessons learned from the Tribal Wireless Project were used to provide innovative wireless solutions for the connectivity problems of several HBCUs and HSIs. With the expertise gained from a prototype project at HBCU Bethune Cookman to develop a secure 802.11b wireless campus network, AN-MSI assisted other MSIs in implementing their own secure wireless networks. Other HBCUs received AN-MSI grants to explore how to integrate small, wireless devices (e.g., PDAs and cell phones) into their curricula.
- Using the cost-effective wireless systems piloted with Tribal colleges, three HSIs in Puerto Rico are installing a wireless backbone to reduce exorbitant connectivity costs and possibly form the basis for a regional network on the island. The project is playing a key role in helping to inform the Puerto Rican community of the benefits and possible means of forming such a regional network.

3.1.4 IT products and services attuned to the needs of MSIs:

- A six-session videoconference series about online teaching and learning was held from November 2001 to April 2002, with all sessions and materials now available on CD-ROM. The series was sponsored by AN-MSI and hosted by the University of Texas El-Paso, with synchronous online sessions reaching about 75 attendees at 15 MSIs nationwide. CDs were sent to AN-MSI participants and the sponsors have mailed out an additional 75 copies to MSIs who have requested them.
- AN-MSI's Network Committee developed a "Mainstream Network Model" that dozens of participating MSIs have used as a standard in assessing or updating their own campus networks. The bound copy of the model was released in February of 2002.

- AN-MSI's program website and 4 listserves provide the latest information on IT developments and legislation, IT solutions, training opportunities, funding opportunities, and project updates. The general AN-MSI listserv has 114 participants as of May 2003, and the three community-focused listserves each have 35-45 participants. From the establishment of the general listserv on February 22, 2001 through May 13, 2003, 722 messages have been sent to and from AN-MSI participants.
- The Knowledge Management online repository sponsored by AN-MSI and served from Winston Salem State University provides MSIs nationwide with a repository for the detailed IT information that their campuses need to function but that is often lost or degraded when their current IT staff move on to other jobs.
- AN-MSI hired experienced grant writers to support collaborative proposal writing. As of January 2001, these grant writers have been available to faculty and IT staff at AN-MSI institutions who want to participate in collaborative proposals but have little time to write them.

3.2 Impact of AN-MSI events, activities, and products on participating MSI communities, institutions, and individuals:

A full analysis of the impact of the AN-MSI program through the summer of 2003 will be contained in the program's final evaluation report, after data from the June 2003 AN-MSI survey has been collected and analyzed. In this section, I summarize the major outcomes of the AN-MSI activities and products listed above, as reported by program participants and MSI representatives in surveys, interviews, and discussions conducted between December 2000 and April 2003.

In the interviews conducted in early 2003, 32 program participants and MSI representatives from 7 HBCUs, 13 HSIs, and 7 TCUs that were among the most involved schools in the program were asked about the impact of AN-MSI on their campuses' IT infrastructure and connectivity, strategic planning, IT staff training, and collaborations with other MSIs. They were also asked about the program's impacts on the larger MSI community and on them as individuals. The key impacts reported by these interviewees are summarized below.

3.2.1 The project was an ambitious "experiment" in collaboration that laid a cross-community foundation for MSIs to build upon.

Many interviewees emphasized the unique and historic nature of the AN-MSI program, in that it brought together institutions and minority communities who had no prior history of, or infrastructure for, collaboration with one another. Several interviewees went so far as to describe AN-MSI as a "sociological experiment" or "experiment in collaboration." For many participants, it was their first experience developing ongoing professional relationships with IT personnel from other ethnic communities. And even within ethnic communities, it was the first time that many participants had met or worked with their peers at other institutions. Interviewees from TCUs said the biggest benefit of the program for them was being able to meet with IT staff at other Tribal schools to discuss the unique challenges that their very small, under-equipped schools face in trying to prepare their students for an increasingly technological world. Interviewees from the California HSIs emphasized that it wasn't until they met each other at AN-MSI meetings that they began to realize the huge potential for collaborative proposals

amongst themselves—a realization that resulted in a \$3.2 million Department of Education Title V grant to develop campus security and remote security support for five HSIs. Interviewees from two HBCUs and three HSIs described how equipment left over from the Tribal Wireless Project and the advice of other AN-MSI participants made it possible for them to install wireless systems on their own campuses. Faculty members and IT staff at an HSI and HBCU who collaborated extensively on AN-MSI’s distance learning videoconference series spoke of how the experience had given them “friends and colleagues” in other communities and “people I know I can always call” for advice about IT. These are just a few examples of the collaborative AN-MSI projects in which over two-thirds of interviewees reported participating.

