Appendix A22

Cyberinternet appendix from the State of South Dakota

Great Plains Education Foundation, Inc.
P. O. Box 850
Aberdeen, SD 57402-0850
605-725-8608

December 27, 2006

The Honorable Mike Rounds
Governor, State of South Dakota
State Capitol Building
500 East Capitol
Pierre, SD 57501-5070

Re: Internet 3

Dear Governor Rounds:

I have now confirmed with all members of the Board of Directors of the Great Plains Education Foundation that it will pay to acquire the cable and equipment to "light up" what is informally called Internet 3 in South Dakota in the approximate amount of $8,000,000 on behalf of the State of South Dakota.

This is the "Base Plan' proposed in the Northern Tier Network Consortium Report dated October 26, 2006. A map from that report which is found at Appendix I, Page 1 is attached for your reference.

It is our understanding that the State of South Dakota will fund the operation of this South Dakota Internet 3 network although the timing of this is such that those costs estimated to be 1.7 million dollars per year, need not be in the current budget proposal. We also understand that the costs contained in the October 26, 2006 report were estimates that the Requests for Proposals will have to be issued to obtain actual bids and actual costs. Great Plains or its representative requests to be a part of the RFP and bid process.

This is obviously a summary letter to get this matter going. In summary, Great Plains is willing to pay to get the Internet 3 infrastructure in place as set forth on the attached exhibit and

the State will pay to operate this absolutely state of the art system. A more complete operating agreement may be advisable as this matter progresses.

Sincerely,

Harvey C. Jewett

HCJ:aks
Enclosure
cc: Dr. Tad Perry
GP Board of Directors

Northern Tier Network Consortium

"The Sacajawea Portage"

A Regional Fiber Optic Network Initiative
For the Research and education Community in
North Dakota, Montana, Idaho, and South Dakota

January 4, 2007

Prepared by:

Fiber Channels, Inc.
520 Idaho Avenue
Escondido, CA 92025
760-294-1668

Table of Contents

"Sacajawea Portage" - A Regional Fiber Optic Network Initiative

Exhibits

Technical Plan
January 4, 2007

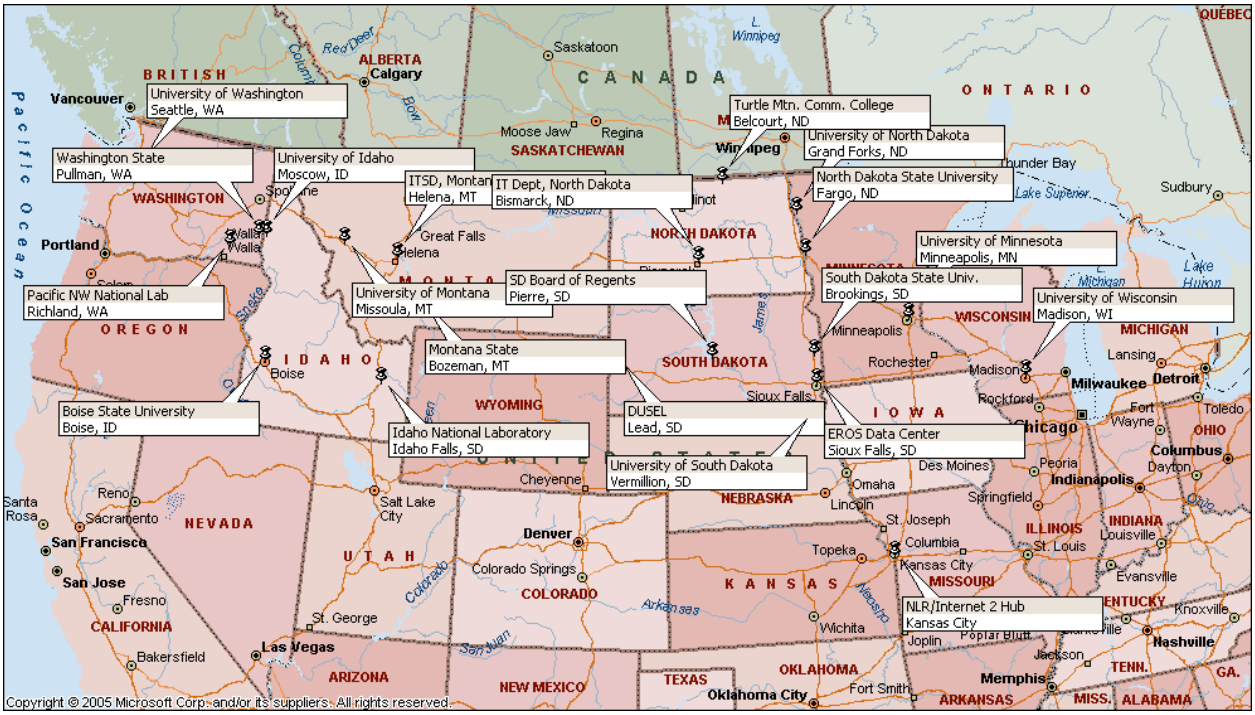
I. The Consortium

The Northern Tier Network Consortium ("NTNC", or the "Consortium") was founded in 2003 and is comprised of 21 members from nine states (See Exhibit 1), including fourteen colleges and universities and seven non-academic, research-oriented and state-operated IT organizations. The purpose of this Consortium is to expand the broadband networking opportunities available to the region to support advanced Research and Education.

The Northern Tier Network Consortium States

- Wisconsin
- Minnesota
- Iowa
- Nebraska
- North Dakota
- South Dakota
- Montana
- Idaho
- Washington

Exhibit 1, Northern Tier Network Consortium States



The Consortium was formed to facilitate and coordinate the development, deployment, and operation of an advanced broadband[1] information services network. In so doing, the Consortium intends to construct a powerful optical infrastructure to meet the networking needs of the Research and Educational institutions in the nine states that make up the Northern Tier, ensuring cost-effective network connectivity now, while providing flexibility and capacity for the future.

In connection with the development of the network, the Consortium is committed to the following:

- Overseeing the deployment of a robust, cost effective, state of the art intercampus communications infrastructure and supporting resources accessible to all educational institutions across the Northern Tier;
- Facilitating high-quality operational support for the new infrastructure;
- Ensuring that the advanced communications infrastructure can be utilized fully and effectively by the institutions it serves;
- Representing the common interests of the institutions it serves in leveraging relationships with vendors and in working with statewide and national governmental bodies;
- Catalyzing partnerships with governmental agencies and the private sector to facilitate availability of pre-competitive communications services and equipment in support of advanced information technology applications;
- Advancing the national network communications infrastructure through active participation in Internet *2*, National Lambda Rail (NLR), and other initiatives; and
- Coordinating the development and promulgation of common protocol standards and practices among participating institutions to ensure end to end quality of service and interoperability.

II. The Problem

Due to the relatively sparse population of the area combined with the long distances between population centers and the high cost of constructing underground optical fiber networks, the major national telecom carriers have been reluctant to invest the capital to upgrade the telecommunications infrastructure across the region. While states to the west, south, and east of the region, along with Canada, are served by multiple optical fiber backbone networks, the states making up the Northern Tier Network Consortium, for the most part, have had to rely on regional interconnects (IXC's), CATV operators, incumbent local exchange carriers (ILEC's), and competitive local exchange carriers (CLEC's) for their voice and data transmission needs.

[1] Broadband communications refers to the transmission of many television, voice and/or data signals through a single system. The transmission may be through the atmosphere or through wires or glass fibers. In general, the term broadband is used to imply two-way interaction with video, as well as voice and/or data in at least one direction.

Enjoying near monopoly protections, and lacking any effective competition, these companies have kept prices for their services at the highest possible levels, charging costs for those services that range from three to ten times what their counterparts are charging where competitive optical fiber backbone networks traverse their states. Those surrounding states, including Minnesota, Washington, Wyoming, Iowa, Nebraska, Utah, and Colorado, which are connected to Tier 1 Internet Service Providers on the major national Research and Education fiber backbones, are able to secure bulk internet transport and commodity internet services from competitive long-haul carriers and Tier 1 Internet Service Providers at aggregate costs as low as $24/megabit/month. This is compared to aggregate costs for internet transport and commodity internet services in the central states of the Northern Tier (North Dakota, South Dakota, Montana, and Idaho) that range from $75/megabit/month, to as much as $150/megabit/month, exclusive of local connectivity and collocation costs.

III. The Opportunity

Educational networks in Idaho, Montana, North Dakota, and South Dakota, as well as those nationwide, have traditionally depended upon managed services provided by both traditional telephone companies and nontraditional providers such as cable companies. Utilizing the networks of these companies has required careful long-term planning to allow for the development of detailed specifications, bidding, and ultimately the building of a network. This process can easily take two years from the start of planning to the first segment of a new network becoming operational. The growing dependence on telecommunications networks, the explosive growth of traffic and peer-to-peer applications, and rapid changes in technology mean that by the time a network upgrade becomes operational, it may be obsolete and the related long-term contracts may need to be either cancelled or renegotiated.

By making the transition to an "owned" fiber-optic infrastructure with scalable network components, additional bandwidth may be added incrementally without a need to redesign the underlying technology. For example, the Consortium expects that its network will utilize 10 Gigabit channels across its optical backbone for interconnectivity purposes. As additional bandwidth is needed, the Consortium can add another 10 Gigabits to the backbone, basically overnight, by adding the appropriate interface cards to the network. Compared to a managed services model in which it takes anywhere from three months to a year for a new service to be delivered, the optical network's configuration flexibility will outfit the area's research and higher educational institutions with the best network and with one that will keep the area at the forefront of network design and development.

In addition, the acquisition of a facilities-based long-haul optical fiber backbone across the region will allow the four states to form a regional optical network that can take advantage of nationally negotiated commodity internet rates that are a fraction of the rates currently being charged by carriers to the Research and Education facilities in the four states. At present, the higher education and research sites in the four-state region are paying as much as $158/Mb per month for commodity internet services while their peer organizations in the adjoining states of

Minnesota, Washington, Iowa, Nebraska, and Washington are able to acquire the same services at rates of $10-$15/Mb per month, via their membership in the national organization of Regional Optical Networks, known as "The Quilt" (www.thequilt.net). Furthermore, owning and operating their own optical fiber infrastructure and optical transmission, routing, and distribution system will allow them to eliminate the extremely costly leased circuits they currently rely on to connect from their campuses to one of the major internet access nodes located in Chicago, Kansas City, Denver, Ogden, or Seattle.

This technical plan shows how the individual states can build-out their networks and by collaborating together, can become part of the national backbone network.

The consortium proposes to acquire an optical fiber backbone from east to west and from north to south across the region which will allow the major research institutions in each of the states to connect to a regional optical fiber network, that in turn will connect to the regional and national networks (See Exhibit 3) in adjoining states, the rest of the United States, Canada, Mexico, Central and South America, and to countries on other continents via the trans-Atlantic and the trans-Pacific cables.

This includes:

- BOREAS, the regional network serving research and higher education in Minnesota, Wisconsin, and Iowa;
- The Pacific Northwest GigaPOP at the University of Washington in Seattle, which, in partnership with CENIC (the Corporation for Education Network Initiatives in California) owns and operates a regional network across Washington, Oregon, California, Utah, Colorado, Nevada and Arizona;
- NLR (The National Lambda Rail [www.nlr.org]), the national fiber optic backbone operating from coast to coast and from border to border, but which currently does not pass through or connect to any of the four states participating in this initiative;
- CANARIE, the Canadian National Research Network;
- CUDI, the National Research and Education Network in Mexico; and
- CLARA, (http://www.redclara.net/en/index.htm) the Latin American Cooperation of Advanced Networks, serving thirteen countries in Central and South America; and
- Internet *2,* which develops and deploys advanced network applications and technologies for research and higher education, accelerating the creation of tomorrow's Internet.

IV. The States

Exhibit 2
***"Sacajawea Portage"* Regional Optical Fiber Network Initiative**
(North Dakota, Montana, Idaho, South Dakota)

The Backbone Network via State Collaboration

Four of the states (See Exhibit 2) participating in the Northern Tier Network Consortium, North Dakota, South Dakota, Montana, and Idaho, are currently collaborating to design and share the cost of acquiring or building a facilities-based, optical fiber network, which will provide a fiber optic cable bridge between the major national network node sites located to the east, south, west, and north of the region, to be called the ***"Sacajawea Portage"***. The objective is to create a robust, broadband backbone throughout the region by pooling the capabilities in each state to achieve greater value. The network, when completed, will span the currently under-served areas of the United States from east to west, between Minneapolis, MN and Spokane, WA; and from north to south, between Calgary, Alberta and Denver, CO; and between Winnipeg, Manitoba and Kansas City, KS. (See Exhibit 3!)

Exhibit 3, US and Canada Regional Optical Fiber Research and Education Networks

Although there are several local and regional carriers operating in individual states in the area, only one national carrier network, AT&T's (a segment of which is shown in Exhibit 3, in dark green), offers service on any east to west route that traverses more than one of the four states in the region. This route from Seattle to Chicago which essentially follows Interstate 94, makes up one segment of a AT&T's national network. Making broadband capacity available to the Research and Education community on this route would allow the region to connect to two major national hub sites, the Pacific Northwest GigaPOP (dark green) network in Spokane, and the Argonne Lab and NLR and Internet 2 node sites in Chicago, via the BOREAS (red) network node site in Minneapolis.

One other carrier, 360 Networks, (shown in Exhibit 3, in orange), operates broadband routes on north to south paths from Calgary to Denver, crossing Montana and Wyoming, and linking the region to Internet *2* and the National Lambda Rail (black) network in Denver, Ogden (via Boise), and Seattle (via Boise and Spokane), and the CANARIE (lime green) network in Canada.

