THE QUILT CIRCLE

Advanced Regional Networks in Support of Research and Education

2025

A Letter From the President

It is with great pleasure that I welcome you to the 2025 edition of our annual Quilt Circle magazine, spotlighting the remarkable endeavors of regional Research and Education (R&E) networks across our nation. As president of this esteemed community, I am honored to present a compilation of stories that exemplify the dedication, innovation and collaborative spirit that define non-profit R&E networks.

This year's edition highlights the transformative impact of our collective efforts in advancing research, bridging the digital divide, and fostering innovation in high-performance computing and networking infrastructure. Our commitment to supporting research remains steadfast, with continued investments in groundbreaking initiatives that propel scientific discovery and technological advancements.

The Quilt and several of our Quilt member organizations celebrate significant milestones this year. These celebrations serve as a testament to the resilience and dedication of our networks, reinforcing our shared commitment to advancing research and education for decades to come. Speaking of resilience and dedication, don't miss the article on the responsiveness of MCNC to restore and support devastated areas of North Carolina in the aftermath of Hurricane Helene.

Artificial intelligence and machine learning are at the forefront of technological transformation, and our members are actively exploring their applications across various domains. CENIC, our member in California, is supporting transformative AI efforts with their institutional partners through an effort titled CENIC AIR.

The Quilt's involvement in the National Science Foundation's Campus Cyberinfrastructure program remains a cornerstone of our R&E mission, ensuring that institutions nationwide have access to cutting-edge cyberinfrastructure resources that support classroom curriculum and academic research.

The imperative to bridge the digital divide has never been greater. Through strategic partnerships and collaborative projects, Quilt members are enhancing digital literacy, expanding digital opportunities programs, and strengthening our communities' ability to engage with the rapidly evolving digital landscape.

Our investments in high-capacity network infrastructure and network management technologies underscores our R&E networks' unwavering commitment to meeting the ever-growing demands of research and education, ensuring that institutions can seamlessly exchange vast amounts of data at unprecedented speeds. In parallel, expanding high-performance computing capacity remains a top priority – equipping researchers with the computational power required to tackle grand challenges.

As we reflect on our achievements and set our sights on the future, it is clear that our physical IT networks and human networks are stronger than ever. Through collaboration, innovation and shared purpose, we are driving meaningful progress and shaping the future of research and education networking. I extend my heartfelt gratitude to all our members, partners and stakeholders for their unwavering support and dedication to The Quilt community. It is through our collective efforts that we continue to push the boundaries of possibility, empowering future generations and fostering a brighter, more connected world.

Thank you for joining us on this journey of discovery – may the stories within these pages inspire and propel us toward new frontiers.

Warm regards,

Jen Leasure
President and CEO

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CENIC AIR brings AI innovation to research and education in California

Last year, as national networking experts continued to debate the role of R&E networks in the realm of artificial intelligence projects and products, CENIC launched its artificial intelligence resource called CENIC AIR to serve the growing research and education needs of its members.

Recognized as the U.S. locus of AI and machine learning innovation, the California member institutions of CENIC have embraced their significant role in creating the next generation of industry innovators as well as educating the next-generation workforce that these industries will depend on.

"Our member educational institutions are on the leading edge of global AI innovation, so the opportunity to provide a collaborative, networked platform to support both education and research has been clear for some time," said CENIC CEO Louis Fox. "CENIC provides the fiber-based network foundation for CENIC AIR, but it goes beyond that. By supporting and enabling a human network of faculty and member institutions, we've enabled them to create the very platform itself; plus collaborate on funding applications, research and curriculum development."

CENIC AIR builds on the strength of several other R&E network platforms including the National Research Platform (NRP), originally conceived as the Pacific Research Platform a decade ago by networking leaders at the University of California San Diego. Participating CENIC member institutions and institutions who would like to participate in CENIC AIR or make use of these (or NRP) resources may do so via a secure big-data "carpool lane" at their campus border known as a Science DMZ, and CENIC offers a variety of models to implement this as well as network consulting and collaboration.

In its first year, early adopters learned the importance of engaging campus faculty and IT directors at the same time and at the same table to reduce the classic fragmentation of early networking initiatives at educational institutions.

During the 2024 CENIC Biennial Conference "The Right Connection", California State University campuses presented *Bootstrapping Cyberinfrastructure*, noting that colleges and universities often focus on the administrative and teaching needs rather than research needs which can sever key innovation ties.

Those lessons are now being shared with the San Diego Community College District, the first of California's community college districts to participate in CENIC AIR.

"As a nation, we can't afford to lose the innovative insights of our diverse communities by having any community lost simply by a lack of access to our cyberinfrastructure and the AI resources offered," said Fox. "In California, we are working to ensure every community college, minority-serving institution, and all colleges and universities are connected, engaged and empowered by access to the resources that will unleash our knowledge-based competitive edge into the future."

In effect, CENIC makes it possible for California's research and education community to become its own rising tide that lifts all members' boats.

To read the full story, visit the CENIC blog at https://cenic.org/blog.

CENIC connects California to the world – advancing education and research statewide by providing the world-class network essential for innovation, collaboration, and economic growth. This non-profit organization operates the California Research & Education Network (CalREN), a high-capacity network designed to meet the unique requirements of over 20 million users, including the vast majority of K-20 students together with educators, researchers, and others at vital public serving institutions. Visit **www.cenic.org**

Merit's 'word of the year' is collaboration

Merit is jumping into 2025 at full speed. The Michigan network has several new projects and collaborations in the works that are making significant impacts throughout their state.

MOON-Light got Lit

Merit and Michigan State University collaborated to successfully complete the Michigan Open Optical Network (MOON-Light) to provide affordable, reliable high-speed internet to more than 28,000 previously unserved homes across the state. This equipment-only upgrade enables ISPs to tap into Merit's backbone via Dark Wave and Michigan's rural ISPs are starting to see the light!

GREAT in the Great Lakes State

Merit expressed great pride in their collaborations with the Michigan High-Speed Internet Office (MIHI) to advance connectivity and digital opportunity in the state. Through the hard work of the Moonshot team, Merit aided in the creation of nearly 34,000 successful challenges to Michigan's Broadband Map! This monumental number would not have been possible without local champions convening to spread the word about the Michigan BEAD Challenge and Merit's Challenge Platform.

Merit also has supported BEAD investments by partnering with MIHI to host a connection-building event as part of the second day of Merit's Michigan Broadband Summit – Building Bridges For BEAD: A Community and ISP Networking Expo. This unique forum helped initiate conversations between nearly 100 communities with BEAD-eligible locations and prospective BEAD applicants in their area. Merit followed up by organizing a beneficial webinar: *How to Effectively Navigate BEAD Letters of Support*, hosted by Merit Vice President Charlotte Bewersdorff and Bob Stovall with special guest Eric Frederick, chief connectivity officer for Michigan.

Looking Ahead

Merit began engaging with Michigan's Inclusive Training, Technology and Equity Network (MITTEN), a $13 million grant program to bolster digital inclusion and capacity building efforts for regional entities and collaboratives throughout the state. To support these efforts, Merit, in collaboration with The Quilt, Arizona State University and The Marconi Society, began offering the Digital Opportunities Program Certificate designed to address the need for expertise in bridging the digital divide within our communities.

Merit also recently launched a new initiative as Michigan's exclusive eduroam connector. This effort focuses on expanding K-20 students' reach with a secure wireless service developed for the research and education community. It allows students, researchers and staff to connect to more than 38,000 locations worldwide, including 3,300 in the United States.

Throw in Tribal Capacity work, more BEAD, Compass Projects, Dynamic Honeypots and a Merit SOC, there are plenty of opportunities on the horizon. Merit would like to extend an invitation for colleagues at The Quilt to connect and see where there might be collaborative opportunities to work together in 2025!

The State of Digital Equity in MI: Getting Organized, Getting Connected, Taking Action. – enlightening panel discussion at the 2024 Michigan Broadband Summit.

Merit Network, Inc. is an independent non-profit corporation governed by Michigan's public universities. Merit owns and operates America's longest-running regional research and education network. In 1966, Michigan's public universities created Merit as a shared resource to help meet their common need for networking assistance. Since its formation, Merit Network has remained at the forefront of research and education networking expertise and services. Merit provides high-performance networking and IT solutions to Michigan's public universities, colleges, K-12 organizations, libraries, state government, health care, and other non-profit organizations. Visit **www.merit.edu**

GP-ENGINE revolutionizing HPC capabilities in the Great Plains

The Great Plains Extended Network of GPUs for Interactive Experimenters (GP-ENGINE) project, in collaboration with the Great Plains Network (GPN) and funded by the National Science Foundation (award #OAC-2322218), continues to enhance HPC capabilities throughout the Midwest.

GP-ENGINE represents a significant increase in research computing. By providing advanced computational resources and fostering a collaborative research environment, the project will make a lasting impact on scientific research in the Great Plains region and beyond in a wide range of scientific disciplines. New supercomputing nodes placed at 10 universities within the Great Plains has increased both local and national resources by sharing spare capacity through the National Research Platform and the OSG (formerly called the Open Science Grid).

The project was awarded to the University of Missouri. The principal investigators are J. Alex Hurt (University of Missouri), Derek Weitzel (University of Nebraska-Lincoln), Brian Burkhart (OneNet), and Paul Kern (South Dakota State University). GP-ENGINE evolved from two earlier awards: GP-ARGO and the Great Plains Regional CyberTeam. GP-ARGO provided advanced computing resources, while the CyberTeam developed Cyberinfrastructure workforce skills. By integrating the strengths of these programs, GP-ENGINE offers a robust infrastructure that leverages the power of GPUs to support a wide range of research activities.

GP-ENGINE integrates into the National Research Platform. Instead of relying on a single supercomputing facility, computational tasks are distributed across nodes at partner universities across the Great Plains Network. These nodes are equipped with GPUs and CPUs (Nvidia and AMD) – offering substantial computational power – and distribution enhances the overall computational capacity, reliability and accessibility for researchers across the region.

The project provides more than 10,000 GPU hours per month for data processing workloads. This includes significant contributions to both local and national research initiatives such as The National Radio Astronomy Observatory (NRAO), which is now able to study the universe at unprecedented speeds. Additionally, GP-ENGINE supports training deep neural network models for satellite imagery research; burned-area detection in satellite imagery following forest fires; integration and benchmarking of the first publicly available Grace Hopper AI SuperChip; and teaching courses on AI/ML at GPN institutions such as University of Oklahoma, University of Nebraska-Omaha, and the University of Missouri.

Beyond its technological advancements, GP-ENGINE fosters a robust community of researchers and computing professionals across the Midwest. It provides comprehensive training and support, covering topics such as containerizing research workflows, interactive computing, and utilizing AI/ML libraries effectively. The resources used during tutorials are shared open-source on GitHub to allow all current and prospective NRP users to view and share it with others.

For information and updates on GP-ENGINE, visit https://gp-engine.org or http://greatplains.net/.

GREAT PLAINS NETWORK

The Great Plains Network (GPN) is a non-profit consortium aggregating networks through GigaPoP connections while advocating research on behalf of universities and community innovators across the Midwest and Great Plains who seek collaboration, cyberinfrastructure and support for big data and big ideas, at the speed of the modern Internet. GPN was founded by researchers and for researchers to advance regional capabilities with respect to advanced networking and access to national cyberinfrastructure. Visit **www.greatplains.net**

Front Range GigaPoP celebrates 25 years of innovation and collaboration

FRGP 25th Anniversary Celebration held at Colorado State University SPUR Campus on Sept. 4, 2024.

In September 2024, Front Range GigaPoP (FRGP) celebrated its 25th anniversary by reflecting on the journey of this remarkable network and the community that has made it an enduring success. Since its inception in 1999, FRGP has transformed the technological landscape of the Mountain West, ensuring connectivity, collaboration and innovation for academic, research and governmental institutions.

Yesterday

In the late 1980s, the National Science Foundation (NSF) announced a shift from NSFnet to a commercially-driven internet model. For the Mountain West, with its vast distances and limited infrastructure, this transition posed a significant challenge. While other regions were developing networking hubs, the Mountain West faced the risk of becoming a "network flyover country."

Recognizing this need, the University Corporation for Atmospheric Research (UCAR) stepped forward to manage the FRGP with the initial drivers being Colorado State University and the University of Wyoming, which led to cohesive and cost-effective collaborations to help bridge geographical and institutional gaps. From the start, UCAR played a critical role, providing technical management, engineering, purchasing and budgeting, staffing, contracting, and legal counsel. UCAR also established a sustainable financial model, making FRGP a resilient solution.

Today

The success of FRGP lies in its vibrant and collaborative community. By pooling resources and expertise, participants have created a network that is resilient and accessible, cost-effective and flexible, and diverse in its applications and reach.

The FRGP network now includes 32 participants, up from an original seven, ranging from schools and universities to governmental and research institutions. These include the University of Colorado campuses, Colorado State University, the State of Wyoming, NOAA, and many other higher education institutions, school districts and agencies.

FRGP has continually evolved to meet the demands of modern networking. From its early DS3 circuits to today's 400 Gbps waves, the network has embraced cutting-edge technologies such as Wave Division Multiplexing, peering with multiple entities like Internet2 and Google, commodity carriers operating at 100 Gbps, and advanced DDoS mitigation. FRGP also has been instrumental in enabling NSF-funded projects, such as WINS and BiSON-West.

Tomorrow

The future of FRGP is intertwined with the development of broadband in Colorado and beyond. Brandy Reitter, executive director of the Colorado Broadband Office, highlighted that there are opportunities for new collaborations to ensure continued growth and connectivity for the region.

The success of FRGP is a testament to the dedication of its staff, participants, vendors, and supporters. As we celebrate 25 years of FRGP, we honor its legacy and look forward to a future of continued innovation and collaboration.

Four of the FRGP founders include Scott Baily and Pat Burns (Colorado State University), Bob Morison (University of Wyoming), and Marla Meehl (UCAR).

