Navajo Technical University Technology Plan

Introduction:

Navajo Technical University's (NTU) spacious campus is situated on the eastern edge of the Navajo Nation in Crownpoint, New Mexico. Campus facilities are designed to blend in with the Chaco Canyon area's mesa's and high plateau ranges.

At its 1979 inception as the Navajo Skill Center, the school attempted to meet the immediate needs of an unemployed population. Students enrolled here quickly learned the rudiments of a trade, graduated, and joined the workforce. It soon became clear that the students wanted more. Prompted by the school's expanding mission, in 1985 the Board of Directors changed the Skill Center's name to Crownpoint Institute of Technology (CIT). By Executive Mandate in 1994, CIT was designated a Land Grant college; this status has led to rapid expansion of the school's facilities and services as well as to its increasing influence in the academic community. In November 2006, the Navajo Tribal Council approved the Board of Trustees request to change the name to Navajo Technical Univeristy (NTU).

NTU developed swiftly into a respected technical-vocational tribal college, and now University, that addresses the continually changing requirements of its students. The Institute offers a broad selection of certificate and degree programs, each designed to prepare students for entry into careers and further education. Our graduates' professional and academic success is living testimony to the quality of their education at NTU.

Vision:
Our vision is to continue to develop the Campus Wide Technology Infrastructure in support of the Navajo Technical University Academic Mission. By providing a common level of technology and technology services across the campus of Navajo Technical University, the Information Technology Department is better positioned to address Navajo Technical University's Academic objectives.

Information Technology continues to have a growing impact on Navajo Technical University Computing Systems and all higher education institutions. Faculty use information technology to provide students with new educational resources that enhance teaching and learning. Faculty also uses information technology to support their research by having access to more information resources and researchers worldwide. Students can access instructional materials and information resources from anywhere technology is in place. Administrators have easier access to information to allow them to better make decisions and provide support for faculty, staff and students.

Executive summary:

Technology is a tool that enables faculty, staff and administrators to work more productively, offering solutions for time management, student monitoring and intervention, and more interesting and effective lessons and classroom activities. Technology is a tool that enables students to interact with and explore the world, bringing a wealth of information and experiences into the classroom, thus potentially overcoming geographical isolation, physical barriers, and economic hardships. Technology is a tool that encourages student creativity and self-direction and helps students develop skills that prepare them for responsible citizenship within the nation and world. Ultimately, technology is a tool that helps every instructor and student to be successful, encouraging mastery of basic skills and development of critical thinking and problem-solving abilities. Technology can be a support tool to reinvent schools so that all students achieve more and are better prepared for the workplace. Recent studies are showing that students with exposure to computers are doing better academically than their peers that do not.

Safety:

The advent of technology has increased the potential for creating a safe environment for teaching and learning. A technology infrastructure that includes integrated security and protection systems, such as telephones in every classroom, warning devices, and monitoring cameras, protect individuals and the facility itself. The real benefit of technology in a safe and orderly educational environment, however, is in the resources it brings into the classroom and school library media center. Because technology opens doors to the world while simultaneously

focusing students on the task at hand, student interest and motivation are heightened while discipline problems decrease. When students are motivated and successful, they tend to work harder and longer, raising the possibility of higher student achievement. This success fosters a culture in which learning is the expectation and ultimate goal.

Quality of Faculty, Staff and Administrators:

Because technology increases productivity, brings world-wide experience and expertise into the classroom, and stimulates interest in learning, it is the ultimate tool in the professional educator's capabilities. As such, it offers a variety of tools that help decrease the time spent on paperwork, thus increasing time available to spend with students. Access to the Internet and research networks through high speed and high capacity internet connections offers endless opportunities for professional development, educational research, and up-to-date curriculum resources. With tools such as Interlibrary Loan, Jenzabar, JICS, MOODLE and Accuplacer, instructors, administrators, and staff have complete access to a variety of information that allows them to track individual progress and mastery of skills, develop institutional strategies, develop and enhance skill sets, and policies that assist in that mastery; and ultimately create a quality, data-driven environment that affects high student achievement.

