QUILT CIRCLE

National Regional Networks Consortium

...Advanced regional networking in support of research and education

A Letter From the President

As you open this year's edition of *The Quilt Circle* you will find our largest compilation yet of the impressive examples of the role our Quilt members play as key enablers of projects and programs of vital importance to the research and education missions of the institutions they collectively serve. Naturally, The Quilt is proud of the key role our member networks play in serving their communities. Our annual publication gives us the opportunity to showcase the work of our members across the country in a single collection. Like The Quilt itself, we believe that this single collection of examples of our Quilt member missions in action, is more powerful than the sum of its parts.

This year's Quilt Circle cover is truly a fitting one to represent the key roles of our regional research and education network community in serving their communities. For those of you already familiar with the work of the regional research and education (R&E) network in your area and for those who are just learning about them for the first time in this edition of *The Quilt Circle*, you will quickly learn how our research and education networks are a unique set of key partners in fulfilling the missions and goals of their member institutions.

The key to our research and education network success is ensuring our community of connected institutions are able to access advanced networking capabilities, tools and services when and how they need it, with the best possible performance so that the network is not an impediment to scientific discovery. Research and education networks are driven by the interests and missions of these institutions. Each are key enablers bridging the human network with physical networks at the community, state, national, and international levels.

The 2016 edition of *The Quilt Circle* demonstrates the key role regional networks play in providing advanced networking infrastructure for scientific research, discovery and innovation. This edition also showcases how other member communities benefit from the advanced capacity, tools, access and support that research and education networks provide. You will also read about several efforts across our Quilt membership to expand the pipeline of computer science and network engineering talent to support our research and education community as well as broaden the diversity of talent in these areas. Finally, you will enjoy learning about the tools and support our Quilt members are providing to their communities in an area of critical importance to our advanced research and education networking enterprise, network security.

Because of the rich collaborations of our members, The Quilt continues to be a vibrant community where our regional networking organization members gather to engage with one another. The collaborative spirit that is the foundation for our member networks and the creation of The Quilt over 15 years ago is the same driving force behind the success of the organization today in accomplishing our program objectives. Through The Quilt, our members collaborate at the highest levels to ensure our country's scientific community and academic pursuits have access to the most advanced technology capabilities available. Our work together this year is a valuable reminder of the key roles we all play in the success of one another's organizations and in building the national fabric of regional networks into a Quilt community.

Jen Leasure

Jen Leasure
President and CEO

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www.3rox.net

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CENIC and the Pacific Research Platform: Big News for Big Data

From biomedical data to particle physics, researchers depend heavily on high-speed access to large datasets, scientific instruments, and computing resources. To meet the needs of researchers in California and beyond, the National Science Foundation awarded a five-year grant to fund the Pacific Research Platform (PRP).

The PRP, led by researchers at UC San Diego and UC Berkeley, will enable fast and secure data transfers between participating institutions, which include all ten University of California campuses, Stanford, Caltech, USC, and San Diego State University – all of which are connected via the 100 Gbps CENIC Network.
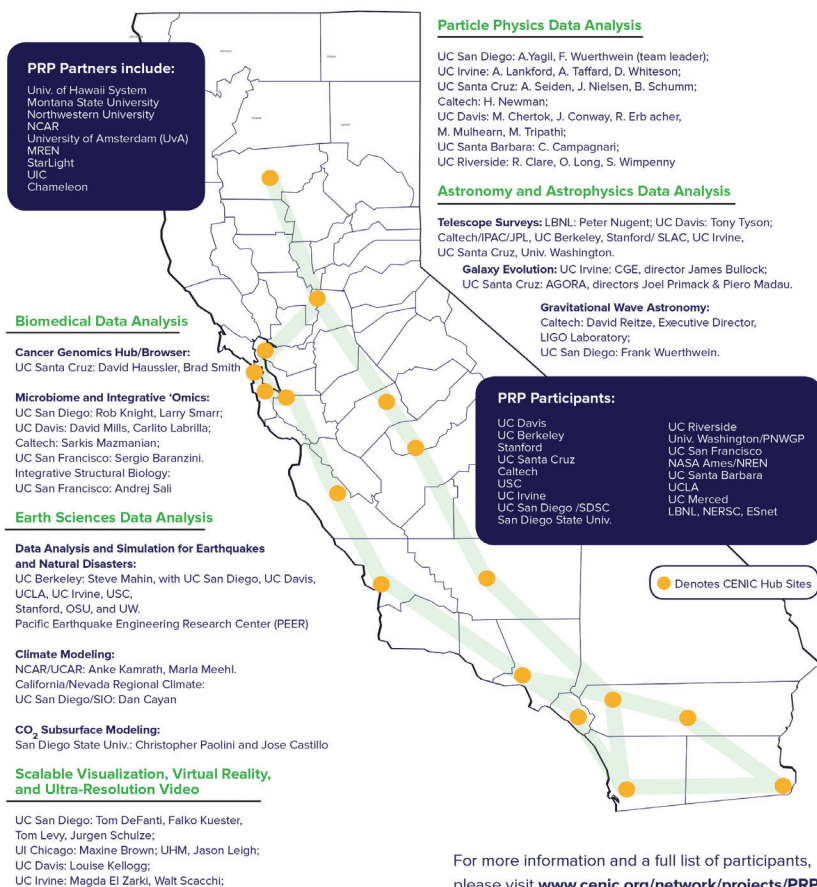
The initiative also extends to Lawrence Berkeley National Laboratory, the National Energy Research Scientific Computing Center, NASA Ames, the National Center for Atmospheric Research, and several campuses outside of California. Partner networks include the Pacific Northwest Gigapop, the Energy Sciences Network, NASA Research and Engineering Network, the Metropolitan Research & Education Network, StarLight, and the Front Range Gigapop – with a long-term goal of engaging other research and education networks in the U.S. and abroad.

The project uses CENIC's California Research and Education Network (CalREN), and integrates Science DMZs, developed by ESnet as secure network enclaves for data-intensive science and high-speed data transport, thereby creating a secure, seamless fabric that will enable researchers worldwide to collaborate while not losing any of the advantages of network architecture specially optimized for the unique needs of big-data research.

"The Pacific Research Platform forms an appropriately designed digital fabric to support a wide variety of multi-institutional Big Data science and engineering projects. CENIC has become the catalyst for demonstrating that this vision is capable of being realized," said Larry Smarr, founding director of the California Institute for Telecommunications and Information Technology and the Harry E. Gruber Professor of Computer Science and Engineering at UC San Diego.

ESnet Director Gregory Bell agrees. "At their best, advanced networks change our perspective about what is possible, and this CENIC collaboration is an inspiring case in point: campuses are thinking more regionally, they are sharing information and coordinating goals, and they are collaborating to produce better science outcomes. This is good news – and a strong example – for our nation's research and discovery infrastructure."

The PRP supports a broad range of data-intensive research projects that will have wide-reaching impacts on science and technology worldwide. Cancer genomics, human and microbiome 'omics integration, biomolecular structure modeling, galaxy formation and evolution, telescope surveys, particle physics data analysis, simulations for earthquakes and natural disasters, climate modeling, virtual reality and ultra-resolution video development are just a few of the projects that are benefiting from the use of the PRP. The PRP will be extensible across other data-rich domains as well as other national and international networks potentially leading to a national and eventually global data-intensive research cyber-infrastructure.

PRP Partners include:
Univ. of Hawaii System
Montana State University
Northwestern University
NCAR
University of Amsterdam (UvA)
MREN
StarLight
UIC
Chameleon

Particle Physics Data Analysis
UC San Diego: A.Yagil, F. Wuerthwein (team leader);
UC Irvine: A. Lankford, A. Taffard, D. Whiteson;
UC Santa Cruz: A. Seiden, J. Nielsen, B. Schumm;
Caltech: H. Newman;
UC Davis: M. Chertok, J. Conway, R. Erb acher,
M. Mulhearn, M. Tripathi;
UC Santa Barbara: C. Campagnari;
UC Riverside: R. Clare, O. Long, S. Wimpenny

Astronomy and Astrophysics Data Analysis
Telescope Surveys: LBNL: Peter Nugent; UC Davis: Tony Tyson;
Caltech/IPAC/JPL, UC Berkeley, Stanford/ SLAC, UC Irvine,
UC Santa Cruz, Univ. Washington.
Galaxy Evolution: UC Irvine: CGE, director James Bullock;
UC Santa Cruz: AGORA, directors Joel Primack & Piero Madau.

Gravitational Wave Astronomy:
Caltech: David Reitze, Executive Director,
LIGO Laboratory;
UC San Diego: Frank Wuerthwein.

Biomedical Data Analysis

Cancer Genomics Hub/Browser:
UC Santa Cruz: David Haussler, Brad Smith

Microbiome and Integrative 'Omics:
UC San Diego: Rob Knight, Larry Smarr;
UC Davis: David Mills, Carlito Labrilla;
Caltech: Sarkis Mazmanian;
UC San Francisco: Sergio Baranzini.
Integrative Structural Biology:
UC San Francisco: Andrej Sali

Earth Sciences Data Analysis

**Data Analysis and Simulation for Earthquakes
and Natural Disasters:**
UC Berkeley: Steve Mahin, with UC San Diego, UC Davis,
UCLA, UC Irvine, USC,
Stanford, OSU, and UW.
Pacific Earthquake Engineering Research Center (PEER)

Climate Modeling:
NCAR/UCAR: Anke Kamrath, Marla Meehl.
California/Nevada Regional Climate:
UC San Diego/SIO: Dan Cayan

CO_2 Subsurface Modeling:
San Diego State Univ.: Christopher Paolini and Jose Castillo

**Scalable Visualization, Virtual Reality,
and Ultra-Resolution Video**

UC San Diego: Tom DeFanti, Falko Kuester,
Tom Levy, Jurgen Schulze;
UI Chicago: Maxine Brown; UHM, Jason Leigh;
UC Davis: Louise Kellogg;
UC Irvine: Magda El Zarki, Walt Scacchi;

PRP Participants:

UC Davis
UC Berkeley
Stanford
UC Santa Cruz
Caltech
USC
UC Irvine
UC San Diego /SDSC
San Diego State Univ.