The vast majority of interviewees felt that AN-MSI had done an admirable job building a human network of IT professionals that provided valuable professional development opportunities, resources, ideas, models for IT development, and a community of fellow MSI representatives whom they could turn to for advice and collaborate with on grants. Indeed, the majority of interviewees felt that **the establishment of a nationwide, multi-ethnic community of IT professionals and faculty researchers was AN-MSI’s most important and impressive accomplishment**. As an HSI faculty member with a great deal of experience in national collaborations said of AN-MSI:

“It’s very impressive when you look at the overall impact, the fact that so many people are now talking to each other. How else do you bring that together? I don’t know of any other thing that has been that successful in doing those things—creating all that collaboration between MSIs...The fact that AN-MSI was able to bring a bunch of institutions to the table that wouldn’t have come to the table in other ways, I think that has a tremendous impact, and I think that’s money well-spent.”

Although most interviewees felt the program had laid a solid foundation for ongoing collaboration between MSIs, they were concerned about the loss of funding for program initiatives after August 2003. The vast majority of interviewees felt that without additional funding at this critical juncture, much of the program’s future potential would be lost.

3.2.2 There were “tremendous” impacts on IT strategic planning, network infrastructure, and/or staff development for the MSIs who devoted the most time and effort to the project.

The majority of interviewees felt that AN-MSI contributed to their own campuses’ IT planning, IT infrastructure, and/or IT staff training in valuable ways. As with most programs, there was a fairly strong correlation between a school’s level of participation in the program and how much they got back from it. This correlation was strongest among the HBCUs, where those campuses with the highest representation on AN-MSI committees and campus consulting teams were more likely to receive AN-MSI project funding and much more likely to report numerous positive impacts at the campus level. The correlation was somewhat weaker at HSIs because many of the most active program participants came from large state schools with less urgent IT needs, and a few small HSIs received considerable benefits with little prior participation. Still, even though the majority of HSI representatives came into the program expecting to “give more than we would receive,” many HSIs reported significant infrastructure improvements, “career-changing” professional development opportunities for their IT staff, and collaborative ventures with other MSIs that “wouldn’t have happened without AN-MSI.” Indeed, many of the program’s most avid supporters in the final round of interviews were from HSIs.

The correlation between campus time investment and campus gain was weakest among the TCUs. More than half of the interviewees from Tribal schools, including those who had attended numerous project events, felt that many AN-MSI initiatives were not well-tailored to

the needs of their small Tribal schools. As these interviewees explained, their schools' miniscule IT budgets and staff often made it difficult to implement strategies designed for larger, better-financed schools. Furthermore, their remote locations and lack of backup IT staff made it difficult for many TCU representatives to travel to AN-MSI events outside their region. Not surprisingly, the most significant campus outcomes for TCUs came from those that were selected to participate in the Tribal Wireless Project or who requested visits from AN-MSI consultants for IT strategic planning. TCU interviewees also emphasized the value of the two AN-MSI regional workshops that focused on TCUs and recommended more such workshops in the future as a good way of meeting the Tribal schools' unique needs.

Overall, the vast majority of interviewees reported that what they got back from AN-MSI was more than worth the investment they put in. When asked if the program was worth continuing after the initial grant was finished, 9 out of 10 respondents said yes, with two-thirds using expressions like "Absolutely," "Without a doubt," and "Anything I can do to support it, I will." There were enthusiastic supporters for the program within every community, but generally interviewees from HSIs were more uniformly pleased with the program's impacts on their campuses and community. About half of the interviewees from HBCUs felt the program had a "tremendous" or "huge" impact on their campuses, with the other half reporting some local impacts but fewer than they had wanted—often due to programmatic or institutional funding constraints. Yet even interviewees who had hoped to see a greater impact on their own campus were generally supportive of the program and felt that they as individuals had gained something of value by participating in it.