Community:

Technology is the ultimate vehicle for communication with the community. E-mail, hybrid electronic learning tools and telepresence in every classroom, and school resources electronically available throughout the community allow and encourage local governance at the community chapter level and distance learning participation. The highest level of student achievement occurs when schools, and community organizations work together. (Dede, 1998). With technology, the school and its values of learning and achievement can enter every home in a community, thus enhancing and extending teaching and learning to every individual regardless of age or socioeconomic status.

Community Relations:

- Navajo Nation Cyber Team
- The Navajo Nation
- Crownpoint Chapter planning
- Eastern Navajo Head start planning
- Internet to the Hogan / Dine' Grid

Operation:

Technology is an infrastructure, a seamless network of wires, equipment, Applications and personnel that supports Navajo Technical University's goal to realize the benefits of a technology-rich environment that enhances teaching and learning through individual outcomes of increased productivity and more efficient time management.

Distance learning, brought into the classroom via the Internet through copper cables, fiber optics, wireless radios or even satellite feeds, also allows students to complete University courses. With adequate technical support within NTU's educational system, instructors, staff and administrators can focus on the important aspects of instruction, rather than on the wires applications and hardware.

Professional Development:
Professional development in an educational environment is very important for the development of its constituents. Every modern proposal to reform, restructure, or transform schools emphasizes professional development as a primary vehicle in efforts to bring about needed change. (Guskey, 1994)

The probable benefit that students can derive from the combination of technology in the classroom requires that NTU instructors, staff, and administrators become trained and updated in technology use on a bi-annual basis. Staff development should be available to all instructors, staff and administrators at the point of need, anytime, anywhere, any place. The gaining of knowledge and the combination of skills must be ongoing. To keep up this lifelong learning, the observation of peers in the teaching profession who integrate the technology successfully in the classroom is particularly beneficial to instructors. Observation of students using educational technologies is equally beneficial.

Support from administrators is paramount to success in training. Administrators are in a position to provide time and resources for training. Administrators' beliefs that training and the subsequent use of educational technologies in the classroom will make a difference in the classroom will carry over to the instructors. Without that belief, efforts to integrate technology into the classroom will be limited by the individual instructor's ability to maintain change and gain resources.

Infrastructure / Connectivity:

Although NTU's IT department has created a WAN and LAN, and uses an Internet Service Provider to support administrative and instructional technology applications, more development of the LAN must occur to fully integrate technology into the computing environment of NTU. A more robust infrastructure will improve reliable Internet access and data transmissions for instructional purposes and passing of research data between partners.

Network:

Progressively and Systematically Increase Network Bandwidth
Usage of our fiber-optic and wireless campus backbone is increasing every day. More and more data processing, communications, and application access are being conducted over the network. We see this significantly increasing in the future as more and more peripherals are made to work

on the network.

We increase the bandwidth of our network backbone to the next acceleration level to try to stay ahead of the demand in some systematic way. We have converted our multi-mode fiber to single-mode fiber so we can establish a higher network backbone speed for all users on campus.

Connectivity to the school building is only the initial link to the world. It also must extend to the classroom. This connectivity, better known as a Local Area Network, allows instructional and administrative computers to access remote databases, data storage, datasets, point cloud data and applications, both within the building and to the outside world.

Currently, NTU's LAN connects workstations, storage devices, personal computers, mobile computers, virtual compute nodes, IoT devices, and printers. Each node (individual computer) in NTU's LAN has its own CPU with which it executes programs, but it also is able to access data and devices anywhere on the LAN. NTU users can share devices, such as printers, computer nodes, and data. Users can also use the LAN to communicate with each other, by sending e-mails or engaging in collaborative application sessions.

The current LAN uses a star bus topology and a peer to peer protocol. Progress has been made in to create a single-mode fiber optic 10 Gbit/second FDDI campus backbone network that currently connects 35 buildings that are internally wired. There is one building, our Veterinary school, connected to the fiber optic LAN over unlicensed wireless microwave. Intermediate plans are to upgrade the unlicensed wireless microwave system to a licensed system that will provide 10 Gbit/second throughput . Future plans are to interconnect the building and main LAN over single-mode fiber optics. NTU has outlying buildings that since been connected over single-mode fiber optics.