UC Riverside
Univ. Washington/PNWGP
UC San Francisco
NASA Ames/NREN
UC Santa Barbara
UCLA
UC Merced
LBNL, NERSC, ESnet

Denotes CENIC Hub Sites

For more information and a full list of participants,
please visit **www.cenic.org/network/projects/PRP**

LONI Critical to Louisiana's Goal to Advance Manufacturing Innovation

We are experiencing a revolutionary transformation in manufacturing today. From printed human organs to invisibly small computers and robots. The scenes that existed only in sci-fi movies a few decades ago are becoming reality at a breathtaking speed, thanks to Advanced Manufacturing Technology (AMT), such as 3D printing and nanomanufacturing technologies. From all around the world, researchers are relentlessly pushing the frontier of AMT, not only continuously refining and improving the ways with which existing products are made, but also seeking novel ways for new products and materials.
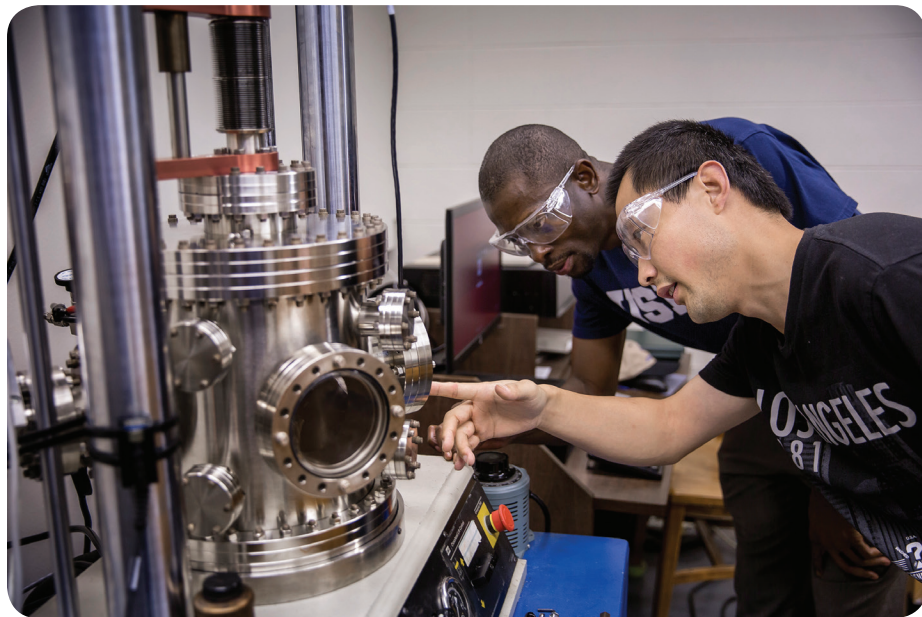
In the State of Louisiana, one such research project recently got under way. The Louisiana Consortium for Innovation in Manufacturing and Materials (CIMM), a $20 million grant from the National Science Foundation, is led by Michael Khonsari, professor of mechanical engineering at Louisiana State University, along with co-investigators Guoqiang Li, Wen Jin Meng, Philip Sprunger and Bala Ramachandran. As a five-year, multi-institutional effort, CIMM aims to advance our knowledge in 3D metal printing and multi-scale metal forming, which will foster the design and fabrication of new structures, devices, and systems.

One of the focuses of CIMM is to improve the understanding of the complex multi-scale thermos-physical phenomena associated with the laser-based 3D metal printing process, which involves synthesizing metal/alloy powders, melting them with lasers and re-solidifying them into final products. To achieve their goals, the researchers need to couple experimentation with hierarchical modeling and simulation. Once experimentally validated, the models and simulation tools will lead to significant scientific advances and accelerate further technology development.

For research projects like CIMM, which requires strong computational and data capabilities, Louisiana Optical Network Initiative (LONI) provides the much needed, robust cyberinfrastructure. A state-of-the-art research and education network, LONI connects the major research universities, government, education, and industry partners in Louisiana to its fiber optic network and provides researchers with access to high performance computing (HPC) resources.

Another key aspect of CIMM is to build and sustain strong multi-institutional research teams across the state. The high speed network of LONI, combined with high definition (HD) video capabilities, will allow for extensive communication between researchers at different campuses, which is essential for establishing sustainable research collaborations.

Over the last decade, LONI has become an indispensable component of the research strengths of the state. The Queen Bee 2 supercomputer, currently ranked as the 63rd fastest in the world, offers a computational capacity of more than 1 peta (10^{15}) floating point operations per second (FLOPS), which will enable CIMM researchers to undertake their large-scale ab initio, molecular dynamics, and finite element simulations. In the meanwhile, utilizing the data and network capabilities of LONI, the researchers will adopt the Integrated Computational Material Engineering (ICME) approach - by integrating the data from modeling, computation, and experimentation, and making it available through a web-based interface, the efficiency of material selection and processes design can be significantly improved.

LONI offers its participants a world-class network and high performance computing environment with the strategic integration of highly available and scalable bandwidth, computational, storage and personnel resources.

MCNC Keeps North Carolina Connected and Protected with Security Portfolio

For three decades, MCNC has consistently been a leader in Internet technology growth, development, and deployment. NCREN helps create unprecedented opportunities for North Carolina citizens where they live, access education, seek economic gain, participate in their governance, and access health care. With constantly emerging opportunities also comes with great responsibility for MCNC.

Security is an essential part of today's technology-driven society. Securing an organization's networking infrastructure requires employees and institutions alike to proactively manage and protect personal and organizational assets. MCNC manages security threats and responses in the context of business risks and has added capabilities this year to rapidly detect and respond to security issues.

MCNC has established an Enterprise Risk Management Committee (ERMC) as a way for the organization to identify, catalog, and analyze risk issues facing MCNC. The ERMC is comprised of key decision makers from each MCNC business unit. These business stakeholders are involved in formally reviewing security concerns and deciding how MCNC will respond to the concerns. This process ensures that potential consequences of security events are analyzed in terms of their potential impact on the organization and customers. Once the potential consequences are understood, then responses can be crafted to match the risk.
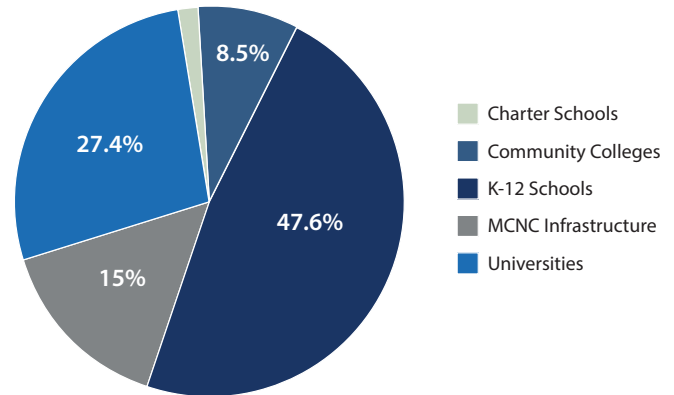
The Enterprise Security Risk Register is the mechanism utilized to track MCNC's security risks. As new security risks are identified, they are evaluated and added to the register as appropriate. The ERMC quickly identified Distributed Denial of Service, or DDoS, as an elevated priority for MCNC customers.

The last three years have seen a surge in the effective use of DDoS as a weapon of cyberattack. No longer only the domain of elite attackers, today's DDoS attacks can be easily launched by those with limited technical skills, and the results can seriously impair the business operations of the victim.
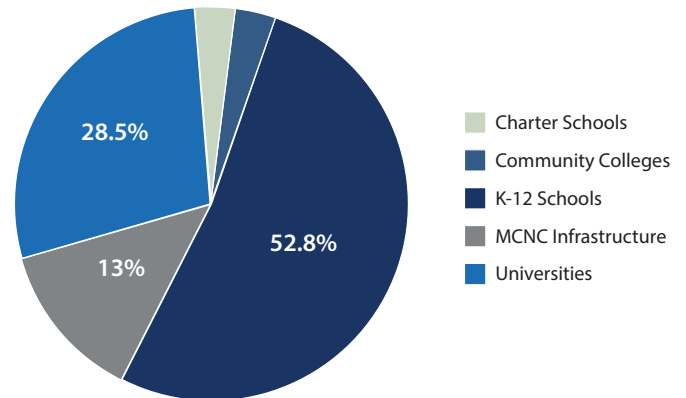
MCNC has prioritized investments in expanding and strengthening abilities to mitigate the negative effects of DDoS attacks on NCREN. These new protection capabilities will greatly enhance mitigation tactics towards DDoS attack traffic and will provide tools to address certain DDoS attack types that cannot be easily mitigated today. While these enhanced capabilities will not eliminate all negative effects of DDoS attacks, they should improve attack response times and strengthen MCNC's ability to protect customer networks.

MCNC is guided by values in innovation, economic development, relationships with state and local government, thought leadership, and security solutions. MCNC's expanded security portfolio builds upon these values to continue offering further differentiation from commercial service providers. An organizational goal of MCNC is to support the entire ecosystem of high-function broadband Internet. By taking a risk management approach to security – thoughtfully analyzing and making decisions based on risk levels as well as enterprise impacts – MCNC will continue to strengthen its security posture for NCREN customers for years to come.

