NYSERNet, Inc.

Annual Report 2009

NYSERNet Board of Directors

Dear Colleagues,

I am pleased to present NYSERNet's 2009 annual report. One might ask why, in our silver anniversary year, this is the first such report. The answer lies in our evolution.

From its beginning, NYSERNet has had an engaged, active Board. In our semi-annual Board meetings and biennial strategic retreats reporting has occurred regularly. With Board guidance, over the last quarter century we have taken many calculated strategic risks, creating networks, network services, and valuable assets for the state, nation, and globe. Though NYSERNet's number of employees has not increased, its organization today is more multi-faceted than ever. With our network and other services fundamental to the academic and research enterprise, we have extended our reach to a broader academic community as well as industry and government, catalyzing collaboration. New external factors, such as the federal broadband grants and the FCC's broadband plan, now call upon the academic networking community to assume a leadership role.

NYSERNet's work no longer occupies a niche, but has become seminal to the mainstream, and our audience is now far broader. With this annual report we begin telling our story to our full audience. Our first such effort has required much attention to format, presentation and content, and comment on any aspect of this report is welcome. Thanks are due to our Board, staff and many in the community who have contributed over the years to the story we have to tell.

Regards,

Timothy L. Lance, President and Chair, NYSERNet, Inc.

Strategic Plan

Like its 2000 and 2005 predecessors, NYSERNet's 2009 Strategic Plan originated in a Board retreat's consensus, enriched and finalized by further Board discussion and direct staff involvement. This continues NYSERNet's proud tradition of calculated, strategic investments of capitol and mind share.

Strategic plans point the way forward, but also provide useful benchmarks of progress. The 2000 plan's five strategic goals were:

1. Unify NYSERNet's two Boards;
2. Provide advanced networking;
3. Explore the network's possibilities;
4. Engage a broader community;
5. Sustain and enhance NYSERNet's state and national visibility.

Ultimately, we opted to continue with both Boards, maintaining Org Board's breadth and diversity and the smaller Net Board's focused, long-term responsibility. Multifaceted, complex, interlocking operations trace from each of the plan's four remaining goals. The second goal, which grew out of October 1999's strategic retreat in Savannah, where we committed to exploring control of transport, led over five years to several seminal efforts. These include our New York City fiber deployment, creation of a global peering point in Manhattan, and a statewide optical infrastructure, with the latter's network-dependent applications, such as our colocation facility at 32 Avenue of the Americas, dynamic waves for data intensive research, and the Business Continuity Center, exceeding anything imagined in 2000.

Our 2009 goals result directly from realization of the last four goals above (and indeed from rejection of the first). They are as follows:

1. Evolve NYSERNet's network assets – R&E Network, NYC fiber, and peering facility in Manhattan;
2. Develop the Syracuse Business Continuity Center;
3. Collaboratively anticipate, design, and deliver new services and capabilities;
4. Sustain our visibility in forums where the national and global future of research and education networking is being deliberated and determined;
5. Continue to build our relationship with New York's corporate community and its government, particularly NYSTAR;
6. Leverage our standing to secure support and funding for high-value efforts for NYSERNet and its member institutions.

Reflecting the principles that produced the 2000 plan's goals and their 2005 reinforcement, two commitments underlying the current plan also push us into new territory. After a decade of steadily expanding outreach to government at both the state and federal level, NYSERNet is now widely viewed as a resource, its opinion often sought. Concurrently, in the hope of bringing researchers together around "grand challenge" problems larger than any discipline, institution or

sector, like energy, climate, and health care, we have engaged New York's corporate research community. Though building partnerships has long been a core value, these broader affiliations certainly force NYSERNet to grow.

We remain committed to advanced, dedicated networking for the research and education community. A founding principle for all the regional networks, in many this objective has been eclipsed. So our strategic plan's most striking aspect may be our sustained commitment to providing specialized resources for the research and education community, now encompassing government and corporate research. The big problems we must all confront together demand no less.