The campus network, which now includes about 800 nodes, now uses Category6 and 6A cable from access equipment back to wiring closets. Within building backbones are single-mode fiber optics.

The upgrade of the current backbone to a more robust 10 Gigabit TCP/IP protocol has provided the capability for higher resolution videos, interactive collaboration systems, transfer of big data and VoIP. All the data related traffic traverses the dedicated data network and the voice system has been allocated its own network infrastructure. Current network expansion plan will include enhanced wireless broadband facilities for off-campus access, complete the migration to the "AC" standard to enhance the campus WIFI, provide more single mode fiber optic to satellite facilities, SSO network authentication, and virtual software servers to support a distributed computing environments

Viruses are software programs that are intentionally designed to attach themselves to other computer files so when the original computer file is executed, the virus replicates itself. These viruses can also perform some destructive action, like erasing files. Even non-destructive viruses can produce some harm by consuming system resources, reducing CPU speed, or otherwise reducing the efficiency of your computer. It is estimated that PC Viruses cost businesses

approximately $55 Billion in damages in 2003. The same calculations were done in 2002 and 2001, at $20-30 Billion and $13 Billion, respectively (Trend Micro, 2004).
Every anti-virus prevention program always starts with step 1: Get protected with anti-virus software and step 2: Keep your anti-virus software updated.
An Academic site license for Palo Alto Traps and Malwarebytes were purchased to function as NTU's Anti-virus software packages. The anti-virus software packages are made available to all faculty and staff computers and loaded on all departmental lab computers. Open source Antivirus software is provided to students that have no computer protection.

Servers and Services:

NTU currently operates its campus enterprise resources platform (ERP), Jenzabar, off campus and in the cloud. Jenzabar provides NTU a secure remote desktop/server access from their reliable pool of server farms distributed across the US. Other modules that access the Jenzabar database are housed on a virtual machine and securely accessible over the open Internet. This gives NTU the capacity to operate even when the regional interconnects malfunction.

NTU currently operates its campus learning platform (CLP), Moodle, off campus and in the cloud. eThink Education provides a secure web accessible platform from their reliable pool of server farms distributed across the US. This gives NTU the capacity to operate even when the regional interconnects malfunction.

NTU currently operates its campus E-Mail system through the free Google for Education infrastructure. At its core, Google for Education not only provides the simple email commination

Currently, we are developing a local file storage and collaborative system that addresses data storage for both campus employees and students. With the development of a client/server network the use of RAID 5 direct attached storage will be used. RAID 5 results in excellent performance and good fault tolerance. Level 5 is one of the most popular implementations of RAID.

To address future needs the IT department will look into the implementation of a SAN or iSCSI system. While a RAID 5 direct attached storage configuration is sufficient while the college has only a few packaged applications, the scalability limitations of a direct-attached configuration will become increasingly evident as new applications are added. Over time, however, this arrangement will prove unwieldy. As user files begin to grow, it will become a constant challenge trying to stay ahead of the curve.

Network servers / specifications:

Public Server:

Web server

DNS cache server
DNS authoritative server
Moodle
Microsoft App Server

Protected Servers
VMware Virtual Center Server
Program specific servers

Firewall: Palo Alto Appliance and software
has pioneered the next generation of network security with an innovative platform that allows you to secure your network and safely enable an increasingly complex and rapidly growing number of applications. At the core of this platform is the next-generation firewall, which delivers visibility and control over applications, users, and content within the firewall using a highly optimised hardware and software architecture.

Network The Network core is configured with a switch stack of Brocade ICX 7750 core switches. The core system then interconnects distribution switches that comprise of Brocade/Ruckus 6000 series and 7000 series equipment. From the distribution layer we interconnect Ruckus 7000 series access layer switches so end systems can gain access to the campuse's WLAN, LAN, and WAN.