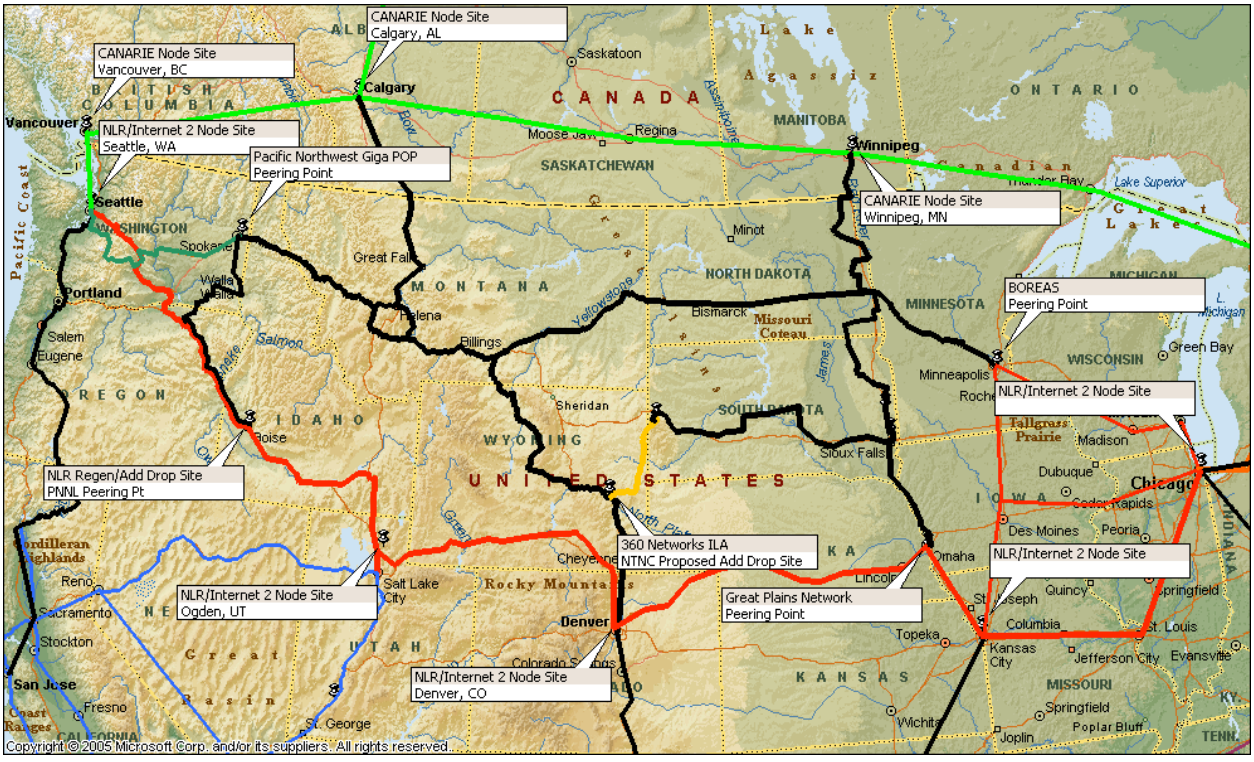
It is proposed that the Northern Tier Network Consortium acquire rights to dark fiber (fiber on which no optical transmission or routing equipment has been installed) where available, on these routes from AT&T, 360 Networks, and several regional carriers, and install its own optical fiber

transmission and routing equipment to form the nucleus of a fiber optic backbone across the region.

The intent of this initiative is to collaborate with the regional and national carriers to acquire dark fiber on the existing carrier backbone routes that cross the four states in the region to connect the region to existing broadband fiber-based networks that span the country to the north, south, east, and west of the Northern Tier. If the DUSEL Laboratory project is funded by the federal government, the consortium should also consider building one additional route (shown in gold on the following map) to connect the backbone from the town of Lead (site of the DUSEL Research Laboratory) in South Dakota to an access point on the 360 Networks route in Orin, WY, and via 360 Networks via existing dark fiber to Internet *2*, NLR, and the Front Range GigaPOP located in Denver, CO.

The proposed network (shown in Exhibit 4, in black and gold), would effectively connect the states making up the "***Sacajawea Portage"*** to the rest of the national and regional networks that serve the Research and Education Community nationwide and provide the access and financial leverage which will ensure the community receives competitive pricing and contractual terms for expanding network services.

Exhibit 4, *"Sacajawea Portage"* Proposed Backbone Map *(Black and Gold Routes)*



The advantages this will bring to the region include:

- Significantly higher speed data transport capability
- Markedly reduced costs for comparable data transport speeds and volumes
- Improved financial viability for research-based business requiring high volume data transport and storage
- Improved ability to attract high-end research-based facilities and personnel
- Improved regional and national security and emergency response
- Increased public/private cooperation and partnership opportunities for mutual benefit
- Reduced population flight resulting from lack of high tech opportunity and economic development in the region.

With the exception of the 173-mile segment (shown in Exhibit 4, in gold), between Lead, South Dakota and Orin, Wyoming (near Douglas, WY), the initiative proposes acquiring rights to use (RTU's) dark fiber, or dim fiber (*fiber on which the optical transmission and amplification equipment has been installed but lacks the individual wave division multiplexing cards required to light separate individual colors of the spectrum*) from regional and national carriers, on their existing routes. That will allow the consortium to acquire and install its own optical transmission and wave division multiplexing equipment and operate a facilities-based network for the benefit of the Research and Education community across the region.

On that 173 mile segment, lack of a suitable existing conduit or pole route could make it necessary to construct and install new underground conduit routes and cable, or install new cable on existing pole routes between the two communities. Costs for this build are estimated at $4.5 million. It would require a detailed site survey to provide firm cost estimates for such construction, which would only be justified if the DUSEL Laboratory is fully-funded, and it is determined that the site's research mission requires diverse fiber routes for its operation. Costs could range as high as $25,000/mile, or more, for portions of that segment where there are no existing facilities that can be shared.

Nothing herein implies other entities will not be served or benefit from the use of the NTNC network. Rather, the primary design and engineering philosophy of the network is intended to facilitate the objectives of the Research and Education community, including:

- Technical compatibility with other regional and national optical networks;
- Peering (no cost traffic handoff) with other regional and national optical networks;
- Participation in nationally-negotiated Research and Education discounted leased capacity (The Quilt) and purchase agreements (NLR and Internet *2*) for equipment, bandwidth, and ISP services;
- Sharing in network-related research findings from projects funded nationally by EDA, NSF, NIH, DOD, DOE, private foundations, etc;

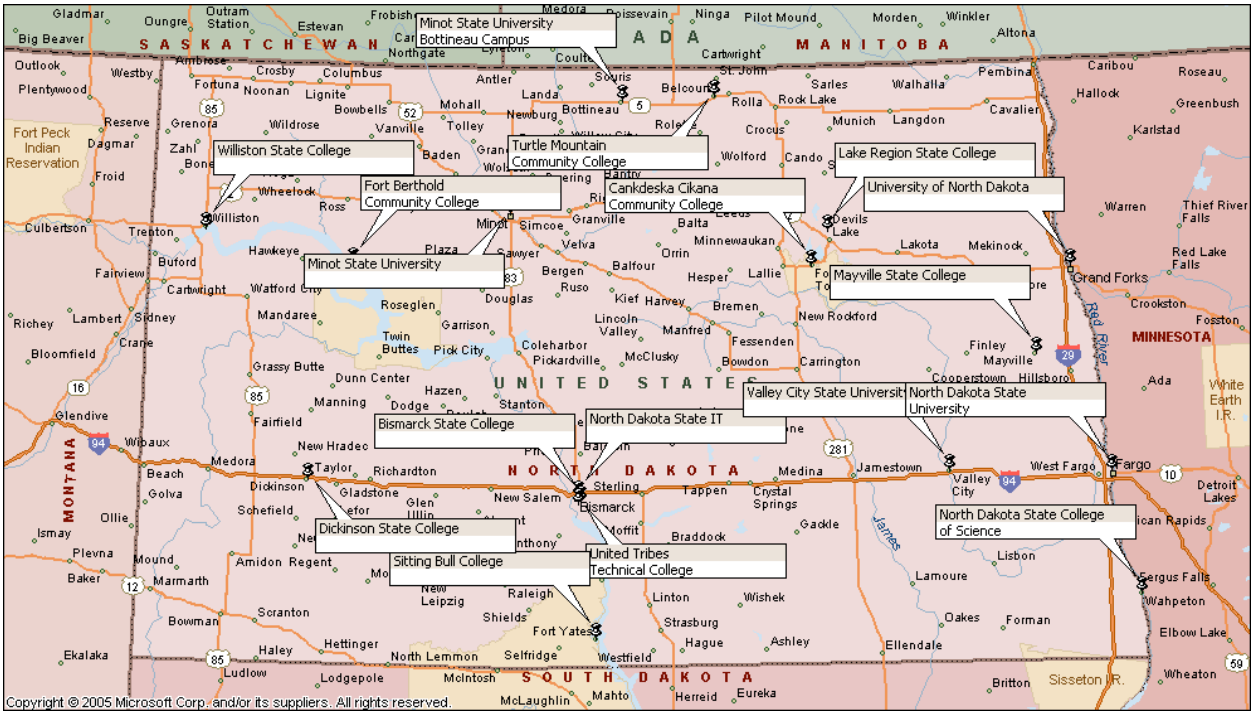
- Collaboration between multiple campuses and research oriented facilities located across multiple states and internationally;
- Direct access to national and international backbone routes, hub sites, and Tier 1 Internet Peering Sites.

To date, the four states participating in this project have collaborated to secure the planning grant to fund this study, and are working diligently together to justify and secure the funding necessary to acquire rights to the optical fiber and purchase the optronic, wave division multiplexing, and routing equipment that is necessary to light and operate the network.

The "Sacajawea Portage" Optical Fiber Initiative

V. North Dakota

Exhibit 5, North Dakota, Target Research and Education Sites



A. Target Sites

The survey of research and higher education sites in North Dakota identified the following target locations for that will benefit from enhanced facilities-based fiber optic backbone architecture:

a. North Dakota State IT Department
b. University of North Dakota
c. North Dakota State University
d. North Dakota State College of Science
e. Minot State University, Minot
f. Minot State University, Bottineau
g. Turtle Mountain Community College
h. Williston State College
i. Cankdeska-Cikana College
j. Lake Region State College
k. Valley City State University

l. Bismarck State College
m. Mayville State College
n. Dickinson State College
o. Sitting Bull College
p. United Tribes Technical College

B. Needs and Benefits

The leaders for pursuing and acquiring education, research and development broadband networking capabilities for the State have long been the two research universities, North Dakota State University and the University of North Dakota. The State of North Dakota's Information Technology Department has often been a partner and collaborator in those pursuits.

The ND CIO has been a supporter of the broadband networking efforts since the position became a reality in 1999. North Dakota's Information Technology Department provides a statewide network (StageNet) that is present in virtually every community and to American Indian reservations in the state. All state government agencies and all public K-20 educational institutions are currently required to acquire their network services from ND ITD.

Implementation of the LARIAT project between Seattle and Billings will extend a 2.5 Gigabit bandwidth lit circuit into Montana. By extending that same fiber backbone east to North Dakota as part of its participation in the Northern Tier Consortium, North Dakota will be able to expand its capacity from the current 310 Megabit capacity, to a 10 Gigabit Dense Wave Division Multiplexing backbone with multiple 1 Gigabit, 2.5 Gigabit, and 10 Gigabit wave lengths available for future growth;

The local regions that will benefit initially are those communities that already have university and/or non-profit research programs and provide support for start-up companies. They currently are the Fargo, North Dakota and Moorhead, Minnesota community (separated by the Red River), the Grand Forks, North Dakota and East Grand Forks, Minnesota community (separated by the Red River) and Bismarck, North Dakota.

Other communities that will benefit as the service is established and matures are K-20, state, county and local government agencies, non-profits organizations and for-profit companies that partner with the research universities, With ND ITD's STAGENET presence throughout the state, their participation will enable network connections for economic development efforts.

The primary projects that will benefit from such networking include many of the research programs at each research university:

C. North Dakota State University

NDSU Centers of Excellence

During the 2003 legislative session, the North Dakota Legislature, acting on Governor John Hoeven's proposal, created "Centers of Excellence" within North Dakota's university system. The Centers of Excellence initiative provides up to $50 million to develop centers across the state, with dollars leveraged with private and federal matching funds to generate new jobs. We anticipate the Northern Tier Network to provide value to all these programs across the state. The NDSU Research & Technology Park project was declared a Center of Excellence and was awarded a $1.25 million grant to develop a technology incubator. NDSU has also received $7 million in Centers of Excellence funding for projects in advanced electronics, polymers, coatings and agriculture biotechnology. Earlier awards included a Center of Excellence in Beef Systems and a Center for Genetic Research.

1. The Center for Nanoscale Sciences and Engineering (CNSE): CNSE is awarded about $25M a year in Department of Defense grants and contracts for its work in material science and micro-electronics. Its private sector partners include Alien Technologies, Inc, Crane and Tessera – all micro-electronic and material science-based companies. Public sector partners include several research universities – UAlaska, UC-Riverside -- and Wright-Patterson Air Force Base in Ohio.

2. The College of Agriculture is using Alien Technologies RFID tags and NDSU sensors to read the tags. This project is funded by DoD and includes collecting and transmitting information acquired through the RFID tag projects…including the tagging of cattle for NDSU's Food Safety program.

3. Civil Engineering. Scientists are using computer modeling to simulate material science strength in sea shells. Broadband networking is needed because the scientists use national supercomputing centers as well as NDSU's CHPC.

4. Computer Science. A scientist and his graduate students recently received an international award for the development of a data mining algorithm that will be used to make databases work faster and more efficient. This work is being discussed with scientists at Argonne National Lab to be applied to its scientific work which includes enormous amounts of data to be transferred between the two sites.