And yet we ventured
for the gain proposed.
Choked the respect of likely peril fear'd;
And since we are o'erset, venture again.
Come, we will all put forth,
body and goods.

William Shakespeare, Henry IV, part 2

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NYSERNet's latest strategic plan
in its entirety can be found at
www.nysernet.org/nn_strategic_plan.pdf

NYSERNet Staff

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Program Manager, NYC Fiber Services

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Manager, Data Center

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Stephan M. Knapp
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Colocation Supervisor

Elaine M. Verrastro
Administrative Assistant

Metropolitan Fiber Network

NYSERNet's New York City Metropolitan Fiber Network entered its fifth year of operation in 2009. Nine of New York's most prestigious institutions now use NYSERNet provided fibers to connect thirty-five locations with tailored optical networks, enhancing their internal and external communication capabilities and promoting network robustness.

This program aimed to leverage the glut of fiber left in the wake of the dotcom bubble's collapse to provide NYSERNet members with the unlimited upgradeability fiber promised. Its present maturity and stability belie the daunting challenges that NYSERNet's Board, staff and the network's anchor institutions faced at the project's beginning.

The borough's numerous fiber facilities, sheer density of locations that might connect, and 9/11's devastating effects on the City's telecommunications infrastructure, which motivated its institutions to seek ways of promoting communications survivability in the event of future disasters, led NYSERNet to select Manhattan for this project.

Notwithstanding, Manhattan turned out to be a more difficult location in which to implement this program than any expected. Fiber was available aplenty, but not near the desired locations. And the estimated costs of acquiring and lighting it, which exceeded the expectations of many of those initially expressing interest, caused some to abandon the project. Resulting network redesigns drove up costs for institutions still interested.

Ultimately, The American Museum of Natural History, City University of New York (CUNY), Columbia University, Mount Sinai School of Medicine, New York Presbyterian Hospital, and Weill Medical College of Cornell University (later joined by Fordham University; CUNY's Lehman, John Jay & Baruch Colleges; New York University and The Rockefeller University) formed the core of this

collaborative effort, with Lexent Metro Connect chosen to construct and maintain our custom built fiber plant.

As new connectors joined, the network evolved. Diverse paths and ring closures, alternate connections for existing and future locations, and options to reach Brooklyn and Queens are the most significant enhancements since 2004. Participating institutions routinely invent new ways for the investment to benefit themselves—economically adding diverse service providers, creating scalable DWDM networks, and, most recently, extending their networks to NYSERNet's Business Continuity Center in Syracuse.

This project inspired other regional networks to pursue ownership of dark fiber, and spawned similar efforts by NYSERNet members in Buffalo, Rochester, Syracuse and Albany, effectively future-proofing New York's university research community from a networking perspective. They now possess the ability to satisfy future demands for bandwidth by upgrading the equipment they use to light these networks.

Perhaps the biggest unanticipated benefit was creation of a global network peering point at NYSERNet's Colo@32, the Metropolitan Fiber Network's heart. An interconnection-friendly alternative to carrier-dominated collocation facilities, the Colo@32 is where member networks constructed on the Metropolitan Fiber Network meet to exchange traffic and connect to network service providers. The Colo@32 also hosts national and international research and education network providers peering with each other through MAN LAN, making it the most important exchange point for R&E traffic in the U.S.