The American Registry for Internet Numbers (ARIN) approved a /22 public IP scheme for Navajo Technical University. This grants us 1024 public IP addresses that we plan to subnet for campus and community connectivity. We have implemented Virtual local area networks (vlans) behind the firewall system. This structure virtually segments programs, staff and students.

Phones:

Mitel VoIP telephone platform: Campus phone service is upgraded to digital which is both more reliable and of higher quality. This solution is designed to offer the campus superior telephone service and call handling capabilities. In addition it will provide voice mail and auto attendant for all employees. After hour and busy extension messaging will offer the incoming caller options to leave a message or to transfer to a cell phone or pager. Modular and scalable, the Mitel VoIP system utilizes a cloud enable call processing system. The Mitel VoIP system will enable the IT office to simply plug phone hardware in where wired connectivity is available. Wireless solutions are being explored.

Academic Technology

Laptop Program

Still exploring the option to Institute a program in which each incoming student is issued a laptop. This is being done at many institutions with good results, and might prove to be an effective strategy for enhancing student performance at NTU.
The experience for the student can certainly increase his/her marketability in a world that is becoming more technology and knowledge oriented every day.
Implement a pilot program for Laptops to be issued that will include a small segment of faculty and students. The Laptop initiative would encompass not only laptop computers but other computing platforms appropriate for students in residence halls and off-campus residences. It could also include wireless environments for laptops, as well as fixed environments for desktop computers. Based on positive findings of the pilot program, then a more thorough, but phased, implementation would begin. Faculty would also have a choice of laptop or desktop - the one best suited for their needs.

Support Academic Departmental Computer Labs:

Departmental computer labs need help in terms of technical support, acquisition of hardware and software, and staying current with the hardware and software technology. Our departmental labs run the whole range from vastly outdated to somewhat state-of-the-art with most falling on the far side of currency. In some cases, departmental computer labs were created with computers that were being discarded and were out of date the day they were created.
Finally, there are no standards for the creation, maintenance and operation of departmental computer labs.

The implementation would be that the two year old computers being recycled out of the open student computer labs be refurbished - upgraded, cleaned and sanitized and placed in the departmental labs and that an IT Department budget is created to support this refurbishment. Under this scheme, no departmental lab will receive a computer that is more than 2-years old. Additionally, an academic technology advisory group consisting of representatives of each of the academic departments and IT department be formed to deal with the approval of the formation of new departmental computer labs and the recycling of computers into existing departmental computer labs. This group will also decide on the guidelines for the formation of new departmental computer labs to include funding for acquisition of hardware and software, on-going technical support, and continued operations support. This advisory group will also determine a departmental lab per-station assessment to be made on an annual basis that will be used to fund the appropriate type and level of technical support that may be requested by the departmental computer labs. Finally, that a line item budget be created for the funding of departmental computer lab acquisition of software licenses through the IT Department.

GOALS:

To provide a technology infrastructure at NTU that gives advanced capabilities to students,

faculty, and staff.

To increase the computational resource capability on NTU's campus in support of experiential online teaching, classroom instruction, collaboration with other institutions of higher learning and educational & government agencies, science, technology, engineering and math research projects, thus ensuring NTU is a leading college in computation and education in the Southwest.

To develop an advanced connectivity model for the Navajo Nation by connecting the Eastern Agency in a way that eliminates the digital divide and provides opportunities for citizens and communities on the Reservation and border towns in E-learning, E-government, E-commerce, and public safety.

To develop a state of the art E-learning environment at NTU that will enable the delivery of degree programs, basic skills development, and continuing education opportunities to Dine communities and individuals, thus increasing the availability of education opportunities.

To develop a cyberinfrastructure at NTU designed to support information technology, educational technology, economic development, advanced health technologies, planning technologies, cultural technologies and collaboration technologies.

To build a support infrastructure for individuals, communities, and education that advances the effective use of technology at NTU and on the Navajo Nation.

To develop projects and opportunities for high school and elementary school students designed to give them computational enabled experiences that can lead them to careers in STEM.