5. Humanities. A professor of Anthropology, his technical staff and his graduate students have developed a three-dimensional virtual environment for the preservation of American Indian artifacts. The program also developed a 10 minute animated video for the Lewis and Clark Signature event. The development of this project took hundreds of minutes rendering on the NDSU Center for High Performance Computing. Rendering resources will be needed at other national supercomputing sites to grow this popular program.

6. TerraGrid participation. NDSU would like to become part of the TerraGrid community. This will only be possible with networking capabilities such as those proposed for the ***"Sacajawea Portage".***

D. University of North Dakota

1. The Center of Excellence in Life Sciences and Advanced Technologies (COELSAT) is under development at UND. Facilities will house faculty and staff in centers for Engineered Surfaces, Genomics, Proteomics and Bioinformatics; Infectious Diseases; and High Performance Computing. The development of COELSAT addresses a key roadblock for North Dakota job creation in life sciences and advanced technologies by providing commercialization facilities that anticipate 100 to 140 high value jobs at the end of its first 5 years. US and Canadian companies (such as Alion, Avianax, BORDERS, ImClone and Cangene) are looking at close working proximity to UND faculty, access to intellectual property and the potential for partnering with other market sector companies. Research and collaboration efforts require advanced networks for accessing, storing, manipulating and visualizing large amounts of data as well as communication tools for shared discovery and review.

2. The UND Center of Excellence for UAV and Simulation Applications will bring together UND's DoD Center of Excellence for UAV Education with collaborations in research and development with private sector partners (such as Lockheed Martin, Frasca International and Alion), FAA Center of Excellence for General Aviation Research, and with Mayo Clinic for Flight Medicine Residency incorporating UAV training. The work of this Center will promote the commercialization of new products (e.g. UAV sensor payloads) and services (e.g. UAV flight training), as well promote private sector job growth estimated at 25 high value jobs. Recent designation of the Grand Forks AFB and the Fargo Air National Guard as UAV bases provides synergy with the Center's Research and Education efforts. An advanced network would allow for segmenting to assure uninterrupted real time communication for research and training purposes.

3. The Energy & Environmental Research Center's (EERC's) National Center for Hydrogen Technology. The EERC was designated the National Center for Hydrogen Technology by the U.S. Department of Energy (DOE) in November 2004 in recognition of over 50 years of hydrogen research from fossil and renewable energy. A year later, the NCHT received funding from the North Dakota Centers of Excellence Commission. The NCHT is leading more than $26 million in hydrogen-related contracts with more than 50 private sector partners. An additional $30 million of near-term opportunities are in discussion with a variety of other sponsors, for a total of nearly $60 million. NCHT activities include producing clean hydrogen fossil fuels; developing innovative hydrogen production systems and vehicles for the U.S. military; producing hydrogen from renewable sources; developing the hydrogen dispensing system of the future; creating

new technologies that produce pure, clean hydrogen from ethanol plants; and integrating new technologies for hydrogen fuel cell vehicles. A new 15,000-square-foot hydrogen testing facility at the EERC is expected to be completed in spring 2007. The facility will result in 50 to 100 new, high-paying private sector-equivalent jobs at the EERC and an additional 50 to 100 new private sector jobs in the greater Grand Forks area.

4. UND's regional weather information center (RWIC) has a multi-year contract with the Army to do high-performance computing research. This requires large amounts of data to be moved between the UND campus and the Army High Performance Computing Research Center in Minneapolis, MN. Limited network bandwidth has threatened this research contract in the past and could do so again. The Northern Tier network could assure required network capability. Other RWIC research has enabled a spin off company which already has provided high value North Dakota jobs with more anticipated.

5. The Northern Plains Center for Behavioral Sciences will house research projects from nursing and psychology faculty dealing with behavior and its effect on physical and mental health. Current and future research projects will focus on vulnerable populations in North Dakota such as American Indians, the elderly, migrants and Hispanic farm workers and include the effects of pesticides on cognitive development of rural children; Alzheimer's disease and dementia in adults and addictive behavior, such as alcoholism and compulsive gambling.

6. The Grand Forks Air Force Base Realignment Impact Committee (BRIC) is working with the Department of Defense to address the economic impact on cities and towns surrounding the GFAFB with the future departure of tankers from the base. Enhanced network communications in surrounding communities or on GFAFB land that DoD may release could improve the possibilities of partnering for UAV research and spin off companies.

7. State of North Dakota (K-12):

    a. North Dakota's EduTech -- a K-12 organization that offers a variety of IT-related services to help North Dakota schools and educators improve student achievement.
    b. ND's K-12 community participates actively in the Internet2 SEGP program – accessing many of its capabilities for K-12 curriculum.

North Dakota was part of a 4-state partnership that acquired National Science Foundation funds to develop its share of Northern Tier networking engineering plan. It is anticipated North Dakota will continue to participate in such efforts to advance the networking vitality of the region. The State of North Dakota has made significant contributions in funding STAGENet to provide network connections for education and research and government throughout the state. It is anticipated that STAGENet support will continue. At the same time ITD is building out

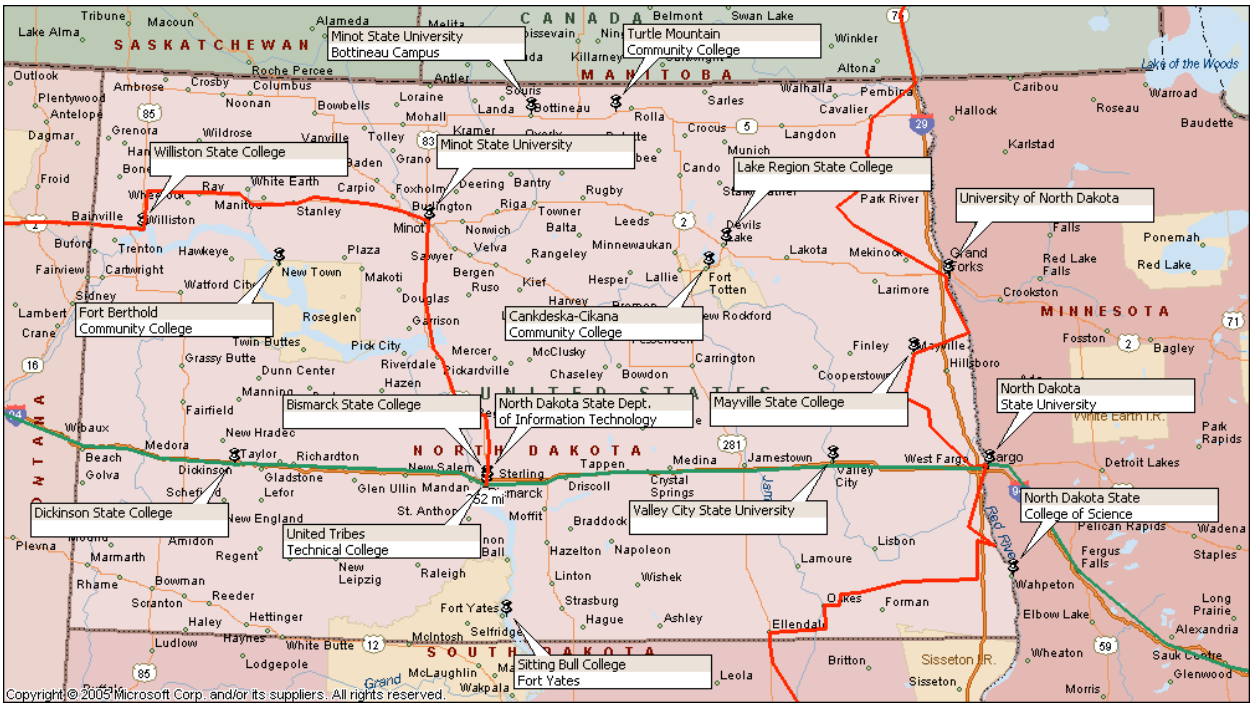
metropolitan fiber networks in the 4 major cities and research universities are seeking to upgrade network capacity on campus and to their research parks. This NTNC-West segment will put ND's major cities on the fiber 'Interstate Highway' to overcome the view by government agencies, business, researchers, students and employees that North Dakota is 'off the beaten path'.

The Solution

The proposed solution is that North Dakota participate with the other states making up the ***"Sacajawea Portage"*** optical fiber initiative to acquire or build a portion of the four-state backbone, along with its own statewide optical fiber network and light it with dense wave division multiplexing equipment (DWDM). This would capable of supporting multiple 10 Gigabit/second lambdas for use by the Research and Education Community throughout the state and the Region. The proposed network fiber would be acquired from existing carriers operating within the state and/or constructed jointly with them, or unilaterally where existing fiber is not available and they choose not to participate. This network would in turn be connected to the national and regional network hub sites that are already in place in:

- Seattle to the west (via Spokane),
- Chicago to the east (via Minneapolis),
- Kansas City to the south (via Omaha),
- Denver to the southwest,
- Ogden to the southwest (via Boise),
- Calgary to the northwest, and
- Winnipeg to the north

Exhibit 6, Proposed North Dakota Northern Tier Backbone Routes
(Red and Dark Green)



The total one time cost to acquire and/or light all four segments, necessary to connect the state to the backbone routes linking it to the NLR/Internet *2* hub sites in Chicago (via BOREAS in Minneapolis), Kansas City, and Seattle (via the Pacific NW Gigapop in Spokane) is $2,917,000 million with annually recurring operating costs estimated at $841,190. Two optional routes that would provide additional campus access and route diversity would add an additional on-time cost of $1,509,802 and recurring annual cost of $318,970.

North Dakota - Northern Tier Consortium Backbone Cost Estimates

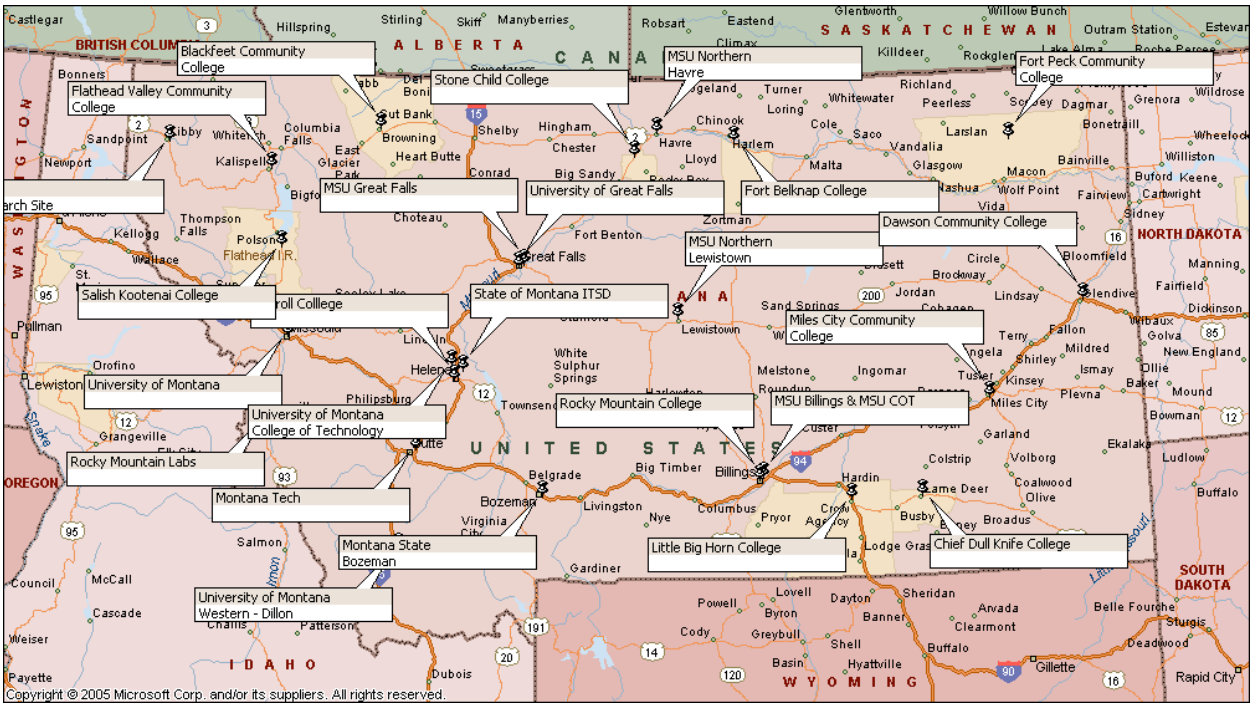
From	To	Miles	Add/Drop & Terminal Sites	Amp Sites	Regens	Fiber Count	Total One-Time Cost	Total Annual Recurring Cost
Canadian Border	Fargo	77	2	1	0	2	$ 524,800	$ 125,48
Fargo	South Dakota Border	153	2	3	0	2	$ 737,200	$ 171,74
Beach	Fargo	345	3	6	1	2	$ 910,000	$ 307,93
Fargo	Minneapolis	225	3	3	0	2	$ 745,000	$ 236,04
Total, North Dakota		**800**	**10**	**13**	**1**	**2**	**$ 2,917,000**	**$ 841,19**
North Dakota Optional Routes								
ND Border	Winnipeg	65	1	1		2	$ 385,001	$ 76,18
MT Border	Bismarck	252	3	3		2	$ 1,124,801	$ 242,79
Total ND Optional Routes		**317**	**4**	**4**	**0**	**2**	**$ 1,509,802**	**$ 318,97**

Note: Backbone costs do not include costs of routers and local connectivity between the backbone and individual campuses.

Although alternative, less expensive routes may be identified during site surveys and field engineering, these cost estimates reflect the best information available at the time of the feasibility study.