NYSERNet
advances network technology
and related applications
to satisfy needs
common to the institutions
composing New York State's
research and education community,
providing a forum for exploration
of the opportunities and challenges
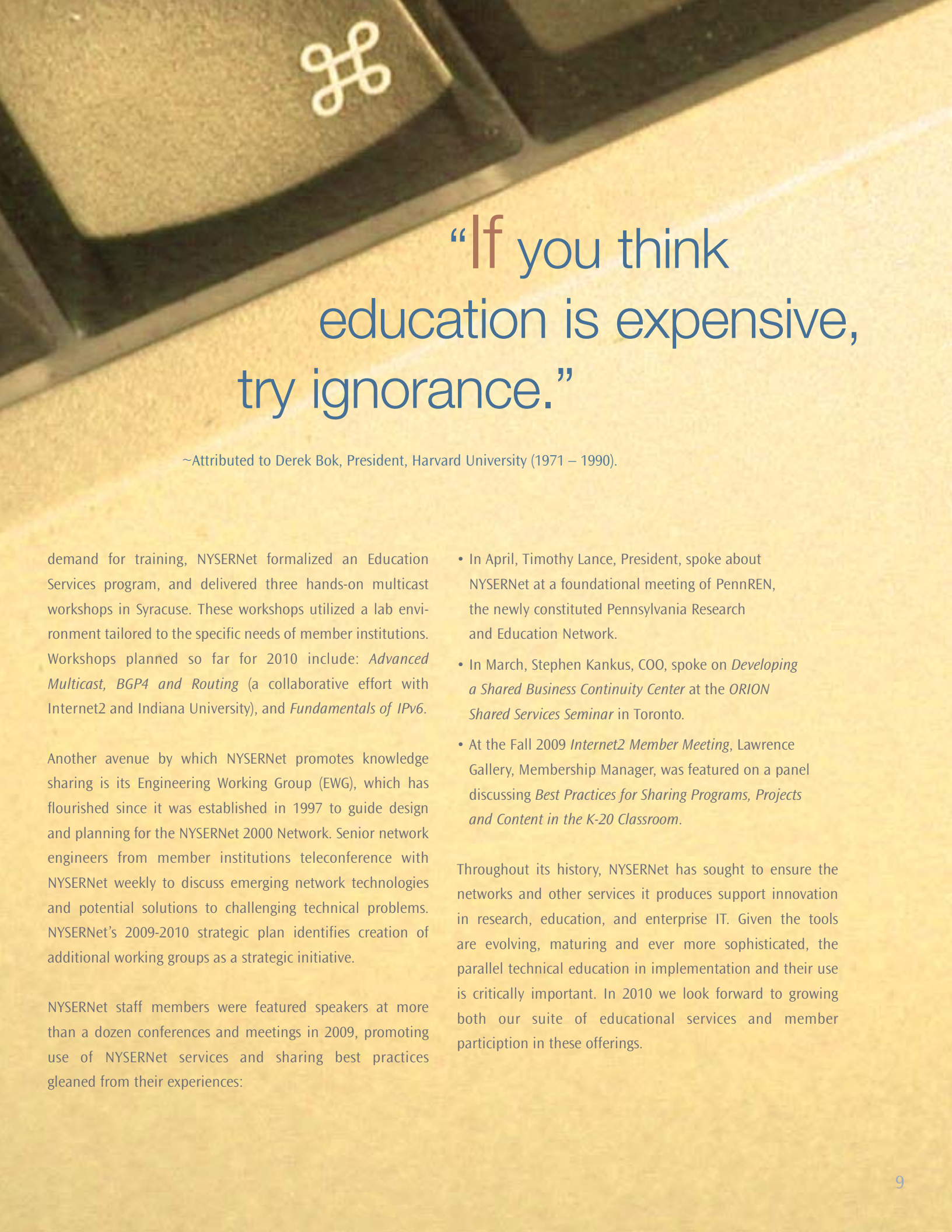these innovations present.

Knowledge Transfer

NYSERTech 2009, *Multimedia via the NYSERNet R&E Network* featured speakers and panelists discussing best practices, comparing strategies, and providing live demonstrations of multimedia activities designed for the K20 classroom. The event, July 29th, at SUNY Oswego's Metro Center in downtown Syracuse, attracted more than fifty participants from NYSERNet member institutions. NYSERTech 2010, on July 28th in Syracuse, explores cloud computing's potential for shaping the academic IT environment.