Front Range GigaPOP (FRGP), since 1999, has advanced the research and educational goals of government, nonprofit, research, and educational participants in the region by establishing and maintaining a unique multi-state network infrastructure. The FRGP is owned and controlled by the FRGP participant research and education community. Visit **www.frgp.net**

Neighboring RENs work together with LEARN to transform southeast connectivity

LONESTAR EDUCATION AND RESEARCH NETWORK

Bringing network resilience to Southeast Texas wasn't easy. LEARN's members in this area struggled to manage redundancy – particularly between Dallas, Tyler, Houston, and Beaumont. After multiple years and the formation of a long-term partnership with a neighboring state's research and education network, LEARN's commitment to bring connectivity to the region came to fruition.

After an extensive examination of fiber assets in the region, LEARN determined that using currently available paths were inviable and/or fiscally irresponsible. However, LEARN's neighbor network, the Louisiana Optical Network Infrastructure (LONI), did have a clearly accessible path. Exploring a potential collaboration, retired LEARN President and CEO Mike Philips reached out to his longtime neighbors and colleagues. "Being next-door neighbors, LEARN and LONI have always had a good relationship, and we'd talked about partnering for years and years when this opportunity presented itself," described Gary Mumphrey, LONI's Chief Technology Officer.

The idea that eventually became the Beaumont Loop Project offered a creative way to resolve regional connectivity issues for LEARN while also offering LONI an opportunity to connect through Dallas and access prime internet and peering services for their members.

Formalizing the collaboration was just the beginning of what became a complex, multi-year project. To create the new route, LONI had to first get Louisiana fiber to Beaumont, including a three-mile build in Louisiana through Lake Charles. The additional fiber being brought into Texas from Louisiana allowed network traffic out of Beaumont to move north to Dallas or alternately to LONI's Internet2 connection in Baton Rouge, with the eventual goal of shifting the fiber protection routing through Shreveport and Tyler to create redundancy for both the Beaumont and Tyler spurs.

LEARN is now able to offer protection to the Tyler and Beaumont spurs, and LONI also realizes benefits from the project. "LEARN is helping us get to Dallas, which is a major national market for content providers like Facebook, Google and Netflix, and we don't have that opportunity in Louisiana. Now we can take advantage of more opportunities for peering, and we're getting a direct routed path to those networks," explained Mumphrey.

One unexpected evolution that grew out of the project was the creation of the Midsouth U.S. Internet Exchange (MUS-IX), which provides increased internet connectivity, bandwidth and content peering to participating members including LEARN, OneNet (Oklahoma), ARE-ON (Arkansas), and LONI. The goal of MUS-IX is to maximize the mutual efforts of the regional partners to create a centralized collaboration hub that reduces costs, enhances services, and coordinates participation in national research and education initiatives.

LEARN and LONI encourage other research and education networks to embrace the idea of working together. By reaching out years ago on what started as a simple logistical goal, the beneficial impacts of a strong partnership between neighbors have multiplied exponentially.

While the Beaumont Loop Project is completed, LEARN and LONI plan to continue working together to maximize connectivity and resources for their communities.

The Richard W. Setzer Student Center at Lamar University in Beaumont, Texas. Lamar University is a LEARN member.

Lonestar Education and Research Network (LEARN) is a consortium of 42 organizations throughout Texas that includes institutions of higher education, community colleges, and K–12 public schools. Organized as a 501(c)(3), LEARN connects its members and over 300 affiliated organizations to statewide resources through high-performance optical and IP network services. Visit www.tx-learn.org

Florida LambdaRail helping to build brighter futures in the sunshine state

Florida LambdaRail (FLR) is Florida's independent statewide research and education fiber-optic network. FLR is owned and operated on behalf of its partner institutions and affiliates and is dedicated to producing knowledge and prosperity within the state through education and research activities that drive our members' 21st century economy initiatives.

FLR brings people together annually to reaffirm its commitment to advancing research and innovation in Florida. Last year's event brought together several key stakeholders, including FLR members and affiliates, to explore opportunities for expanding research networking and cyberinfrastructure across the state.

The first day featured presentations from FLR affiliates showcasing their research efforts. National level keynotes were Kevin Thompson from NSF and Robert Sears of NOAA, each highlighting their programs and the value of partnering regionally with research and education networks to advance science. FLR's Chief Network Architect Chris Griffin also updated the community on network upgrades, which included an update on FLR's recently completed 400 Gbps backbone modernization.

The meeting's second and third days were research-centric, offering attendees valuable insights and resources to enhance their work. Highlights from the two days included an NSF CC* Program Briefing facilitated by Kevin Thompson as well as a proposal development workshop led by NSF CC* Program Director Amy Apon. There was also an FLR Technical Meeting where engineers from FLR institutions attended a full-day technical briefing covering networking performance, security measures and Q&A. And, finally, members of SSERCA, the Sunshine State Engineering and Research Computing Alliance, held their all-staff meeting on site.

There also was a collaborative workshop for Writing Campus Cyberinfrastructure (CI) Plans, which was sponsored by FLR and spearheaded by the University of Miami. Supported by an NSF planning grant, the workshop was part of a broader effort to foster data science innovation across South Florida's small and minority-serving academic institutions and represents a key step toward building the "South Florida Regional Data Science Cyberinfrastructure."

Research and networking leaders from the University of Miami, Florida International University, Florida Atlantic University, the University of Oklahoma, Internet2, Minority Serving – Cyberinfrastructure Consortium (MS-CC), and Southern Crossroads (SoX) all joined with research faculty and IT leaders from seven small, minority-serving institutions to collaborate in real-time on the development of their campus cyberinfrastructure plans. Florida Memorial University and Bethune-Cookman University (BCU) both left with Campus CI plans while St. Thomas University matured theirs. BCU also joined the regional compute planning grant effort and all three MSIs joined a regional networking proposal.

"FLR's aim is to create a robust, interconnected framework that supports higher education institutions in their research and educational missions," commented FLR CEO Jon Ellis. "This workshop not only facilitated cross-institutional collaboration but also laid the groundwork for future advancements in regional data science infrastructure."

Florida LambdaRail's annual meeting exemplifies its dedication to enhancing research capabilities. By providing a platform for knowledge sharing, collaboration and strategic planning, FLR empowers institutions to achieve their academic and research goals. For more information, visit www.flrnet.org.

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OARnet celebrates decades of client service excellence

OARnet's Business Relationship Managers provide personalized and professional services to a large and diverse range of clients in Ohio including K-12 schools, health care facilities, public broadcasting locations, research facilities and thousands of local and state government sites, which also includes public safety and the emergency communications network.

To support these communities, under the leadership of former Chief Relationship Officer Denis Walsh, OARnet established two distinct market segments (government and education) within the Client Services Team to develop expertise and strong relationships in each market. These relationships allowed the team to develop a deeper understanding of each clients' unique issues, concerns and objectives as well as identify the appropriate resources and services needed to support their success. Today, the Client Services Team is responsible for consulting with clients, vendors and OARnet's technical team to identify technology solutions and develop project plans, timelines and contingencies to achieve desired outcomes.

"We bridge the gap between our clients, vendors and OARnet's technical resources to ensure the development of quality solutions that address customer needs," said Walsh, who supported OARnet clients for more than 20 years before retiring in October 2024.

Client Services also escalates potential issues to OARnet's engineers and communicates relevant information to clients. With a 24x7x365 Network Operations Center (NOC), OARnet is constantly surveilling its network connections to proactively eliminate issues before they impact clients.

When unusual challenges arise, the Client Services Team works with clients and engineering resources to develop unique and timely solutions. During the COVID-19 pandemic, OARnet helped broadcasting clients support the governor's public health addresses as well as rapidly developed network connections to mass testing and vaccination sites. This team also supports technology needs for research projects, such as the VROhio project that encompasses nine colleges in Ohio, funded by a National Science Foundation CC* grant.

Aggregate purchasing to gain lower pricing is another significant way that OARnet serves its clients. One example is VMware by Broadcom, a technology that provides a platform for cloud computing and virtualization, which OARnet has delivered at a significant savings rate since 2008.

"Coordinating the purchasing power of 90-plus colleges, for example, gets discounts far greater than what any school could achieve on its own," said David Ginn, who was appointed chief relationship officer at OARnet in November 2024.

In addition, the Client Services Team identifies what solutions clients may need in the future and works to proactively develop a statewide strategy to obtain the resources needed in the most cost-effective manner. In recent years, OARnet expanded its security services portfolio and hired a cybersecurity architect. OARnet also is in the process of upgrading its statewide fiber-optic backbone to 400 Gbps to accommodate clients' anticipated technology needs to ensure Ohio's role as a technology leader.

"By remaining accessible and in constant touch, our Client Services Team converts the technological capabilities of our state-of-the-art network into a top-notch experience for our clients' staff who keep Ohio connected," said Pankaj Shah, executive director of OARnet.

The Ohio Academic Resources Network (OARnet), a division of the Ohio Department of Higher Education's Ohio Technology Consortium (OH-TECH), serves the state's government, education, health care and public broadcasting communities. Through innovative public-private partnerships and a state-of-the-art fiber optic network, OARnet expands access to affordable broadband and delivers critical networking and technology services for academic and commercial R&D. Visit **www.oar.net**

CEN celebrates 25 years of connecting Connecticut

CEN
SINCE 2000
25 YEARS
CONNECTING CT COMMUNITIES

The Connecticut Education Network (CEN) has had a remarkable journey over the past 25 years.

Since establishment, CEN has evolved into a key player in Connecticut's technological infrastructure, exemplifying both adaptability and leadership. Today, the network boasts an expanded backbone from 10-100 Gbps to an impressive 400 Gbps, enhancing capacity by as much as 40 times across all locations. This expansion not only reflects CEN's technical capabilities but underscores their dedication to innovation and commitment to fulfilling the evolving needs of their members.

CEN has several key projects currently in various stages of implementation, with significant progress made in expanding their network infrastructure to connect new communities.

The Next Generation Infrastructure, or NGI project, aims to expand CEN's capacity, accommodate new members, and serve as the backbone for high-performance community wireless projects. These investments will enhance the network's capacity and resiliency, ensuring equitable access to high-quality internet for schools, colleges, libraries, health care facilities, and government agencies across the state.

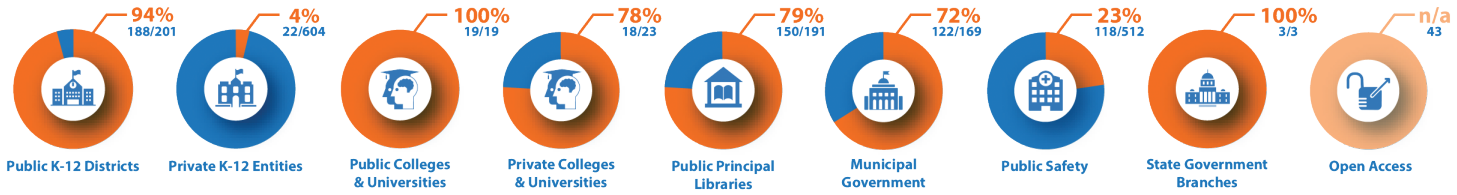
The Connecting CT's Communities Initiative (C3I) offers a fully subsidized fiber build to connect municipalities, council of governments, libraries, and charter schools to CEN's Dedicated Internet Access service. This provides essential benefits including dedicated bandwidth, exclusive access to Internet2, and critical cybersecurity protections.

And, finally, the Community Wi-Fi Grant Program is designed to improve internet access across the entire state, particularly in underserved and economically-disadvantaged communities. It provides $10 million in reimbursement subgrants to enhance Wi-Fi infrastructure for work, education and health monitoring through local institutions. Additionally, the program also promotes the use of eduroam, a secure platform for authenticated Wi-Fi access to further extend connectivity.

CEN anticipates completing major milestones for NGI and C3I by the end of this year, while the Community Wi-Fi Grant Program is preparing to accept applications with grant awarding beginning this spring.

As CEN reflects on 25 years of service, they are gearing up for an impactful future. Focused efforts over the past five years have yielded a 22 percent growth in membership, now serving approximately 1.9 million citizens, with a remarkable increase in community engagement with more than 800 members attending their member conference in 2024. CEN also added nine new service offerings during this same time frame.

CEN's journey from a small education-only network to a robust statewide infrastructure for all community anchor institutions is a testament to a member-first mentality. As they look toward the horizon, CEN remains committed to delivering value, igniting innovation, fostering collaboration, and empowering our communities.



The Connecticut Education Network (CEN) is the state's premier open-access, high-capacity internet, cloud, cybersecurity, and network services provider. Established in 2000, CEN has been a leader in advancing the capabilities of its members, ensuring equitable access to secure and dependable connectivity that supports education, research, government, digital citizenry, aggregation, and collaboration. Visit **ctedunet.net**

MAX goes big with 400G network upgrade

Mid-Atlantic Crossroads (MAX) in Maryland is nearing the finish line of a significant network upgrade. Despite setbacks caused by the COVID-19 pandemic and related supply chain disruptions, MAX engineers have remained steadfast in their determination to complete this upgrade, positioning MAX as one of the first Regional Optical Networks (RONs) in the U.S. to offer a 400G routed network.

This major overhaul, utilizing equipment from Ciena for the optical transport and Cisco for the packet networking layers, boosts data transmission capabilities for delivering unmatched bandwidth, low latency and enhanced scalability, all while reducing both rack space and power consumption for a more efficient network footprint.

Rather than simply upgrading its existing network piecemeal, MAX chose to replace all powered infrastructure components from the ground up – assessing the power and environmental requirements, testing, cleaning and leveraging existing backbone fiber where possible, deploying additional tools for managing the new environment, providing training, and tracking the effort through standard project management practices and tools.