Interestingly, many interviewees felt that the largest campus-level impacts of AN-MSI were still to come—if the funding to support continued collaboration could somehow be found. "We've just gotten started," said more than one interviewee. "It would be a travesty to stop this program now," said another, echoing the opinions stated by numerous participants.

3.2.3 AN-MSI's campus consulting visits produced substantial benefits for participating campuses and individuals.

The Campus Visit network assessments and strategic planning consultations sponsored by AN-MSI appear to have produced the program's most concrete and demonstrable impacts. In the interviews conducted over the last two years, interviewees from both the consulting teams and the participating campuses emphasized the nationwide need for such assessments and the benefits they had produced for those involved. As one representative from a small HSI that had received on-site consulting from AN-MSI said:

"The payoff has been a hundred-fold. If you look at our network as a body of water, we've turned a rain puddle into the Great Salt Lake. It's been miraculous. I mean an absolute, complete turnaround... What they're doing with those visits is actually ahead of its time and admirable. By far, the campus assessment piece and their assistance with rebuilding networks for small campuses, I can tell you that is just an absolute godsend, probably to 80% of the college campuses in this country. I thank my lucky stars here that we found out about them... Having a place to go to for outside IT advice, having that resource, is just wonderful. It is amazing what that does—how it empowers an institution."

An IT administrator at a much larger HSI described the impact of their AN-MSI Campus Visit and subsequent consulting visits in the following way:

"Because of that report and the visits since, we have totally restructured our campus IT administration... I think [the program] is excellent and the quality has been wonderful. It's been invaluable. I have leaned on them several times and relied on their expertise on numerous occasions, and they've not let me down. I couldn't say enough good things about them. They're wonderful, very professional, know what they're talking about, and

they allow us the flexibility to come to our own decision... We could not have done it without them, especially with the budget situation in our state the way it is. We would not have had the resources to go out and hire consultants from some company, consultants of their caliber, to give us the information we so desperately needed.”

The president of a Tribal college that had received an AN-MSI Campus Visit said of the visit:

“That was excellent... We had been struggling and struggling with technology and employment kinds of stuff, and how you do this and that, mainly in the IT personnel area. How do you hire people? How do you know that they have the skill? How can you tell, as the president of the college? I don’t have an IT background. How can I tell if this IT staff person is good when they’re doing all this stuff I know nothing about? Anyway, these gentlemen were just great. It was so helpful for us just to talk to them... That was one of the most valuable things that AN-MSI ever did, was that visit... because they sat with us, they talked person-to-person, they answered everybody’s questions. They talked about things that were really relevant to us and made some really good suggestions.”

Due to factors like available IT funding and the level of buy-in from campus presidents, some MSIs who received Campus Visits reported fewer concrete impacts than others. In general, the 12 HSIs who received Campus Visits or consulting through AN-MSI seemed to reap the greatest benefits from them, primarily because these schools already had the financial resources to act on the advice they were given. For the majority of the 30 TCUs and 5 HBCUs who received AN-MSI consulting, the ultimate payoffs are yet to come. At many of these schools, a lack of funding has delayed implementation of the networking advice they were given. Nonetheless, most of these schools expressed satisfaction with their visits and were waiting for the funding to put their plans into action. As one HBCU representative said, “Once we get the money, we know what we need to do.” The reports that AN-MSI consultants wrote were described as “useful blueprints for the future” that increased the IT staff’s chances of securing the funds they would need. As one Chief Information Officer at an HBCU put it, the report “gave us leverage, an outside source to say, okay, here are these guys coming in saying the same things that we’ve been saying. You’ve got somebody backing you up, basically.”