In 2009, NYSERNet promoted a conference aimed at senior technology leaders in New York State's higher education community. The 2009 New York State Conference of Higher Education CIOs drew fifty-one individuals from thirty-seven academic institutions to Syracuse University, the host and primary sponsor, for a three-day event featuring presentations about IT/library partnerships, the evolving semantic web, and strategies to meet economic challenges. The program concluded with a presentation by Richard Katz, author of *The Tower and The Cloud,* on cloud computing's potential impacts on enterprise IT. The NYSCIO 2010 conference will be held July 14-16 at the University at Buffalo.

In 2009, collaborating with commercial training provider BTS, NYSERNet re-emphasized its historical role as a resource for hands-on technical training, offering three events on fiber optic splicing and fault isolation, two in New York City (hosted and co-sponsored by New York University ITS) and one in Syracuse. When a follow-up member survey suggested additional unmet

"If you think education is expensive, try ignorance."

~Attributed to Derek Bok, President, Harvard University (1971 – 1990).

demand for training, NYSERNet formalized an Education Services program, and delivered three hands-on multicast workshops in Syracuse. These workshops utilized a lab environment tailored to the specific needs of member institutions. Workshops planned so far for 2010 include: *Advanced Multicast, BGP4 and Routing* (a collaborative effort with Internet2 and Indiana University), and *Fundamentals of IPv6*.

Another avenue by which NYSERNet promotes knowledge sharing is its Engineering Working Group (EWG), which has flourished since it was established in 1997 to guide design and planning for the NYSERNet 2000 Network. Senior network engineers from member institutions teleconference with NYSERNet weekly to discuss emerging network technologies and potential solutions to challenging technical problems. NYSERNet's 2009-2010 strategic plan identifies creation of additional working groups as a strategic initiative.

NYSERNet staff members were featured speakers at more than a dozen conferences and meetings in 2009, promoting use of NYSERNet services and sharing best practices gleaned from their experiences:

• In April, Timothy Lance, President, spoke about NYSERNet at a foundational meeting of PennREN, the newly constituted Pennsylvania Research and Education Network.

• In March, Stephen Kankus, COO, spoke on *Developing a Shared Business Continuity Center* at the *ORION Shared Services Seminar* in Toronto.

• At the Fall 2009 *Internet2 Member Meeting*, Lawrence Gallery, Membership Manager, was featured on a panel discussing *Best Practices for Sharing Programs, Projects and Content in the K-20 Classroom*.

Throughout its history, NYSERNet has sought to ensure the networks and other services it produces support innovation in research, education, and enterprise IT. Given the tools are evolving, maturing and ever more sophisticated, the parallel technical education in implementation and their use is critically important. In 2010 we look forward to growing both our suite of educational services and member particiption in these offerings.
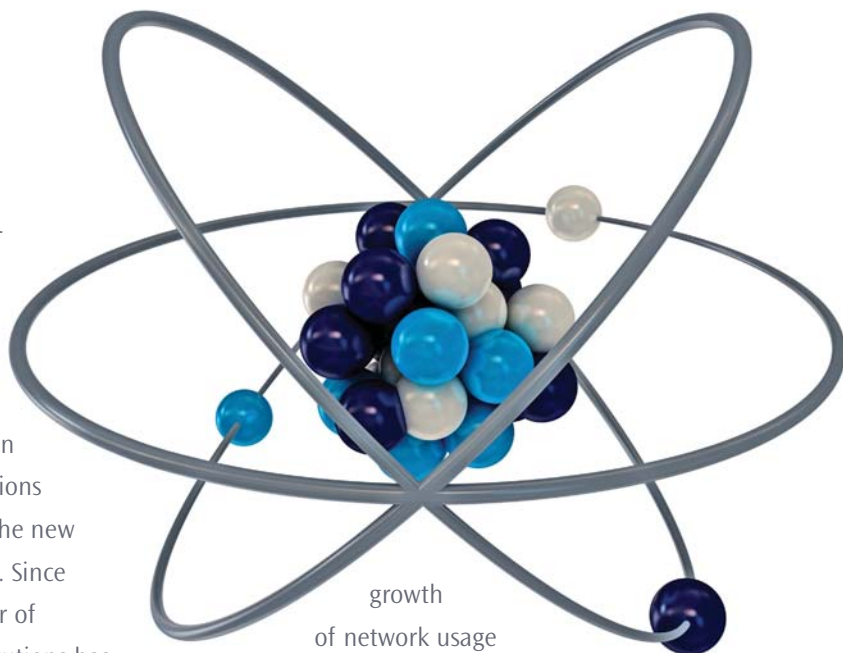
R&E Network