Tripti Sinha is assistant vice president and chief technology officer for the University of Maryland who also serves as MAX executive director. She explained that this comprehensive refresh was driven by MAX's commitment to providing customers with the fastest, most reliable network available.

"This latest refresh represents our unwavering dedication to delivering state-of-the-art connectivity for our partners, and it underscores our commitment to exceeding the evolving and ever-growing needs of the research and education communities that we serve," said Sinha.

One of the biggest challenges in the upgrade was minimizing downtime for customers. To ensure seamless transitions, some redundant network connections were temporarily attached to both the old and new networks simultaneously. According to Carrie Groff, associate director of service development and community relations at MAX, every effort was made to ensure minimal disruption for customers.

"Our team is deeply committed to providing exceptional service and reliable support to our customers, and we understand the importance of uninterrupted connectivity," added Groff. "Our top priority remains the satisfaction and continued trust of those we serve, and we are excited to provide this level of service and capability to our partners, new and current."

The MAX network spans a dozen Points of Presence (POPs) across the DMV (D.C., Maryland and Virginia) area, interconnected by five fiber rings to ensure redundancy via multiple paths for optimal performance and minimal downtime. The refreshed network will offer increased redundancy and future-proof performance with an initial pair of 400G lambdas connecting each of the edge PoPs into diverse cores, plus a full mesh of 800G lambdas between the four core PoPs.

Set for completion in early 2025, this massive upgrade positions MAX to meet the growing needs of its customers for years ahead.

MAX
MID-ATLANTIC CROSSROADS

Mid-Atlantic Crossroads (MAX) is a center at the University of Maryland that operates a multi-state advanced cyberinfrastructure platform. MAX's all-optical, Layer-1 core network is the foundation for a high-performance infrastructure providing state-of-the-art network technology and services. MAX participants include universities, federal research labs, and other research-focused organizations in the Washington, Baltimore and Northern Virginia metropolitan areas. MAX serves as a connector and traffic aggregator to the Internet2 national backbone and peers with other major networks. Its mission is to provide cutting-edge network connectivity for its participants, tailored and generic data transport solutions, and advanced services to accommodate and optimize large data flows and to facilitate network and application research. Visit **www.maxgigapop.net**

NJ EDGE supports high-performance networking for higher education

NJ Edge recently partnered with FABRIC, Rutgers, The State University of New Jersey, and Princeton University to provide high-performance network infrastructure connecting university researchers and their local compute clusters and scientific instruments to the larger FABRIC infrastructure.

FABRIC (Adaptive Programmable Research Infrastructure for Computer Science and Science Applications) is an expanding global research testbed designed to help shape future generations of computer networks. Funded by the NSF Mid-Scale Research Infrastructure program, FABRIC is a novel, adaptive and programmable national research network testbed that allows computer science and networking researchers to develop and test innovative architectures that could yield a faster, more secure internet. Additionally, FABRIC Across Borders (FAB) extends the network to four more nodes in Asia and Europe, creating an international infrastructure that enables cutting-edge experimentation and research at scale for advanced networking, cybersecurity, distributed computing, storage, virtual reality, 5G, machine learning, and science applications.

Dr. Forough Ghahramani, assistant vice president for research and innovation at NJ Edge, commented that this collaboration will create opportunities to explore innovative solutions not previously possible for a large variety of high-end science applications as well as provide a platform on which to educate and train the next generation of researchers on future advanced distributed system designs. His colleague, Bruce Tyrrell, associate vice president of programs and services, added that NJ Edge is uniquely well-positioned to provide infrastructure support to these types of research networking initiatives. "As a backbone and external services provider to both Rutgers and Princeton University, (we) have the capacity and capability to meet the high-bandwidth research needs of our partner institutions," he explained. "Our extensive optical backbone enables (us) to efficiently and economically deploy 100G transport services to all of our members."

The FABRIC team is led by researchers from UNC Chapel Hill, University of Kentucky, Clemson University, Illinois Institute of Technology, and ESnet. The team also includes researchers from many other universities, including Rutgers, The State University of New Jersey, and Princeton University to help test the design of the facility and integrate their computing facilities, testbeds, and instruments into FABRIC.

"FABRIC aims to be an infrastructure to explore impactful new ideas that are impossible or impractical with the current Internet. It provides an experimental sandbox that is connected to globally-distributed testbeds, scientific instruments, computing centers, data, and campuses that researchers rely on every day," added Paul Ruth, FABRIC Lead PI. "NJ Edge enables us to support research across many facilities including the COSMOS wireless testbed, Princeton's experimental P4 testbed, and remotely-controlled instruments such as a CyroEM microscope at Rutgers."

To learn more about FABRIC capabilities, visit https://portal.fabric-testbed.net/about/about-fabric or contact Forough Ghahramani at research@njeged.net for additional information.

NJ Edge serves as a member-owned, nonprofit provider of high-performance optical fiber networking and internetworking, Internet2, and a vast array of best-in-class technology solutions for cybersecurity, educational technologies, cloud computing, and professional managed services. Edge provides these solutions to colleges and universities, K-12 school districts, government entities, hospital networks and nonprofit business entities as part of a membership-based consortium. Edge's membership spans across the nation. Edge's common good mission ensures success by empowering members for digital transformation with affordable, reliable and thought-leading purpose-built, advanced connectivity, technologies and services. Visit **https://njedge.net**

KINBER expands digital coaching program in Pennsylvania

KINBER is a non-profit organization in Pennsylvania committed to working with communities, governments, businesses, schools and other nonprofits to advance digital inclusion and sustainable innovation, creating more opportunities and improving quality of life for all.

As part of its work, KINBER has continued to focus on building the capacity of trusted community partners to provide digital navigation services to underserved local residents. KINBER recently partnered with Tech2Elevate to expand its digital coaching program in Beaver and Erie Counties. This program provides one-on-one digital training to residents to help them learn basic technology skills to access online resources and remote health care.

Through Tech2Elevate's partnership, residents like Ms. Mason learn to use technology more effectively to accomplish their personal goals. She remarked that the program "was a godsend made especially for me...as a matter of fact, I think I'll push further to get seniors because I know there's some out there, as I am, that want to know more and they just haven't had the opportunity."

The partnership's expanded digital navigation services provide Beaver and Erie residents with an accessible program to learn how to complete digital tasks and use online services to pay bills, have telehealth appointments, or complete job applications. Residents can access these training sessions at local libraries and other community locations. Tech2Elevate's Digital Coaches work with the residents to both solve immediate tech problems and to identify and achieve longer term digital learning goals. Digital Coaches also help residents learn how to stay safe online and provide them with information on affordable internet connectivity and digital devices.

Beaver County resident and client Ms. Mason with Tech2Elevate Digital Coach Chynita.

Julie Mulcahy, a librarian at Laughlin Memorial Library, explained that many visitors come in and simply don't know how to use their phones. "They'll help them learn how to send text messages, take pictures, open attachments…just basic things," Mulcahy added. "Things that maybe we take for granted that they need a little extra help with."

Through KINBER's partnership with Tech2Elevate, the digital navigation program now has expanded to eight locations, grown the coaching team to six staff members, and served more than a 100 clients in its first three months. This partnership has allowed the program to expand offerings to now include advanced classes for older adults in addition to improving employment opportunities for clients by accessing scholarships awarded through the Google Career Certificate Program.

KINBER President and CEO Nathan Flood considers the new partnership with Tech2Elevate to be well aligned with KINBER's mission, empowering communities to thrive in a digital world. "Programs like Tech2Elevate's digital navigation services provide these residents with tech help that is tailored to them – whatever their personal needs may be for their online activities," he said.

The KINBER and Tech2Elevate partnership expands essential services and opportunities, helping more residents stay connected, engaged and empowered as more of our world moves online.

For more information about this initiative, visit www.KINBER.org.

KINBER

empowers communities to thrive in a digital world.

The Keystone Initiative for Network Based Education and Research (KINBER) is Pennsylvania's statewide research, education, and community network. The non-profit organization is a trusted technology partner that provides a strategic and competitive advantage to 100+ Pennsylvania-based organizations through high-speed broadband connectivity, collaboration, and innovative use of digital technologies. KINBER is committed to delivering equitable, reliable, and affordable digital infrastructure and tools to inspire tomorrow's scientific discoveries, enable the exchange of ideas and culture among diverse populations, educate the next generation of citizens, and revitalize Pennsylvania's economy. Visit **www.kinber.org**

KeystoneREN democratizes access to cyberinfrastructure in Pennsylvania

KeystoneREN, in partnership with Penn State University, is helping smaller, lesser-resourced campuses access advanced cyberinfrastructure in new and exciting ways. Through support from an NSF-funded Campus Cyberinfrastructure Regional Network Award for $1.1 million, participating campuses across Pennsylvania now have access to advanced cyberinfrastructure resources and technologies not previously available to them.

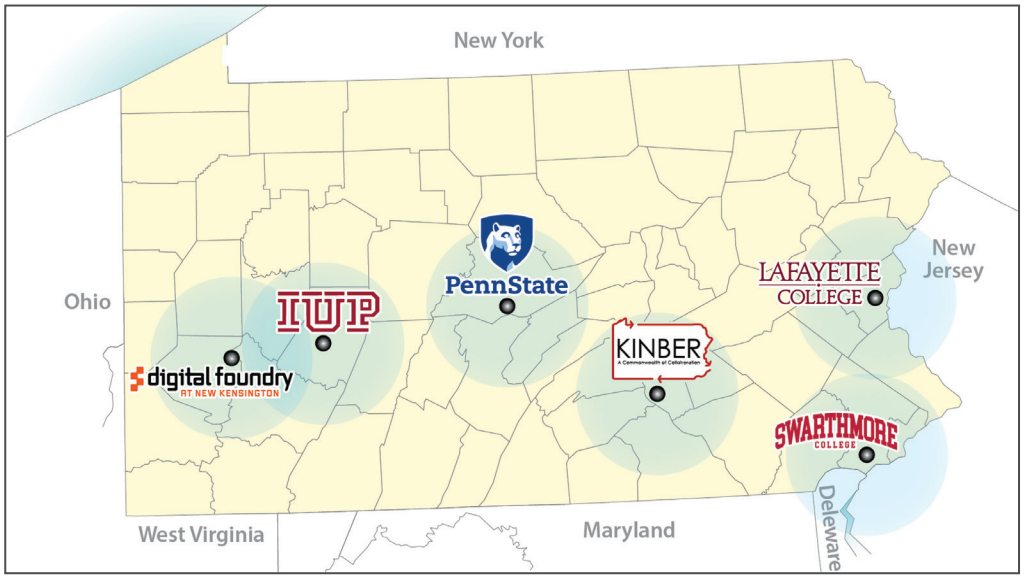
The PA Science DMZ, led by project principal investigator (PI) Wayne Figurelle, assistant director for innovation and outreach for the Institute for Computational and Data Sciences (ICDS) at Penn State University, with Co-PIs Frederick Adkins, professor of mathematical and computer sciences at Indiana University of Pennsylvania; Jason Simms, research computing manager at Swarthmore College; and Grant Dull, executive director of KeystoneREN, addresses critical infrastructure and connectivity gaps across five participating institutions: Penn State University, Indiana University of Pennsylvania, Lafayette College, The Digital Foundry at New Kensington, and Swarthmore College.

Built as a performance-based security enclave network, the PA Science DMZ is ideal for giving a preferred path for lowest latency and best performance that would otherwise transit the public or "commodity" internet. The benefits of this project are positively impacting a range of areas and domains spanning from data analytics and applied research in worker safety to robotics and geospatial data as well as enhancing cybersecurity and STEM education at Indiana University of Pennsylvania. At Lafayette College, the improved connectivity will support molecular dynamics simulations and biology research. And, at Digital Foundry New Kensington the infrastructure will allow enhanced external access to a Digital Learning and Demonstration Lab. Swarthmore College will use the solution and toolsets primarily for collaborative linguistics and social interactions research but the benefits also will span other areas and disciplines.

The PA Science DMZ also opens the door to a multitude of additional research opportunities, both within the initial consortium of participating schools and through collaborations with smaller institutions that are currently unable to adequately access critical tools of contemporary science. By implementing a regional model for aggregating cyberinfrastructure hardware and human resources, the PA Science DMZ provides a robust and economically efficient template for additional initiatives within the state and nationwide, fostering a more inclusive and interconnected cyberinfrastructure landscape. Already plans are underway for additional expansion to even more campuses in order to accelerate innovation across STEM research and education in the commonwealth and beyond.

In addition to the PA Science DMZ, KeystoneREN also helps small to mid-sized institutions successfully pursue an essential series of NSF Campus Cyberinfrastructure Awards that help scaffold success and ensure sustainability, which can be a huge challenge at so many campuses. For example, Franklin & Marshall College (F&M), a private liberal arts college in Lancaster, recently was awarded a campus storage grant *CC Campus: Building a Complete Research Storage Solution at Franklin & Marshall College.* This project builds on success of F&M's previous NSF CC* awards (Campus Network in 2017 and Campus Compute in 2019). This series of awards received by F&M helped position the college for more than $4.5 million in grants received just in 2024. "Our success in the NSF CC* program has positioned the college for even greater funding opportunities and helped F&M attract world-class faculty as a result of our total cyberinfrastructure capacity," said Carrie Rampp, vice president, CIO and chair of the KeystoneREN board of managers.

KeystoneREN also offers support in applying for NSF CC* funding beyond the boundaries of Pennsylvania. To find out how KeystoneREN can best support your REN/RON, member stakeholders and small to mid-sized campuses in pursuing funding opportunities to advance sustainable cyberinfrastructure, email information@keystoneren.org.



2024 Pennsylvania Science DMZ Partners (Proposed)

KeystoneREN, as Pennsylvania's statewide hub for research and education networking, leverages advanced cyberinfrastructure and researcher engagement programs and support to offer cost-effective connectivity. Visit **www.keystoneren.org**

Link Oregon drives statewide research computing innovation

This Link Oregon Network Map shows an artistic rendering of their 50 service locations as of 2023.