DDoS Attacks on NCREN By Number of Attacks

- Charter Schools
- Community Colleges
- K-12 Schools
- MCNC Infrastructure
- Universities

8.5%
27.4%
47.6%
15%

DDoS Attacks on NCREN By Volume (Gbps)

- Charter Schools
- Community Colleges
- K-12 Schools
- MCNC Infrastructure
- Universities

28.5%
52.8%
13%

> MCNC manages security threats and responses in the context of business risks and has added capabilities this year to rapidly detect and respond to security issues.

WVNET Instrumental in Creating Adult Continuing Education Portal: WVROCKS

West Virginia has a proven solution to encourage adult workers to return to school and earn their college degree. In 2011, the West Virginia Network (WVNET) in Morgantown began to plan and implement a statewide portal that offers online courses for the popular Regent's Bachelor of Arts Program (RBA), a degree program geared toward adult learners who have some college education, but have not finished their degrees. A team of WVNET's staff: Judge Dan O'Hanlon, Director, Dr. Roxann Humbert, Statewide Director for e-Learning, and Dr. Mary Stewart, Director Distance Learning and Education Services created the West Virginia Remote Online Collaborative Knowledge System, known as "WVROCKS."

Dr. Humbert spent a year researching programs and best practices in other states. She also worked with an advisory group representing the West Virginia colleges that offered the RBA degree. The advisory group included representatives from bursar's offices, registrar's offices, admissions, student billing, and academic affairs. In developing the model for the portal, the goal was to offer affordable, accessible, and accelerated upper level courses that RBA students, enrolled at any participating college or university in the state, could take online and count toward the completion of their degree.

The first WVROCKS session was launched in the fall of 2012 with three participating institutions. The initial session enrolled 55 students in five different courses. Under the direction of Humbert and Stewart, the program has grown to more than 650 enrollments in more than 40 different courses from five different colleges and universities in the state: Bluefield State College, Fairmont State University, Marshall University, Concord University, and Shepherd University. "The joy for me is to see students complete their degrees when they otherwise would not be able to do so," said Stewart.

All WVROCKS courses are offered in a compressed, eight-week format. Courses are taught by Ph.D. instructors recruited from institutions across West Virginia. The system operates through the Blackboard Learn LMS software, which is hosted at WVNET.

WVROCKS demonstrates how you can do a lot with a little, making the most efficient use of resources. WVROCKS operates without a direct budget appropriation and on a staff of just two dedicated and experienced educators, as well as the handful of support staff from WVNET. This small team manages a program whose student enrollment is equivalent to a small community and technical college.

Humbert attributes WVROCKS's growth to the hard work of the leadership team, as well as the need for a centralized repository of supplemental online courses, and ongoing support from WVNET and the West Virginia Higher Education Policy Commission. "The beauty of this program is that students remain a student on their home campus," Humbert said. "They register for classes on their home campus, they get their degree from their home campus, and they get their grades from their home campus. WVROCKS online classes are just a way to facilitate the completion of their degree."

OSHEAN Helps Community Care Alliance Move Business-Critical Applications to the Cloud

In early 2013, the Chief Security Officer of NRI Community Services spearheaded an effort to "align technology to improve business" by increasing resource utilization and operational efficiency. NRI Community Service is part of Community Care Alliance, a multi-service, non-profit, unified health and human service agency that currently offers more than 50 programs at eight (8) sites to support and empower individuals and families.

As part of the plan to align technology, NRI implemented new commercial Internet connections and linked its data center to OSHEAN's Beacon 2.0 fiber optic backbone, one of the most advanced optical networks in the country. OSHEAN was able to further assist NRI by connecting the three major buildings at high speed with Air Fiber site-2-site wireless connections for internal traffic.

Key to architecting a virtual infrastructure is providing users with shared storage for cloud applications and virtual machines. OSHEAN's Beacon 2.0 network provides a direct, on-net connection to one of the world's leading cloud service providers to support advanced virtual compute, storage and desktop-as-a-service (DaaS) offerings.

Virtualization and pooled storage enabled the sharing of applications and greater efficiencies for both doctors and clients, reducing unnecessary paper work. Consolidating physical servers into one data center with direct connection to that shared storage provided the final piece of groundwork for a seamless transition to virtualization.

During the next phase of NRI's plan, the expanded network will, again using virtualization and shared storage, consolidate individual applications into a hybrid cloud environment to achieve better support and ubiquitous access, while providing disaster recovery and business continuity. Cloud technologies enable resource and budget constrained non-profit organizations like Community Care Alliance to manage a much smaller set of applications, which facilitates better use of those limited IT resources without affecting the quality of support to individual users. IT staff is now able to focus time on performing tasks that are closer to the mission of the organization rather than routine IT functions.

Cloud-based solutions also help to ease the financial burden for small businesses and non-profits by shifting expenses away from the traditional, resource intensive capital-expense model and over to the much more cash-friendly and predictable operating expense-based model. Desktop virtualization makes it much easier to plan and budget for IT expenses such as email and desktops on a per employee basis - and to accurately forecast how much staffing needs will cost. This approach further frees up valuable resources for mission-based projects, which are incredibly important for community organizations serving those in need.

Looking forward, strategic collaboration enabled by OSHEAN can also help community organizations understand clients in a larger context, ultimately resulting in better family and patient care. Cloud technologies can be utilized on a greater scale to help share resources among all of Rhode Island's community organizations. As a result, this powerful technology will allow community organizations with similar goals to cooperate, instead of compete for limited funding.

Florida LambdaRail 100 Gbps Backbone Supports Regional Network-Wide Science DMZ

Florida LambdaRail (FLR) spent $3.5 million in 2015 expanding its network backbone from 20 gigabits per second (Gbps) to 100 Gbps. The resulting infrastructure features expanded optical capacity of 16 Tbps that is facilitating academic research and discovery across Florida while supporting research and education connections across the globe. To take full advantage of this new capacity, FLR will move ahead in 2016 with establishing a network-wide Science DMZ to support its members' regional and international research initiatives.

Florida). The GENI environment is currently leading the development of advanced applications and will only prove more useful in a Science DMZ. Moving into the future, the FLR Science DMZ will prove to be an essential supporting element in proposals for research grants and other funding and as a resource for direct connectivity for research that bypasses conventional public networks.

Science DMZs utilize a friction free network architecture that is purposely designed to support high performance computing and intensive science applications using different methodologies when compared to the typical enterprise network. The Science DMZ security architecture and policies are specifically developed to not interfere with the applications or transmission of data and is optimized for performance and adaptability to new innovations and projects. A highly optimized end-to-end path utilizing Science DMZs increases the efficiency of data transmission and also helps to assure symmetric traffic patterns so high bitrate research data traffic doesn't accidentally end up traversing and congesting low bandwidth Internet paths.
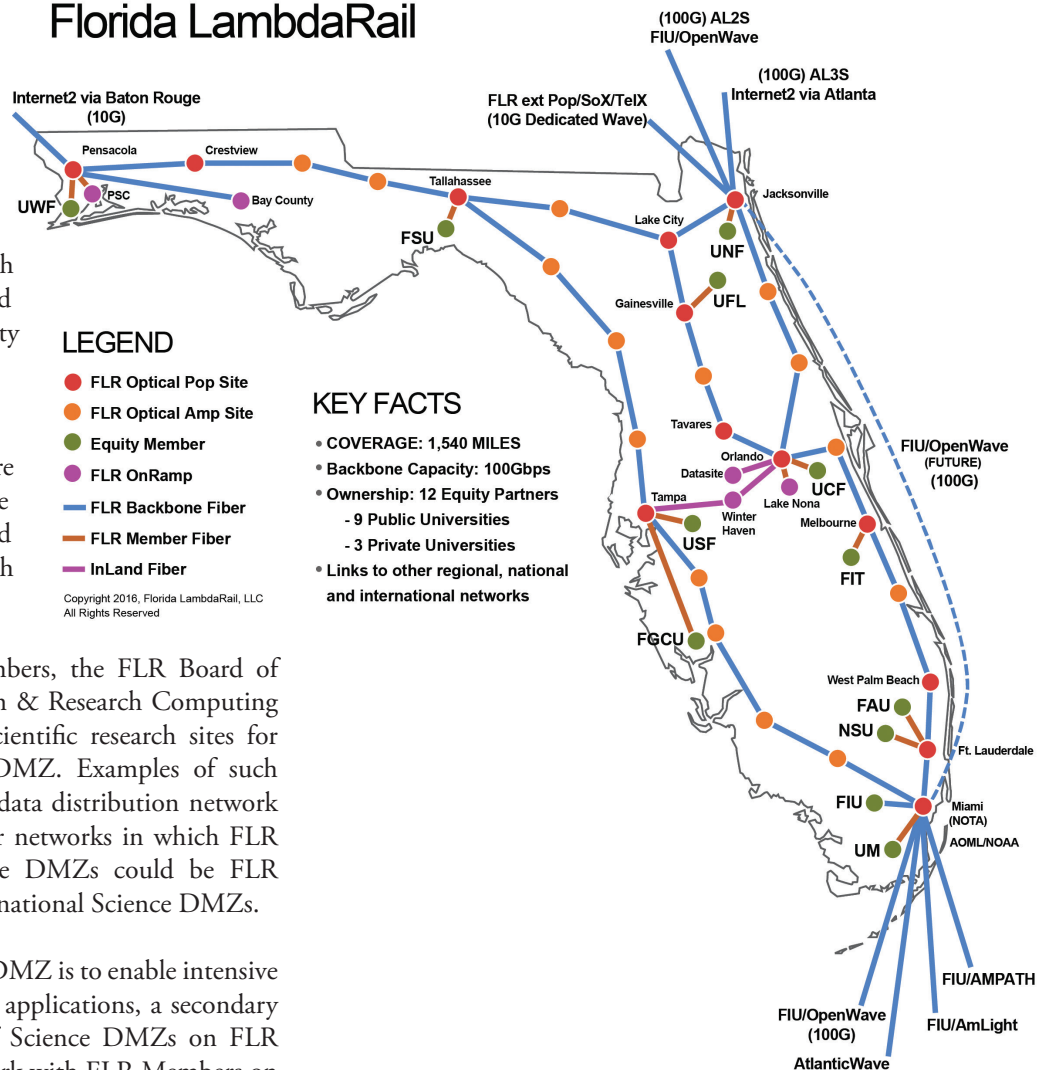
FLR Engineers will work with FLR Members, the FLR Board of Directors and the Sunshine State Education & Research Computing Alliance (SSERCA) to identify external scientific research sites for network peering with the FLR Science DMZ. Examples of such sites would be the Large Hadron Collider data distribution network (LHCnet), ESnet members, and other peer networks in which FLR members are engaged. Connected Science DMZs could be FLR members as well as both National and International Science DMZs.