VI. Montana

Exhibit 7, Montana, Target Research and Education Sites



Target Sites - The survey of Montana's research and higher education sites identified the following target sites:

A. The University of Montana

In addition to traditional research programs in the sciences and humanities, The University of Montana supports several groups that take computational approaches to problems inspired by but not unique to the Rocky Mountain West. Located within its nationally recognized School of Forestry and Conservation are research groups which utilize remote sensing, modeling, and simulation to address natural system issues. Prof. Steve Running's Numerical Terradynamics Simulation Group, which has receive over $10M of support over a ten year period to participate in the design of NASA's EOS platforms and their sensors, have developed various capabilities to quantitatively describe the structure and function of ecosystems, from regional to global scales, using emerging technologies in satellites, geographic information systems, computer simulation and visualization, and biophysical theory. The National Center for Landscape Fire Analysis is a locus for research and technology development for various federal, state, and local partners engaged in fire, fuels management, and research in the western United States. The NCLFA uses

remote sensing and other information technology applications to improve fire and fuels management at the landscape scale and develop innovative approaches for delivery of these products. The Rocky Mountains Cooperative Ecosystem Studies Unit focuses on improving the scientific base for managing ecosystems in the rapidly changing social, cultural, and environmental landscape of the Rocky Mountain Region, as well as other national and international ecosystems which share these characteristics.

Within its Division of Biological Sciences are unique programs such as the Avian Science Center, which promote ecological awareness and informed decision making through the collection, synthesis, and dissemination of science-based information on western birds, and the Avian Flight Laboratory, which focuses on the what, how, and from whence of bird flight, looking specifically at physical mechanisms, performance, and ecological implications of bird flight. Also within DBS is the Flathead Lake Biological Station, a state-of-the-art ecological Research and Education center located in the Rocky Mountains near Glacier National Park. The Biological Station conducts public workshops, college courses, graduate programs and research focused on terrestrial and freshwater ecology in the Crown of the Continent Ecosystem. Related to the work of the Biological Station is the Nyack Microbial Observatory, a long term look at a complex ecosystem on the edge of Glacier National Park that is the home to many wildlife species, including threatened grizzly bear, gray wolf, and bull trout. The NMO takes a unique view of such a systems, from terrestrial to microorganism aquatic interface to the aquatic food web. Supporting these and other research programs are facilities such as The University of Montana Murdock DNA Sequencing Facility, equipped with the ABI3130xl genetic analyzer for DNA sequencing and fragment analysis (GeneScan), to serves the needs of molecular biology researchers at universities, institutions, and government laboratories on the state and national levels.

The University also host several unique cross-disciplinary projects. The Center for Riverine Science and Stream Renaturalization looks at issues related to maintenance of river function, multiple use, and environmental soundness within the landscape, and in particular the creation of economically sound, innovative solutions to re-naturalize (rehabilitate) physically, geochemically and biologically impacted river systems, e.g., such as those impacted by mining and other types of natural resource extraction. Another prominent cross-disciplinary group is the NIH Center for Structural and Functional Neuroscience, established as a Center for Biomedical Research Excellence through the Institutional Development Award (IDeA) program of the National Center for Research Resources (NCRR). This Center utilizes approaches at the interface of chemistry, biochemistry, pharmacology, toxicology and molecular biology to advance our understanding of protein structure and function in the central nervous system, particularly as related to signal transduction, transport, development and pathogenesis.

In the College of Health Professions and Biomedical Sciences are groups such as the Center for Environment Health, whose primary mission is to advance knowledge of environmental impacts on human health. The Center brings together a critical mass of researchers to investigate mechanisms of pulmonary and cardiovascular diseases, immune and autoimmune disorders,

developmental defects, neurodegenerative diseases, genetic susceptibility, and the impacts that environmental factors have in causing or exacerbating these conditions. Also included are the Montana Neuroscience Institute and the International Heart Institute of Montana, both cooperatives effort with the St. Patrick Hospital and Health Sciences Center, the former promoting Research and Education in the treatment of neurological disorders, the latter focusing on novel treatments for heart valve disease.

B. Montana State University

Montana State University (MSU) is a comprehensive, land-grant university with an enrollment of approximately 12,000 students in Baccalaureate, Master's and Doctoral programs across seven colleges and two divisions. Recently, MSU has been included as one of the 94 top tier of research institutions in the Nation, averaging over $100 million in research expenditures per year. Research strengths span many disciplines, with world class faculty research in Agriculture, Physics, Engineering, Chemistry, Microbiology, Neuroscience, Infectious Disease, Economics, Business as well as the Humanities, Social Sciences and History. MSU has strong graduate programs and a long standing tradition of excellence in undergraduate research and entrepreneurship.

Many of the research groups at MSU are heavily invested in computational research, access to remote instruments and resources and are involved in multi-disciplinary, distributed research projects and research centers.

The MSU Solar Physics Group is engaged in solar research supported by NASA, NSF, and AFOSR. In both research and graduate education they collaborate closely with the solar group at the *Lockheed-Martin Solar and Astrophysics Laboratory*, and the *Solar & Stellar X-ray Group* at the *Harvard-Smithsonian Center for Astrophysics*.

The Center for Bio-inspired Nano-Materials is engaged in research and training focused on the use of protein cages and protein architectures for the synthesis of nanomaterials for biomedical applications, such as drug delivery, for use with magnetic systems and as nano-catalysts. This group of MSU faculty members is involved in distributed collaborations with Scripps Institute, Brookhaven National Lab, Lawrence Berkeley Lab and the European Synchrotron Facility.

The Center for Computational Biology is a multi-disciplinary research center, focused on computational neuroscience, biomedical engineering and the development of neural prosthetics. The Center hosts a shared computing facility linked to national supercomputing centers and supports computational work in chemistry, genomics, and theoretical biology in addition to neuroscience.

The Big Sky Institute (BSI) is an exciting new Research and Education center that develops and connects the important *science* about the *place* that is known as the Greater Yellowstone

Ecosystem to an engaged local to international *community*. MSU's prominence in Yellowstone research and BSI's place-based science mission help to position MSU as the "University of the Yellowstone."

Of great importance to economic development and energy related research, Montana State leads the **Big Sky Carbon Sequestration Partnership (BSCSP)** which is building a new energy future for Montana, Idaho, South Dakota, Wyoming, the Pacific Northwest and the nation BSCSP is one of the U.S. Department of Energy's (DOE) seven regional partnerships. BSCSP is developing a framework to address carbon dioxide (CO^2) emissions that contribute to climate change and working with stakeholders to create the vision for a new, sustainable energy future that cleanly meets the region's energy needs.

MSU is also engaged in several collaborative efforts engaged in bio-preparedness, infectious disease, rural health and medical education. MSU is part of the **Regional Center of Excellence (RCE) for Biodefense and Emerging Infectious Diseases Research** with Washington, Wyoming, Alaska, Montana, Idaho (WWAMI) The WWAMI RCE is one of eight regional centers established by the **National Institute of Allergy and Infectious Diseases** to develop the tools necessary to protect the public from potential agents of bioterrorism and from emerging natural biological threats.

The wealth of research activities at Montana State feed directly into tech transfer opportunities supported by **Tech Ranch and TechLink**, located adjacent to the MSU campus. TechRanch is a hi-tech business incubator specializing in software and internet related businesses. MSU Tech Link Center helps the private sector commercialize NASA, federal laboratory, and university technologies, to solve industry problems, to create or exploit business opportunities, and to stimulate economic development in the five-state region of Montana, Idaho, North and South Dakota, and Wyoming.

C. State of Montana Information Technology Services Division

The **Montana/ITSD** has for over a decade cooperated with the state's universities to build and support a state network, **SummitNet**. SummitNet has provided "anchor tenancy" to expand networking generally within the state. It provides services to a wide variety of state agencies scattered across the state, as well as intercampus links to the four campuses of the University of Montana, four campuses of Montana State University, and state community colleges. With other commercial partners SummitNet also supports video conferencing for the partners noted above, along with the state's tribal colleges and a significant portion of the state's K-12 entities.

D. USDA US Forest Service Laboratories

Located in the Missoula area in general, and in some cases co-located on the University of Montana – Missoula campus, are several specialized laboratories, such as …

E. NIH Rocky Mountain Laboratory

The Laboratory of Persistent Viral Diseases (LPVD) is concerned with studies of persistent active or latent viral or prion disease infections. Investigators place particular emphasis on persistent infections of the nervous system and of the hemopoietic and lymphoid systems. The laboratory is also studying the roles of persistent infection in the development of retrovirus-induced immunosuppression. Models being examined include prion diseases of various species, murine and human retroviruses, and tick-borne encephalitis viruses.

The major research goals of the laboratory are to understand basic pathogenic mechanisms induced by these infections, to study immune or other defense mechanisms used by infected individuals against infections, and to develop drug therapies capable of reducing or eliminating such infections.

Major Areas of Research

- Study of the nature of the transmissible agent responsible for prion diseases
- Study of the pathogenesis of prion diseases using biochemical, cell culture, and animal model methods
- Development of drug therapies for prion diseases
- Characterization of mechanisms of pathogenesis, immunosuppression, and immunity of retroviral infection in animals and humans with particular reference to infections involving hematopoietic cells and brain cells
- Study of genetic control of host defense mechanisms against retroviral diseases, including leukemia and CNS degenerative disease
- Study of the effects of viral genes on the pathogenesis of Langat virus and other members of the tick-borne encephalopathy family
- Study of the biochemistry of retroviral recombination with endogenous viral DNA as well as the generation of retroviral variants in different cell types

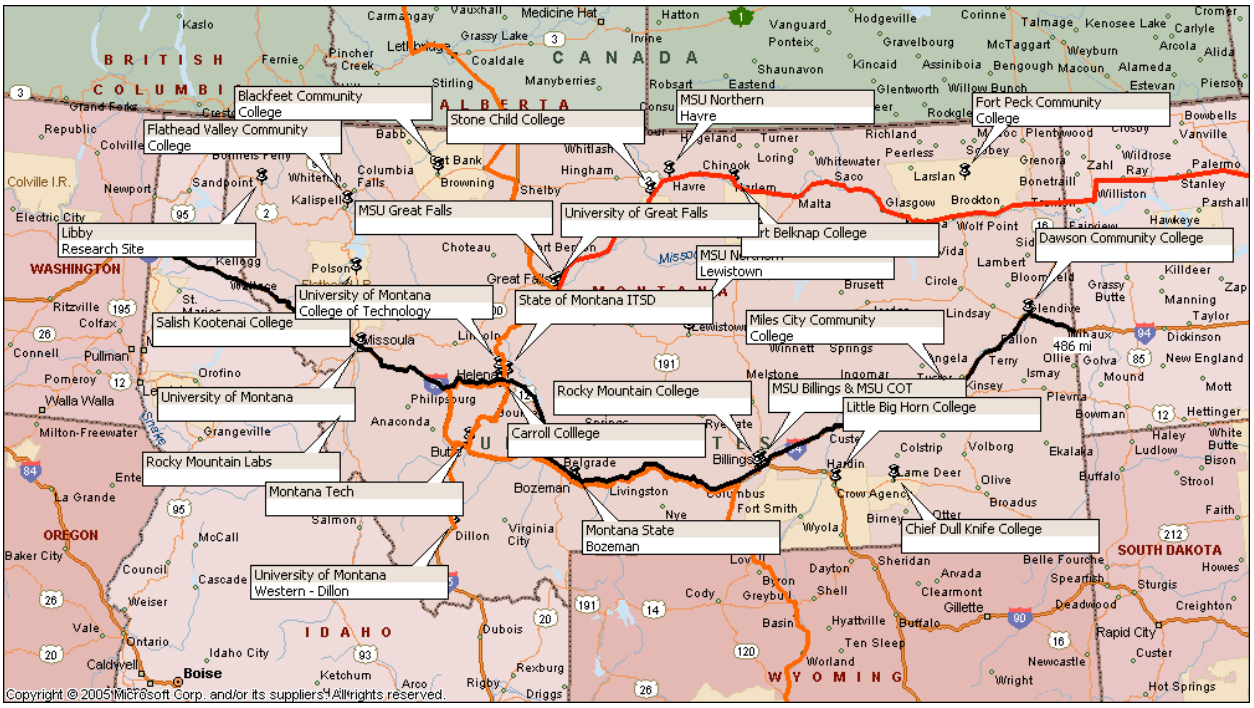
The Solution

The proposed solution is that Montana participate with the other states making up the ***"Sacajawea Portage"*** optical fiber initiative to acquire or build a portion of the four-state backbone, along with its own statewide optical fiber network and light it with dense wave division multiplexing equipment (DWDM). This would capable of supporting multiple 10 Gigabit/second lambdas for use by the Research and Education community throughout the state and the region. The proposed network fiber would be acquired from existing carriers operating within the state and/or constructed jointly with them, or unilaterally where existing fiber is not available and they choose not to participate.

This network would in turn be connected to the national and regional network hub sites that are already in place in:

- Seattle to the west (via Spokane),
- Chicago to the east (via Minneapolis),
- Kansas City to the southeast (via Omaha),
- Denver to the south,
- Ogden to the southwest (via Boise),
- Calgary to the north, and
- Winnipeg to the northeast

Exhibit 8, Proposed Montana Northern Tier Backbone Routes
(Black and Orange)
Note: Optional Route Diversity Shown in Red



The total one time cost to acquire and/or light all six segments, necessary to connect the state to the backbone routes linking it to the NLR/Internet *2* hub sites in Denver, Chicago, and Seattle is $5,190,600 million with annually recurring operating costs estimated at $1,299,115. Three optional routes that would provide additional campus access (MSU Northern in Havre, Stone Child College, Fort Belknap College, and Fort Peck Community College) and additional route diversity, would add an additional on-time cost of $3,901,200 and recurring annual cost of $847,950.

