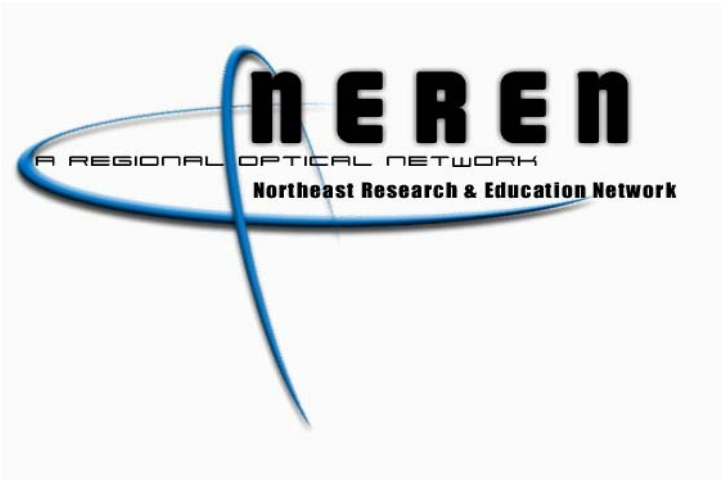


A Revolutionary Idea in Networking

December 2004

NEREN – Overview

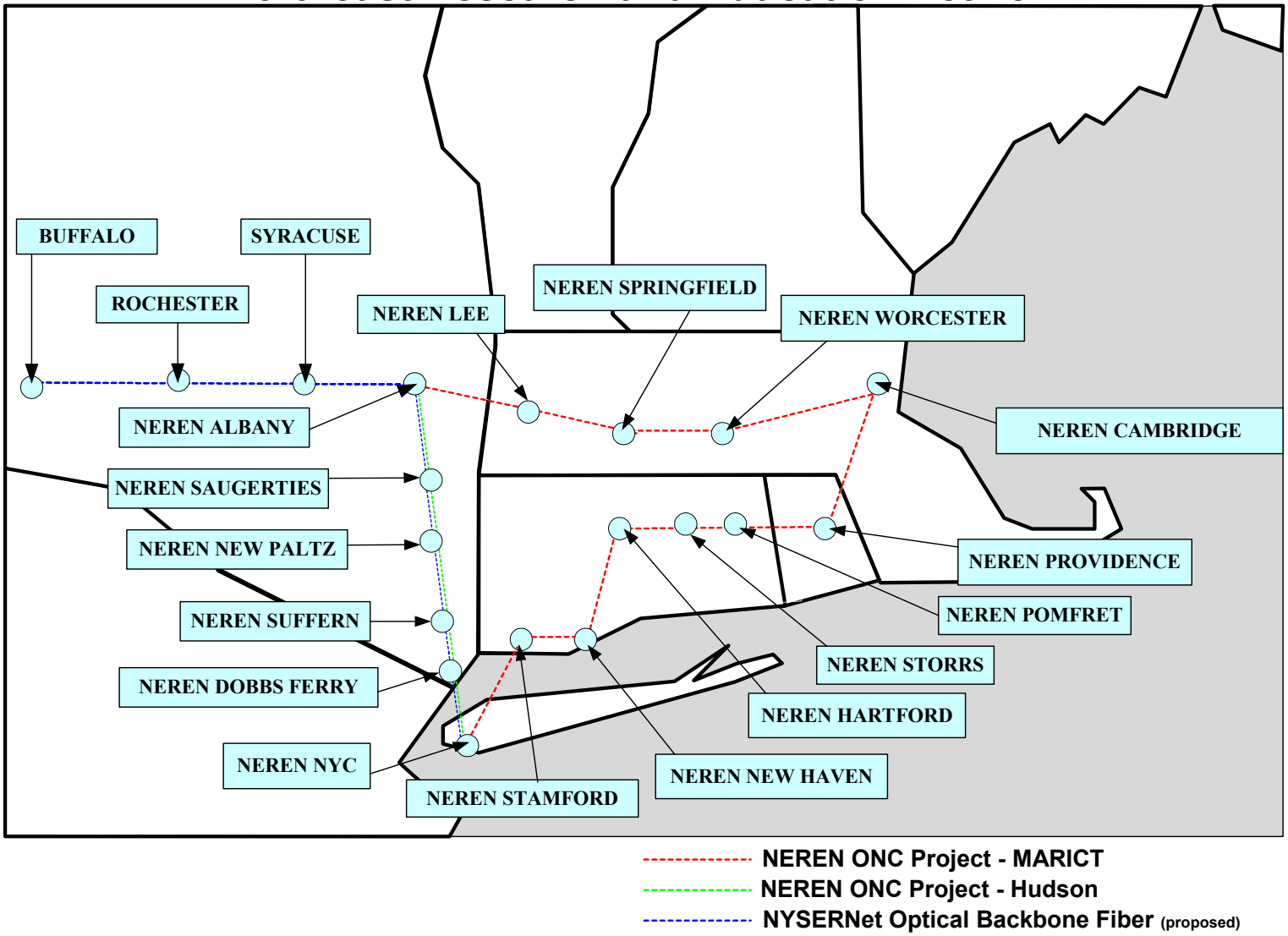
At the dawn of the twenty-first century, the Northeast finds itself competing with other regions in the United States, and around the globe, to create a vibrant diversified economy, an educated workforce, rewarding employment opportunities and security for its citizens. Increasingly, these workforce development, homeland security, economic development and educational programs are reliant upon information technology to gain a competitive edge in a global economy. A fundamental enabler of technology-based programs is the utilization of optical fiber networks; networks built with glass strands the thickness of a human hair, that link educators, students, researchers, first responders and citizens across the region.