NYSERNet's fifth-generation network marks its fifth anniversary in 2010. Nineteen member institutions transitioned to the new network in 2005. Since then the number of connecting institutions has more than doubled, the most recent addition, Colgate University, making the total thirty-nine.

The equipment used to build the network was state-of-the-art in 2005, but today some is beginning to show its age. NYSERNet engineers recently replaced the network router in our New York City point of presence, The Colo@32. This project dramatically increases our capacity for additional connections and will provide a cornerstone for future upgrades.

During 2010, we plan to replace components now obsolete. We will add capacity for more optical connections in New York City. There, demand for access to the network's high-speed transport capabilities is high. We'll also upgrade the processors in our backbone routers in Syracuse and Buffalo to the latest versions.

Driven by big science projects like the Large Hadron Collider and the constant growth of network usage for collaboration, multimedia and research, NYSERNet members' bandwidth usage continues to increase. In mid-2009, NYSERNet connected to National LambdaRail for the first time, thus providing a third national backbone connection. In 2010 we will upgrade our two connections to Internet2 and our peering connection to MAN LAN from one to ten gigabits per second, bringing the external connection bandwidth of the R&E network to twenty gigabits per second.

The NYSERNet network also provides members with access to high-capacity dedicated circuits, both through direct connections to our optical backbone and through the NYSERNet circuit service. The primary use for circuits has been member connections to NYSERNet's Business Continuity Center in Syracuse, but an increasing number of members are using them for internal connectivity and access to commercial Internet providers.
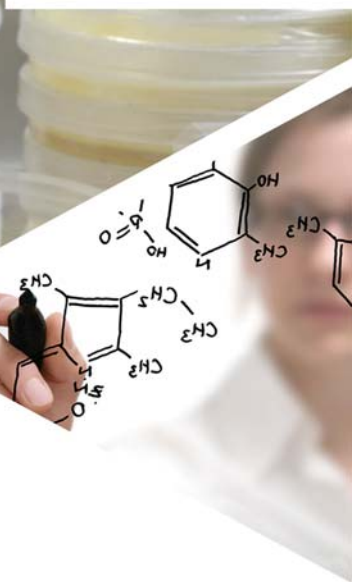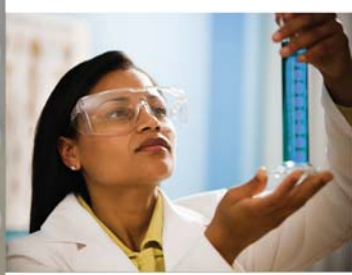
Business Continuity Center

In July 2009, NYSERNet's Business Continuity Center (BCC) began its third year of operation, with member participation growing steadily. Seven NYSERNet member institutions occupy one-third of BCC's current capacity of fifty standard-size data center cabinets. Six members are planning implementations.

Designed by member institutions to leverage NYSERNet's advanced network capabilities to enhance their disaster recovery and business continuity strategies, the BCC provides an unparalleled resource for deploying highly reliable, highly available business continuity solutions.

The BCC consists of a commercial-grade, 2000 sq. ft. datacenter incorporating sophisticated power delivery and HVAC systems, infrastructure monitoring, fire prevention and security. The center is highly connected, offering participants affordable access to the commercial Internet, NYSERNet's Research & Education Network, and NYSERNet's DWDM network. NYSERNet's expert professional services complete the BCC offering.