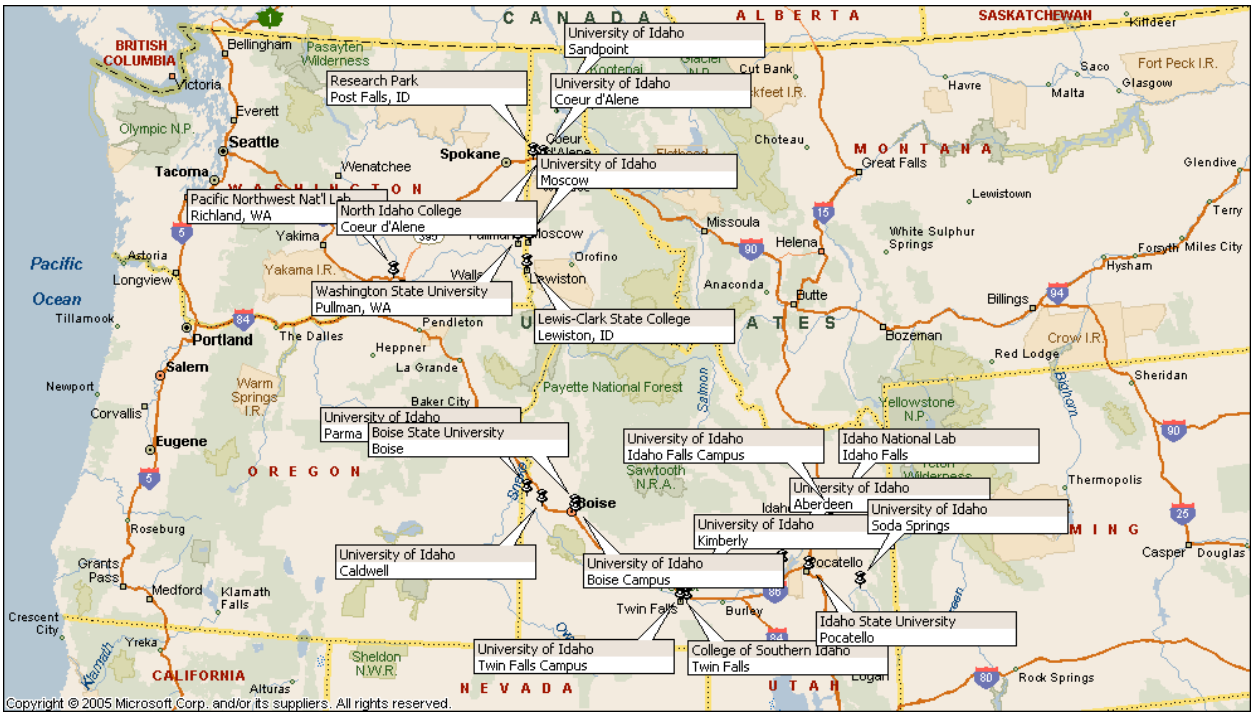
Montana - Northern Tier Consortium Backbone Cost Estimates								
From	To	Miles	Add/Drop & Terminal Sites	Amp Sites	Regens	Fiber Count	Total One-Time Cost	Total Annual Recurring Cost
Cataldo, ID	North Dakota Border	749	3	13	3	2	$ 2,482,800	$ 631,46
Sweet Grass	Great Falls	118	2	1		2	$ 635,800	$ 143,43
Great Falls	Helena	91	2	1		2	$ 533,400	$ 135,33
Helena	Butte	66	2	1		2	$ 511,000	$ 127,83
Butte	Bozeman	85	2	1		2	$ 519,000	$ 133,53
Butte	Dillon	65	2	1		2	$ 508,600	$ 127,53
Total, Montana		**1,174**	**13**	**18**	**3**	**2**	**$ 5,190,600**	**$ 1,299,11**
Montana Optional Routes								
Calgary	Sweet Grass	194	2	3	0	2	$ 589,000	$ 140,74
Laurel, MT	Orin, WY	355	2	1	1	2	$ 1,492,000	$ 288,13
Great Falls, MT	ND Border	398	3	6	1	2	$ 1,820,200	$ 419,08
Total MT Optional Routes		**947**	**7**	**10**	**2**	**2**	**$ 3,901,200**	**$ 847,95**

Note: Backbone costs do not include costs of local routers and connectivity between the backbone and individual campuses.

Although alternative, less expensive routes may be identified during site surveys and field engineering, these cost estimates reflect the best information available at the time of the feasibility study.

VII. Idaho

Exhibit 9, Idaho, Target Research and Education Sites



The survey of Idaho's research and higher education sites identified the following target sites:

A. University of Idaho Campuses

1. Moscow;
2. Coeur d'Alene;
3. Post Falls;
4. Boise;
5. Idaho Falls;
6. Twin Falls;
7. Parma;
8. Caldwell;
9. Aberdeen;
10. Sandpoint;
11. Soda Springs;
12. Kimberly;

B. Boise State in Boise

C. Idaho State University in Pocatello

D. State Colleges

1. North Idaho College, Coeur d'Alene;
2. Lewis-Clark State College, Lewiston;
3. College of Southern Idaho, Twin Falls;

E. Idaho National Laboratory in Idaho Falls;

Additional sites that would benefit from an enhanced broadband fiber optic infrastructure include the:

F. Idaho State Board of Education

G. Idaho Department of Administration

To date, within Idaho, there are several individuals and entities working collaboratively and discussing programs that may lead to a common statewide high-bandwith backbone network. Key among these are: Harvey Hughett, CIO of University of Idaho; Dave O'Neill, CIO of Boise State University; Randy Gaines, CIO of Idaho State University; Brent Stacey, Idaho National Laboratory; Steve Steiner, Idaho Transportation Department; the Office of the State Board of Education (position vacant); and the Idaho Department of Administration. Discussions also have taken place with other possible collaborators, including the Economic Development Administration Officer based in Boise, Idaho, Rick Trembley. Although not in Idaho, Mary Doyle, CIO for Washington State University (just 8 miles from UI) has shown interest. The UI and WSU are linked by IRU fiber and share similar access needs.

H. Existing Services

Carriers that were identified with optical fiber infrastructure that could be leveraged to improve the availability of broadband communications throughout the state included:

1. AT&T NextGen Network which passes laterally across the northern panhandle of the state between Spokane, WA and Cataldo, ID;
2. 360 Networks whose north/south backbone traverses the southwestern corner of the state;
3. Level 3 Communications whose backbone route traverses the southwestern part of the state (shown in red in Exhibit 10);
4. Wiltel Communications, a subsidiary of Level 3 Communications, whose backbone route traverses the southwestern part of the state; and

5. Syringa Networks whose members' backbone routes form a ring (shown on the following map in turquoise) in the southern part of the state.

The University of Idaho derives its high-speed internet services via a fiber spur, by which it connects to the Washington State University in Pullman, Washington, and from there via lit services *(leased circuits acquired from carriers who have installed optronics, wave division multiplexing, and routing equipment that "lights" the individual wave lengths and distributes the traffic over the fiber)* on 360 Networks fiber routes to the Pacific Northwest GigaPOP in Seattle, WA.

Currently there is no intra-state long-haul fiber route linking the northern half of the state to the southern half of the state which effectively isolates the University of Idaho campus in Moscow from the Boise State and the Idaho State campuses located in southern Idaho. Today, traffic going south from Moscow would have to exit to the west into Pullman, WA, then south to Boise via 360 Networks' legacy backbone route through eastern Washington. This older 360 Networks route has no available dark fiber and will require an over-build before additional fiber can be made available.

The most compelling need to improve communications between the state's research and higher education facilities is a new, diverse route linking the southern half of the state through Boise to the northern half of the state through Moscow, and Moscow to Coeur d'Alene. This second segment would provide the added advantage of providing route diversity to the University of Idaho in Moscow. It is estimated that the 110 mile route that would need to be built to connect the University of Idaho in Moscow to the AT&T interstate fiber backbone in Coeur d'Alene would cost approximately $6 million to build unless the work can be done totally, or partially in conjunction with the new highway construction that is planned to be completed by the Idaho Department of Transportation along Route 95. By constructing that segment in parallel with the new highway construction, construction costs could be reduced by as much as fifty to sixty percent. Unfortunately, this project is not expected to be completed for several years.

However, an alternate route between Moscow and Lewiston, Idaho and between Lewiston and Clarkston, WA has been identified that would reduce the cost of providing diverse fiber access to the University of Idaho by approximately 90%. It involves a joint venture with the Port of Whitman, WA for a new joint build for approximately nine miles south from Moscow, and then swapping fiber with an existing carrier to complete the segment into Lewiston and across the river to Clarkston, WA. At that point, the 360 Networks fiber path between Spokane and Boise can be accessed to provide a diverse path to a major regional and national routing node in Boise to the South. This could be completed at a cost of approximately $640,000 to complete the construction and light the route from Moscow to Clarkston, WA.

I. Needs and Benefits

Initially, the primary region that will benefit from the Northern Tier Network Consortium will be northern Idaho, although all areas of the state eventually will be linked and benefit. Entities that will benefit most heavily in the beginning will be the premier research university in the state, the University of Idaho. Also benefiting will be regional educational centers and the Research Park at Post Falls, Idaho. As mentioned, as connectivity allows, other universities and research centers across the state will be linked to the NT and entities across the state will benefit.

The University of Idaho alone has established Research and Education centers in Post Falls, Coeur d'Alene, Boise, Idaho Falls, Twin Falls, Parma, Caldwell, Aberdeen, Sandpoint, Soda Springs, and Kimberly. Additionally, UI has extension faculty in 42 of Idaho's 44 counties. Boise State University and Idaho State University also have various distributed education centers in southern Idaho. Also, state colleges in Coeur d'Alene, Lewiston, Twin Falls, and other areas could benefit.

Idaho hopes to collaborate with neighboring states to share costs to fund common needs. In return, Idaho is looking at various strategies for providing route redundancy to the backbone, with reciprocity agreements. Also, collaborative research projects and joint grant initiatives are anticipated as connectivity facilitates these.

Research, teaching, and dissemination of information are intimately associated and mutually complementary, and many Idaho faculty are actively engaged in research that will benefit economic development and the sharing of education. Research has led to new Idaho companies and new Idaho jobs in agriculture, forest and engineering industries, biotechnology, computer support and environmental problem solving.

Organizations that will benefit from this broadband initiative in Idaho include:

GeoInformatics and GEON Research in Structure and Tectonics – Dr. John Oldow's research centers on regional tectonics of the Northern Rocky Mountains, Inland Northwest, and Cascadia, and processes relate to active plate margins. The primary emphasis is placed on deciphering the time-integrated history and three-dimensional geometry and kinematics of transpressional and transtensional deformational belts. Research projects are largely field based and include investigation of both active and ancient orogenic belts in many parts of the world. Field work typically involves high-bandwidth geologic mapping and the application of structural and stratigraphic analysis, potential-field geophysics, laser surface-imaging, and GPS geodesy to regional tectonic problems. Laboratory activities include use of digital data management systems (GIS), reduction and modeling of geophysical and geodetic measurements, and the formulation of geologic models derived from stratigraphic, kinematic, and geophysical constraints and three-dimensional restorable cross-sections.

The Initiative for Bioinformatics and Evolutionary Studies (IBEST) at the University of Idaho is also the umbrella organization that coordinates the Bioinformatics and

Computational Biology graduate degree program with an interdisciplinary group of faculty and students. Steve Krone (Mathematics) and Eva Top (Biological Sciences) are collaborating on an NIH-funded project that is a joint theoretical and experimental investigation into the role of spatial structure in the spread and persistence of self-transmissible antibiotic resistance plasmids. Terry Soule, James Foster and Conrad Shue, computer scientists, have been working with Larry Forney and Stephen Bent, microbial ecologists, to analyze the diversity of bacterial species from various environments. Steven Krone from Mathematics and Terry Soule from Computer Science are collaborating on a project entitled Evolving Ecological Networks. Many of the above projects require high bandwidth for visualization and remote site training.

DOE Grant for Bioremediation This collaborative bioremediation project is located at the Idaho National Laboratory near Idaho Falls. Professors of Microbiology, Molecular Biology and Biochemistry Ron Crawford and Andrzej Paszczynski, along with postdoctoral fellow Janice Strap, are part of a team that will work to better understand how naturally occurring processes result in the breakdown of the toxic chemical trichloroethylene.

Northern Idaho Elementary School Science Programs David McIlroy, a University of Idaho physics professor, is working on a National Science Foundation grant that will benefit elementary school science programs in rural northern Idaho. John Davis of the Department of Curriculum and Instruction is a co-principal investigator on the project. The focus of the grant is to pair UI graduate students with elementary school science teachers to improve communication skills of graduate students, as well as to develop inquiry-based physical science classes.

Antibiotic Resistance in Bacteria through - NIH Grant Antibiotics have had a major impact on improving human and animal health. However, the benefits of an antibiotic can be short-lived. Bacteria have the ability to quickly develop a resistance to antibiotics that decreases the effectiveness of the medicine in treating infectious diseases. This study is working to resolve this international concern.

National Institutes of Health Grant To Continue Biomedical Research on Infectious Diseases A renewal grant from the National Institutes of Health will allow University of Idaho scientists to continue biomedical research focused on infectious diseases. The five-year grant from the NIH Institutional Development Award program funds one of two UI Centers of Biomedical Research Excellence. This center is devoted to the study of molecular and cellular basis of host-pathogen interactions.

The Solution

The proposed solution is that Idaho participate with the other states making up the ***"Sacajawea Portage"*** optical fiber initiative to acquire or build a portion of the four-state backbone, along

with its own statewide optical fiber network and light it with dense wave division multiplexing equipment (DWDM). This would capable of supporting multiple 10 Gigabit/second lambdas for use by the Research and Education Community throughout the state and the Region. The proposed network fiber would be acquired from existing carriers operating within the state and/or constructed jointly with them, or unilaterally where existing fiber is not available and they choose not to participate.