While the primary goal of the FLR Science DMZ is to enable intensive science and High Performance Computing applications, a secondary goal is to highlight the increased need of Science DMZs on FLR higher education member campuses and work with FLR Members on a strategy to support academic research. The Science DMZ within the FLR network will allow FLR members and affiliates to fully exploit the benefits of the three Global Environment Network Innovations (GENI) racks in service at FLR member institutions (The University of Florida, Florida International University and the University of North

Florida LambdaRail

LEGEND

- 🔴 FLR Optical Pop Site
- 🟠 FLR Optical Amp Site
- 🟢 Equity Member
- 🟣 FLR OnRamp
- — FLR Backbone Fiber
- — FLR Member Fiber
- — InLand Fiber

KEY FACTS

- COVERAGE: 1,540 MILES
- Backbone Capacity: 100Gbps
- Ownership: 12 Equity Partners
  - 9 Public Universities
  - 3 Private Universities
- Links to other regional, national and international networks

FLR
Florida LambdaRail
Florida's 100 Gigabit Research and Education Network

rev 2/2016

Connecticut Education Network: Foundation for Digital Education and Research

The Connecticut Education Network (CEN) is the regional education network that connects higher education institutions, all Connecticut public K-12 school districts, and libraries throughout the state. CEN's network reaches from Boston to New York and leverages Internet2 to expand that reach nationally and internationally. CEN's core mission is to serve educational needs in Connecticut, and this includes researchers' needs for high-performance and data-intensive computing.

CEN benefits from a strong state governance and advocacy body, the Commission for Educational Technology (CET). Enacted by the Governor more than 15 years ago to oversee all educational technology activities, including CEN, the Commission concentrates its efforts on four key areas, infrastructure, digital learning, data & privacy, and best practices. "These areas work together and complement each other," says Commission Executive Director Doug Casey, "and CEN provides the foundation from which all digital education and research can take place. It is an essential, foundational component that we are committed to building for the benefit of every student and citizen in Connecticut."

CEN's current customer subscriptions utilize approximately 50Gbps of total bandwidth available. With the completion of a core upgrade currently in progress, CEN's network will be able to expand to 40Gb or 100Gb circuits. CEN is currently working in Cambridge, Massachussets to augment current capacity to reach 300Gb total connectivity. This capacity augmentation will also support a second 100GbE connection to Internet2. CEN is also in the process of activating 200GbE circuits to New York City in support of multiple peering and Internet exchange opportunities. The extension of CEN's optical backbone into New York City with a high-capacity connection gives CEN members the ability to directly connect to multiple Internet exchanges and strategic peers like Quilt members NYSERNet and NJEDge, while receiving better connectivity to content delivery networks and large content sources (see map).
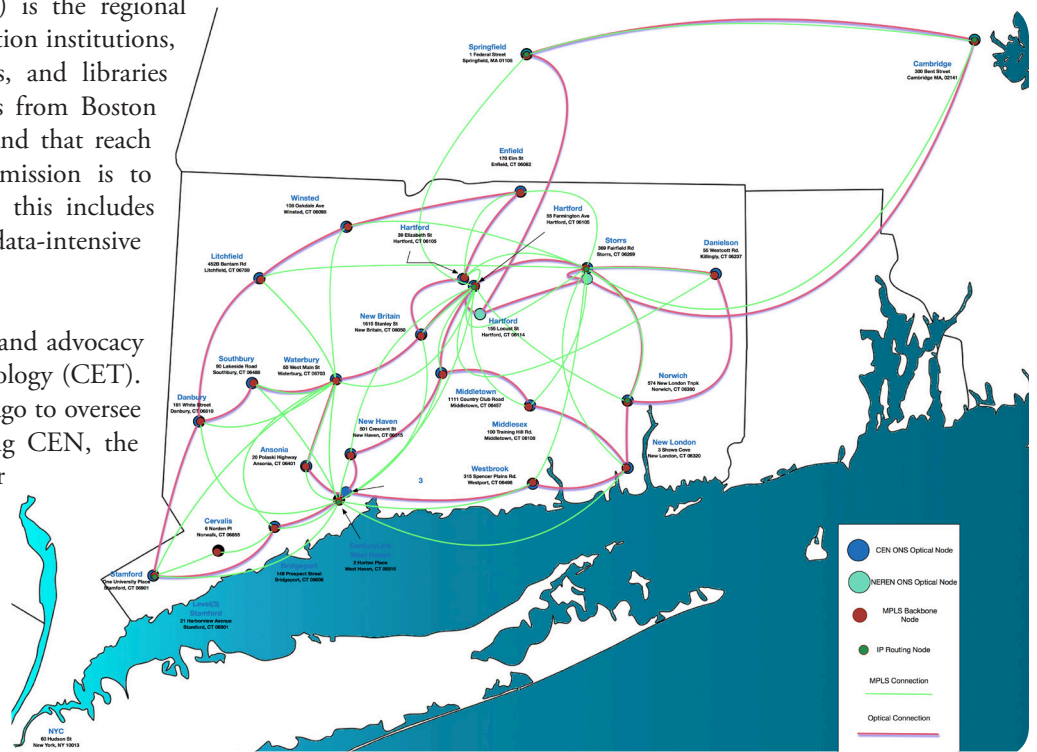
Additional ongoing efforts include:

- Peering with multiple cloud providers is being explored to connect directly with their networks.

- Establishing a 20GbE circuit to OSHEAN (the Rhode Island reasearch and education network) as well as a 10GbE peering with the UMass System.

- Actively connecting sites through our network backbone to our data center and colocation facilities

- CEN is an active participant in the CT Gig Project, a coalition of municipalities, state officials, and other interested parties committed to bringing high-speed, low-cost Internet to all residents and businesses in Connecticut.

One of CEN's success stories is their annual member conference. Readers are invited to attend the next conference on May 13, 2016. The keynote speaker is Jennifer Corriero from TakingIT Global. For more information, see www.cen.ct.gov/cen.

About CEN

Connecticut Education Network (CEN), the nation's first all-optical research and education network, delivers reliable, high-speed Internet access, data transport, and value added services to its members drawn from K-12, higher education, libraries and municipalities throughout Connecticut. Visit www.cen.ct.gov/cen for more information.

The Illinois Century Network Helps Accelerate Illinois Modernization

As the State of Illinois moves forward in modernizing how it serves its residents and businesses, the Illinois Century Network (ICN) will serve as a key resource in transforming State technology. Illinois is in the midst of a digital revolution and the ICN is the foundation for accelerating Illinois modernization and will play a key role in providing better, quicker and more efficient service across the State.

Recent upgrades and an expansion of the ICN have resulted in 1000 miles of new fiber construction and the purchase of existing fiber routes. These upgrades provided dramatic benefits that include:

- 3900% increase in broadband capacity
- 90% reduction in rates
- 44% reduction in operating costs

With the higher bandwidth available, community anchor institutions throughout Illinois benefitted. For example, schools are now able to launch one-to-one programs, providing each student access to a computing device.

Illinois commercial providers also benefitted. Following the upgrade, ICN started selling dark fiber and broadband service to commercial providers facilitating the deployment of high speed broadband into rural areas.

The Regional Technology Centers (RTC) are the secret sauce of the ICN. There are nine RTC offices strategically placed around the State, each staffed by highly trained and technical engineers. These engineers provide technical support and assistance to anchor institutions in the local community. This includes network architecture advice within a location, traffic monitoring and capacity management, network configuration and location to location private network planning. Regarding network architecture, RTC staff advise on best practice approaches for in-building networks, including advice on equipment available via state master contracts, ensuring the lowest cost solutions for anchor institutions.

"The RTC staff live and work in the regions they support. Seeing firsthand the benefits to the community from high speed broadband is an incredible motivator," according to Robin Woodsome, Network Operations Manager, and Manager of the RTC offices.

The ICN is supporting the migration of services and applications to the cloud, via both ICN data centers and via interworking with third party cloud providers. The goal is for anchor institutions to not have to manage their own server farms.

Modernizing Illinois' technology infrastructure is an important initiative for the State of Illinois and ICN will play a central role as the State works to transform technology systems, protect private information from cyberattack, reduce costs, and provide better service to Illinois residents, businesses and anchor institutions. The ICN will continue to play a major role in the State of Illinois by serving its anchor institutions and its citizens. The ICN network is continuously expanding its footprint by building new fiber connections to institutions and also working with commercial providers for last mile connections.