Within the Northeast region, many local fiber optic rings or loops have been constructed to provide digital connectivity for various universities and, in some cases, link several universities together in a collaborative network. A number of these rings are confined to specific geographic areas including Amherst, Worcester, Boston, and limited regions of Vermont, New Hampshire and Maine. Others, such as New York, Rhode Island and Connecticut, are statewide networks. These rings comprise the infrastructure that provides the capacity necessary for advanced research and computer applications, requiring greater bandwidth for high speed connectivity, to function within a respective institution and through the Internet. Over the past five years, these rings have been constructed and enhanced quietly, becoming the best kept secret with respect to digital networking in the research and education (R & E) communities in the Northeast.

Over the past eighteen months, the idea of integrating these independent rings into a powerful and robust advanced, high speed, R & E network infrastructure has emerged throughout the region. The idea is a simple and exciting one: connect the existing fiber optic rings by filling the gaps between them. The resulting possibilities for cooperation and collaboration amongst the region's research and education community are immeasurable. This community could include every public and private university, every local school system, hospital, museum, library and public safety organization (police, fire, emergency medical services) in the region. Planning and the design of the ***NorthEast Research and Education Network****, or* ***NEREN***, have taken place with strong participation from state and regional R & E network organizations such as: Northern Crossroads (Boston), OSHEAN (Rhode Island), NYSERNet (New York), The Connecticut Education Network, and The University of Massachusetts, Amherst. Importantly, Northern Crossroads is the point-of-presence for Internet2[1] for New England, as is NYSERNet for the State of New York.

[1]Internet2 is a consortium of more than 200 U.S. Universities, which, through work with the industry and government, develops and deploys advanced network applications and technologies for research and higher education, accelerating the creation of tomorrow's Internet. www.internet2.edu

Northeast Research and Education Network



The Benefits

Today, more than ever, enterprises of all types require communications networking capabilities to sustain a competitive edge, assure advancement, and support our citizens. In the same way that the construction of the U.S. interstate highway system in the last century, and the railroads before them, fundamentally altered interstate commerce, enabled new industries, and bolstered the United States economy, NEREN will foster the development of digital highways, transporting information and ideas, the most valuable resource in today's economy, throughout the region.

Until the establishment of NEREN, the Northeast region did not have a facilities-based optical network focused on the needs of the Research and Education arena. The absence of such a resource limited access to peer-to-peer collaboration, intellectual investigation, and research funding allocation. Without NEREN, the Northeast's individually proficient Research and Education communities were limited in their ability to collaborate and explore in the global economy.