This network would in turn be connected to the national and regional network hub sites that are already in place in:

- Seattle to the west (via Spokane),
- Chicago to the east (via Minneapolis),
- Kansas City to the south (via Omaha),
- Denver to the southeast,
- Ogden to the south (via Boise),
- Calgary to the north, and
- Winnipeg to the north

Idaho's responsibility would be to acquire or upgrade, light, and maintain the fiber from:

1. The NTNC backbone route from Spokane, WA to Cataldo, ID on the Idaho/Montana border (approximately 85 miles) via the AT&T Next Gen Route (shown in black);
2. The existing intercampus route between Moscow, ID and 360 Network's POP in Pullman, WA (approximately nine miles);
3. The diverse intrastate route from Moscow, ID to 360 Network's Amp site in Clarkston, WA shown in black;
4. The interstate route from Spokane, WA to Boise, ID (approximately 367 miles), to connect to the PNNL-owned fiber, thereby providing connectivity to PNNL, a diverse route to Seattle, and access to the NLR/Internet *2* node site in Ogden, UT.

The one-time cost to acquire and light the backbone network with one 10 Gbps DWDM lambda between Spokane, WA and Cataldo, ID, across northern Idaho is estimated at $275,000 with annually recurring operating costs estimated at $75,725;

The one-time cost to negotiate a public/private partnership with 360 Networks to acquire rights to multiple 10 Gbps waves and light one wave on a 10 Gbps DWDM platform on the existing route between Spokane, WA and Boise, ID is estimated at $1,580,000 with annually recurring operating costs estimated at $423,400;

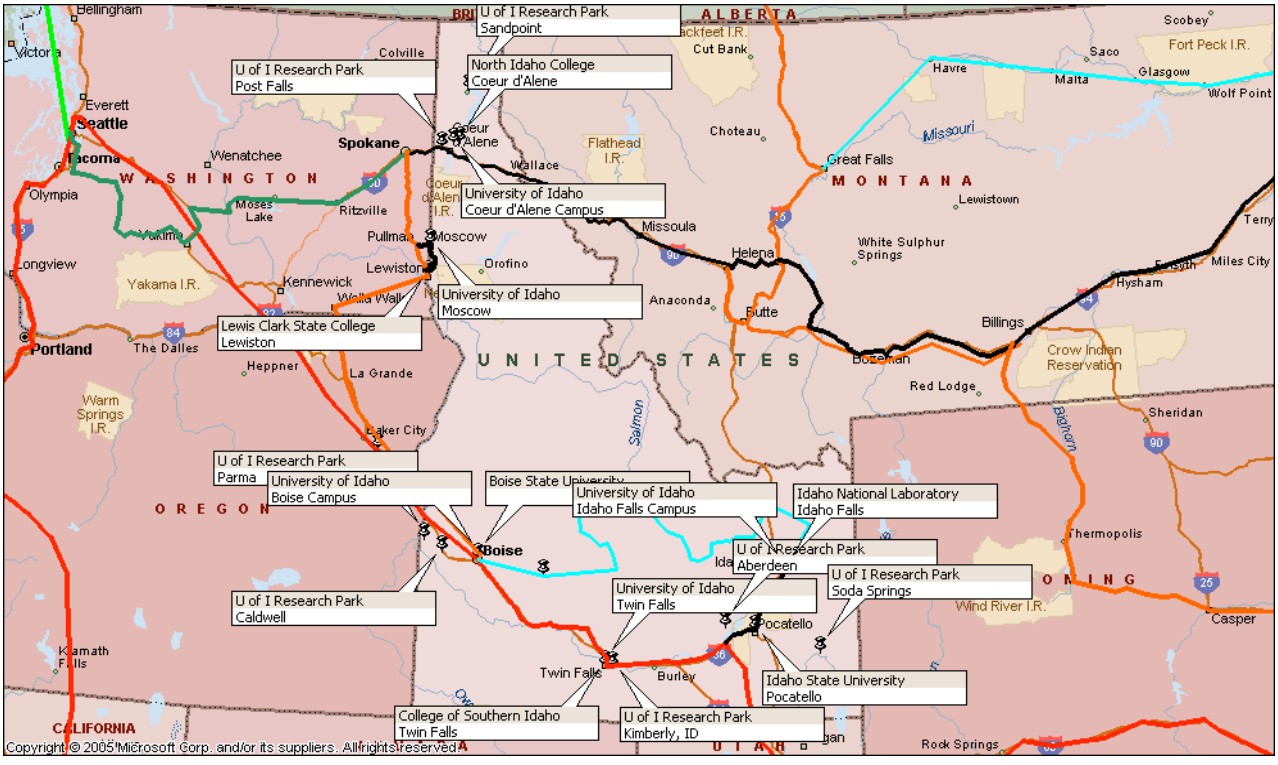
The one-time to acquire two additional fibers between Moscow, ID and Pullman, WA
From the Port of Whitman and light it with one 10Gbps DWDM lambda is estimated at $595,000 with annually recurring operating costs estimated at $109.700**.**

The estimated one-time cost to construct and light the backbone network from Moscow, ID to Clarkston, WA with one 10 Gbps DWDM lambda is $662,500 with annually recurring operating costs estimated at $114,500.

The total one time cost to acquire and/or light all three segments, including the intra-state segments in Idaho and the segments necessary to connect the state to the backbone routes linking it to the national network in Boise and Spokane is $3,113,000 million with annually recurring operating costs estimated at $723,325.

Although alternative, less expensive routes may be identified during site surveys and field engineering, these cost estimates reflect the best information available at the time of the feasibility study. Additionally, they provide for a robust and diverse backbone architecture throughout the state that will connect the three research universities with each other and with Idaho National Laboratory, and provide diverse access to the regional and national fiber backbones and NLR and Internet 2 access node sites in Chicago, Kansas City, Denver, Boise, and Seattle.

Exhibit 10, Proposed Idaho Northern Tier Fiber Backbone
(Black and Orange in Idaho and Washington)



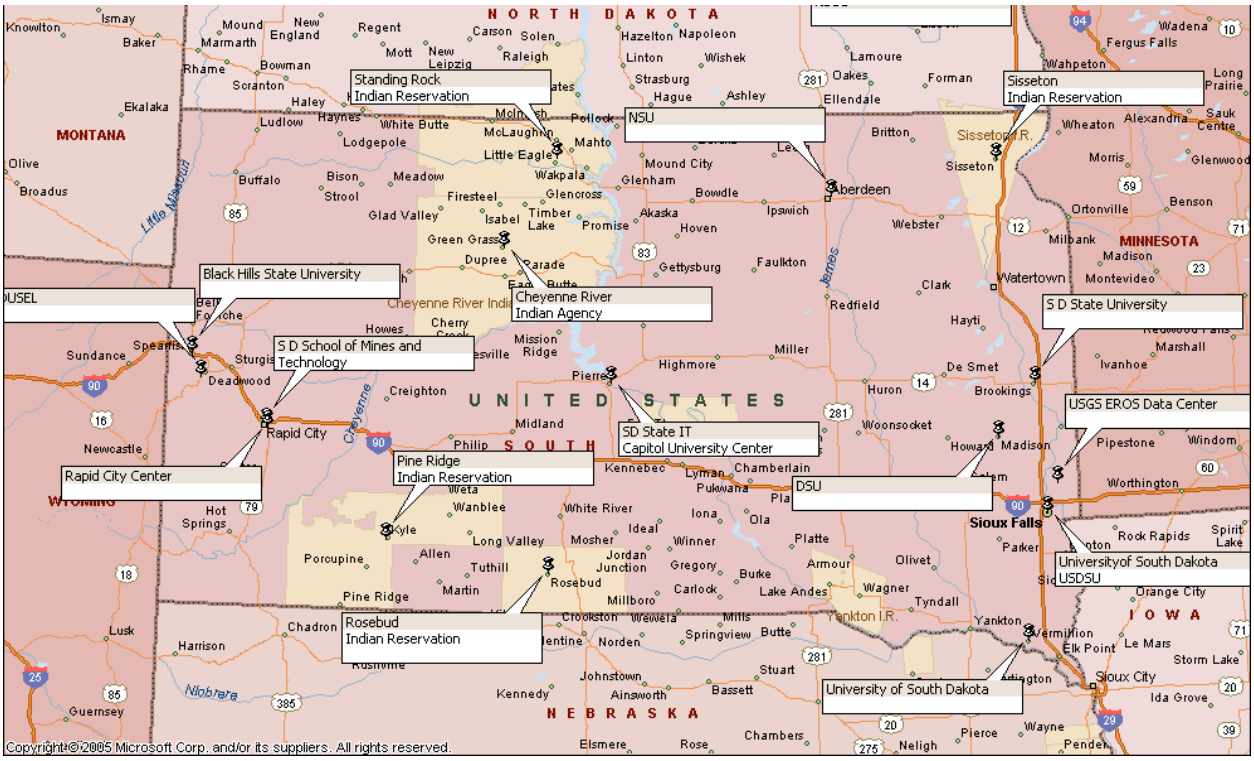
Idaho - Northern Tier Consortium Backbone Cost Estimates								
From	To	Miles	Add/Drop & Terminal Sites	Amp Sites	Regens	Fiber Count	Total One-Time Cost	Total Annual Recurring Cost
Spokane	Cataldo, ID	85	1	1		2	$ 275,000	$ 75,725
Spokane	Boise	367	4	5		2	$ 1,580,800	$ 423,400
Moscow	Pullman	9	2	0		2	$ 595,000	$ 109,700
Moscow	Clarkston, WA	25	2	0		2	$ 662,500	$ 114,500
Total, Idaho		**486**	**9**	**6**		**2**	**$ 3,113,300**	**$ 723,325**

Note: Backbone costs do not include costs of local routers and connectivity between the backbone and individual campuses.

Although alternative, less expensive routes may be identified during site surveys and field engineering, these cost estimates reflect the best information available at the time of the feasibility study.

VIII. South Dakota

Exhibit 11, South Dakota, Target Research and Education Sites



The survey of South Dakota's Research and Education community identified the following "Regental Schools" (governed and supervised by the South Dakota Board of Regents) and state research laboratory:

A. Target Sites

1. Northern State University in Aberdeen;
2. South Dakota State University in Brookings;
3. University of South Dakota in Vermilion
4. Dakota State University in Madison;
5. South Dakota School of Mines in Rapid City;
6. Black Hills State University in Spearfish;

7. South Dakota Public Universities and Research Center (SDPURC);

8. Capital University Center in Pierre;

9. Deep underground science and engineering laboratory (DUSEL) in Lead;

Additional target sites located at:

1. State Bureau of Information and Telecommunications (BIT) in Pierre

2. USGS EROS Data Center near Sioux Falls

3. Ellsworth Air Force Base near Rapid City

4. Rapid City Center

    - West River Nursing, USD and SDSU
    - West River Agriculture
    - West River Grad School (Serving Black Hills State, South Dakota School of Mines, USD, SDSU);

5. Indian Reservation Tribal Schools

    Sisseton-Wahpeton Community College - Sisseton
    Mission – Sinte Gleska University
    Oglala Lakota College – Kyle and Eagle Butte

B. Existing Services

Today the aggregate broadband requirements of these sites are largely serviced by the State Bureau of Information and Telecommunications and via lit service agreements (these lit services are acquired via leased circuits from carriers who have installed and operate the optical transmission and wave division multiplexing and routing equipment necessary to transmit and distribute multiple voice, video, and data circuits via a single pair of optical fibers) with the various local and regional carriers operating throughout the state. There is no existing, state-owned, facilities-based optical fiber network in place that can provide the flexibility and rapid response required to respond to the massive data transmission and exchange requirements of facilities such as the EROS Data Center, the new DUSEL Laboratoryoratory, and the research professionals located or interested in affiliating with the state's major universities. The result is that:

- the universities are stymied in their attempts to compete for the large federal grants;

- the research talent that would normally affiliate with the "Regental Schools" is lured away to other institutions with the bandwidth and access necessary to support their research projects;
- even though laboratories such as EROS, which currently has 1.2 Gigabit capacity, some researchers at SDSU were, until recently, relying on slow-speed data transmission circuits, transport of data files between campus and EROS via private automobile and overnight air freight of CD's, some of which exceed multiple terabytes per day. While this has been alleviated somewhat by the recently acquired 1-Gbps circuit between SDSU and EROS, the available bandwidth is still insufficient for the size and number of files which will need to be transmitted and received daily. Prior to installation of the Gigabit circuit between SDSU and EROS, the rate was $430/Mbper month for 250 Mb of service available to higher education;
- based on the most recent contract with South Dakota BIT, aggregate costs of internet transport and commodity internet services for all campuses are $93.90/megabit.

(*By connecting directly via state-owned fiber to a Tier 1 Internet Service Provider, and thereby able to benefit from deeply discounted bulk internet transport and commodity internet service rates negotiated by "The Quilt", the cost of these bulk transport and commodity internet services to the Research and Education community, in the state could be reduced as much as 75%. "The Quilt" is a consortium of regional Research and Education networks operating throughout the United States.);*

- students coming up through the state's educational system are out-migrating to other states where technology has kept up with the national expansion of network technology;
- after struggling for years with only 15 Mbps of bandwidth for research and aggregate bandwidth of 43 Mbps of aggregate bandwidth, SDSU only recently acquired access to a 1-Gbps circuit between SDSU and the EROS lab northeast of Sioux Falls. While this has improved daily operations, this is still only a fraction of the bandwidth they need, as compared to the10 Gigabits of available bandwidth which are available to their peer institutions throughout the country, including the adjoining states of Minnesota, Nebraska, Wyoming, and Iowa, and;
- some researchers from the universities worked at home where their household cable modems capacity exceeds the bandwidth to them available in their offices on the campus;
- current demand for additional capacity is growing at a rate of 20% annually, to as much as 400% annually in some departments, and at current pricing levels for leased services, the demand will never be affordable;
- SDSU's plans for research positions is projected to grow by 300% in the next few years, but this will not be feasible without significantly expanded bandwidth resources;

C. Needs and Benefits

South Dakota School of Mines and Technology

South Dakota School of Mines and Technology has created several Centers of Excellence and prestigious laboratories.