"Our new connection has been phenomenal! We love it. Please pass on my thanks to the team up there. We really appreciate you guys."

- Darin Hostetter, Director of Technology, Marshall CUSD #C2

About ICN
The Illinois Century Network (ICN) began in 1997 with the recommendation from the Higher Education Technology Task Force to create a single, statewide educational network. The ICN became reality in May of 1999 with the signing of legislation called the Illinois Century Network Act. The ICN has evolved significantly since 1999 and is now a 2000 mile state wide high speed broadband network serving K12 and Higher Education, Public Libraries and Museums, State and Local Government, the Healthcare community and Commercial service providers. The ICN is managed and operated by the Illinois Department of Central Management Services. Visit: www.illinois.gov/icn for more information.

Advanced Networking Services Being Developed by The Metropolitan Research and Education Network

Current changes in communications architecture are dominated by six major themes: 1) providing for higher levels of fundamental resource abstraction through virtualization, 2) programmable networks made possible by such virtualization, especially through new types of orchestration techniques, 3) large scale capacity, especially 100 Gbps paths, 4) techniques that enable migrations from static to dynamic network environments, 5) techniques that enable highly granulated network customization, and 6) closely integrating programmable clouds with programmable networks. MREN is actively addressing these issues through multiple national and international projects.

MREN has decades of experience supporting programmable networking. In an effort to provide dynamic network environments based on programmable resources, MREN, in partnership with the StarLight national and international communities, has been exploring and applying techniques for programmable networking based on Software Defined Network (SDN) which includes OpenFlow implementations. MREN supports multiple projects related to the National Science Foundation's (NSF) Global Environment for Network Innovations (GENI) initiative, such as deployments of InstaGENI, ExoGENI, CENI, the International GENI (iGENI), the world's first and most extensive international SDN/OpenFlow testbed, the GENI Experiment Engine (GEE), and a Software Defined Networking Exchange (SDX) at the StarLight facility, which has Software Defined Infrastructure extensions (SDI).

MREN supports an NSF CloudLab project which is the national Chameleon cloud research testbed being used by over 500 computer scientists across the country. MREN recently assisted with federating GENI, Chameleon, and SAVI, a Canadian cloud testbed. MREN also supports multiple projects utilizing science clouds such as the Open Science Data Cloud. One current project related to an NSF grant awarded to the StarLight consortium, MREN supports facility developments to enable the creation of an international SDX to support large-scale international data intensive science research projects.

To address the need for large scale network capacity, MREN, in partnership with the StarLight community, designed, developed and implemented, the StarWave 100 Gbps Exchange Facility which supports many of the 32 separate 100 Gbps paths at the StarLight Facility. During SC15 MREN, the StarLight consortium and its research partners, designed and staged a series of demonstrations to showcase capabilities of SDXs, including capabilities for provisioning and dynamically controlling individual high-capacity streams transported nationally and internationally over wide-area networks to, from, and around the large conference show floor.

With significant support from ESnet, MREN supported more than 15 sets of 100 Gbps demonstrations at SC15, almost all of which were provisioned over national and international WANs. Another series of demonstrations, in partnership with the Open Common Consortium (OCC), showcased the capabilities for customized SDXs to support the complex workflows required by precision medicine applications – precision medicine enabled by precision networking. Another series showcased SDX capabilities made possible by the cloud partnership between the OCC and the National Oceanographic and Atmospheric Administration. Others, in partnership with the NASA Goddard Space Flight Center and the Naval Research Lab, focused on high capacity WAN streaming for large scale data intensive computationally intensive applications.
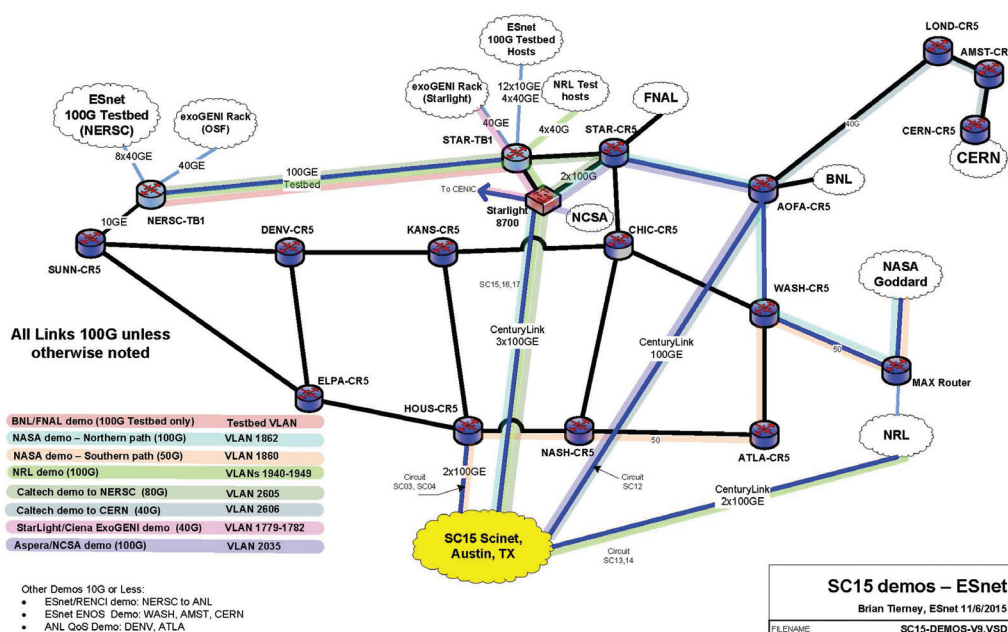
Quilt Members Support Women in IT Networking at SC15

The Women in IT Networking at SC (WINS) program was introduced at the annual SC15 conference in November 2015 in Austin, Texas. The WINS program was created in order to help address the gender gap that is prevalent in technology fields. The percentage of women studying computer sciences and engineering, and entering related fields including high performance computing (HPC) and high performance networking (HPN), has been traditionally low. But alarmingly, the numbers are in decline, down from 37% in 1985 to 18% in 2013. The WINS program aims to fill this increasing gender gap in the computer science and engineering fields related to networking by creating opportunities for early career female engineers to attend and work at the SC15 conference as a SCinet volunteer by providing full travel support to the event.

Selected from a competitive pool of 19 highly qualified candidates, five scholarship recipients participated in the ground-up construction of SCinet, one of the most powerful and advanced networks in the world created to support the annual SC conference. The network takes close to two years to design, a month to set up, a week to operate, and a day to tear down. SCinet relies on approximately 150 volunteers who deploy, configure, and maintain over 80 miles of fiber optic cable and hundreds of computing and networking systems. These volunteers are assigned to one of 19 teams that are each focused on a unique area of the overall network implementation. All 19 teams are critical to creating SCinet, which must seamlessly serve the nearly 13,000 bandwidth-hungry attendees of the annual SC conference. The inaugural WINS program recipients, pictured above from left to right, were:

- Sana Bellamine from the Corporation for Education Network Initiatives in California (CENIC) who participated on the Network Measurement Team

- Kathy West from the Indiana University of Pennsylvania (IUP) who participated on the Network Security Team

- Amy Liebowitz from the University of Michigan who participated on the conference Local Area Networking Team

- Debbie Fligor from the University of Illinois at Urbana-Champaign who participated on the Network Routing Team

- Megan Sorensen from the Idaho State University who participated on the conference Wireless Team

One goal of the WINS program is to continue professional development for these individuals after the SC conference. Toward this goal, several of the WINS recipients were also funded to attend and present at the 2016 Quilt Winter Member Meeting. The Quilt is a national consortium of advanced research and education networks. The conference provided an additional opportunity for WINS recipients to build their professional networks and gain exposure to advanced technology topics at the national level. At the conference, these recipients shared their experiences as SC15 SCinet volunteers and their interest and careers in technology. Each recipient believed the WINS experience was incredibly valuable to their personal and professional growth and credited strong family support and encouragement to pursue their career interests in an IT field.

WINS is a joint effort between the Energy Sciences Network (ESnet), the Keystone Initiative for Network Based Education and Research (KINBER), and University Corporation for Atmospheric Research (UCAR) funded by the National Science Foundation via the Rocky Mountain Cyberinfrastructure Mentoring and Outreach Alliance (RMCMOA) regional cyberinfrastructure award. The WINS team plans to continue its work in 2016 working with the SCinet team, the National Science Foundation, the Department of Energy, and the broader Quilt community to continue and expand this program next year at SC16 in Salt Lake City, Utah (USA).

Engaging Students in Networking Careers at GlobalNOC

During fall 2015, the Indiana University Global Research Network Operations Center (GlobalNOC) hosted its first career day for students from the Schools of Informatics and Engineering and Technology at Indiana University-Purdue University Indianapolis (IUPUI). An earlier invitation to an Informatics Career Day to hear the GlobalNOC's Brandon Beale speak was so well received—over a dozen students stayed after to learn more—that Brandon decided to host something onsite in Indianapolis, where the GlobalNOC is located.

"Our goals were to introduce the IUPUI talent pool to the GlobalNOC and opportunities in the field of network operations," says Beale. "We wanted especially to engage students in Computer and Information Technology (CIT), and Informatics—we already had tremendous support from the Informatics Career Office. The event was a success by all accounts."

Twenty-three students toured the GlobalNOC and the Data Center. Beale first described the work GlobalNOC does, then each hiring manager (Engineering, Service Desk, Systems) gave a presentation about their specific area and careers that students might pursue. "It is very likely we will hire someone from that event—we already have 11 interviews scheduled," says Beale. "We saw a lot of excitement."