Oregon is entering a bold era of digital transformation and scientific discovery, with leaders across government, industry and academia uniting to advance research and innovation in many fields – from semiconductor manufacturing to genomic research to quantum computing.

Within this innovation ecosystem, Link Oregon is championing cutting-edge research computing initiatives and fostering dynamic, cross-institutional collaborations. By forging these powerful partnerships, Link Oregon is looking forward to the next wave of breakthroughs that will define the state's technological future.

Over the past year, Link Oregon has helped write the next chapter of connectivity in the state.

Link Oregon has been able to partner with university members on a range of NSF Campus Cyberinfrastructure (CC*) and Regional Innovation Engine (RIE) proposals. The envisioned projects address revolutionizing semiconductor manufacturing, strategic planning for an inclusive statewide research cyberinfrastructure framework, a regional strategy for energy storage technologies, and developing a network operations model for hybrid classical-quantum networks. Christy Long, associate CIO at the University of Oregon, and expert consultant Dr. Gwen Jacobs have been key contributors to this effort.

The statewide research computing collaboration group, comprised of senior HPC leaders across Oregon universities, also is driving a new collaboration and resource sharing model. Last fall, this led to Oregon's first multi-institutional research presence at the SC24 conference, showcasing the growing body of exceptional, compute-intensive and network-enabled research among Oregon's universities, under the banner of "Oregon Innovates." Highlights included unique inter-institutional collaborations in the areas of genomic science and cancer research, AI/robotics, earth/ocean sciences, and seismic/tsunami hazards research.

Link Oregon also welcomed a chief scientist for the 2024-25 academic year with noted network researcher Ram Durairajan, a computer science professor at the University of Oregon. Professor Durairajan's exploration of relationships between network topology and resiliency, machine learning for network security and operations, and quantum networking will assist Link Oregon to stay ahead of technological advancements and to develop lasting collaborative partnerships with Oregon researchers.

The network also was part of a statewide team in 2024 led by professor Will Pazner of Portland State University on the NSF CC* Oregon Regional Computing Accelerator (Orca) project, deploying a GPU-enabled computing cluster available to smaller and under-resourced institutions and enabling research and education related to AI, machine learning, data science and other computational-intensive research.

Finally, Link Oregon continued extensive testing last year to evaluate 400G-ZR+ optical technology as an alternative to traditional optical transponders to support one of its university members' investments in research and cyberinfrastructure initiatives, including the national-class Jen-Hsun Huang and Lori Mills Huang Collaborative Innovation Complex under development at Oregon State University. In addition, they bolstered their offerings with enhanced DDoS Mitigation Services, expanding beyond standard volumetric mitigation to network analytics, automatic DDoS detection and diversion and web application security.

The adage "If you want to go fast, go alone; if you want to go far, go together" aptly captures Link Oregon's philosophy. While remaining focused on their core mission of delivering advanced broadband connectivity and related services for Oregon's public and non-profit sectors, Link Oregon also is committed to going the extra distance for the state's diverse innovation ecosystem to facilitate impactful connections and collaborations.

Link Oregon is a federally tax-exempt 501(c)(3) Oregon non-profit organization and the Research and Education Network (REN) for the state of Oregon, serving the public and non-profit sectors. We operate a statewide middle-mile fiber infrastructure spanning over 2,500 miles that delivers state-of-the-art broadband services to our member organizations. We collaborate with a vast network of ecosystem partners, spanning commercial telecom providers, legislators, broadband policy leaders, digital equity advocates and non-profit affiliates who are vital to our mission to expand high-speed broadband connectivity across the state for a future-ready Oregon. Visit **www.linkoregon.org**

OneNet's OFFN making the impossible practical for higher education in Oklahoma

Supercomputing and high-speed data transfer capabilities have made scientific discovery more practical. As a result, research computing in Oklahoma is growing by leaps and bounds thanks to OneNet's OneOklahoma Friction Free Network (OFNN).

OFFN is OneNet's dedicated Science DMZ that provides access to supercomputing resources across the state and the ability to transfer data to research facilities around the world.

"Supercomputing makes the impossible practical," said Henry Neeman, Director of Supercomputing Center for Education and Research at University of Oklahoma, who was one of the original designers of OFFN.

Oklahoma has received nine grant awards from the National Science Foundation since 2013 to create and expand OFFN. OneNet has received nearly $5 million in funding through six of those awards. When all of the awarded projects are complete, OFFN will connect 30 higher education locations to the network. These projects are increasing bandwidth at participating campus locations to 10 Gbps or 100 Gbps connections. These connections give campuses access to supercomputers at several universities that have offered to share their supercomputing resources with other institutions. Researchers also take advantage of OFFN's high-speed data capabilities to move research data to supercomputers or other research facilities throughout the U.S. and Europe.

The College of the Muscogee Nation (CMN) is a one success of the OFFN. They are not only new to OFFN, but new to OneNet as well. As Oklahoma's recognized tribal college, CMN plans to utilize the network for science and education projects in traditional Myskoke foods, water and soil research, and field conservation and sustainable agriculture.

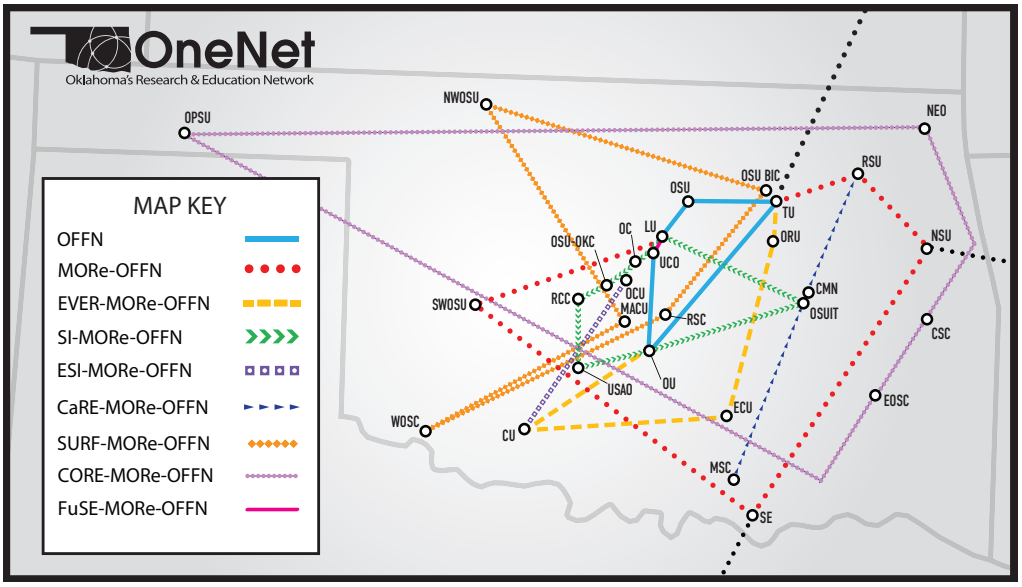
"As researchers, faculty members and administrators, we are continuing the legacy of education of our people," said Dr. Monte Randall, CMN president. "To have the OneNet system on our campus and being able to connect to all of the Research 1 institutions in the State of Oklahoma is huge for us."

Rogers State University (RSU) also shares in the success and was able to connect to OFFN through an early grant, then received a fiber build and upgrade to their connectivity through a later grant. Faculty are using the connection to improve interactive learning for their popular game development courses.

"OFFN enabled the use of interactive and multimedia-rich educational content, making learning more engaging and effective," said Dr. R. Curtis Sparling, department head and assistant professor for RSU. "Students can now collaborate in real-time on projects, assignments and group activities, enhancing their teamwork and communications skills."

"Thanks to NSF's CC* program, research computing in Oklahoma has grown exponentially in the last 10 years," said Brian Burkhart, OneNet's chief technology officer and the principal investigator on several of the projects. "As we bring more higher education institutions onto the OFFN network, we reach more students, faculty and staff across Oklahoma with opportunities for learning, discovering and sharing; growing the knowledge base and future workforce for our state."

Watch OneNet's OFFN highlight video!



OneNet, as a division of the Oklahoma State Regents for Higher Education, advances research and education in communities across Oklahoma by delivering high-speed, affordable connectivity and technology solutions to research, education, health care and government institutions. OneNet serves colleges and universities, research centers and laboratories, public and private schools, libraries, tribal organizations, hospitals and clinics, and local, state and federal governments. Visit **www.OneNet.net**

Unlocking secrets of bone health through multi-omics and LONI supercomputing

In the ever-evolving world of biomedical research, scientists are increasingly turning to multi-omics approaches to better understand complex diseases. By integrating various layers of biological data – such as genomics, transcriptomics, proteomics, epigenomics, and metabolomics – researchers can gain a more complete picture of underlying biological processes. This approach provides deeper insights and helps uncover potential biomarker signatures that might be missed when relying on a single type of data.

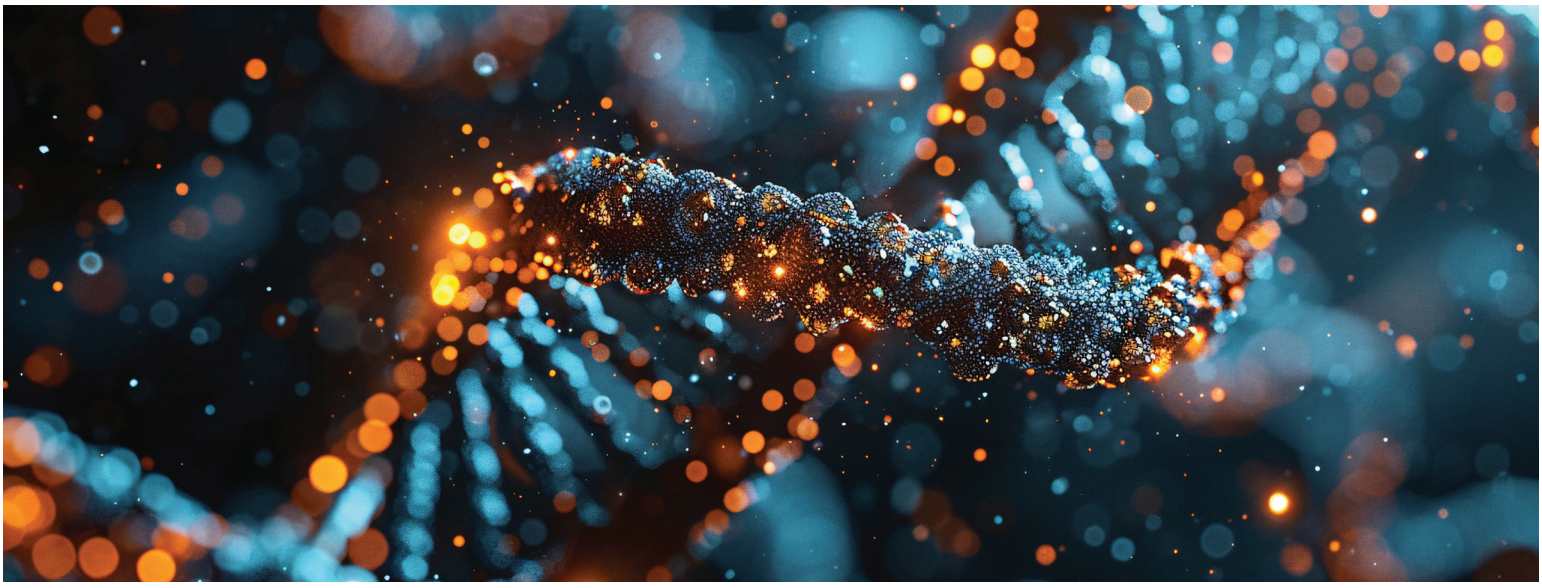
At the forefront of this effort is the Tulane Center for Biomedical Informatics and Genomics (CBG), led by Center Chief Dr. Hong-Wen Deng. CBG is leveraging the power of multi-omics through the Louisiana Osteoporosis Study, one of the largest population-based cohorts focused on bone and muscle health as well as aging-related diseases. With data collected from more than 17,500 participants – including clinical assessments for aging and frailty, DXA-derived body composition measurements (for bone, muscle and obesity studies), and multi-omics profiles such as genomic, transcriptomic, epigenomics, proteomic, metabolomic, metagenomics and single cell and spatial omics data – the team is uncovering valuable insights into complex conditions like osteoporosis, sarcopenia, obesity, Alzheimer's and other age-associated disorders.

But gathering this massive amount of data is only half the battle; analyzing it efficiently is just as critical and that's where cutting-edge technology comes in.

Structural variant (SV) identification, a key step in understanding genetic variations, traditionally takes about a week per sample using conventional computational methods. Thanks to the Louisiana Optical Network Infrastructure (LONI) and its latest supercomputer QB-4, the CBG team has reduced the computational time by 50 percent. By combining meta-SV calling approaches with multi-omics data, the team can efficiently detect novel genomic structural variations from human whole-genome sequencing data. This breakthrough would be impossible without LONI's powerful computing capabilities, which handle the large-scale, data-intensive analytics required for such cutting-edge research. With a customized analytical pipeline designed specifically for the LONI environment, the team has already identified novel SVs linked to osteoporosis pathophysiology. Their findings are paving the way for potential new therapeutic targets not only for osteoporosis but for a range of complex diseases driven by genetic variation.

Beyond analytical projects, the CBG team also is leveraging LONI's advanced GPU-powered HPC systems to develop a novel genomic foundation model called GenoBERT, which uses a Full-Attention Small Language Model for Enhanced Genotype Imputation. This groundbreaking approach takes a reference-free method to improve rare variant imputation, addressing critical challenges in genotype prediction.

By blending multi-omics science with LONI's computational power, Tulane CBG researchers are pushing the boundaries of biomedical discovery – one dataset at a time.