- **CENTER OF EXCELLENCE FOR ADVANCED MANUFACTURING AND PRODUCTION (CAMP) -** The mission of CAMP is to provide an innovative educational program based on the concept of enterprise teams, to create an electronic community using advanced telecommunications technology to facilitate interaction between higher education and industry, and to provide a focus for manufacturing assistance.
- **GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND REMOTE SENSING LAB -** The Geographic Information Systems (GIS) and Remote Sensing laboratory provides the campus and broader community with a facility for generating and analyzing spatially referenced digital information, including maps and remotely-sensed data. The laboratory was developed by the Department of Geology and Geological Engineering in close cooperation with the South Dakota Space Grant Consortium and EROS Data Center in Sioux Falls, South Dakota. The lab became a NASA Center of Excellence in Remote Sensing in 1998. It became an ESRI Authorized Learning Center in 2000, and now offers many GIS workshops every year.
- **ADDITIVE MANUFACTURING LABORATORY (AML)** - The Additive Manufacturing Laboratory (AML) provides manufacturing research and development in the form of material addition in size scales from microns to meters. This laboratory houses the laser powder deposition (LPD) system that facilitates laser cladding, solid free-form fabrication, and graded alloy development of both metallic and non-metallic materials.
- **ADVANCED MATERIALS PROCESSING AND JOINING LAB (AMP); NSF CENTER FOR FRICTION STIR PROCESSING (CFSP)** - The Advanced Materials Processing and Joining Center (AMP) was created in 2001 under a grant from the Army Research Laboratory. This equipment provides AMP with the most versatile, fully instrumented Friction Stir Welding (FSW) and Processing (FSP) research and development tools found anywhere in the world. The NSF Industry University Cooperative Research Center (I/UCRC) for Friction Stir Processing (CFSP) brings together SDSMT, BYU, USC, UMR, and WSU and 20 industrial sponsors from around the world to perform research and development programs to enhance the understanding of the science of FSP and accelerate its implementation into industrial environments. The School of Mines AMP Center has been designated as the Lead Institution for this NSF I/UCRC Research Center.
- **CENTER FOR ACCELERATED APPLICATIONS AT THE NANOSCALE (CAAN)** - The Center for Accelerated Applications at the Nanoscale (CAAN) focuses on the increasingly important nanotechnology field. The ultimate value of nanotechnology is

quality. By building products at the molecular level, they will last longer, work better, and push their potential to new levels.

- **COMPUTATIONAL MECHANICS LABORATORY (CML)** - Computational mechanics is concerned with the numerical simulation of advanced engineering problems. It brings together highly sophisticated methods of structural and applied mechanics, computer science and applied mathematics, and encompasses numerical methods for application to various mechanical engineering problems.
- **CENTER FOR BIOPROCESSING RESEARCH AND DEVELOPMENT (CBRD)** - The Center for Bioprocessing Research and Development is the newest of the 2010 centers created through Governor Rounds' 2010 Initiative for Economic Development. CBRD's focus is on research that leads to new technologies for processing plant-derived lignocellulose materials into biomaterials such as ethanol and key building block chemicals.
- **COMPOSITES AND POLYMER ENGINEERING LABORATORY (CAPE)** - The Composites and Polymer Engineering Laboratory (CAPE) is a user facility that is open to all students and faculty. The 9000 square foot facility houses state-of-the-art equipment to conduct novel and cutting-edge research and development in rapid tooling and polymer and composite processing and prototyping.
- **ENGINEERING AND MINING EXPERIMENT STATION (EMES)** - The Engineering and Mining Experiment Station (EMES), has provided analytical services to the public and private sectors including a wide variety of classical and advanced instrumental techniques for the characterization and testing of minerals, ores, raw materials, and manufactured products.
- **INSTITUTE OF ATMOSPHERIC SCIENCES (IAS)** - Areas of scientific emphasis include aspects of atmospheric studies varying from air quality to convection in the atmosphere to ecosystem structure and the effects of climate on our earth's ecosystems.
- **SOUTH DAKOTA SPACE GRANT CONSORTIUM -** The South Dakota Space Grant Consortium (SDSGC) was established under a grant from the National Aeronautics and Space Administration (NASA). The vision of the SDSGC is to expand opportunities for all South Dakotans through education, research, and public service in the fields of aerospace, earth, and space science.

South Dakota State University

The Geographic Information Science Center of Excellence (the "Center of Excellence") is a collaboration between South Dakota State University (SDSU) and the U.S. Geological Survey Earth Resources Observation and Science Data Center (EDC). As a result of its efforts, the Center of Excellence accesses and shares enormous amounts of data with: (i) EDC, a leading source of land information for exploring Earth's changes; (ii) the National Aeronautics and Space Administration's (NASA) Goddard Space Flight Center with respect to their use of the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument, NASA's Earth observation system; (iii) NASA's Marshall Flight Center, which develops key space transportation and propulsion technologies; (iv) the National Snow and Ice Data Center, which is

part of the University of Colorado Cooperative Institute for Research in Environmental Sciences and which is funded by NASA to archive and distribute data from NASA's past and current satellites and field measurement programs; (v) the National Center for Atmospheric Research, which is an NSF federally funded research and development center exploring and understanding the Earth's atmosphere and its interactions with the sun, the oceans, the biosphere, and human society; and (vi) with NASA's Jet Propulsion Laboratory, the leading center for robotic exploration of the solar system.

On January 10, 2006 in the state of the state address, Governor Mike Rounds outlined South Dakota's 2010 education plan, which included more than 50 separate initiatives targeting positive changes to the state's education system. As a result of the Governor's education plan, research in South Dakota has been revived as illustrated by the following initiatives: (i) Honing the calibration and validation of imaging and sensoring equipment which EROS Data Center and other similar imaging laboratories utilize to collect their data. Dr. Dennis Helder is conducting this project via the Center of Excellence, through which the data can be downloaded, analyzed, and made available online or shared with the above mentioned organizations for further time series analysis. (ii) South Dakota View ("SD View"), which is a consortium of educational institutions, government agencies, and private sector organizations in South Dakota with a common goal of building partnerships and infrastructure to facilitate the availability, timely distribution, and utilization of remotely sensed data. Dr. Mary O'Neil, Principal Investigator of SD View, has downloaded more than 300 images of South Dakota from Landstat satellites. South Dakota is imaged every eight days and requires fifteen images to cover the entire state, which when combined will result in an estimated additional _500__ images over the next five years. Although the rate at which the files are growing is expected to decline as historical data is captured, downloading these images entails 320 Mb per image, so it will continue to grow at an enormous rate for the foreseeable future. (iii) Other researchers access data from European sources, such as Dr. Matt Davis, who is pulling images of the entire Congo Rainforest for his research.

Significantly, and until recently, following SDSU's funding of a one (1) Gigabit link connecting the Center of Excellence and the EROS Data Center, researchers were literally driving back and forth between locations in order to deliver the data sets. With the deployment of the ***"Sacajawea Portage"*** Network, these same data sets could be transferred electronically in less than 20 minutes. Moreover, researchers currently at SDSU, and those considering a move to SDSU, expect that a leading broadband network is forthcoming and that it will meet their connectivity needs today and in the future.

University of South Dakota

The following is representative of the research being conducted at the University of South Dakota ("USD"). The proteomics facility at the USD Medical School, which is operated by Dr. Eduardo Callegari, utilizes information from the National Center for Bioinformatics to analyze mass spectrometry data. The size of the data is approximately 2.8 Gigabytes, the transfer of

which currently requires ninety minutes. However, transfer of the same data at 1.0 Gigabits per second, requires only an estimated 30 seconds for transfer. Similarly in 2005, a supplemental grant from the South Dakota Biomedical Research Infrastructure Network ("BRIN") was used to acquire approximately 1 Terabyte of storage for researchers at Black Hills State University in Spearfish, South Dakota and at Augustana College in Sioux Falls, South Dakota. As a result, the mass spectrometry data and other information can be backed up to a large tape library funded by BRIN resources at USD via the network.

Around the world, thousands of researchers are studying zebrafish (*Cypriniformes*) from a molecular and developmental standpoint as a model for human health and disease. The Zebrafish Information Network, a leader in developing bioinformatics tools to describe gene expression patterns and phenotypes, has established a consortium of contributing and collaborating researchers, one of whom is USD's Dr. Paula Mabee. Dr. Mabee is the Principal Investigator on a recently funded NSF Tree of Life grant, the purpose of which was to gather DNA sequence and morphological data to reconstruct the phylogeny of the *Cypriniformes*. Therefore, the morphological database being developed for the Tree of Life grant and the genomic database of the zebrafish can be connected. Additionally, Dr. Molly Nepokroeff is analyzing large scale datasets for phylogeny reconstruction for which Principal Investigators are analyzing between 8,000 and 10,000 genes for a moderate number of taxa. These types of analysis require significant computing and network resources.

Other areas of research that generate and utilize large datasets are modeling of chemical structures accomplished in the South Dakota 2010 Center for Research and Development of Light-activated Materials; visualizing neuro-anatomy and physiology [this is in the NIH-funded Center of Biomedical Research Excellence]; digitizing art and oral history of Native Americans in the northern plains; and study of natural resources through GPS in collaboration with the US Geological Survey.

The Deep Underground Science and Engineering Laboratory

On July 21, 2005, NSF selected two site-specific proposals submitted in response to Solicitation NSF-05-506, entitled "Deep Underground Science and Engineering Laboratory ("DUSEL") Site and Conceptual Design." The two selected sites were the Homestake Mine in South Dakota and the Henderson Mine in Colorado. Each team received $500,000 to produce a conceptual design for a possible DUSEL at their respective locations. The monetary awards resulted from the second stage of a planned three-stage community planning process which is providing input for NSF's future decision on whether to move forward on a construction of a DUSEL. In anticipation of a possible DUSEL at the Homestake Mine, it is critical for South Dakota to have the appropriate and necessary network infrastructure so that researchers can share the data they generate with other researchers throughout the United States. This need has been reinforced by a NSN panel that reviewed the Conceptual Design and indicated the importance of developing a cyber-infrastructure at the Mine.

D. The Solution

The proposed solution is that South Dakota participate with the other states making up the ***"Sacajawea Portage"*** optical fiber initiative to acquire or build a portion of the four-state backbone, along with its own statewide optical fiber network and light it with dense wave division multiplexing equipment (DWDM). This fiber network would capable of supporting multiple 10 Gigabit/second lambdas for use by the State BIT and the Research and Education Community throughout the state and the Region. The proposed network fiber would be acquired from existing carriers operating within the state and/or constructed jointly with them, or unilaterally where existing fiber is not available and they choose not to participate. This network would in turn be connected to the national and regional network hub sites that are already in place in:

- Seattle to the west (via Spokane,
- Chicago to the east (via Minneapolis),
- Kansas City to the South,
- Denver to the southwest,
- Ogden to the southwest (via Boise),
- Calgary to the north, and
- Winnipeg to the north

South Dakota's responsibility would be to acquire and light the fiber to connect:

1. The backbone route from the North Dakota border, south to Kansas City to connect to NLR and Internet 2; Note: Costs for this segment could possibly be shared with rest of Northern Tier which also would benefit from this diversity.
2. The intra state route from Sioux Falls west via Pierre to Rapid City;
3. The intra state route from Rapid City west to Sturgis;
4. The intra state route from Sturgis to Spearfish, to DUSEL in Lead;
5. The backbone route from Lead, SD to Denver, CO via Orin, WY.

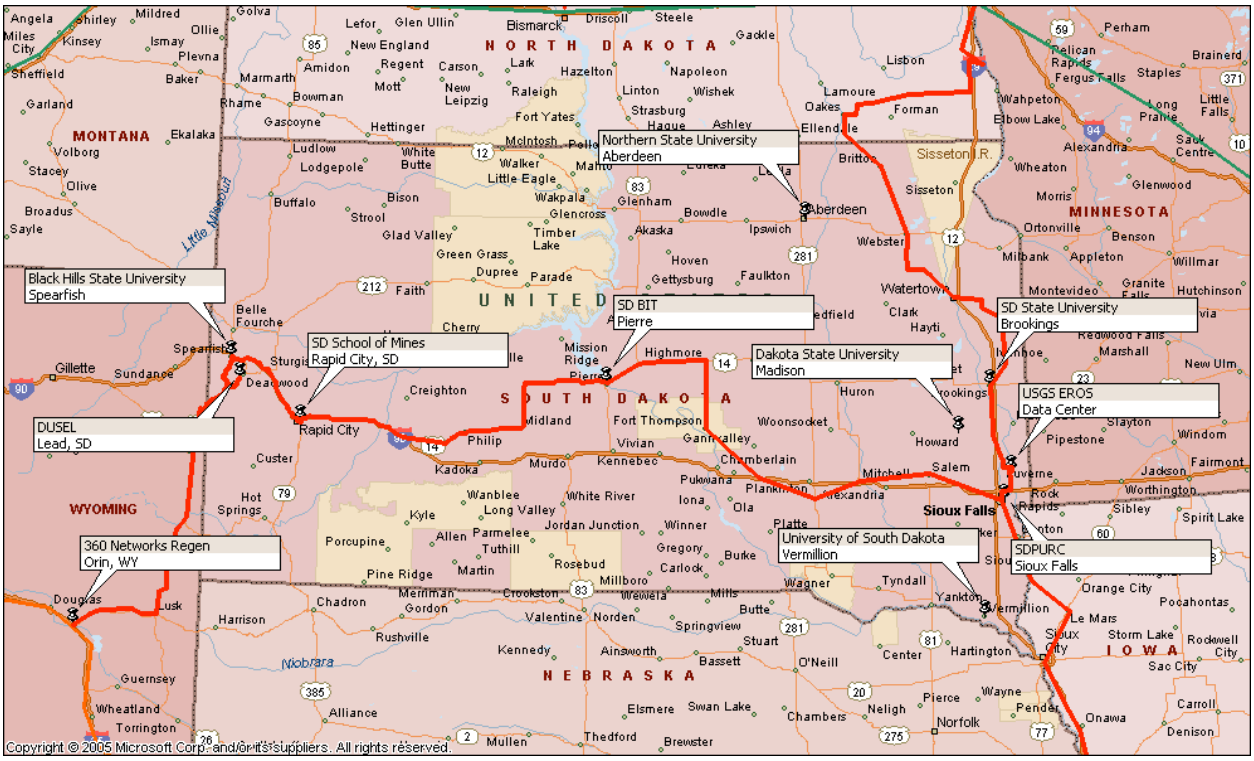
An optional backbone route from Sturgis, SD to Bismarck, ND could be implemented if South Dakota determines it needs additional network access diversity, or if it determines the route from Lead, SD to Denver, CO is prohibitively expensive.