John Fernkas, a junior studying informatics with a minor and specialization in business management, was one of the students who took part in the IUPUI career day. "I actually had no idea how big of an impact GlobalNOC has when it came to some of the largest and most notable research networks in the nation," says Fernkas. "When you think of a network operations center, you might think of people in a dark room staring at computer screens waiting for something to go wrong. Yes, that is part of what GlobalNOC does, but I find it fascinating that GlobalNOC is much more than that. They are a start-to-finish service provider."

Fernkas is no newcomer to servers and networking. Around the age of 15, he purchased a full-height server rack and some old servers from a local surplus shop and began tinkering with Linux, Cisco networking equipment, and file and web services. He said, "I think I could offer my knowledge to the team and its customers while learning a thing or two about successful IT businesses along the way."

"Many of the students didn't even know about our world-class facility because we are behind locked doors," says Beale. "Even though Informatics is in the same building, they had no idea what lies on the other side. They were in awe. What we have at GlobalNOC is unique. These students have a chance to do something awesome right here in Indiana. They can't get this kind of exposure at any other university."

Beale's goal is to formalize a recurring semester-long internship program starting with this pool of students. "We're shifting to be more strategic with recruiting and hiring," says Beale. "We need a continual pipeline of talent with known skill sets to recruit into our research and education networking community. This effort was the beginning of that shift. We're excited by the response that we got and look forward to furthering this initiative."

UETN to Play Critical Role in Utah's Comprehensive Plan for Digital Teaching and Learning

Picture a future where nearly every student carries a networked tablet or laptop and excels in a school culture that supports teachers and technology. In Utah, that vision is closer to reality thanks to education leaders and state lawmakers.

In 2015, the Utah State Legislature appropriated $5 million to the "Digital Teaching and Learning Program Proposal". Over the summer, a 13-member task force of state, district and charter school leaders met more than a dozen times to develop a comprehensive master plan. The resulting master plan, entitled *Essential Elements for Technology Powered Learning* addresses research, leadership, professional learning, and infrastructure in Utah. It also covers training, content, software, devices, support, procurement, and communication.
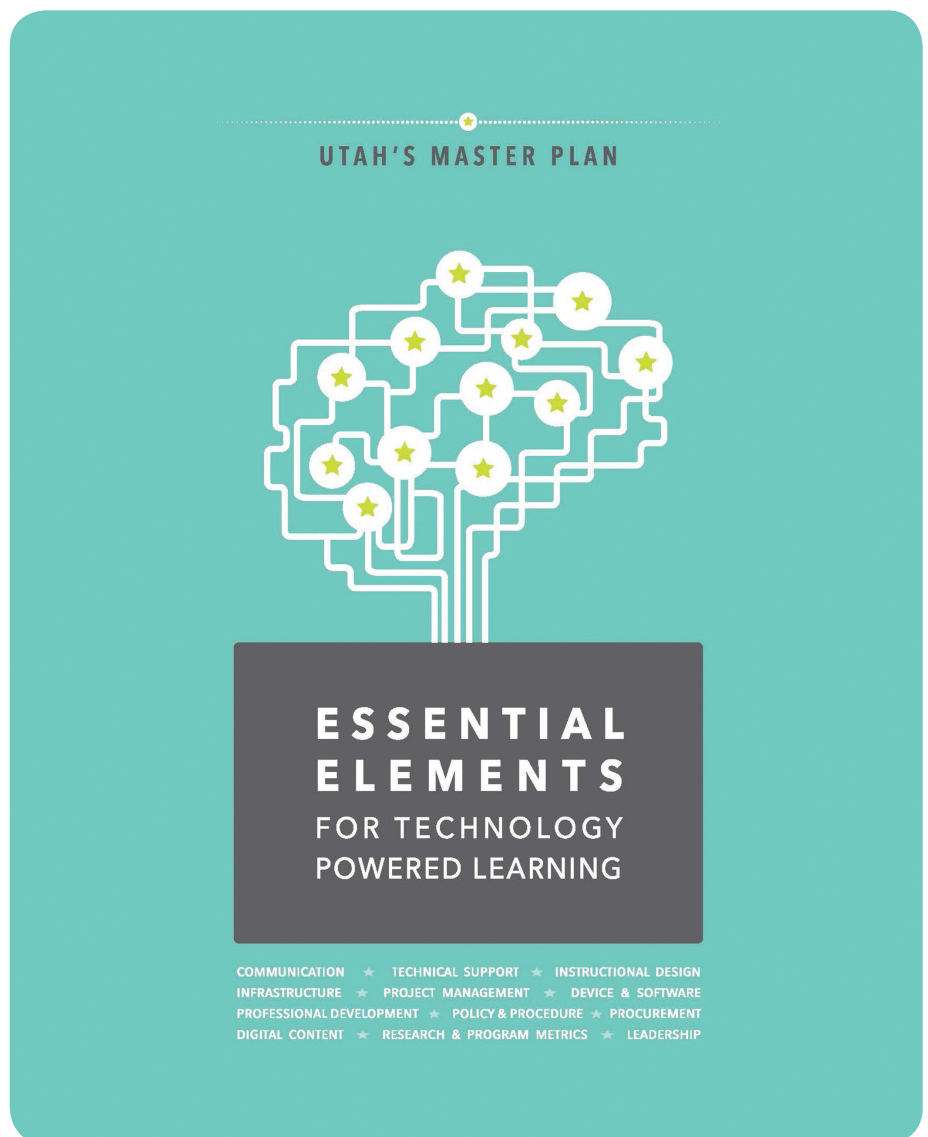
The Utah Education and Telehealth Network (UETN) will play an important role in implementing the resulting plan and ensuring its success. Throughout the key elements of the plan, UETN is recognized for their history and leadership and the plan emphasizes the critical resource that is UETN. The plan outlines UETN's role in training, infrastructure, security, technical support, procurement, and maintaining a software/hardware inventory.

UETN has already started the inventory database by contracting with two firms to conduct a technology inventory and engineering study for districts and charter schools. The results show that student access in Utah districts and charter schools is limited by the number of devices available and by inadequate and aging infrastructure in many schools. On average only 0.61 computing devices per student are available and schools average 0.58 WiFi access points per classroom or instructional space.

While putting today's technology into a statewide context, the task force also emphasized that teachers are key to quality instruction. "A technology initiative isn't about [just] the device. It has to be much more than that if it's going to succeed. It has to be about changing the culture, changing the way we teach. It's not a replacement for the teacher. It is, in fact, an enhancement, a tool for the teacher," explained David L. Thomas, the chair of the Utah Digital Teaching and Learning Task Force to Salt Lake City's Deseret News in July.

UETN's CEO and Executive Director Ray Timothy concurs that the plan requires a multi-faceted approach. "The plan is poised to bring opportunity, equity, training, and technology to all Utah institutions that participate. Students, educators and the public all stand to benefit." "I'm impressed with the collaborative nature of this plan. We have utilized knowledge from experts around the state to create a document that has great potential for success," said Fred Donaldson, a task force member and executive administrator of the DaVinci Academy of Science and the Arts, one of the Utah's 117 public charter schools.

In October 2015, the Utah State Board of Education unanimously adopted the plan. The Utah State Legislature is now considering legislation that would allocate $25-million to fund the plan.

UTAH'S MASTER PLAN

ESSENTIAL ELEMENTS FOR TECHNOLOGY POWERED LEARNING

COMMUNICATION ★ TECHNICAL SUPPORT ★ INSTRUCTIONAL DESIGN
INFRASTRUCTURE ★ PROJECT MANAGEMENT ★ DEVICE & SOFTWARE
PROFESSIONAL DEVELOPMENT ★ POLICY & PROCEDURE ★ PROCUREMENT
DIGITAL CONTENT ★ RESEARCH & PROGRAM METRICS ★ LEADERSHIP

KanREN: Helping K-12 Be *"Future Ready"*

With a focused commitment to help K-12 districts and Kansas communities, the Kansas Research and Education Network (KanREN) has become a regional partner with the US Department of Education (USDoE) and the Alliance for Excellent Education (Alliance) in the Future Ready Schools initiative.

"We bring a broad range of expertise and deep knowledge to provide unbiased assistance," said Cort Buffington, Executive Director, KanREN. "We're here to help K-12 Schools and their communities make the best connectivity decisions they can—with the future in mind. Our work with higher education and research positions us to know what's coming in connectivity and technology, while our ongoing work with school districts of all sizes gives us insight into specific needs of Kansas schools. Becoming a regional partner in the Future Ready Schools effort codifies our commitment to the learners and educators of Kansas."

The "Future Ready" initiative, launched in the fall of 2014 focuses on helping K-12 school districts maximize digital learning opportunities and move quickly toward preparing students for success. The Future Ready Framework provides a planning cycle along with structured implementation support that equips school leaders with the knowledge, support, tools and resources to dynamically lead their districts through a team-driven planning process to generate a digital learning action plan.

The Seven Gears of the Future Ready Framework are:

- Curriculum, Instruction, Assessment
- Personalized Professional Learning
- Technology and Infrastructure
- Data and Privacy
- Community Partnerships
- Budget and Resources
- Use of Space and Time

"Partnerships are a key aspect of the Future Ready effort. The Alliance for Excellent Education seeks out regional organizations such as KanREN to support local school districts in the use of the Future Ready offerings such as the summits, planning dashboard, mentoring program, and online tools and resources. The unique expertise that these networks can bring to this effort is unmatched,." said Sara Hall, Vice President for Policy and Advocacy and the Executive Director of Future Ready. "We are grateful to have regional partners like KanREN to extend our reach and help schools prepare digital learning environments for their students."