Apparently, the AN-MSI Campus Visits often had as much of an impact on the IT experts who were conducting them as on the campuses being visited. The top IT administrators of three HSIs, one HBCU, and one TCU who were interviewed this winter each described how much they or members of their IT staff had learned by doing Campus Visits. Some gained a broader perspective of the IT issues faced by other MSIs; others gained technical expertise by getting an up-close look at how other campuses were wiring their networks or the shortcomings of certain approaches; still others gained “hands-on” knowledge of how to navigate cultural issues and work within the constraints inherent in different cultural and institutional contexts. An administrator at an HBCU described the professional development gained through conducting Campus Visits the following way:

“I’d call it almost on-the-job training. Where it’s professional to professional—a sharing of knowledge... Through the consulting jobs, we’re learning what other campuses have. You’re learning when you’re writing up the reports, and you’re actually doing research at that point, and you’re talking to other people to make sure that what you’re writing down is going to be supportable. It’s professional development on the go.”

An administrator at an HSI said the following in describing the growth he had seen in one of his staff members who had conducted numerous Campus Visits:

“Probably for me, one of the biggest benefits has been that our own staff has been very much involved in visiting the various campuses to assess networks and information security. [One staff member] visited, Tribal colleges, HBCUs, HSIs—he’s been in all of them. That was probably the greatest transformation that I’ve seen. We took a tech and sent him out and we got back someone whose life was altered by those visits and whose charge was altered by those visits. He came back feeling much better about what he was doing here... He is now our active director of telecommunications network services. But all of that, the self-assurance, the learning, the renewed interest and vigor, stemmed from AN-MSI... He wouldn’t have been able to do what he’s

doing today if it had not been for those experiences...I've been in this business now for twenty-five years or so, and I don't think I've ever seen that kind of a metamorphosis so quickly with anyone else."

An IT staff member at a TCU said of his experience doing Campus Visits:

"I learn so much. I really enjoyed this [multiple-school] visit because you get to see how the other schools are using their technology and there's some instances where they're using something that we're not ...and it was like, "Hey, you know, I could try this here at our university." They were great. You know, I can't say it enough. I learned so much, especially in this last trip. I wish I could have gone to more."

3.2.4 AN-MSI provided intensive professional development in both technology and cultural diversity for many individual participants.

Helping to conduct the AN-MSI consulting visits is just one of many ways that individuals participating in the program developed their professional knowledge and skills. The majority of interviewees commented on how much they learned about the latest technology and the IT solutions at other schools by attending AN-MSI's meetings, conferences, and workshops, and by receiving posts on the AN-MSI listserv. A participant who came to multiple AN-MSI meetings and participated in several AN-MSI projects described it as an "intensive professional development experience, because you come back to it again and again." In this respect, AN-MSI produced benefits well beyond that of any single workshop or annual conference. Interviewees from every community gave examples of things they had learned at AN-MSI meetings that had greatly influenced the IT decisions and developments on their own campus, from discovering a cost-effective means of wireless connectivity, to finding ways to monitor network security, to getting involved in high performance computing. The opinions of numerous participants were reflected by an interviewee who said, "Without going to those AN-MSI meetings, I never would have heard of that. Or at least it would have taken me a lot longer to find out about it." As an administrator at an HBCU said, attending AN-MSI meetings put her and her fellow attendees "in the mainstream as far as tech issues are concerned...It taught us what questions to ask...and exposed us to ideas, organizations, and conferences that we didn't know about before."

An equal number of interviewees talked about the enriched understanding of cultural diversity that being a part of AN-MSI had given them, calling it "a real educational process" that gave them "an appreciation for other people's situations." Every year, interviewees from the program commented on the personal rewards of learning about other cultures and getting to know people outside their own institutional context. These interviewees placed a high value on the sense of community that had formed between AN-MSI participants of diverse backgrounds and emphasized the importance of being able to talk openly about their institutions' similarities and differences in order to come to consensus on shared goals. As a number of interviewees articulated, this intensive exposure to other cultures was not only personally rewarding, but professionally instructive. As one interviewee who had participated in many AN-MSI consulting visits said:

"I think the greatest impact is having three minority communities working together, and I think that's been a learning experience for all three, or all four, if you count those from majority organizations...The idiosyncrasies of all three communities or four communities come into play. I think the diversity knowledge is a key element which has never been really brought up. I gained an enormous amount from that. I mean, I've been in enough diversity training programs in my career, but it wasn't until I got involved in this that it was really the practical application of diversity training and knowledge—gaining more knowledge about the nuances. Because all of these communities are different. Different priorities and different styles. So I think that was one of the major outcomes. And I don't think they were looking for that from the outset."