Member institutions employ the BCC to satisfy their unique DR/BC requirements, with specific applications, and their enabling technical means accordingly varied. The classes of applications implemented or planned include the following:

• Broadcast emergency communications capabilities to keep the campus community informed during a crisis.

• Standby backup of critical campus communication infrastructure—Domain Name Services (DNS), directory services (LDAP), web and email.

• Hot standby versions of critical information systems, including student information systems, file and authentication services and databases.

For many member institutions, budget uncertainty and constraints, along with shifting and competing priorities, have pushed back participation timelines. We expect this trend to slowly reverse in 2010 and 2011. Accommodating these additional participants means expanding the center's power distribution and HVAC. This full implementation, including an additional 30 tons of cooling and 225 kVA of power distribution capacity, should take place in 2010.

Other BCC infrastructure upgrades planned for 2010 include expanding video and infrastructure monitoring capabilities, deploying intelligent fan control systems for dry coolers, and installing sensors to monitor dry coolers' glycol pressures, fans, pumps and power.
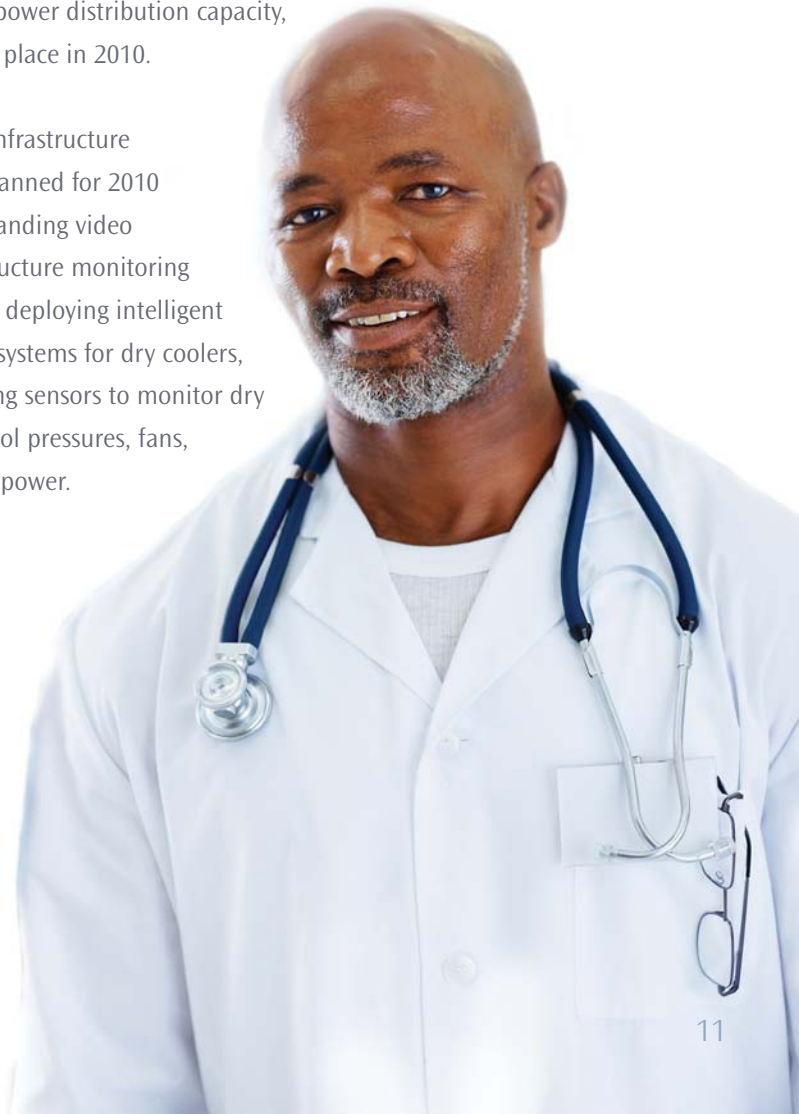
Changes
in Commercial Internet Service

Created in 1985 to connect New York's higher education community to five super computer centers via the fledgling NSFNET, NYSERNet has helped lead network development for two and a half decades. From these roots, and via successive generations of networks—from 56 Kb/s to T1 to T3 to OC3 and beyond—NYSERNet contributed to advancing the technology and protocols at the heart of today's global Internet.