LONI's technology assets include a 1,600-mile fiber system that provides members with private and public cloud access up to 400G with an improved level of service and enhanced support for digital activities for teaching, learning, research, and administrative functions. The high-performance computing (HPC) service allows researchers to conduct and store complex experiments using computers specialized for highly-intensive computational processing. This HPC service provided by LONI enables greater collaboration on research that produces fast results with greater accuracy.

The Louisiana Optical Network Infrastructure (LONI) is a state-of-the-art fiber optics, high-performance computing, and distributed storage network cyberinfrastructure. LONI is a membership-driven organization operating as a managed service provider (MSP) under the authority of the Louisiana Board of Regents to deliver innovative and reliable solutions for its members. The resources provided by LONI enable greater collaboration on research that produces results faster and with greater accuracy. LONI is owned and operated under the authority of the Louisiana Board of Regents. Visit **https://loni.laregents.edu**

Meet the WINS women of Colorado

Since 1999, the Front Range GigaPoP (FRGP) has advanced research and educational goals for its regional participants through a unique multi-state physical and human network infrastructure. As part of its mission, FRGP supports professional and skill development opportunities for members, including participation in the Women in IT Networking at SC (WINS) program.

Founded in 2015, WINS addresses the historically low participation of women in SCinet, the high-performance network supporting the annual Supercomputing (SC) conference. Originating from a La Jolla Quilt meeting discussion, the program supplemented an existing University Corporation for Atmospheric Research (UCAR) National Science Foundation grant (NSF Award #1440642). Over the past decade, WINS has significantly diversified SCinet, increasing women's participation from 9.8 percent at SC14 to 23.9 percent at SC24. The program provides participants with valuable skills, leadership and professional development opportunities.

Colorado has played a pivotal role in WINS, with 31 applications (13.2 percent of the total) and six awardees: Angie Asmus, Sahana Aswathanarayan, Cassie Dymeck, Karen Lopez, Brenna Meade, and Kate Robinson. These women have excelled in their careers, assumed SCinet leadership roles, and contributed to the community.

Karen Lopez, a network automation engineer at National Renewable Energy Laboratory (NREL) successfully completed her MS in IT Management at the Colorado School of Mines and participated in The Quilt MOR leadership development program after her WINS award. She continues to participate on the SCinet DevOps team and added WINS social media to her activities. Recently, she encouraged Sahana Aswathanarayan, a NREL colleague, to apply for WINS, with Sahana joining the SCinet Edge Team in 2024. Added Lopez, "The WINS program has introduced me to opportunities and experiences that have enhanced my technical and leadership skills while deepening my commitment to supporting and encouraging other women in IT."

Kate Robinson was a 2017 WINS awardee while at Western Colorado University, joining the SCinet Wide Area Networking Team. Her SCinet experience led to her to join ESnet as a network engineer in 2019, where she took on SCinet leadership roles starting with WAN Deputy Team Lead, followed by WAN Team Lead, and then SCinet Technical Director at SC23. She joined WINS management team in 2019 and then moved into the WINS co-lead position in SC24. Robinson continues to initiate activities to raise awareness of women's underrepresentation in IT and supports professional development activities for WINS awardees outside of their SCinet roles. "I live in a very rural area in Colorado, and WINS broadened my exposure and reach," she said.

Brenna Meade, originally from the University of Denver, transitioned to a leadership position as Senior Network Architect at International Networks, Indiana University (IU). Selected for WINS in 2018, she has assumed key roles such as SCinet WAN Team Lead and SCinet Technical Director. This past year, she became the WINS management lead, and successfully transitioned WINS management from UCAR to IU. Meade's leadership has earned the respect of WINS awardees and SCinet leaders, driving the program's continued success. "WINS transformed my life and career," she explained. "As a Colorado native, I'm thrilled to help more women join networking and access the same opportunities I did."

Angie Asmus, from Colorado State University (CSU), has advanced to Director of Network and Telecommunications for CSU IT. Selected for WINS in 2016, she has participated annually, taking on roles such as Edge Team Lead and SCinet Chair for SC24. Her appointment as the fourth woman SCinet Chair since 1996 underscores the program's impact. "I am proud to represent the program and Colorado from this pioneering vantage," Asmus added.

"Women in Colorado have been core drivers for WINS," closed veteran technology leader Marla Meehl, one of the world's pioneering women in the field of advanced networking and recipient of the inaugural Dave Reese Quilt Distinguished Service Award in 2021. "Despite being a small state, we've made a significant impact, empowering women to lead and innovate in IT."

The Women in IT Networking at SC (WINS) program was developed in 2015 as a means for addressing the prevalent gender gap that exists in Information Technology particularly in the fields of network engineering and high-performance computing. What is SC? - SC is an annual conference co-sponsored by the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) Computer Society. The conference focuses on the science and application of HPC and communication technologies. Since 1988, volunteers funded from academic, government and corporate organizations in the HPC industry have worked together to produce the SC Conference series. Visit **https://women-in-networking.net**

MOREnet addresses digital literacy through libraries in the Show-Me State

Since early 2021, the Missouri Research and Education Network (MOREnet) has been actively working toward digital equity and advancing digital literacy in the Show-Me State.

It started as many things do: a shared goal between several partner organizations.

Phase one was simply a website to serve as a centralized hub for sharing digital literacy resources. Developed in partnership with the Missouri State Library, MOREnet established www.digitalequity.missouri.org. This site was initially used by librarians as a place to locate and download resources to understand how others were addressing digital literacy in their communities. Public libraries are often where citizens of all backgrounds go to learn essential digital skills through public access computers that have a robust internet connection and friendly, helpful staff to lend a hand.

About a year later, phase two focused on content creation. Working with the University of Missouri Office of Extension and Engagement, which received a grant from the AT&T Foundation, MOREnet's technology integration specialists developed 13 train-the-trainer modules, each complete with instructor notes, a detailed slide deck as well as leave-behind handouts for the end users participating in training. Those modules included a range of topics from evaluating bandwidth options and basic internet/password security to setting up home networks and troubleshooting/optimizing those networks. The initial target audience for the facilitator training program was Missouri's public libraries, but courses also were offered to community agencies and technical schools.

Shortly after the roll-out of the "Getting Started with Technology" facilitator training, MOREnet was awarded a grant from the Missouri Department of Economic Development/Office of Broadband Development, to fund the Digital Demonstration Projects Grant Program, which made it possible for MOREnet to extend the reach of the program. The call to action through promotional efforts was to send residents in rural or underserved areas to their local library to learn how to utilize technology for everyday tasks such as paying bills, applying for employment, and evaluating the information found online while keeping important data out of the wrong hands.

The grant-funded outreach allowed the project to springboard into additional phases.

MOREnet since has expanded by conducting regional workshops designed to equip staff at public libraries, community colleges and now non-profit organizations with the tools needed to conduct their own workshops. The program also now has an interactive map added to its website to allow visitors to find a trained facilitator in their area, while providing users direct access to training resources and modules to better understand and utilize technology for daily tasks.

More than 90 facilitators have been trained and are now active across 21 counties with more being added each quarter. The facilitators are part of a growing community utilizing Canvas LMS for access to real-time updates and improvements to the curriculum as well as enabling a forum to share best practices and ideas with their peers.

Additionally, Missouri libraries have access to Northstar Digital Literacy to enhance staff skills and expand digital equity within their communities. Comprehensive modules, interactive assessments and flexible learning formats proved effective in improving staff skills and empowering them to become digital literacy champions. Based on pilot programs, broader community engagement with digital literacy initiatives will lead to positive outcomes including reduced recidivism, decreased senior isolation, and improved career prospects for Missourians.

MOREnet
Be better connected.

The Missouri Research and Education Network (MOREnet) is both a data network as well as a human network. It provides internet connectivity, access to Internet2, technical services, resources and support, as well as technical training to Missouri's public sector entities, including K-12 schools, colleges and universities, public libraries, health care, government and other affiliated organizations. Visit **www.more.net**

MCNC rolls up its sleeves as Helene changes Western NC forever

Installing fiber infrastructure has always been a challenge in Western North Carolina due to its unique geography and mountainous terrain; repairing it fast in the midst of devastation is a whole new level.

Hurricane Helene made landfall in Florida on Sept. 26, 2024 as a Category 3 storm. The following day, it was downgraded to a tropical storm but left a path of catastrophic damage and destruction as it made its way up the East Coast through Georgia, into the Carolinas, Virginia, and eventually Tennessee. Western North Carolina was hit particularly hard.

Helene dealt devastating blows to telecommunications and broadband infrastructure in the western part of the state. In the aftermath, the team at MCNC was exceptional under extreme circumstances as they tirelessly worked to restore network operations as quickly as possible.

MCNC Vice President and Chief Operating Officer Tommy Jacobson explained that all network visibility to the west was lost when the three main fiber paths into the Asheville/Hendersonville region failed as the storm passed. But, within 24 hours and with help from a regional partner, MCNC had restored limited internet services. Within a week MCNC had managed to repair two of those fiber paths, one that included placing 9.5 miles of temporary fiber on an alternate path to an NCDOT road that had been destroyed. And, as a result, MCNC's fiber path was restored to its full suite of services including dark fiber and wave capacity to the region.

"Helene was unlike anything I've ever had to deal with in my 30-plus years at MCNC," Jacobson added. "Hopefully nothing like I'll ever have to deal with again. Our entire team, from our staff to our vendors to our state partners, performed amazing work to restore services as quickly and as safely as we could."

Jeremy Rollins, MCNC's Manager of Fiber Engineering and Operations, explained that MCNC engineers were able to get out there around the same time search and rescue units also were being deployed. "Over the years I've been involved in many similar situations like this," he said, "but this one was more emotionally taxing than anything I've ever faced working in this industry. It was sad to witness everything happening around us, but we had an important mission to accomplish, and we executed it. Since that experience, it's been hard to process, but I think our customers were appreciative of our small part in restoring a little bit of normalcy."

For over four decades, MCNC has relied on those around them in times of need and in turn they have been there for them. Nothing has been the same in Western North Carolina since Helene made its mark on the region. The recovery efforts to rebuild are estimated in the billions of dollars, and residents will need resources and help for months (maybe years) to come – and MCNC will continue to be there ready to serve.

MCNC is a non-profit, client-focused technology organization. Founded in 1980, MCNC owns and operates NCREN, one of America's longest-running regional research and education networks. With more than 40 years of innovation, MCNC continues to provide high-performance services for education, research, libraries, health care, public safety, and other community anchor institutions throughout North Carolina. Visit **www.mcnc.org**

ESnet and Berkeley Lab create cellular system for researchers to connect remote sensors

(Pictured from left): The test tower set up on a sensor pad in Fervo, Utah; the Wi-Fi HaLow unit at the site's westernmost pad; and a 30x magnified view of the test tower from the HaLow unit's location.

In remote "greenfield" sites all over the United States, scientists are using sensors to record data on groundwater, soil emissions, tremors, snowpack temperatures, cloud formation, and many other Earth system features. However, what makes the locations for these deployments ideal for experiments also makes them challenging to retrieve the important data being collected.

A small team of networking experts from the Energy Sciences Network (ESnet), the U.S. Department of Energy (DOE) Office of Science user facility stewarded by Lawrence Berkeley National Laboratory (Berkeley Lab), working with field scientists from Berkeley Lab's Earth and Environmental Sciences Area (EESA) has been working for two years on ways to make that process easier. In late 2024, they successfully field-tested a novel prototype for an affordable and flexible private cellular system that will simplify connectivity for sensor sites in these remote, resource-constrained locations.

The Greenfield Wireless Edge Site Characterization System comprises a portable private cellular tower and a mobile test unit. The tower is 4 meters tall and weighs approximately 200 pounds; it breaks down into several manageable cases. A Starlink Mini terminal is mounted on the crossbar that is used to backhaul data from the system to ESnet's fiber network (available through peering arrangements in multiple U.S. locations); a multi-sector cellular antenna; an omnidirectional Wi-Fi HaLow antenna for long-range, low-bandwidth connections; and an omnidirectional 5 GHz antenna for long-range, high-bandwidth, point-to-multipoint links. Below that is a 4G private cellular CBRS radio unit. The companion mobile testing unit features a ruggedized enclosure with battery packs, a GPS receiver, antennas for multiple wireless networking technologies, and an integrated field computer. The system can measure all wireless signal parameters every 10 seconds and link them to a GPS location, producing multi-technology wireless coverage maps.

After conducting a dry run at Berkeley Lab, the Greenfield Wireless team successfully analyzed connectivity options at an Ameriflux soil-emissions-testing site in California's Sacramento Delta and at two geothermal sites in Utah and Nevada, working in collaboration with the Utah Educational Network (UEN) and the Nevada Climate-ecohydrological Assessment Network (NevCAN). Field research sites differ in size, terrain, availability of power, data transfer needs and other essential characteristics, and "modeling only gets you so far," explains Andrew Wiedlea, the ESnet computer systems engineer who leads its Wireless Edge program. "Our system lets us identify the best technology for a site in a single measurement activity."

For field scientists, the collaboration with ESnet allows access to reliable and robust communications infrastructure as well as real-time communications capabilities for effective sensor management and even new science use cases. "For example, at one of our field sites, ESnet's infrastructure allowed us to stream large amounts of unprocessed radar data to Berkeley Lab, allowing our servers to take action and control these systems in real time," says Stijn Wielandt, a research scientist for EESA and co-lead of the Greenfield Wireless collaboration. "This type of self-driving field laboratory is a game changer for environmental sciences."

The Greenfield Wireless team can be reached at engage@es.net.

Field scientists test the Greenfield Wireless Edge Site Characterization System in November 2024. Pictured (from left) are Howard Yao and Stijn Wielandt (Berkeley Lab Earth and Environmental Sciences Area), with Andrew Wiedlea and James Kafader (ESnet).