3.3 The benefits of AN-MSI as rated by survey respondents

In a survey conducted every May, AN-MSI meeting attendees over the previous year are asked to consult a list of potential benefits from the program and rate each as “not a benefit I have experienced” (0 points), “a minor benefit I have experienced” (1 point) or “a major benefit I have experienced” (2 points). Table 2 shows how survey respondents rated the program’s benefits in May of 2002—about one year after most of AN-MSI’s key projects had moved into their implementation stage. I present this table to give the reader a more comprehensive sense of the benefits that AN-MSI participants have experienced.

Table 2: Benefits of participating in AN-MSI in 2001-02 (N = 42) Rating scale: 0 = not a benefit of AN-MSI; 1 = a minor benefit; 2 = a major benefit	% who rated as benefit	Mean rating (0-2)
Networking with IT people at MSIs within my community	95%	1.70
Networking with IT people from other MSI communities	97%	1.69
Getting funding to attend IT-related meetings	92%	1.66
Coming to understand the similarities and differences between ethnic communities	97%	1.64
Coming to understand the similarities and differences between MSIs	92%	1.59
Being part of a diverse community of IT professionals pursuing common goals	92%	1.51
Expanding my own knowledge of IT-related issues	85%	1.50
Being on a listserv that allows me to post and receive IT-related info and project updates	97%	1.39
Helping to expand others’ knowledge of IT-related issues	85%	1.36
Having greater MSI visibility and leverage within government and majority organizations	82%	1.34
Collaborating with AN-MSI participants from other institutions on IT grants or initiatives	72%	1.21
Educating people on my campus about IT-related needs and how to address them	78%	1.14
Getting information about technology initiatives and funding opportunities	76%	1.14
Educating government and corporations about the IT needs of MSIs	74%	1.13
Getting training in IT through workshops sponsored by AN-MSI	67%	1.06
Getting funding to spend my time working on community-wide technology initiatives	51%	0.81
Getting AN-MSI funding for technology initiatives that directly affect my campus	46%	0.69

4. Lessons learned through the administration and evaluation of AN-MSI

After four years of developing and refining a national IT collaboration across three diverse communities that had been woefully underrepresented in past IT efforts, the administrators and evaluators of the AN-MSI program have gained a unique and valuable perspective on the challenges, rewards, and essential elements of such a collaboration. We arguably know more than anyone about how to create worthwhile collaborations between institutions that differ in size, ethnicity, budget, and mission. It stands to reason that using this knowledge and building upon the foundation that AN-MSI has already laid would be the most efficient and cost-effective means of working with MSIs to address the digital divide issues that still exist. What follows are a few of the key lessons we have learned through our work with AN-MSI. I should note that many of these lessons echo what I have learned in evaluating another of the NSF’s large-scale, national collaborations in technology: the Education Outreach and Training programs of the Partnership for Advanced Computational Infrastructure, which the LEAD Center has been evaluating since 1997.

4.1 Many MSIs are still lacking in the staff expertise, IT equipment, and network connections they need to be competitive with majority institutions. Despite rumors of its demise, the “digital divide” still exists for many of the small and medium-sized MSIs within all three minority

communities, as AN-MSI's on-site network assessments of 48 MSIs nationwide made clear. Training for IT staff is an important need, and many small campuses have only one IT person to support all of their network and desktop needs. Most of the MSIs visited did not have a campus-wide strategic plan, much less one that included IT, and many did not have an annual budget to meet their IT needs, with the money for IT improvements coming from piecemeal grants. Few campuses had a CIO, and fewer still had network management capabilities. Not surprisingly, security is a low priority on most campuses, and almost all have had problems with viruses and intrusions. Remedies for these problems were suggested in the consulting teams' reports, and AN-MSI's projects and workshops helped in addressing many of these issues, but so much more remains to be done. Without consistent funding for IT improvements, training, and professional development, many MSIs nationwide will continue to lag behind majority schools in preparing their students for the 21st century job market. Given the growing number of minority students in the U.S. population and the decrease in their access to majority institutions, this lack of IT competitiveness has ramifications for the entire nation.