To develop at NTU the capacity to participate in computational science and cyberinfrastructure research on a global scale.

To develop an advanced Navajo computational cyberinfrastructure workforce through the development of tuition, education, and internship programs.

Goal I: To provide a technology infrastructure at NTU that gives advanced capabilities to students, faculty, and staff.

Step 1: Space/Environment:

Activities	**Timeline**	**Potential Funding Source**
Cool down current server room	8/15/05	NASA
Build Technology Building	9/01/09	USDA
Build full Cyberinfrastructure Lab	01/01/22	USDA, DOD, Title III, HUD, Earmark

and Center, adding to Technology Building		

Step 2: Stabilize and Develop Operational Technology Environment:

Purchase and install fiber optic switches for the Empowerment Center	7/30/05	Empowerment Center funds
Install, Activate, and Maintain all Data and Voice systems for Dine Family Empowerment Center	8/30/05	Empowerment Center funds
Install, Activate, and Maintain all Data and Voice systems for Renovated Student Services Building	8/30/05	Operational funds
Install Fiber Optic cabling to Renovated Student Services/ Instruction Building	1/1/10	Operational funds
Reintroduce all work stations back to domain, increasing the stability of the network/client server environment	9/30/05	Operational funds
Implement the System Management Service, creating centralized management capability for the network/client server environment	10/30/05	Operational funds
Complete setting up Zimbra server for improved email service to staff and students	03/15/09	Operational funds
Build functioning web server	12/30/05	Operational funds
Research and upgrade sonic wall security features	Ongoing	Operational funds
Acquire OC3 and become members of Lambda Rail/Internet2	12/01/07, Dependent on other agencies, time may slide	Imbed costs in multiple grant proposals

Implement DS3	Dependent upon negotiations with other agencies	Operational funds, costs imbedded in multiple grant proposals

Step 3: Improve Operation of Current Wireless Networks:

Research and address directional signal problems caused by metal buildings and faulty set-up of the wireless antennas	10/30/05	Operational funds
Set up temporary directional antenna to the Renovated Student Services and Instruction	8/30/05	Operational funds, Instruction, Student Services
Purchase and install new radios for the veterinary clinic, improving actual throughput and stabilizing connectivity	8/30/05	Veterinary Clinic
Move the omni to the veterinary clinic, giving ability to roam computers outside of classroom	8/30/05	Operational funds

Goal II: To increase the computational resource capability on NTU's campus in support of experiential online teaching, classroom instruction, collaboration with other institutions of higher learning and educational & government agencies, science, technology, engineering and math research projects, thus ensuring NTU is a leading college in computation and education in the Southwest.

Step 4: Build Blade Cluster (4 Machines):

Master the theoretical knowledge of cluster environments and how to build them	Ongoing	Operational funds
Purchase Four Blade Computers and an IBM Blade Center Cabinet and a SAN Cabinet with a terabyte of storage to construct a cluster	8/15/05	IT budget/NSF TCUP funds
Set up the cluster to handle multiple	Ongoing	Operational funds/IT budget

platforms simultaneously (virtual infrastructure), providing increased redundancy, speed, and stability for operational environment, creating a scalable and endlessly expandable infrastructure		
Port applications to the cluster to serve the campus, e.g., fileservers, web server, Exchange server, active directory server, CISCO works server, etc.	Ongoing	IT budget
Provide the platform for other advanced technologies, e.g. Wireless e-learning, geowall/visualization, Access Node, etc.	Ongoing	Operational funds/NASA/NSF funding to be secured
Install meta-data structure to handle multiple databases on the cluster for the purpose of supporting data mining and advanced research applications	Ongoing	NASA/NSF funding to be secured
Start building virtual labs and other tools designed to support STEM student/faculty research projects within the cluster environment	5/15/07-Ongoing	NASA/NSF funding to be secured
Build a physical lab designed to provide NTU students with skills/knowledge related to cluster and other advanced technologies	12/1/09	USDA, HUD, Title III, Earmark

Goal III: To develop an advanced connectivity model for the Navajo Nation by connecting Eastern Agency that eliminates the digital divide and provides opportunities for citizens and communities

on the Reservation and border towns in E-learning, E-government, E-commerce, and public safety.