Working alongside USDoE and the Alliance, national, state, and regional partners bring expertise and resources to support the effort through tools, professional learning opportunities, expertise and best practices to assist K-12 districts in the process. Regional partners commit to provide a website presence and support the Future Ready effort through state/local conferences, webinars, and outreach. The Professional Learning opportunities available are extensive and on-going, and KanREN both promotes and provides opportunities to extend the reach for K-12 districts and education organizations to participate.

"Regional partners provide critical support in helping state and district leaders shape a vision for how technology can transform learning and provide equity for all students," said Katrina Stevens, Senior Advisor and Future Ready Lead at the U.S. Department of Education. "Working with partners like KanREN brings additional resources and expertise to help make our schools Future Ready."

OneNet: 20 Years of Pioneering Technology

Est. 1996
OneNet®
Celebrating 20 Years

Advancing Technology. Empowering Communities.

OneNet's first network was a hub-and-spoke infrastructure, with hubs in Oklahoma City and Tulsa and spokes reaching across the state. That network had a bandwidth of 45Mbps. Two decades later, OneNet's core bandwidths range from 1Gbps to 100Gbps. Today, data travels on more than 2,000 miles of high-speed fiber, including a 10Gbps optical ring around the state. Other advances have opened the door to possibilities that may have seemed inconceivable in OneNet's early years.

Many of OneNet's innovations arise from involvement with Oklahoma's research institutions. Partnerships with these institutions provide cyberinfrastructure funds for building integrated and dedicated software-defined networking (SDN) platforms. OneNet is able to advance SDN strategically throughout the state, meeting operational and research needs. Most recently, OneNet has extended SDN capabilities to campuses, facilitating Science DMZ development.

Oklahomans have always had a pioneering spirit. They staked their claims to a land rich with potential and built a great state from the ground up. Their ability to innovate and push boundaries continues to be reflected in modern Oklahomans. OneNet's history reflects these pioneering qualities as well. As OneNet celebrates its 20th anniversary, the network shows as much growth potential as the first Oklahomans.

Then-state Sen. Ben Robinson formulated the beginnings of OneNet in the early 90s. The root idea was to connect Oklahoma schools through one integrated state network that maximized state-owned and commercial infrastructures in a public-private partnership. This model led to OneNet's creation.

In 1992, voters approved $14 million from a $350 million statewide capital bond issue to create a statewide network. A business plan established OneNet as a division of the Oklahoma State Regents for Higher Education (OSRHE), and the network became operational in 1996.

In June 2015, OneNet deployed a 100Gbps ring to enable big data transfer for Oklahoma's research universities. The ring connects researchers at the University of Oklahoma in Norman and Oklahoma State University campuses in Stillwater and Tulsa to OneNet and its connection to Internet2. As researchers drive demand for big data movement, OneNet has strategically positioned the state to participate in world-class research, such as:

- Oklahoma Center for High Energy Physics – Collaborates with 34 countries on the ATLAS project.

- Center for Analysis and Prediction of Storms – Conducts storm-scale ensemble forecast with NOAA.

- Advanced Radar Research Center – Generates more than 20Tb of data per day for storm prediction research.

Just like the Sooners during the Oklahoma Land Run of 1889, OneNet is hopeful and optimistic about the future.

"Since the beginning, OneNet has held true to our mission of advancing technology across Oklahoma," said OneNet Executive Director Vonley Royal. "OneNet tailors every project toward fulfilling that mission. The spirit of innovation will continue to motivate all of OneNet's strategies and to reverberate throughout the organization."

About OneNet
OneNet, a division of the Oklahoma State Regents for Higher Education, has a mission to advance technology across Oklahoma. OneNet serves colleges and universities; research centers and laboratories; public and private schools; libraries; tribal organizations; hospitals and clinics; nonprofit organizations; and local, state and federal governments. Visit www.OneNet.net for more information.

MOREnet Instrumental in Resolving Bandwidth Challenges for Rural School

As a research and education network, MOREnet understands the value high-quality broadband provides to the research and education community. However, in many cases, the lack of available wireless or fiber poses numerous challenges to those who are trying to implement technology for student-centered learning.

A perfect example of this problem is Ash Grove, Missouri, a rural community with a population of 1,430 located about 20 miles northwest of Springfield. Although the proximity to Missouri's third largest city provides employment opportunities, shopping and DSL Internet, there were major challenges getting the broadband needed to facilitate online testing for the school's sprawling campus which includes two elementary schools and one high school.

To facilitate the required statewide online testing in spring 2015, students from one of the elementary schools would have to be bussed to the Ash Grove High School at a significant cost to the district in money, time and disruption. According to the district's superintendent, Kyle Collins, "We didn't know what to do, but we were sure if anyone could help, it would be MOREnet."

After studying the terrain and infrastructure, MOREnet's networking experts determined that the most cost effective option was utilizing MOREnet's Wireless MAN Service to link two buildings that are approximately 8 miles apart via a private LAN. MOREnet's engineers worked with local city officials to gain access to a water tower and partnered with the local water district to acquire space and power for the radios at no cost.

In addition to eliminating the bussing costs, the connection via a wireless solution enabled increased bandwidth for the elementary school, which allowed the students to stay in their own school for online testing and to implement additional teaching and learning technologies for their students, all while saving approximately $400 a month.

This project highlights MOREnet's unmatched focus on education and the public sector. It emphasizes the importance of a community that collaborates to find the best solution to improve education. "We were happy to be a part of helping Ash Grove meet their testing requirements and couldn't be more pleased with the results and the overall district savings that were enabled," stated John Gillispie, MOREnet Executive Director, "We utilized staff expertise to deliver an innovative solution because we had a unique understanding of their technology needs and the ability to move swiftly during a short window of time."

MOREnet managed the build, maintenance and monitoring, which provides for timely resolutions of any outages that may occur. This end-to-end service offering allows us to strengthen the trusted partnership that sets MOREnet apart from any other provider.

MOREnet received over 30 thank you notes from teachers and students from the Bois D'Arc school district. Several were framed for display.

Pennsylvania Research and Education Receives a Boost from National Science Foundation Grants

Director of Operations, Michael D. Carey, presenting at the perfSONAR workshops.

In February 2014, KINBER began providing training and support for Pennsylvania organizations to submit grants to federal funders. The activities continued under KINBER's NSF grant, awarded in March 2015, with webinars, in person training, sharing announcements, and direct support. KINBER's efforts increased the awareness and accessibility of these funding opportunities and provided guidance and best practices on how to submit an effective proposal.

In response to the grant award, Dr. Stephanie Shanblatt, president, Bucks County Community College, said, "We at Bucks are very excited about the capabilities that this grant is providing for the sciences. By upgrading our cyberinfrastructure, faculty and students will have access to resources previously unimaginable. The resulting educational benefits will serve our students and this region well. KINBER and the University of Pennsylvania have been great partners with us in this endeavor."

Building upon groundwork established by its educational efforts and a National Science Foundation (NSF) grant, the Keystone Initiative for Network Based Education and Research (KINBER) is working with three Pennsylvania NSF 2015 Campus Cyberinfrastructure – Data, Networking, and Innovation (CC*DNI) awardees to strengthen campus cyberinfrastructure in the commonwealth.

Bucks County Community College, Franklin & Marshall College, and Harrisburg Area Community College received grants totaling more than $900,000 to seed campus innovation with projects including Science DMZs, perfSONAR deployment, increased connectivity and access to Internet2, the national research and education backbone. The two community colleges are currently the first and only community colleges nationwide to receive campus cyberinfrastructure awards.

"Campus cyberinfrastructure supports science research and education, and enhancing its performance on these campuses provides expanded opportunities for the students, faculty and community members," said Wendy Huntoon, KINBER CEO and president.

Carrie Rampp, associate vice president & CIO, Franklin & Marshall College, said, "KINBER has been a really strategic partner in this effort. Not only did we learn of this possible opportunity through KINBER, but I doubt we would have applied if it wasn't for the support and advice we received."

Rampp noted that KINBER's expertise has been invaluable and the staff also helped to connect Franklin & Marshall to other institutions that might serve as examples in their planning.

Robert Messner, vice president of Information Technology & CIO, HACC, said, "The CC*DNI award will allow our college to increase our wide-area network connectivity by a factor of 10 between the Midtown and Harrisburg Campus locations, ensuring that our STEM students are provided the most reliable and robust connectivity necessary for their continued success."

"The partnership with KINBER on this grant was critical as it provided our college the necessary information, services, and framework to successfully respond to the rigid grant criteria and obtain the award," said Messner.

About KINBER

As a non-profit membership organization, the Keystone Initiative for Network Based Education and Research (KINBER) is Pennsylvania's statewide research, education and community network devoted to fostering collaboration through technology. Visit www.KINBER.org for more information.

NJEDge strives to deliver "Return on Consortium"(ROC) to members through continued investment in advanced optical network platform. Members and NJEDge staff work together to improve end user experience.

To solve specific bandwidth issues, two NJEDge members, Bloomfield College and the College of St. Elizabeth, turned to NJEDge's network engineering experts. Bloomfield was nearing the maximum capacity of its existing circuit. NJEDge developed a plan for Bloomfield to increase bandwidth by bringing in a new router to accommodate increased traffic and, most importantly, to implement a redundant connection to increase capacity and decrease risk. This increased bandwidth and redundancy enabled the college to go wireless to rid itself of dead zones and to make all dormitories, academic buildings and outside quads Internet accessible. The strategic plan NJEDge recommended was within budget and included an implementation schedule for cutting over the connections and installing software to bring it "live." Similarly, NJEDge's engineer analyzed the College of St. Elizabeth network and identified the location of the bottleneck and delivered an executable plan that matched the college's budget.