4.2 Diverse, large-scale collaborations take time and patience to develop. Although the stakeholders in any program like to see quick, concrete results, large-scale collaborations like AN-MSI often take years to develop, much less to produce quantifiable impacts. Before group priorities can be established and collaborative projects launched, trust must be developed between the participants through *face-to-face interaction* and open, sometimes difficult discussions. Because AN-MSI's funding started with few administrative personnel and no collaborative history in place, the program had to build its membership and its common goals from the ground up. Most of the efforts that were launched through AN-MSI have just begun to bear fruit in the last two years of the program. Because of this slow but necessary developmental process, the full potential of AN-MSI's collaborative efforts may not be realized for several more years. It should be noted that the EOT-PACI program, which is considered by many in the NSF to be a model for successful national collaboration, had a similarly slow start to its collaborative efforts, followed by exponential gains that built upon one another in years three through six.

4.3 A sense of community ownership and accessible, responsive leadership are essential to the long-term stability of, and participant satisfaction with, large-scale collaborations. For collaborative efforts like AN-MSI to persist, all partners and communities need to feel like they have a voice in the effort and the ability to influence how the program is administered. This requires that they have knowledge of what is occurring and how decisions are being made, opportunities to express their opinions and concerns, and leverage with regards to program funding. They need administrators who are open about their agendas and constraints, accessible to input and criticism, and able to communicate well with those who have different agendas, needs, or communication styles. AN-MSI has suffered from its own lapses with regards to open and culturally-sensitive communication from leadership and clear accountability from administrators and project leaders, but evaluation data and group discussions that brought these issues to light eventually resulted in positive changes in both areas.³ In the final round of interviews, a number of interviewees emphasized the need for even greater community leadership and ownership in the ongoing organization that many hope AN-MSI will become.

4.4 Peer-to-peer consulting like that used by AN-MSI has significant advantages for both the consultant and the recipient. Most of the interviewees emphasized the tremendous value of

³ See Foertsch & Clifton (2002)

getting IT advice from knowledgeable peers at other MSIs. This advice came through presentations at AN-MSI meetings, campus consulting visits, and informal consultation by phone. They discussed the drawbacks of trying to get IT advice from vendors who want to sell them a particular product, or high-priced consultants who are accustomed to working with large majority schools and who do not understand MSIs' institutional constraints. The campus consulting visits were considered invaluable by a number of recipients. And, as discussed in section 3.2.3, IT staff from all three communities who acted as consultants felt that they received a tremendous professional development opportunity: Some gained knowledge about IT that they were able to take back to their own institutions; others learned how to work more effectively with people from other ethnic communities and institutional contexts. As a result, AN-MSI's peer-to-peer Campus Visits simultaneously addressed two of the MSIs' greatest needs: reliable advice on how to improve IT networks, and professional development for IT staff.

4.5 Centralized funding for administrators, community leaders, and grant writers is essential in organizing and supporting collaborative efforts. Over time, AN-MSI's administrators and participants learned the importance of using program funds to pay MSI representatives full-time or part-time to serve as Community Leaders, grant writers, project leaders, and project consultants. Many interviewees stressed that the program's group efforts would not have been able to get off the ground without qualified individuals being paid to do the work that collaborative efforts require. AN-MSI learned from experience that too many of the IT staff at MSIs are too busy with their own campus responsibilities to spend much time on these group efforts otherwise. As a number of interviewees pointed out, the program's initiatives progressed much more quickly after a grant writer, PR consultant, and campus visit coordinator were hired.