Step 5: NTU Wireless infrastructure by:
Providing broadband data/voice over IP connections to Crownpoint
Demonstrating the effectiveness, practicality, and usefulness of the technology
Developing a testbed to allow mastery of wireless technology on campus
Provide a wireless solution that can serve as a model to the Navajo Nation
Building an experiential wireless educational environment for IT students

Work with Hans Werner Braun and the Tribal Digital Village Network to master installation skills for the construction of a wireless grid	12/15/05	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA and timelines will slide
Complete spectrum and engineering analysis at NTU	12/15/05	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Order a more advanced towers, radios, directional antennas, and omni for the campus and its buildings	1/30/06	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Acquire two additional IT employees	2/1/09	Lannon Foundation, NSF, Earmark
Install NTU grid hub and test bed	4/30/09	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Achieve necessary permissions from Crownpoint Chapterhouse and the Navajo Nation Telecommunication Regulatory Commission (NNTRC) to install radios to model wireless grid project	12/30/05	Operational funds
Order radios, directional antennas, and omni for Crownpoint chapterhouse	1/30/06	DOD, Title III grants pending—if they do not succeed this will require

		funding from NSF, Earmark, NASA
Install and calibrate radios, directional antenna, and omni for Crownpoint chapterhouse	4/30/09	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Begin developing agreements with public safety organizations, Indian Health Service, the Tribe, forestry agencies operating on the Nation, universities, and others to provide services of use to the Navajo people and research that can utilize both the cluster and wireless capabilities of NTU	4/30/06-Ongoing	Funding from tribal and federal agencies and through grant proposals

Step 6: Expand Wireless network to Eastern Navajo Agency:

Achieve approval from NNTRC for wireless grid to be located for the following chapterhouses: Dalton Pass, Standing Rock, Becenti, Little Water, White Horse, Ricon Marquis, Smith Lake, Mariano Lake, Casamero Lake, Pinedale, Baca, Thoreau, Iyanbito, Churchrock, and Pueblo Pintado	3/15/06	Operational funds
Achieve approval from all the above chapterhouses for wireless grid installation	5/15/06-Ongoing	NSF TCUP/IT Budget
Achieve approval for wireless grid from the General Service Resource Committee	6/15/06	Operational funds

Complete spectrum and engineering analysis at each site	3/15/06	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Develop co-locating agreements with tower owners	6/15/06	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Develop environmental and cultural preservation studies for tower locations	8/15/06	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Build three towers	1/30/07	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Order radios, directional antennas, and omnis	1/30/07	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Install and calibrate radios, directional antennas, and omnis at all locations on the wireless grid	12/15/07	DOD, Title III grants pending—if they do not succeed this will require funding from NSF, Earmark, NASA
Create software infrastructure for managing and implementing the wireless grid	1/15/07-Ongoing	DOD, Title III grants pending—(other resources will be needed) if they do not succeed this will require funding from NSF, Earmark, NASA
Create the security infrastructure for managing and implementing the wireless grid	2/15/07-Ongoing	DOD, Title III grants pending—(other resources will be needed) if they do not succeed this will require funding from NSF, Earmark, NASA

Test and maintain the grid as each element comes online	5/15/09	DOD, Title III grants pending—(other resources will be needed) if they do not succeed this will require funding from NSF, Earmark, NASA
Begin developing agreements with public safety organizations, Indian Health Service, the Tribe, forestry agencies operating on the Nation, universities, and others to provide services of use to the Navajo people and research that can utilize both the cluster and wireless capabilities of NTU	5/15/09	Funding from tribal and federal agencies and through grant proposals

Goal IV: To develop an advanced E-learning environment at NTU that will allow the delivery of degree programs, basic skills development, and continuing education opportunities to Dine communities and individuals, thus increasing the availability of education opportunities.