The Energy Sciences Network (ESnet) is a high-performance, unclassified network built to support scientific research. Funded by the U.S. Department of Energy's Office of Science and managed by Lawrence Berkeley National Laboratory, ESnet provides services to more than 50 DOE research sites, including the entire National Laboratory system, its supercomputing facilities, and its major scientific instruments. ESnet also connects to more than 140 research and commercial networks, enabling DOE-funded scientists to productively collaborate with partners around the world. Visit **www.es.net**

Roads to routers: Sun Corridor expands Arizona's middle-mile infrastructure

In Arizona, one of the fastest-growing states in the U.S., high-speed internet access is continually in demand – even beyond city limits. Recognizing the importance of digital infrastructure, Gov. Katie Hobbs has made expanding broadband access a priority for Arizona. Sun Corridor Network (SCN), Arizona's research and education network, is helping realize this vision by enabling middle-mile infrastructure to close the gap.

Through the Maricopa County Broadband Initiative (MCBI), a government effort to expand broadband infrastructure, SCN is activating 82 miles of fiber to connect rural areas to high-speed broadband. It will also extend an additional 321 miles to a data center in Las Vegas for redundancy as well as integrate advanced data center resources for greater resilience.

For this fiber project, SCN has partnered with the Arizona Department of Transportation (ADOT) to leverage infrastructure along highways on I-17, I-19 and I-40 – which are part of separate, state-led broadband expansion efforts.

"We're pleased to assist this initiative to expand broadband internet access and connect residents with educational opportunities, telemedicine and much more," ADOT Director Jennifer Toth said. "This partnership helps advance Gov. Hobbs' vision of a thriving Arizona for everyone by helping make broadband widely available, reliable and affordable for all."

Maricopa County, the fourth most populous county in the country, is home to more than 60 percent of Arizona's population. Yet many rural areas remain underserved due to fragmented service options. SCN's middle-mile network bridges these gaps by connecting schools, libraries and other institutions to critical resources. Middle-mile infrastructure is vital for linking major networks to local "last-mile" providers, and in Arizona's vast, rugged landscape, expanding this infrastructure unlocks essential services. This means rural residents can access the bandwidth needed for online learning, telehealth services and remote job opportunities, as examples.
SCN's middle-mile expansion has two strategies using both "literal" and "digital" highways.

Through the MCBI, SCN is developing a dedicated fiber network along Hwy 60, which connects rural communities to Phoenix. SCN has secured the fiber and is installing electronics, with plans for on-ramps and off-ramps to enable partnerships with local internet service providers. This includes establishing three Points of Presence (POP) locations where local networks can connect to an internet backbone – in Aguila, Wittmann and downtown Phoenix. The Phoenix POP also serves as a local data center, boosting capacity as well as redundancy. Separately, SCN is working with ADOT to access fiber along I-17 (Phoenix to Flagstaff), I-19 (Tucson to Nogales), and the developing segment along I-40 (Flagstaff to the Arizona-California border). Leveraging these available pathways makes broadband deployment much more efficient and scalable.

As SCN continues its work this year, it remains focused on connecting rural areas with secure broadband essential for learning, employment and community engagement.

"By addressing connectivity gaps and deploying new networks, we hope to play a role in building a stronger Arizona," SCN Executive Director Derek Masseth said. "Every mile of fiber we light up brings us closer to a future where communities, no matter where they are, have the tools they need to succeed."

Sun Corridor Network, Arizona's research and educational network, provides gigabit-speed, reliable connectivity, and access to the national research and education community via Internet2. The network creates direct connections between subscribers, provides opportunities for collaboration and information sharing, and makes available national and international educational resources. Sun Corridor Network is a collaborative effort sponsored by the Arizona Board of Regents' three state universities – Arizona State University, Northern Arizona University, and the University of Arizona. Arizona public schools, colleges and libraries as well as state universities and museums, are eligible to subscribe to the Sun Corridor Network. Visit **https://suncorridor.org**

Software Defined Networking helps optimize the ICN

Software Defined Networking (SDN) has been a game changer for engineers managing the state research and education network, Illinois Century Network (ICN).

The ICN is one of the largest research and education networks in the United States. It serves Illinois K-12, community colleges, higher education, local municipalities, and state agencies. It is owned and operated by the Illinois Department of Innovation and Technology (DoIT).

SDN has saved engineers time and provided cost savings for the state through network management, security management and optimization of the network for ICN.

Software defined networking brings together advances in microprocessor chip design, silicon technology and software, allowing software to facilitate and control networking decisions. Software controlling network decisions means flexibility in networking, management and security versus hardware-based solutions.

Pre-SDN, the flexibility was lacking with rigid network control and management. Allowing software to control or "define" networking means more flexibility for the operator and cost savings for better use of resources. "I really appreciate the greater visibility, easier troubleshooting, enhanced security and better centralized management that SDN provides," said Andre Bouravnev, network design and engineering manager for ICN.

The ICN is a "middle mile" network with more than 2,000 miles of fiber throughout the state. Customer locations are connected either directly via ICN fiber or via a service provider that connects between a customer location and an ICN Point of Presence (POP). Each customer location has customer premise equipment managed and monitored by the ICN that required a tremendous amount of engineer time and resources prior to SDN. There had to be a better way. After a deep technical analysis of available solutions, ICN engineers determined SDN was the answer. To explain the benefits of SDN, it is helpful to characterize benefits to either network, network management or security.

Network: SDN allows virtualizing of network functions, meaning network capability is no longer dependent on fixed hardware architectures, but is now dependent on the needs of the operator. Virtual network functions are programmable and scalable. This leads to cost efficiencies and optimal sizing of network resources to meet varying demands and high security via path encryption.

Network Management: SDN allows DoIT to support seamless Moves/Adds/Changes (MAC) to end point, border or headend equipment. Simply configuring the central system, then waiting for the system to be plugged in upon arrival/drop shipment has streamlined ICN operations in a way that allows the engineers to be more productive and focused on other areas within the enterprise.

Security: Traffic for a customer sub-type (e.g. K-12) can be automatically kept separate from other customer traffic, via the dynamic creation of layer 2 circuits. SDN dynamically creates broadband connections, carrying only certain customer traffic. This separation of customer traffic provides enhanced security.

With SDN, engineers are able to save time and costs on networking, network management and security, allowing them to focus on next generation architectures and to be responsive to customer requests. SDN has allowed ICN to benefit from technology advancements and aims to continue on this trajectory. With best-in-class physical infrastructure in place, and now best-in-class networking and security, the future looks bright at ICN.

The Illinois Century Network (ICN) was created in 1997 by recommendation from the Higher Education Technology Task Force to create a single, state-wide educational network. The ICN became reality in May of 1999. Managed by the Illinois Department of Innovation & Technology (DoIT), the ICN is a high-speed broadband network serving K-12 and higher education, public libraries, government entities and more. Serving millions of citizens every day, in every county, the ICN is one the largest and most successful state-wide networks of its kind in the nation. Visit **https://icn.illinois.gov**

OSHEAN teams up with Newport Housing Authority to close the digital divide

During the COVID-19 pandemic, residents of the Newport Housing Authority in Rhode Island encountered a distinctive challenge: the urgent necessity for affordable and dependable internet access. This need was particularly pronounced as numerous residents, especially senior citizens, found themselves confined to their homes, increasingly reliant on digital connectivity. The steep costs of broadband services exacerbated an already wide digital divide within the community.

"Tommy Sheehan, a resident and member of our Board of Commissioners reached out to not only ask what we're going to do about the digital divide, but he offered his partnership through his non-profit, the Hi Lo Neighborhood Association, and assumed an invaluable leadership role in our broadband equity project," said Rhonda Mitchell, executive director of the Housing Authority of Newport (HAN).

Recognizing this as an issue demanding resolution, Sheehan embarked on a mission. Despite lacking expertise in broadband matters, his expertise in community engagement and deep roots in the area was invaluable in his work to address the digital divide. He firmly believed that every member of the community deserved equal access to high-speed internet, a resource readily available in more affluent neighboring areas.

"Our friend at Commerce RI, Daniela Fairchild, introduced us to the amazing OSHEAN team," said Mitchell. "We worked with Dave Marble, Mark Montalto and their team to create an invaluable partnership! OSHEAN truly helped the housing authority map out our inclusive and equitable broadband vision."

To actualize this vision, this mighty team conceived a community-wide Wi-Fi network. While technically feasible for OSHEAN and its partners to construct, the financial hurdles loomed large. The pandemic, while elongating timelines, also spotlighted the importance of connectivity, presenting fresh funding avenues.

The journey was fraught with challenges, navigating the intricacies of public funding with persistence and resolve. Mitchell spearheaded the administrative pathways, while Sheehan's brother Dennis, a retired finance professor, crafted a compelling grant proposal that secured a substantial grant of $700,000. This funding not only covered the network's construction and maintenance for five years but also proved significantly more cost-effective than initial estimates.

The project, involving a blend of fiber optics, wireless access points and point-to-point links, eventually reached fruition. Its success spurred additional work to extend the same service to Park Holm – another, larger HAN development supported by the federally-funded Community Development Block Grant (CDBG) program. Despite bureaucratic hurdles, this phase succeeded, offering free community Wi-Fi to nearly all HAN residents.

Transitioning to this new service posed its own set of challenges. Many residents, accustomed to cable TV and existing connections, hesitated to switch despite potential cost savings. This reluctance underscored the broader issue of digital equity, emphasizing the necessity of support and education in adopting new technologies, particularly for non-digital natives.

The tale of Newport Housing Authority's community Wi-Fi stands as a testament to the potency of public-private partnerships and the perseverance required to navigate public funding processes. OSHEAN plans to replicate this successful model across other municipal housing authorities, armed with the wisdom and experience garnered from this project. While cognizant of the challenges ahead, OSHEAN remains optimistic and resolute, acknowledging the profound impact equitable internet access can wield on communities.

For more than two decades, **OSHEAN, Inc.,** has played a significant role in connecting people, institutions, technologies, and solutions across the research and education community in southeast New England. By delivering next-generation broadband infrastructure and technology solutions to member institutions and the communities they serve, OSHEAN empowers health care organizations, colleges and universities, K-12 schools, libraries, government agencies, and other community organizations to build relationships, leverage shared expertise, foster innovation, and advance their missions. Visit **www.oshean.org**

NYSERNet reflects on 40 years of future-forward purpose

1985–2025 nysernet

Four Decades. One Mission.

As NYSERNet celebrates 40 years of innovation, their history of member-driven solutions continues to inspire the path forward. Reflecting on four decades of transformative advancements, one clear theme emerges: a commitment to listening to members and evolving to meet their needs.

Nowhere is this more evident than their dedication to equipping institutions with solutions to tackle cybersecurity challenges.

Over the past four decades, NYSERNet has established itself as a trusted partner; delivering advanced optical networking solutions to empower institutions across diverse sectors. A milestone in their evolution came in 2023 in response to a resounding call from members for the need for robust, tailored cybersecurity solutions. This feedback shaped their decision to strengthen their expertise by hiring Emilyann Fogarty as NYSERNet's first chief information security officer in January 2024. Her appointment marked a pivotal moment in aligning their strategic direction with the cybersecurity challenges faced by their community.

"When I began this journey to architect a security offering for our members, I had one goal in mind – we need to solve the actual cybersecurity challenges that plague our institutions," said Fogarty. "By listening and learning from well over 60 different IT security teams across our membership and community, we curated solutions designed to enhance institutional cyber resiliency by aligning our solutions to the NIST Cybersecurity Framework and the CIS Critical Controls. Solutions that are flexible to meet IT security teams where they are, with the people and resources available, and provide actionable data to help teams make risk-informed decisions while maximizing the security controls and technology they already have in place."

NYSERNet members have responded positively to this focus and the resources being provided.

"It's been a pleasure to work with Emilyann and her group. The team is super collaborative and user-focused; they listen carefully. In addition, they know higher ed, research and education. That combination will allow her group to deliver incredible value to a wide variety of educational and research organizations, big and small," said Juan C. Montes, vice president and chief information officer at the American Museum of Natural History.

Guided by member input, NYSERNet's security team has been actively developing a comprehensive suite of security services, designed to enhance institutional resilience and provide peace of mind. NYSERNet has started piloting these new programs with the institutions that helped shape them, with plans to make the offerings widely available in late spring to early summer.

"NYSERNet provided us with invaluable support in facilitating a cybersecurity incident response tabletop exercise," said Melaine Kenyon, vice president for information technology and chief information officer at Daemon University. "The scope included a comprehensive review of our incident response plan and cybersecurity insurance policy. This valuable and affordable service allowed us to strengthen our cybersecurity posture."

As NYSERNet reflects on the past 40 years, it also looks to the future with a renewed sense of purpose. Through strategic initiatives like their security program and expansion of cybersecurity expertise, NYSERNet is poised to lead the way in safeguarding the institutions that make their communities thrive.

NYSERNet staff (left to right): Emilyann Fogarty, Chief Information Security Officer; Larry Gallery, Director of Membership; Elizabeth Reigelsperger, Member Success Advisor; and Paul Robinson, Security Consultant, decorate the NYSERNet sponsorship booth in celebration of the organization's 40th anniversary.

Since 1985, **NYSERNet** has empowered non-profit communities in New York and beyond with a fast, robust fiber-optic network, providing colleges, museums, health care facilities, schools, and research institutions access to gigabit speeds and secure, cutting-edge technology solutions. NYSERNet's growing cybersecurity program safeguards the shared digital future of these vital institutions. Visit **www.nysernet.org**

SoX hits the road to boost campus cyberinfrastructure in the Southeast

SoX meets Jacksonville State University CC* collaborators during Summer 2024 Tour.

Southern Crossroads (SoX) had quite an adventurous 2024. The team traveled to various cities and states across the Southeast United States during the course of the year with their first stop in sunny South Florida.