4.6 Broadening participation in project administration can reduce some of the problems that arise with more "streamlined" administrative structures. In a diverse collaboration like AN-MSI, where a white Program Director has been given the ultimate authority to make decisions that affect minority communities and institutional contexts that he may know less about than the administrators he is working with, it is often unclear if the objections that a single administrator raises to a course of action are objections that most of his or her constituents share. It is a problem that comes into play whenever one assumes that all members of a particular group think alike and want the same things, as we too often do in the case of minority groups. In fact, although there were definitely differences of opinion between the ethnic communities of AN-MSI on certain matters, there were also plenty of differences of opinion *within* communities. As a result, no one person could adequately speak for the entirety of their "group," even when that was what they were called upon to do. The solution to this problem, which has evolved over time and been written into AN-MSI's proposed organizational structure for the future, is to broaden participation in program administration and increase the number of persons and voices that are selected to represent a given group, whether that be a project committee or a community. This way a broader diversity of viewpoints is represented, and program administrators can get a more accurate sense of what the priorities and opinions of a large and diverse group of constituents truly are. In short, with voluntary and diverse collaborative efforts where many participants have competing agendas and outside demands on their time, there are distinct disadvantages to using "streamlined" administrative structures where a small number of individuals are given the bulk of responsibility for representing and producing the outcomes for a large and diverse group. Increasing the number of voices at the table—and the number of hands doing the work—alleviates this problem.

4.7 There is a need for a collaborative organization that bridges all three MSI communities. The vast majority of interviewees emphasized the importance of the three communities continuing to work together to meet their mutual needs in IT. Many offered examples of how the program efforts in another community supported or guided the IT efforts on their own campus. Most interviewees felt that MSIs would have a stronger voice in IT if they spoke as one and greater development in IT if they continued to share ideas and leverage resources with one another. Interviewees from both this year and last year emphasized the sense of unity and common purpose that the AN-MSI project has fostered. Many participants feel that the communities have far more to gain by working together and presenting a united front than they do by working as separate institutions or communities, as they have in the past. In addition, majority institutions, government agencies, and private corporations who wish to work with MSIs in areas of IT now have a single, national organization that reaches all three minority communities at once. Majority organizations who have repeatedly asked, "How can we partner with minority serving institutions in a way that will have the most impact?" now have somewhere to turn.

5. Future potential of the AN-MSI program

After August 2003, when the original four-year grant for AN-MSI has ended, AN-MSI hopes to continue as an IT organization separate from EDUCAUSE, as outlined in the proposal currently being circulated. The question remains as to how this organization will fund its critical MSI-focused activities, services, and product development between the end of its NSF grant and the three or so years it will take to become self-sustaining. It is the program participants' hope that the NSF will recognize the tremendous potential of the AN-MSI program to assist MSIs nationwide in improving their technical and human infrastructure enough to remain competitive with majority institutions and to participate in the cutting-edge scientific and technical developments of NSF programs like Cyberinfrastructure. The need for a cross-community, minority-led organization that serves the considerable IT needs of the nation's MSIs cannot be underscored enough, and AN-MSI has come further than any other group in developing that organization. With the growing number of minority students in our nation's schools and the continued dearth of minorities in the scientific and technical fields that drive our nation's economy, fostering well-trained IT staff, well-equipped IT researchers, and well-developed IT infrastructures at the MSIs that produce the bulk of our nation's minority graduates should be a national priority. As NSF Director Rita Colwell asserted in her March 13, 2003 interview for Black Issues in Higher Education, "We have to ensure that [HBCUs] have the environment, the facilities, the equipment, and the inspired teachers so that education is highly competitive and can entrain students into careers" (p. 25).

While groups like EOT-PACI have done well at encouraging more MSIs to participate in the high-performance computing that the NSF generally favors, many of the schools served by AN-MSI need the IT strategic planning, campus assessments, IT staff development, infrastructure improvement, and human networking that AN-MSI provides before they are even capable of working on high-performance computing. As an evaluator who has observed both efforts, I am concerned that if the NSF and others don't continue to fund more basic IT improvements and staff development at MSIs, there will never be a sufficient number of MSIs capable of taking full advantage of Cyberinfrastructure. By building upon the efforts of AN-MSI, the NSF can greatly broaden the pool of students and researchers ready to use advanced technologies in the years to come.