For Ocean County College, NJEDge diversified the college's connection to the Internet and load balanced across the redundant circuits. It also established a point-to-point connection for Ocean County's two campuses making for a more reliable and faster service. The improved connectivity was 33-fold better than the existing dual lines. With the added bandwidth, academic and administrative services, such as registration, advising, virtual desktop applications and tutoring were enhanced.

"The value I get from NJEDge is saving time and money. As a Connected Member, Ocean County College has the luxury of having NJEDge do all the vetting of vendors, all the heaving lifting. This makes for easy acquisition of new services that best fit our institution.", stated Hatem Aki, Chief Information Officer.

The NJEDge video conferencing tool, Vidyo, has been invaluable to many of our members. In particular, Vidyo's ease of use and portability solved Stockton University's administrative need to connect its two campuses. Robert Heinrich, Stockton's Executive Director of Computer and Telecommunications found Vidyo works well on many levels for its Board of Trustees' public and closed sessions. Vidyo allows all members of the board to view presentations through the screen-sharing application. In addition, at the public meetings more stakeholders can participate virtually. Vidyo is also used in Human Resources as it can establish an interview with a potential candidate without the cost of paying for his travel. Stockton chose Vidyo because it is HD video conferencing that suits the needs of an institution with off-site departments.

For Passaic County Community College, Vidyo has become the driving force to connect its four campuses. "Without it, commute time for staff and faculty would increase and students would not be able to participate in a wide variety of campus activities," says Robert Mondelii, PCCC's Vice President of IT.

Proactively Protecting Merit's Members

Cybersecurity has become a top priority for organizations large and small as the volume of cyber attacks from hackers and criminals continues to grow. To better protect itself and its Members, Merit Network has implemented a proactive approach to cybersecurity.

In 2012, Merit launched the Michigan Cyber Range to provide cybersecurity training and exercises. The Range regularly hosts force-on-force exercises within its Alphaville training environment to help professionals gain valuable experience detecting and responding to cyber attacks. Merit offers many cybersecurity certification courses throughout the year. Individuals from Michigan power companies, public universities, government, the Michigan National Guard, and others have used the Michigan Cyber Range to sharpen their skills to better protect their organizations.

Merit has developed a growing portfolio of cybersecurity defense services for its Members. Managed cybersecurity services that take the burden off Member organizations who subscribe include a managed firewall solution, a managed security service, and professional consulting services. Risk monitoring, secure sandbox, dual-factor authentication service, and secure socket layer (SSL) certificates are also offered. Together the cybersecurity defense services provide a powerful toolkit that can help secure an organization.

"From providing training on the Cyber Range, to the partnerships developed through the Michigan Cyber Civilian Corps, Merit is leading the way for cybersecurity in Michigan. I'm excited to help lead Merit Network into the future of information security, not only for the company, but most importantly for the Members it serves," said Jason Brown, Merit's first Chief Information Security Officer.

To encourage collaboration and foster community amongst its Members, Merit is launching a new online social portal, called the Merit Commons. The portal includes social streams that spur communication and idea sharing between individual Members and Merit staff, as well as supports private conversations between committee members and special groups. Based on Merit's Academica ESP service, the Merit Commons' message streams function like Facebook or Twitter, allowing open conversation between users. It also provides access to Merit's Member Portal where users can access reports, bandwidth graphs, invoices, and other information.

"Merit's core mission involves connecting organizations and building community," said Joseph Sawasky, president and CEO for Merit. "To date, our community activities have been very event and place-based. The expertise in our community across Michigan is tremendous, and we have a great tradition of helping one another. With the Merit Commons, we'll now have another way to unleash the power of our collective knowledge for the benefit of the community."
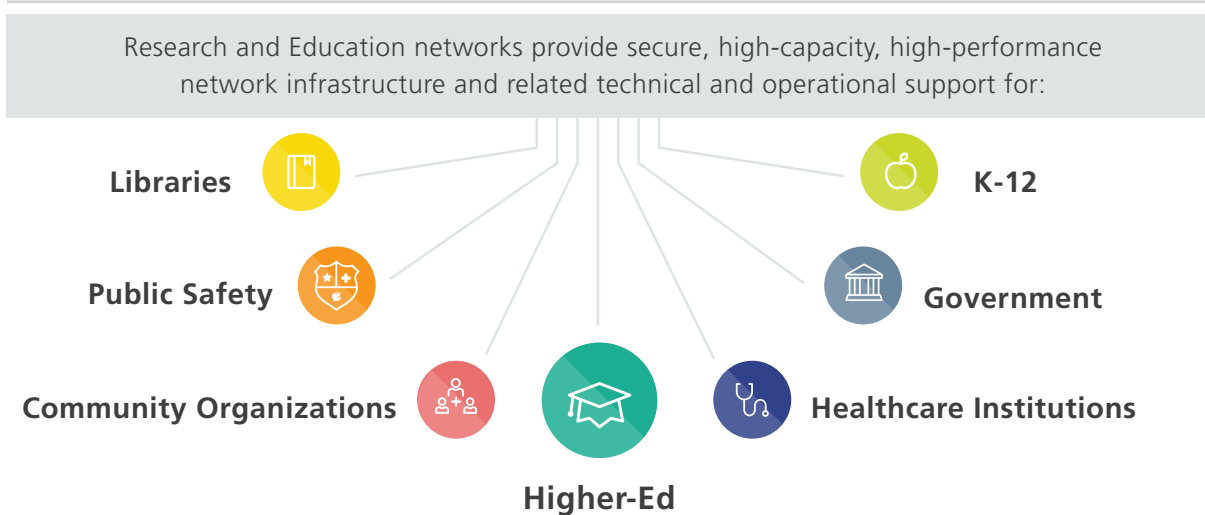
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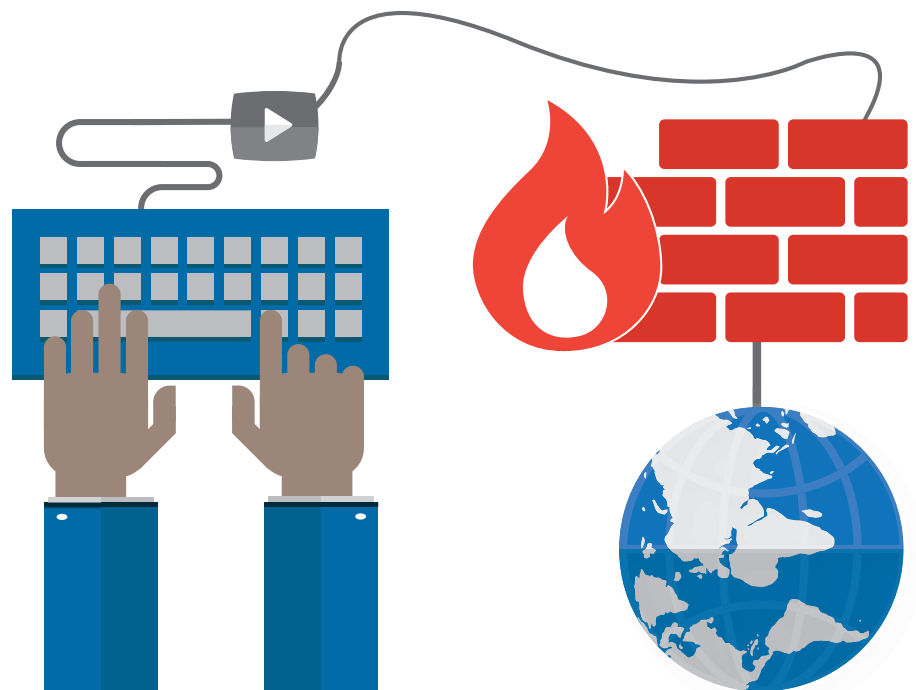
Research and Education Networks:
Enabling Breakthrough Innovations that Power the Greater Good

Research and Education networks provide secure, high-capacity, high-performance network infrastructure and related technical and operational support for:

Libraries

K-12

Public Safety

Government

Community Organizations

Healthcare Institutions

Higher-Ed

Fastest, Most Advanced Technical Infrastructure	Trusted Network-to-Network Collaboration	Resource Sharing and Cost Reduction
Purpose built and dedicated to meeting the needs of our communities. Unparalleled levels of performance, reliability and security. Redundant connectivity to other regional, national and international research and education networks. Separate experimental networks, which foster networking or application research or very large point to point data transfers. Multiple colocation facilities providing participants with geographically separate locations to land different connections. Networks offer Netflix and Akamai caching to offset commercial traffic draws, as well as direct peering with entities such as Google, which all result in better end use experience with better network performance.	Secure and lightning-fast networks connect schools to hospitals to research centers and beyond – enabling exciting new research and education opportunities. Networks are often part of multi-state regional partnerships that provide shared network services across communities as well as diverse backup and connectivity options. Nationwide research and education communities regularly share technical and operational information and expertise for the betterment of all. Networks create a trust fabric between research and educational communities. Member driven collaboration – not a vendor / customer relationship.	Participants enjoy reduced costs for the entirety of services provided due to the shared expertise and services, increased buying power and economies of scale participants obtain from being part of the larger R&E networking group. Equitable and shared cost recovery model that seeks to minimize costs and maximize benefits across the membership by offering participants a way to be a part of regional or national buying aggregation efforts. R&E networks can offer another avenue for participant advocacy, outreach and education around common topics or areas that may benefit from a larger, aggregated voice.

Research & Education Networks are the Ultimate Facilitators of Innovation, including:

- Access Control
- Big Data Solutions
- Climate Modeling
- Cloud Computing
- Cybersecurity
- Disaster Recovery
- Genomic Research
- Global Research
- Healthcare
- Museum Science Centers
- Supercomputing
- Telemedicine
- Transportation
- University Research
- Video Collaboration
- Video Streaming

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