The SoX team was invited by Jon Ellis, CEO of Florida LambdaRail (FLR), to attend its 2024 annual meeting. SoX President Cas D'Angelo was invited to present on SoX's experience with the NSF's Campus Cyberinfrastructure program (CC*). The SoX team later followed up with a roundtable discussion with small colleges in the FLR service area to provide technical expertise, shared knowledge, and lessons learned regarding the NSF proposal process. Post-meeting, conversations continued with several more schools.

SoX also began working with two schools in Alabama – Alabama State University and Jacksonville State University – as well as several schools in the Metropolitan Statistical Area (MSA) in Tennessee including Fisk University, Meharry Medical College, and Tennessee State University (a land-grant university). This project (NSF Award #2346630) was deemed *CC* Regional Networking: Advancing Research and Education at Small Colleges in Rural and Metropolitan Alabama and Tennessee through IT Architecture Enhancements.*

The SoX team then spent the summer visiting each partner campus to meet the IT staff that they would be collaborating with on this newest CC* project. The team thought it would be beneficial to visit each campus at the onset as it was an important opportunity to meet with collaborative partners, tour each data center, and become familiar with the culture of each institution. It also was a time to talk, to engage in roundtable discussions, and to learn about some of the challenges and opportunities at each campus.

One of the highlights for the SoX team was meeting with the faculty and researchers whose work would be directly impacted by the infrastructure. Several researchers gave presentations – providing details of their traditional and applied research – at which time the team discovered many had been saving their datasets on external drives and physically transporting them to other locations to complete transfers. These stories amplified the need for better campus infrastructure.

The "Summer Tour" as it was referred to by Cas D'Angelo, was an eye-opening and successful experience, heightening the team's motivation to assist these small institutions.

During the fall, SoX continued this work with *CC* Regional: Promoting Research and Education at Small Colleges in the Atlanta University Center and at Tuskegee University through Network Architecture Enhancements* (Award #2201548). The team traveled to the campus of Tuskegee University in Alabama as well as the campuses of Clark Atlanta University, Morehouse College, and Spelman College in Georgia to facilitate CC* workshops. The faculty/staff of the Morehouse School of Medicine and the Robert Woodruff Library also were in attendance. Additionally, separate student-facing workshops were held where everyone was intrigued by the network's capabilities and the way it enhanced their instruction, research and studies. Through this award, three HBCUs and the Woodruff Library all were able to connect to SoX at 100G, positioning them well in the R&D space.

SoX, in collaboration with Georgia Tech, has served this community since 2020 and remains dedicated to helping smaller institutions connect to its network. These institutions hold a rich legacy of instruction and producing cutting-edge research. Over the past two years, SoX has undergone a major equipment overhaul that allows it to reach beyond the borders of the network to meet the needs of its community. The equipment refresh is allowing SoX to bolster the cyberinfrastructure of smaller institutions so that they can continue to compete in research.

Fisk University faculty share their research in historic Jubilee Hall during SoX Summer 2024 Tour.

Southern Crossroads (SoX) also known as Southern Light Rail (SLR) is a 501(c)3 organization that serves the Southeastern U.S. Research and Education community. SoX provides high-speed, global connectivity and other commodity services. SoX also serves as the Southeast connector to Internet2, ESnet and other major U.S as well as international research networks. Through its membership in The Quilt, SoX is able to offer low-cost Internet bandwidth throughout the region with Internet Service Providers like CenturyLink, Telia Carrier, GTT, and Cogent. Visit **www.sox.net**

MREN helping build next-gen networks for data-intensive science

With international, national and regional partners, the Metropolitan Research and Education Network (MREN) annually collaborates with SCinet to create a global testbed to support experiments and demonstrations for the ACM/IEEE International Supercomputing Conference for High-Performing Computing, Networking, Storage, and Analysis (SC24). Within the SCinet Network Research Exhibition program, these activities are directed at developing new architecture, services, technologies, and techniques for data-intensive science research.

For SC24 in Atlanta, SCinet, MREN, the StarLight International/National Communications Exchange Facility in Chicago, and its research partners designed, implemented and operated this global testbed to showcase multiple innovations related to data-intensive science research applications, including high energy physics, bioinformatics, fusion energy, synchrotron experiments, HPC based research, radio astronomy, astrophysics, atmospheric science, oceanography, and large scale modeling and simulation, in part by using AI/ML/DL.

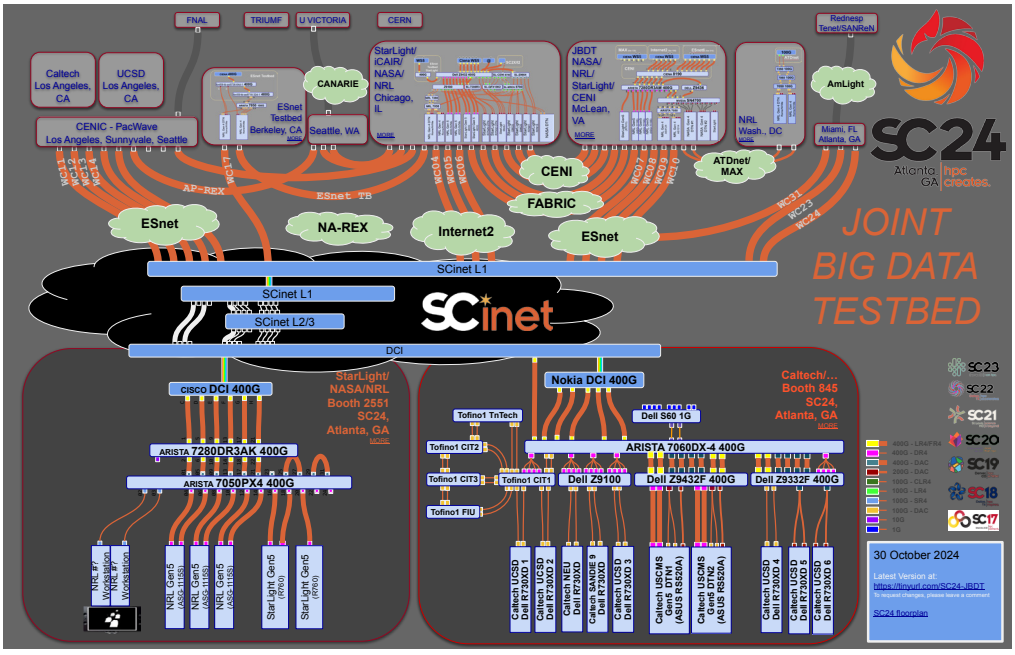
Global science research requires gathering, analyzing and transporting extremely large volumes of data, including by using high capacity, end-to-end flows at Tbps among sensor sites, instruments, analytic sites, HPC centers, and data repositories. For SC24, a key theme was investigating and demonstrating a prototype 1.2 Tbps WAN service over thousands of miles as well as 400 Gbps and 800 Gbps WAN services.

The SCinet WAN testbed included 2* 1.2 Tbps path (2.4 Tbps total on separate fiber) between StarLight and the Joint Big Data Testbed Facility (JBDT) in McLean, Va. (managed with the NASA Goddard Space Flight Center and the Naval Research Lab), a 1.2 Tbps path between the StarLight Facility and StarLight booth at SC24, a 1.6 Tbps path between the JBDT and the StarLight SC24 booth, an extension of the national ESnet 400 Gbps testbed to the StarLight booth, and on NA REX, a 400 Gbps path between the StarLight Facility and Pacific Wave in Seattle, a 400 Gbps path between the StarLight Facility and Pacific Wave in Los Angeles, and a 400 Gbps path between StarLight and Atlanta.

With its research partners, MREN used this testbed to successfully stage 25 large-scale demonstrations, including a SCinet "Data Tsunami" generating over 10 Tbps. Demonstrations included innovative 1.2 Tbps, 800 Gbps and 400 Gbps path services based on Software Defined Networking (SDN), Software Defined Exchanges (SDXs), Data Transfer Nodes (DTNs), Network Services Interface (NSI), transport protocols, measurements, P4 data plane programming, and dynamic L2 provisioning based on AI/ML/DL.

Demonstrations also included advanced services for Global Petascale science, dynamic provisioning with the NSF StarLight International SDX, programmable dynamic WANs, Global Research Platform, and advanced services based on AI/ML/DL for High Energy Physics (Large Hadron Collider Open Network Environment). Additional highlights showcased DTN-as-a-Service, 400 Gbps WAN Disk-to-Disk transfers, dynamic systems provisioning among open exchange points including SENSE Software Defined Networking for End-to-End Networked Science at Exascale, the National Research Platform and high-fidelity visibility for 400 Gbps science data flows with packet marking, analytics and automated responses.

MREN is now planning the design of a multi-100 Gbps international testbed for the Data Mover Challenge hosted by the Supercomputing Asia Conference, and the CERN Data Challenge preparing for the high-luminosity LHC.



The Metropolitan Research and Education Network (MREN) is an advanced, high-performance, regional network supporting organizations in seven states in the upper Midwest. MREN's primary focus is on providing advanced digital communications for leading-edge research and educational applications, primarily communication services for data intensive science. MREN is a founding member of the NSF-supported Pacific Research Platform initiative (PRP), developing a regional Science DMZ that extends from the west coast to the StarLight facility. MREN also is creating a regional MREN Research Platform (MRP) and participating in developing a National Research Platform (NRP). Visit **www.mren.org**

EPOC Deep Dives provide valuable insights into research technology requirements

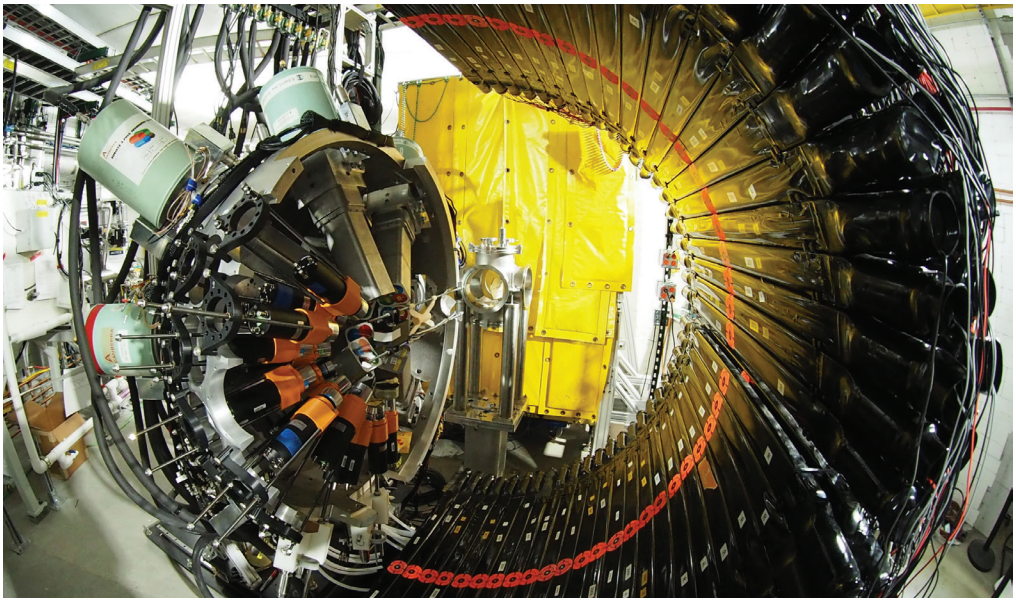


Photo by Robert Grzywacz/Oak Ridge National Laboratory, U.S. Department of Energy.

Scientific progress is built on top of a complex system of hardware, software, networks, and well-defined processes to translate innovative ideas into research outcomes. It's important for regional networks to work with their members to keep all parts of this system current and able to meet the needs of researchers.

The Engagement and Performance Operations Center (EPOC), jointly led by the Texas Advanced Computing Center at the University of Texas Austin (TACC / UT Austin) and the Energy Sciences Network (ESnet), provides researchers with a holistic set of tools and services needed to support research activities. One of the main activities of EPOC is performing Deep Dives with regional networks and member institutions to understand the full research pipeline for collaborative teams. This approach benefits scientists, local CI support and national networking partners, allowing them all to achieve long-term research goals via workflow analysis, storage and computational tuning, and identification of network bottlenecks.

The Deep Dive approach is based on a practice used by ESnet for more than 20 years to better understand the growth requirements of U.S. Department of Energy facilities, which has been adapted for work with individual science groups. The structured conversations include information not only about how the science fits in its field, but also the details of the process of the science and how it interacts with technology. This ties together collaborators who are able to identify science goals and use resources in order to support changing infrastructure needs.

EPOC has completed 23 Deep Dives since starting the project in 2018. Forty-four different organizations including universities, regional networks, federal partners, and other independent institutions have participated. This also has included a broad set of Quilt members: Corporation for Education Network Initiatives in California (CENIC), Florida LambdaRail (FLR), Front Range GigaPoP (FRGP), Great Plains Network (GPN), Indiana GigaPOP (I-Light), Keystone Initiative for Network Based Education and Research (KINBER), Lonestar Education and Research Network (LEARN), NYSERNet, Ohio Academic Resources Network (OARnet), Southern Crossroads (SoX), Sun Corridor Network, and the Wisconsin Research and Education Network (WiscNet).

Deep Dives profiled approximately 40 disciplines of study, including science use cases in astronomy, bioinformatics and genomics in addition to other disciplines outside of the sciences such as archeology, criminal justice, and the performing arts.

Common themes emerged across these studies and disciplines:

- Nearly all campus and regional environments are underprepared for the required growth of networking capacity in the coming years
- Scientific data volumes are increasing, but the ability to store and share data is limited
- There is a gap in providing cyberinfrastructure engineering services to scientific users both in terms of having trained staff available as well as defining what services they can offer
- New scientific instruments are in need of workflow improvements so they can better integrate into campus environments to manage data storage, analysis and sharing with collaborators

EPOC has been transformational to science and education by providing a depth of understanding to achieve better data transfers with the human expertise needed to make the most of research collaborations.