Step 7: Build a NTU Web Site meets higher education standards

Hire a qualified WebMaster	7/30/05	NSF TCUP/Title III, or operational funds
Construct the web site with Common Style Sheet (CSS) and handicapped accessibility standards, supported by a full-featured document management system	7/30/06	NSF TCUP/Title III, or operational funds

Step 8: Implement the Indigenous Knowledge Management System (IKMS) in partnership with the Smithsonian Institute's National Museum of the American Indian (NMAI), other tribal colleges, and the World Indigenous Nations Higher Education Consortium (WINHEC).

Train on the installation and use of the IKMS	11/30/05	Title III if funded, NSF cyberinfrastructure grant possible

database and security system		
Install and set up system	12/15/05	Title III if funded, NSF cyberinfrastructure grant possible
Work with NTU's cultural staff and NMAI to develop procedures and processes for populating the database	5/30/06	Title III if funded, NSF cyberinfrastructure grant possible
Populate database with initial local and NMAI collections	5/30/06	Title III if funded, NSF cyberinfrastructure grant possible
Work with NMAI and high school students to create virtual museum	5/30/06	Title III if funded, NSF cyberinfrastructure grant possible
Install metadata repository in partnership with NMAI, other tribal colleges, and WINHEC	7/30/06	NSF cyberinfrastructure grant possible, other NSF grants
Implement use of IKMS, virtual museum, and metadata repository	7/30/10	Title III if funded, NSF cyberinfrastructure grant possible, other NSF grants

Step 8: Build a NTU asynchronous learning environment (ALE).

Create the basic features of the ALE on NTU's website, e.g., bulletin board, online application, online enrollment, financial aid, email access, automatic testing, scheduling, Power Point online, sound, and animation, etc., tying into IKMS, AIHEC virtual library, NTU library, and metadatarepository systems	6/30/06	NSF TCUP, Title III if funded, NASA or NSF grants
Build a teacher's resource area, including gradebook software	8/30/06	NSF TCUP, Title III if funded, NASA or NSF grants

Complete initial ALE curriculum in Basic Skills, GED, and online courses	11/30/06	NSF TCUP, Title III if funded, NASA, NSF, or other grants
Build a gated discussion capability, online editing software for students and teachers, shared document editing and development capability, and other collaborative tools into the ALE	11/30/06	NSF TCUP, Title III if funded, NASA, NSF, or other grants
Launch first ALE classes	1/10/07	NSF TCUP, Title III if funded, NASA or NSF grants
Construct management tools for the ALE, e.g., tie-ins to student record and financial management systems	5/30/07	NSF TCUP, Title III if funded, NASA or NSF grants

Step 9: Build a NTU synchronous learning environment (ASLE).

Install java chat into the ALE	5/30/06	NSF TCUP, Title III if funded, NASA or NSF grants
Purchase and install computerized voice and motion with webcam	7/30/06	NASA or NSF grant
Install Access Node with multicast capability	7/30/10	NSF grant
Install haptics capability into the ASLE	7/30/10	NSF grant

Step 10:

Begin the process of acquiring, purchasing, and installing virtual hard science labs from National Computational Science Alliance labs and universities

Purchase and install virtual teaching labs in astronomy, chemistry, biology, physics, and the environmental sciences	7/30/10	NASA, NSF funding
Launch first hard science classes using virtual labs	1/10/10	NASA, NSF TCUP, Title III funding

Goal V: To develop a cyberinfrastructure at NTU designed to support information economy economic development, advanced health technologies, planning technologies, cultural technologies and collaboration.

Step 11: Construct a visualization environment for NTU.

Hire Mark Trebian as a consultant to help construct a mobile visualization unit for instruction	1/30/06	NASA, NSF grant
Construct mobile visualization unit	4/28/09	NASA, NSF grant
Hire a visualization specialist to develop curriculum, train high school, elementary school, and NTU instructors in the use of a visualization environment in the classroom, develop visualization projects	2/28/09	NASA, NSF grant
Work with CAD instructor, IHS, veterinary clinic, tribal planners, environmental science instructors, and teachers to identify projects for a geowall visualization unit in Room 333	4/15/06-Ongoing	NASA, NSF grant
Construct geowall unit, tied into the blade cluster	5/15/09	NASA, NSF grant
Begin instruction and scheduled projects at NTU using geowall	8/30/09	NASA, NSF grant

Step 12: Expand the cluster by four machines.