Much has been written about the "digital divide" and the impact it is having on our society. It is reasonable to project that similar comparisons will be made about the economic viability of those regions within the country who have deployed an advanced digital infrastructure, and those who have not. One thing the digital age has taught us thus far is that it is difficult to predict all possible uses and benefits of an advanced technology infrastructure. NEREN is one small effort to help ensure that the citizens of the Northeast will be prepared to take advantage of these yet unknown applications when they are developed. Below are just a few examples of how this infrastructure could be used to address issues we face today, while we develop the applications of tomorrow.

Education and Research

- *Access to Internet2, and eventually the National LambdaRail[2] Project, by elementary, secondary, post-secondary and post-graduate programs as well as by hospitals, libraries, even the corporate community*. Internet2 allows students access to video conferencing and such national enrichment programs including the Jason Project and the Harvard Smithsonian Center for Astrophysics. Students will be able to communicate live, by voice and image, to other students in schools around the globe. They will be able to observe surgical procedures at hospitals as part of their science programs, view activities inside major corporations as part of career educational programs, and take a virtual stroll through the finest museums and galleries in the world.

- *Access to Grid technologies that allow collaboration among researchers from multiple institutions.* "Virtual laboratories," or networked research test beds, can be created where feedback and input on common topics can be aggregated in real time across institutional and state lines. Also, through the use of Grid computing, the capacity of several powerful computers located states apart can be harnessed across Internet2 to solve very complex computational problems.

- *Strengthening of the Northeast's research and development competitiveness*. NEREN can provide a deep well of networked resources and expertise that can be leveraged in the pursuit of increasingly competitive private and federal research and education grants. Also, there can be significantly greater opportunities for collaborative applications and initiatives that build upon the unique strengths of the participating institutions across the Northeast.

[2] National LambdaRail (NLR) is a major initiative of U.S. research universities and private sector technology companies to provide a national scale infrastructure for research and experimentation in networking technologies and applications. www.nlr.net

Homeland Security

- *A common network infrastructure, system redundancy, and coordinated management.* NEREN can provide a robust regional network that can be utilized as a powerful back-up system. It has the potential to provide a powerful platform for homeland security and disaster planning by integrating data and information from police, fire, emergency medical services, hospitals, airports and federal law enforcement agencies throughout the Northeast. It can also be a platform for Internet security for the entire region.

- *Integration with Intelligent Traffic Systems.* First Responder communications systems such as next generation radios and wireless networks are being deployed within states as Homeland Security enhancements. NEREN is uniquely suited to provide a region-wide backbone, to connect such communications systems.

- *Development of a common emergency communications system.* On September 11th when the World Trade Center Towers collapsed, virtually all communications in Manhattan, and those linking it to the rest of the country, were severed. One network, The Research and Education Network in New York, called NYSERNet, maintained its connectivity. The strength and resiliency of these network rings during times of emergency can receive no larger testimony. These same attributes can be transferred throughout the Northeast through NEREN.

- *Isolating key network hardware.* Key network equipment, such as computers, data storage facilities and telecommunications systems, now located inside most of the existing rings, can be relocated more than 100 miles from central cities and accessed through NEREN, thus protecting individual local, state and federal assets.

Economic Development

- *Increase the research and development capacity of the region through synergy and collaboration.* With the development of NEREN, the Northeast can effectively link many of the most renowned and respected research institutions in the world. In addition, it can provide the means for organizing and managing divergent research strengths and talents, allowing for greater opportunities for collaborative research across a wide range of emerging and cutting edge fields and disciplines. With NEREN, the region can increase its ability to attract businesses, particularly start-up companies, representing many different industry clusters and emerging technology fields. NEREN can also expand location options for new or expanding companies, and provide greater flexibility in their location needs, and a wider research and development network to support them now and into the future.