The estimated one-time cost to acquire and light this network across South Dakota, including the connections to the NLR/Internet *2* hub sites in Kansas City, and Denver, and South Dakota's share of the entire east/west and north south backbone routes, is $11.8 million with recurring operating costs estimated at $1.83 million. *(Note: These costs do not include monthly recurring local connectivity costs.)* On existing fiber segments, we propose acquiring two fiber strands and lighting them with 10-Gigabit. DWDM optical transport, multiplexed to multiple 1-Gigabit, 2.5-Gigabit, and 10-Gigabit waves/lambdas, shared by the various consortium member campuses and research facilities. On new segments where no fiber exists or no spare fibers are available,

we propose to jointly build, or overbuild, the segments necessary to provide the connectivity and route diversity to ensure a robust, self-healing optical fiber backbone throughout the state.

Alternatively there is consideration being given to forming a public/private partnership with one, or several, existing carriers whereby the ***“Sacajawea Initiative”*** could fund the optical transmission equipment, DWDM multiplexing equipment, and routing hardware; with the dark fiber (fiber with no optronic equipment installed on the ends), rights-of-way, and some, or all of the recurring operating costs being contributed by the existing carrier.

Exhibit 12, Proposed South Dakota Northern Tier Fiber Backbone

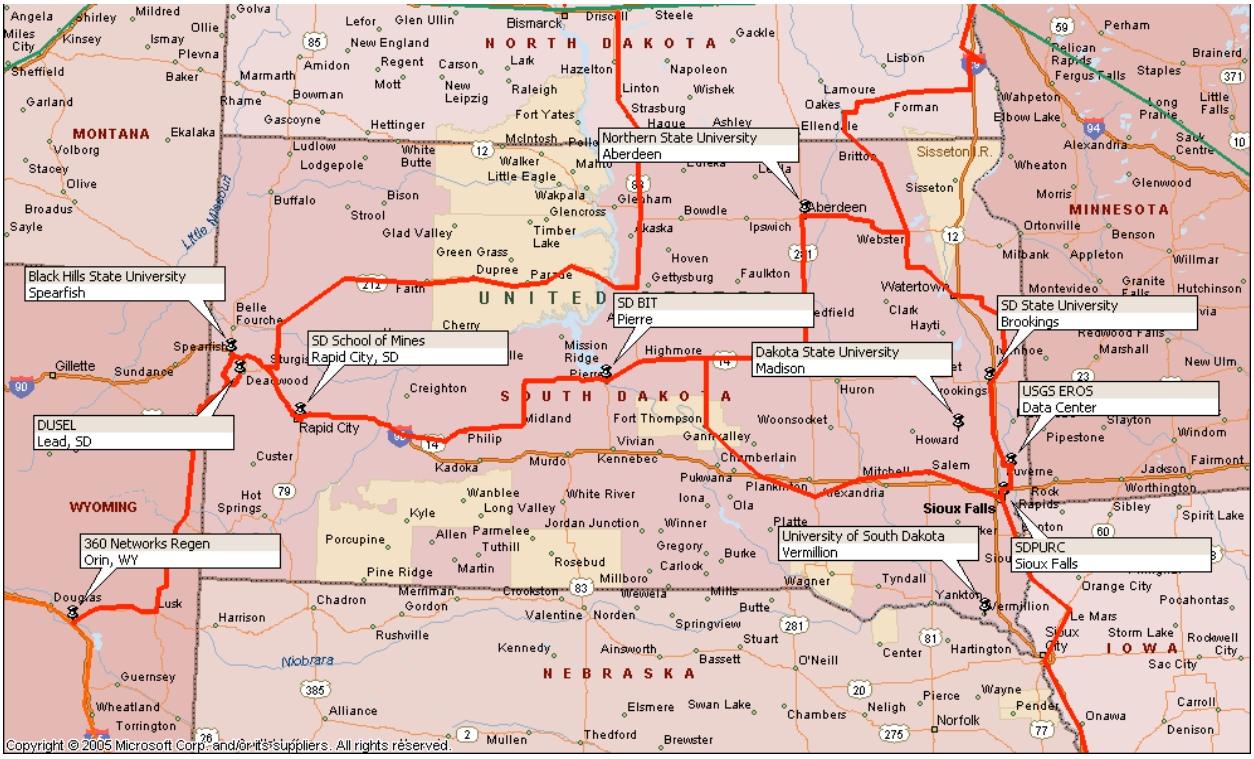


South Dakota - Northern Tier Consortium Backbone Cost Estimates

From	To	Miles	Add/Drop & Terminal Sites	Amp Sites	Regens	Fiber Count	Total One-Time Cost	Total Annual Recurring Cost
North Dakota Border	Omaha Kansas	501	4	4	1	2	$ 2,187,400	$ 442,37
Omaha	City	172	2	3		2	$ 662,400	$ 179,49
Sioux Falls	Rapid City	397	2	11	1	2	$ 1,742,800	$ 422,18
Rapid City	Sturgis	30	2	0		2	$ 397,000	$ 101,30
Sturgis	Spearfish	21	2	0		2	$ 375,400	$ 99,05
Lead, SD	Orin, WY	167	1	3		48	$ 4,520,000	$ 245,25
Orin, WY	Denver, CO	215	1	2	1	2	$ 1,300,000	$ 339,05
Total, South Dakota		**1,503**	**14**	**23**		**2**	**$ 11,185,000**	**$ 1,828,69**

South Dakota - Optional Routes For Additional Backbone Diversity								
Sturgis, SD	Bismarck, ND	329	2	5	1	2	$ 1,539,600	$ 319,800
Pierre	Aberdeen	95	2	2		2	$ 583,000	$ 146,010
Total SD Optional Routes		**424**	**4**	**7**	**1**	**2**	**$ 2,122,600**	**$ 465,810**

Exhibit 12.1, South Dakota Backbone with Optional Routes for Backbone Diversity



Note: Backbone costs do not include costs of local routers and connectivity between the backbone and individual campuses.

Although alternative, less expensive routes may be identified during site surveys and field engineering, these cost estimates reflect the best information available at the time of the feasibility study. Additionally, they provide for a robust and diverse backbone architecture throughout the state that will connect the three main research universities with each other and with DUSEL, and provide diverse access to the regional and national fiber backbones and NLR and Internet 2 access node sites in Chicago, Kansas City, Denver, Boise, and Seattle.

IX. Recommendations

- Upon approval of funding by the granting authorities, state legislatures, and other funding sources, The "Sacajawea Portage" consortium (The Consortium) should form a permanent "Steering Committee" and a "Technical Advisory Committee" which will oversee the ongoing design, engineering, installation, and operation of the network;
- The Consortium should recruit and hire an Executive Director who will be responsible for completing negotiations with:
    - the national and regional carriers operating within the region for rights to dark fiber and rights to lambdas on dim fiber;
    - equipment vendors for optical fiber transport, DSDM and routing equipment;
    - The National Lambda Rail, Internet 2, and other Research and Education networks for traffic peering rights;
    - Internet Service Providers (ISP's) for commodity internet rates at Tier 1 traffic aggregation points;
    - "The Quilt" for membership and rights to purchase bulk internet transport and ISP services at their nationally-negotiated rates.
- The Consortium should develop a one year, five-year, and ten-year business plan for the ongoing funding, acquisition, installation, implementation, management, and operation of the network.
- Montana and North Dakota should complete negotiations as soon as possible with the Pacific Northwest GigaPOP to extend and secure rights to available dark fiber between Billings, MT and Minneapolis, MN, under the existing SURA agreement with AT&T;
- The Consortium should enter into negotiations with national and regional carriers in, and around the four states, to negotiate the rights to dark and dim fiber, and lit services, to connect the campus and research sites to the surrounding regional and national fiber optic backbone routes and hub sites;
- The Consortium should enter into negotiations with the manufacturers of optical fiber transport, dense wave division multiplexing equipment, and routing equipment to negotiate the best terms available to the Research and Education community available, and acquire and light the network;

X. Total Project Costs

Project Totals	Miles	Add/Drop & Terminal Sites	Amp Sites	Regens	Fiber Count	Total One-Time Cost	Total Annual Recurring Cost
Base Project Total (Does Not Include "Optional Routes"	3,963	46	60	4	2	$ 22,405,900	$ 4,692,320
Total Optional Routes	1,688	15	21	3	2	$ 7,533,602	$ 1,632,730
Total, Base Project and Optional Routes	5,651	61	81	7	2	$ 29,939,502	$ 6,325,050

XI. Financing

It is proposed that the ***"Sacajawea Portage"*** Regional Optical Fiber Network be financed on a pro rata basis by the states participating in the initiative. Montana, North Dakota, and South Dakota have already submitted budgetary requests for their portion of the funds necessary to acquire and light the interstate backbone and intra state segments of the network in their respective states, and have been advised the funds are available and have been earmarked for their requests. Idaho is in the process of preparing submittals to request funding approval during their next legislative session. As a minimum, it is recommended that each state appropriate at least 50% of the minimum required for its participation to ensure the implementation of the interstate backbone segments across the region is begun so that the region does not fall even further behind the rest of the nation in its implementation of the nationwide broadband initiative. A significant portion of the recurring operating costs will be offset by savings from existing lit services agreements currently in place.

It is possible that the costs of implementing the ***"Sacajawea Portage"*** may be partially reimbursable from a combination of federal grant monies, private donations.

Discussions with the US Government's Economic Development Agency in the three regions involved have been very encouraging, and we propose to submit a grant request to them during the 4th quarter of 2006 outlining the project and requesting funding. The plan is to finalize the total project cost estimate in a business plan currently under development and due for submittal in October 2006. This plan will determine the aggregate one-time cost of the backbone and the recurring operating cost for five years. A grant application in the amount of half of that total will be submitted to the EDA, with the balance to come from the four states participating in the initiative. Other federal grants in aid and private donations will also be solicited in support of the project. Intra-state routes providing connectivity to member institutions, but not required for the east/west and north/south backbone routes, presumably would be funded by the individual states.

Parallel initiatives currently underway in Oregon and Washington, and Southern Idaho, may result in expanding the ***"Sacajawea Portage"*** initiative to include those states in a six-state initiative, benefiting a larger regional populace with an even more funding potential from EDA.

XII. Cost Assumptions

The following assumptions were used in developing the cost estimates for acquiring, lighting and operating the network:

- Cost of dark fiber for the AT&T route segment from Billings to Minneapolis is based on the SURA agreement with AT&T which allows for an initial pair of dark fibers to be acquired at zero acquisition cost, and an additional two fibers to be acquired between Spokane and Minneapolis at a cost of $500/fiber/mile. (Note: The Pacific Northwest GigaPOP has already acquired rights to two fibers between Seattle and Billings and has agreed to allow The Consortium access to lambdas on the existing two fibers on that segment. Collocation costs of $350/rack and route operation and maintenance costs at $75/route mile per year are also calculated on the negotiated rate for the AT&T/SURA agreement;

- Cost of rights-to-use (RTU) dark fiber, rights-to-use lambdas on dim fiber, equipment collocation, and route operation and maintenance on other routes are based on discussions and negotiations with local, regional and national carriers operating in the region, prevailing market rates, and this writer's recent experience over the last ten years negotiating pricing and terms with local, regional, and long-haul carriers for dark fiber IRU's valued at more than $3 billion. (Note: This experience includes full-time involvement on behalf of the Research and Education community for the last five years.) Based on these discussions and negotiations, the historical relationships between the Research and Education Community and local and regional carriers, and the lack throughout much of the region of any presence by long-haul carriers that regularly market dark fiber, it was assumed that IRU rights to dark fiber or dim fiber lambdas in this geographic region could cost as much as 240% of that experienced throughout the rest of the nation over the last five years. Similarly, it is assumed collocation costs could equal 160% of that experienced throughout the rest of the nation, and route O&M costs are expected to be nearly 250% of that experienced by the rest of the nation.

- Costs of equipment were based on CISCO 15-808 and 15-454 discounted prices for optical fiber transport and DWDM equipment and CISCO 12000 routers that have been generally available to the Research and Education Community over the past five years. Since this equipment is nearing the end of its economic life cycle, and equipment costs are declining rapidly for this technology, it is reasonable to assume The Consortium would benefit from technological advancement and falling costs for this equipment. (As a point of information, the CISCO 15-454 platform, sometimes regarded as a Metropolitan Area Network Solution or "MAN") was recently deployed to light the National Lambda Rail long-haul segment from Atlanta to San Diego, a fact which attests to its functionality and cost-effectiveness in a long-haul environment.)

- Fiber specified is assumed to be Corning SMF-28, or equivalent. (Note: With this fiber, actual experience with the CISCO 15-454 can handle up to 32, 10 Gbps channels in the "C" band, at distances up to 60 Kilometers [18 dB/kilometer].)
- Costs of equipment maintenance, remote hands maintenance, one-time last mile costs, and recurring costs were based on manufacturers' quoted rates, discussions with local, regional, and national carriers, and this writer's actual experience with other regional optical fiber networks throughout the nation.

- Costs of dark of dim fiber rights outside the US, to connect between the North Dakota Border and Winnipeg, and between the Montana border and Calgary, were assumed to be the responsibility of CANARIE, the Canadian Research and Education Network.