Purchase and install four computers to expand the cluster	4/5/07-Ongoing	NASA, NSF grant, IT budget

Step 13: Build a Data Center that can provide services to the Navajo community

Hire Data Management Specialist	2/1/07	USDA, Commerce, Labor economic development
Research NTU, Navajo Nation, IHS, chapterhouses, and businesses needs for data storage and mining	5/5/09	IT Budget
Install data management software and data mining systems	6/1/09	USDA, Commerce, Labor economic development
Begin Data Center operations	7/1/10	USDA, Commerce, Labor economic development, sales to local communities, governments, federal agencies, businesses

Goal VI: To build a support infrastructure for individuals, communities, and education that advances the effective use of technology at NTU and on the Navajo Nation.

Step 14: Set up non-profit corporation to manage wireless, Internet Service Provider, and data warehousing and management services to Navajo community

Set up non-profit corporation	7/1/10	Funds from wireless operations
Hire corporation manager with expertise in universal service e rate and technology management	7/1/10	Funds from wireless operations, data center

Step 15: Using the model developed by the University of Wisconsin—Milwaukee, set up a student internship program that provides NTU-wide support to users of the networks and campus software

Develop support training curriculum for interns	9/1/05	NSF TCUP
Hire at least four NSF TCUP interns	9/1/05	NSF TCUP
Develop phone bank, install incident reporting software in IT office	9/15/05	NSF TCUP
Complete training	10/1/05	NSF TCUP
Inform campus of new support service	10/1/05	NSF TCUP

Begin service, offering it to other agencies for charge over time	10/1/05	NSF TCUP, funds from other agencies

Step 16: Establish, in the new Cyberinfrastructure Lab, a business incubator that will encourage the development of entrepreneurial efforts in IT on the Navajo Reservation, allowing entrepreneurial use of the exceptional technology developed as a result of implementing this plan.

Develop a plan for the incubator that allows NTU to profit from successful technology transfer ventures while avoiding losses generated by unsuccessful ventures	10/01/10	USDA, Commerce, SBA
Work with DOD, NASA, and other government agencies to develop opportunities for entrepreneurs working in the incubator	11/15/07-Ongoing	DOD, NASA, SBRI, SBA, Commerce
Establish a physical space for the incubator in the IT Building	12/01/10	USDA, HUD, SBA, etc.
Begin incubator operations	3/01/11	USDA, HUD, SBA, Commerce

Goal VII: To develop projects and opportunities for high school and elementary school students designed to give them computational enabled experiences that can lead them to careers in STEM.

Develop a technology fair for high school and elementary school students	7/07-Ongoing	NSF, NASA, DOE
Develop workshops, demonstrations and tours to show high school, elementary school, and college students the uses and sophistication of Navajo technology	7/07-Ongoing	NSF, NASA, DOE, workforce development

Goal VIII: To develop at NTU the capacity to participate in computational science and cyberinfrastructure research on a global scale.

Develop a partnership with Little Priest Tribal College, Institute of American Indian Arts, and other tribal colleges with Internet 2 connectivity to develop a distributed cyberinfrastructure lab	9/30/05-Ongoing	NSF Cyberinfrastructure funds
Complete a cyberinfrastructure proposal for a major cyberinfrastructure lab	12/01/05	NSF Cyberinfrastructure funds
Implement cyberinfrastructure lab projects	7/30/10	NSF Cyberinfrastructure funds

Goal IX: To develop an advanced Navajo computational cyberinfrastructure workforce through the development of tuition, education, and internship programs.

The IT Director will work with those writing grants to encourage them to develop tuition, education, and internship programs for technology as part of their proposals	Continuous	Federal grant programs