- *Building the most talented workforce in the nation.* Because NEREN will link elementary and secondary schools with technical and research universities across the region, as well as large-scale educational programs with global reach (e.g., The Jason Project). NEREN's integration of K-20 education systems can significantly augment the development of student skills and competencies, particularly in the areas of science, technology, engineering and math (the STEM skills). The economic vitality and competitiveness of the Northeast is directly dependent upon the quality of our education and training programs. NEREN can have a huge impact in making the region's educational and workforce programs second to none, turning the region into an economic development magnet for company relocations and start-ups.

- *Enhancing the region's technology backbone.* To effectively compete in the global marketplace, productivity is of utmost importance. This is probably no more true than in the Northeast where housing, energy, labor, and healthcare costs, coupled with a high rate of population out-migration, all contribute in making workforce efficiency critical to competitiveness. Technology has been, and will continue to be, the great equalizer and NEREN's backbone and access to top-end institutional research capabilities will advance its impact significantly. It can also provide the platform upon which corporate technology needs can be built and/or enhanced. It can do the same for researchers, students and families, creating a technology-friendly regional community that is very attractive to business and industry; particularly those involved in emerging and growth technologies.

NEREN Governance Overview

The fruits of this cooperative participation among the key regional networking organizations are about to be realized with the incorporation of the NorthEast Research & Education Network (NEREN) in the State of Connecticut.

This Corporation's purposes are to: (1) maximize the educational and information exchange potential of communication network resources by developing advanced networking among Members of the Corporation through regional cooperation and collaboration; (2) pool the ever-expanding body of regional scientific, medical, and educational expertise to support the research, education and healthcare communities; and (3) extend the benefits of its activities to promote technology transfer, economic and workforce development, and network security for government, the nonprofit community, and the broader society.

The Corporation shall initially have eight (8) classes of Members. Those Classes shall consist of seven (7) "State" Classes of Members and one "At Large" Class of Members. The names of the initial State Classes are as follows: (i) Connecticut, (ii) Massachusetts, (iii) New York, (iv) Rhode Island, (v) Maine, (vi) New Hampshire, and (vii) Vermont.

It is our intention to have two representatives from each class as directors on the Board of Directors. Each class will nominate one or more persons for the position of director representing their class, and the Board will elect a nominee.

NEREN has created a convening board that will serve as the interim Board of Directors. The interim board has a single representative from NYSERNet (NY), the University of Connecticut on behalf of the Connecticut Education Network (CT), OSHEAN (RI), UMass Amherst (MA) and the NoX (At Large).

The Directors and Officers of NEREN are:

Chairman
Timothy Lance
President and Board Chairman
NYSERNet, Inc.

President
George Loftus
Executive Director
OSHEAN, Inc.

Secretary
Robert Vietzke
Program Director & Network Architect
University of Connecticut /
Connecticut Education Network

Treasurer
Rosio Alvarez
Executive Director
University of Massachusetts at Amherst

At Large
Leo Donnelly
Senior Technical Analyst
Harvard University / NoX

NEREN Financial Overview

Capital Costs

Initially NEREN will require significant capital investment from the "founders" of the network. From our first discussions it was clear that some members of NEREN would be able to offset the cost of leased-lines that carry our traffic to one of the NEREN gigaPOPs at the NoX in Boston or NYSERNet in Manhattan. The four "founding" organizations are OSHEAN, NYSERNet (to bring its traffic from upstate NY to Manhattan), the University of Connecticut on behalf of the Connecticut Education Network (CEN), and the University of Massachusetts at Amherst.

The plan today is for these four organizations to invest the capital funds necessary to get the NEREN project "off the ground." The capital costs include the twenty-year IRU lease of the fiber and the purchase of shared optical equipment necessary to light the segments.

Annual Recurring Costs

The recurring costs for NEREN are shared by all participants in the NEREN network. We have separated the costs into three categories:

Membership Fees

The membership fees consist of the administrative costs for NEREN divided by the number of member classes.

Connector and Participation Fees

Connector fees are paid by each organization that deploys an actual physical connection to the NEREN backbone.

Participation fees are assessed for each organization that utilizes the NEREN network that is aggregated behind a NEREN connector.

Lambda Fees

Each connecting organization pays a fee for the each lambda that it uses. We anticipate that revenue growth within NEREN will be generated in large part by these lambda fees.