With the 1998 launch of the NYSERNet 2000 network, NYSERNet completed a full-circle evolution, embracing its roots as a provider of network services designed exclusively to support research and education. In parallel, NYSERNet withdrew from being the primary provider of commercial Internet services to its members, relying instead on resale relationships with regional and national ISPs to fulfill member needs for commercial bandwidth.

Within this new paradigm, however, NYSERNet was hardly a passive partner. Employing leverage derived from the aggregate purchasing power of its members, NYSERNet secured favorable terms from its resale partners, while promoting advances in the nature and quality of the network and support services they provide. Perhaps more importantly, NYSERNet drove down the cost of IP bandwidth for its members, routinely securing pricing among the lowest available.

Advances in network technology and members' networking needs quickly rendered NYSERNet 2000 obsolete. It was succeeded in 2005 by a new NYSERNet network with 500 times the bandwidth carrying capacity. Responsive to changes in the marketplace and the needs of its members, NYSERNet's approach to providing commercial Internet services also evolved.

In many of the areas NYSERNet serves, ISP market consolidation reduced competition among Tier 1 ISPs. Price differentials among the remaining providers narrowed and performance gaps closed; now more than ever, public Internet service is a commodity. NYSERNet members' needs have evolved, too. Today they require a level of network availability best met by maintaining multiple Internet connections provided on diverse paths by separate ISPs.

Today, NYSERNet's CIS strategy focuses on providing expanded choice and affordability in all of the geographic markets we serve through a combination of resale and referral relationships. Through NYSERNet, members can choose from six national ISPs, all offering special discounts and favorable terms. Additionally, NYSERNet makes available GigE circuits on its statewide optical network, allowing members to reach providers not otherwise available in their regions. Taken together these changes have resulted in greater choice and reduced costs, enabling NYSERNet members to keep pace with ever-increasing demand for bandwidth.

ARTstor

Bard College

Baruch College

Binghamton University

CANARIE

Canisius College

Central New York Regional Information Center

City University of New York

Clarkson University

Colgate University

Columbia University

Cornell University

Daemen College

DANTE

Erie County Community College

Fordham University

Greater Southern Tier Regional Information Center

Hofstra University

IBM

Internet2

Le Moyne College

Marist College

Massachusetts Institute of Technology

Mohawk Regional Information Center

Monroe #1 Regional Information Center

Mount Sinai School of Medicine

National LambdaRail

New York Presbyterian Hospital

New York University

Niagara University

Northeastern Regional Information Center

Rensselaer Polytechnic Institute

Rochester Institute of Technology

SINET

South Central Regional Information Center

Stony Brook University

Suffolk Regional Information Center

SUNY Geneseo

SUNY Potsdam

Syracuse University

The American Museum of Natural History

The Frick Collection

The New School

The New York Public Library

The Rockefeller University

TWAREN

University at Albany

University at Buffalo

University of Rochester

Upstate Medical University

USLHCNet

Weill Cornell Medical College

Weill Cornell Medical College in Qatar

Western New York Regional Information Center

Yeshiva University

NYSERNet
Members
&
Program
Participants

20
09

The Global Summit Project

NYSERNet has a proud history of working with New York's K-12 community to promote adoption and integration of advances in network technology. In 1994, NYSERNet collaborated with the BOCES Regional Information Centers (RICs) to connect their component school districts to the then-nascent Internet. From then through the late 90's, NYSERNet trained hundreds of New York's teachers and school librarians to integrate the Internet's capabilities into the classroom, the Internet's commercialization curtailing these efforts.