EPOC
Engagement and Performance Operations Center

The Engagement and Performance Operations Center (EPOC) is a production platform for operations, applied training, monitoring, and research and education support. It was established in 2018 as a collaborative focal point for operational expertise and analysis and is jointly led by the Texas Advanced Computing Center (TACC) and the Energy Sciences Network (ESnet). Visit **https://epoc.global**

New consortium MetrANOVA accelerating scientific research worldwide

Group photo from a October 2024 MetrANOVA and perfSONAR joint meeting

In an era where data drives discovery, the ability to measure, analyze and predict network behavior is ever more critical.

Five global R&E organizations joined forces in 2024 to form MetrANOVA (for Advancing Network Observation, Visualization and Analysis). Together with ESnet, GÉANT, GlobalNOC at Indiana University, Internet2 and the Texas Advanced Computing Center (TACC), this new consortium now operates and connects a dizzying number of national, regional and local R&E networks – yet they represent just a portion of the decentralized fabric linking scientific researchers in hundreds of countries.

"To ensure we are designing and operating networks that best serve our shared purpose – accelerating scientific research – we need a greater understanding of the whole system," said Edward Balas, MetrANOVA lead and head of ESnet's Measurement and Analysis Group. "MetrANOVA was formed to develop and disseminate common network measurement and analysis tools, tactics and techniques. We hope these will help members and the broader R&E community better understand the structure, use and performance of this complex, multidomain global web by using interoperable software, appropriate data-sharing techniques, and composable design patterns."

Network measurement has long been a core competency of the R&E community, but to do it well requires expertise and technical capabilities that can be hard to acquire. The founding consortium members have each developed compelling network measurement tools, and all five have actively contributed to the perfSONAR consortium – using it to actively measure end-to-end performance and identify impairments.

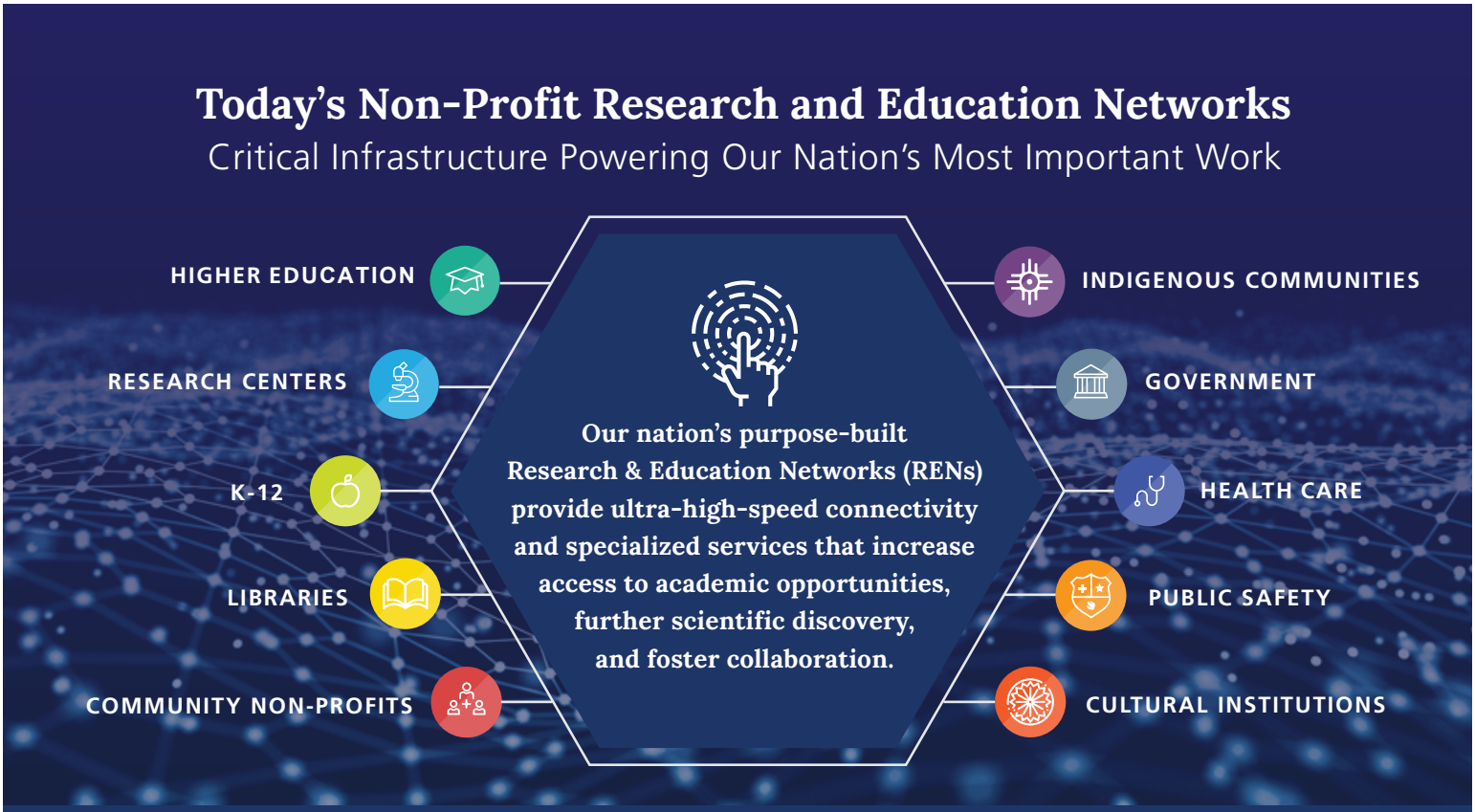
In 2024, members presented on MetrANOVA at all the major networking conferences, including CommEx, TNC, NORDUnet24 and TechEX, to raise awareness of the effort. They established two workstreams, to develop the Technical Stack and a Data Sharing Policy. The Technical Stack group has deployed an interim working environment in which ESnet, Internet2, and IU networks can share autonomous system (AS)-level flow data, combined into one composite view. They've added features to a Grafana map widget that support TACC's use case of dynamic topology; evaluated data storage options using flow analysis as the motivating use case; and analyzed Simple Network Management Protocol (SNMP) verses streaming telemetry. Early indications are that streaming telemetry (given current implementations) show vast improvement in measurement error. The Data Sharing Policy team, meanwhile, has gathered and analyzed member policies, offered guidance and consideration for those without policies, and provided requirements to technical teams.

In October 2024, 18 MetrANOVA members from three continents and six R&E institutions met in Berkeley, California for a two-day workshop. They agreed to an ambitious goal of demonstrating a preliminary measurement stack at TechEX at the end of the year, in which three deployments using aggregated flow data and perfSONAR demonstrated the value of federated, cross-data-source analysis.

MetrANOVA's current focus is on ways to perform controlled, policy-based sharing of data between instances of the technical stack. They hope to demo this capability in a second interaction of the technical stack to run at SC25 in November 2025.
Visit **www.metranova.org** and/or contact Ed Balas at **ebalas@es.net**.

Today's Non-Profit Research and Education Networks

Critical Infrastructure Powering Our Nation's Most Important Work



The nation's REN's are able to provide users with:

The Fastest, Most Advanced Network Services and Applications - Powering big data sharing across states, the country, and the globe.

- Offer secure, resilient, high-capacity, high-performance networks that spark innovative collaboration and opportunities.
- Create resilient connections for enhanced end-user continuity through geographic and provider-diverse networks.
- Optimize advanced cloud services for demanding applications, network security, and research.
- Strategically manage network traffic with peering and caching partners resulting in the most cost-effective and optimized network performance path for end-users.
- Interconnect with the U.S. National Research and Education Network, Internet2, as well as other federal agency mission-driven science networks so that a member connection to a single REN links end-users to the national and global research and education network fabric.

Powerful Partnerships - Driving innovation amongst academic, research, governmental, and commercial partners.

- Leverage our unique position in state broadband landscapes to forge strategic relationships with a variety of industry and other partners.
- Promote a "to-and-through" community anchor institution strategy with strategic partners to deliver economical internet connectivity to unserved and underserved areas.
- Facilitate vibrant member communities of practice that are founded on common interest uses for REN technology solutions.
- Offer operational transparency through member-directed governance model.
- Minimize costs and maximize benefits across end-users through economies of scale and shared cost recovery models.

Highly Secure Network Infrastructure - Protecting our users' most valuable data assets and discoveries.

- Bolster individual end-user cybersecurity operational protections as well as response and mitigation strategies by facilitating REN Security Communities of Practice.
- Augment user institution security resources to identify network threats and vulnerabilities by monitoring active threats from information sharing and analysis centers.
- Provide next-generation firewall services and robust disaster recovery solutions.
- Adopt the Mutually Agreed Norms for Routing Security (MANRS) – a global initiative that provides crucial fixes to reduce the most common network routing threats.
- Offer incident response assistance and incident escalation services.

REN's are the ultimate facilitators of innovation, including:

Artificial Intelligence Applications
Digital Humanities
Digital Learning
Digital Archiving

Smart Cities
Earthquake Sensing
Genomic Research
State Broadband Moonshot Initiatives
Precision Agriculture

Climate Modeling
Global Health Research
Wildfire Science
And much more!

To learn more about how RENs can transform and enrich your organization's mission and goals and to find one in your state or region, visit www.thequilt.net.

About Us

The Quilt is a national coalition of non-profit U.S. regional research and education networks representing 43 networks across the country. Participants in The Quilt provide advanced network services and applications to over 900 universities and thousands of other educational and community anchor institutions. Our goal is to promote consistent, reliable, inter-operable and efficient advanced networking services that extend to the broadest possible community and to represent common interests in the development and delivery of advanced cyberinfrastructure that enables innovation through our education and research mission.

Our Mission

The Quilt: A collaboration of U.S. research and education networks committed to innovation and advancement of these purpose-built networks that empower our public service missions.

Our Name

Just like the various fabric patches of a quilt highlight different colors, patterns and textures, each regional network reflects the diversity and the unique qualities found in different parts of the country and the different institutions that particular network serves. Yet all regional patches must be stitched together seamlessly, coherently and interoperably to serve a larger purpose and community.

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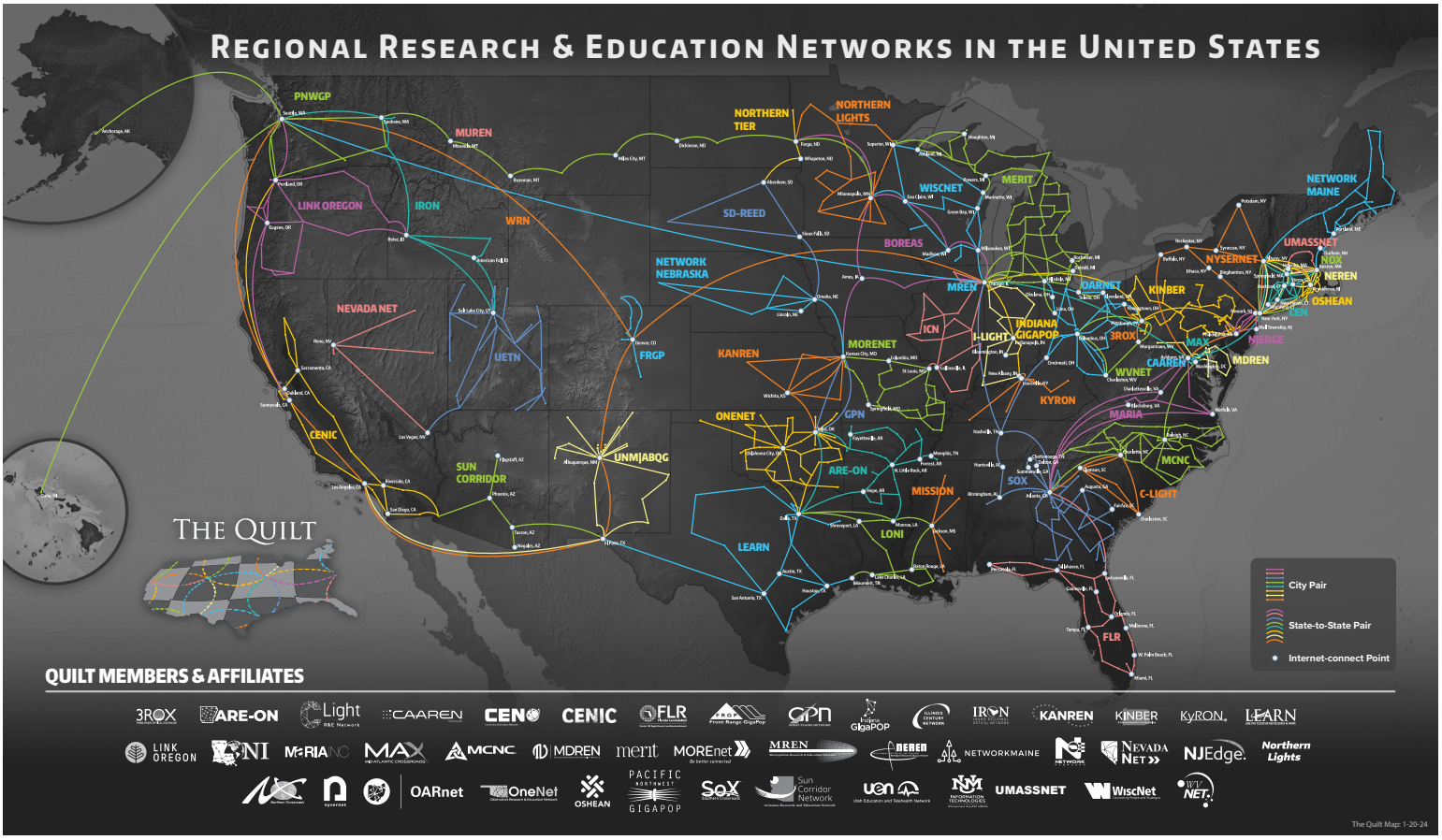

Acknowledgements

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