In 2005, NYSERNet initiated a program designed to raise awareness about a new network's potential to enhance teaching and learning. Because of this most recent effort and the RICs' leadership and commitment, today students and teachers in schools across New York State connect to Internet2 via NYSERNet.

NYSERNet recognizes that simply connecting the RICs to the NYSERNet network is insufficient to ensure broad adoption, and so do the RICs. They have assigned specialists to promote network awareness and support teachers eager to apply it in the classroom. This past summer NYSERNet went one step further, holding a series of meetings with RIC Directors to discuss a joint project aimed to demonstrate the network's unique capabilities to promote student learning. NYSERNet's idea was to engage students from at least one class-room in each connected RIC's service area in an effort to utilize multiple network capabilities in pursuit of some then yet-to-be-determined standards-based educational outcome. The Directors were, without exception, enthusiastic about this idea. They assembled a team of distance learning and instructional technology specialists to work with NYSERNet to implement it. Within a month the Global Summit Project was born.

The Global Summit Project is unique in two ways: it emphasizes employing multiple network capabilities and it commits to achieving outcomes consistent with state and national learning standards. Coincidently, the project is divided into two parts. In the first, participating students develop projects promoting exploration of issues of local or global importance using capabilities unique to the NYSERNet network. In the second, students present their findings via the Virtual Global Summit, a videoconference event engaging the broader Internet2 community.

Beyond conceptualizing the project, NYSERNet's role in the Global Summit is to assist students, teachers and curriculum support staff by identifying applications and resources on Internet2 enabling their projects. NYSERNet deployed a website linking to Internet2-enabled resources categorized by discipline. NYSERNet is also a member of the project evaluation team, and is coordinating the Virtual Global Summit videoconference.

Organizations of all types share concerns about maintaining and recovering IT infrastructure in the event of disaster. IT is central to their function; the potential cost of disruption and risk to human safety is too significant to overlook. Preparing and testing disaster recovery and business continuity plans, and developing systems to promote IT survivability and speed recovery are, therefore, activities central to the CIO.

A host of services exists to support realization of the typical DR/BC plan. Offsite data storage, mirrored data centers, warm and cold recovery sites, and redundant WAN services are readily available in the commercial marketplace. NYSERNet's Business Continuity Center—similar to these, but exceptional in its roots as a non-profit collaboration—is fundamental to many institutions' continuity strategies.

More challenging to address is the need for personnel ready to undertake key technical responsibilities at a moment's notice should staff become incapacitated. The ideal substitute is technically qualified, knowledgeable about the institution's network, and implicitly trusted—rare qualities to find external to any institution.

NYSERNet's new Network Management Continuity Service (NMCS) offers one way to ensure availability of such specialized technical personnel. NMCS leverages the knowledge and experience of NYSERNet's network team, their familiarity with members' network infrastructure, and the long-standing trust between

NYSERNet and its members to offer essential surrogate network management capabilities. These include:

• continuous network monitoring and break-fix service/problem resolution;

• network configuration management;

• encrypted off-site storage of critical network information;

• network vendor and escalation management.

NMCS enrollment begins with a needs assessment. NYSERNet staff members review NMCS features and scope with the subscribing institution's representatives ensuring fit with the institution's needs. Together they perform a comprehensive review of the organization's network design, review network documentation and procedures, and design a subscriber-provided training program for the NMCS staff.

Once training is complete and the subscriber has provided NYSERNet with the necessary router/switch configuration files, network diagrams, databases, and contact information—all stored securely by NYSERNet—enrollment is complete and NMCS is primed. All that is required to signal NYSERNet to assume network management responsibility is a call to NYSERNet's NOC by authorized personnel.

Annual review meetings and semi-annual testing—included in the three-year term agreement—ensure that all network documentation stays current and that the NMCS is ready should it become necessary to deploy.

NMCS Network Management Continuity Service