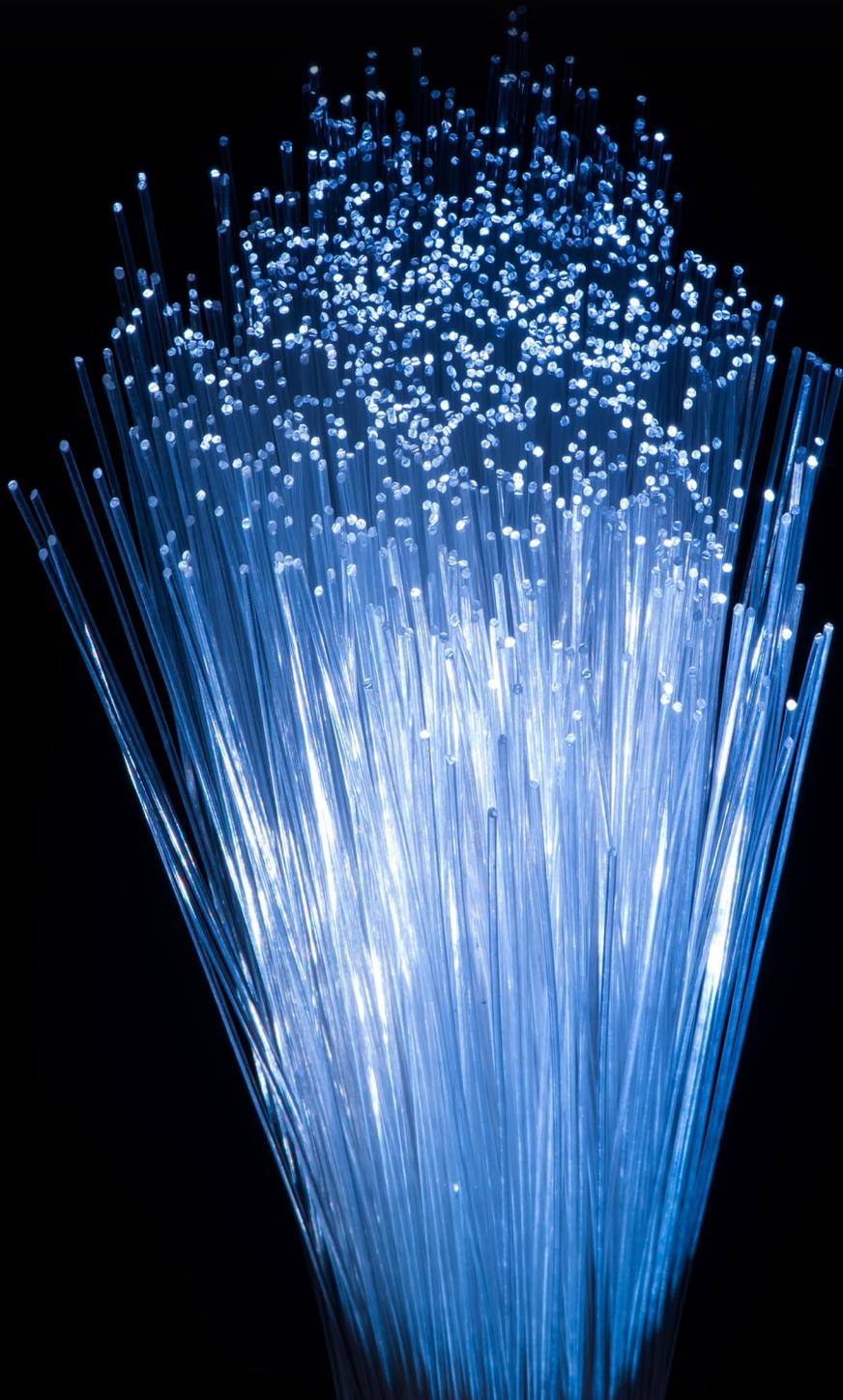


THE QUILT CIRCLE

2021 EDITION



Advanced Regional Networks
in Support of Research and Education

A Letter From the President

Welcome to the 2021 edition of *The Quilt Circle*. As it's been said many times already; we are living in unprecedented times. Each edition of our *Quilt Circle* highlights the impact of our community's networking infrastructure through powerful collaborations fostered by our members' unique organizations. This year's edition is no different. Strike that! This year's edition is vastly different because the past 12 months have been vastly different.

Among the many important lessons learned during this pandemic is that our nation's health, education system, workforce, and economic security are dependent on robust, resilient, reliable, and affordable internet access. Today's Research and Education Networks (RENs) serve as the backbone of access, collaboration, and innovation in the United States by providing advanced networking services and applications for colleges, universities, K-12 educational systems, public libraries, health care institutions, museums, cultural institutions, state and local government, and indigenous communities. Working together as one community, RENs all across America continue to empower our local user communities and support their public-service missions – making them truly critical and vital in the time of a pandemic.

RENs are unique because each community in each state is unique. Our networks are governed by their public-service missioned community members so that their missions are our missions. It's an ever-evolving relationship that spurs innovation coast to coast as well as across the globe. This *Quilt Circle* provides wonderful examples of how the foundation of trust established by our members over the past decades with their user communities enabled powerful solutions to meet some of the toughest challenges many of us have ever faced in this last year. In this edition, you'll find several examples of the key role of R&E networks in both providing and facilitating the use of our networks as research infrastructure to further scientific discovery and collaborations, at higher education institutions of all sizes. Our Quilt members also are key partners in supporting investments the National Science Foundation (NSF) is making in campus research infrastructure through its campus cyberinfrastructure program. Within these pages, you will learn more about the unique leadership positions RENs play in their respective broadband landscapes to create solutions to bridge the digital divide for urban and rural areas and even inspire one state's broadband moonshot! By bundling new networking solutions with IT applications and a sharp focus on cybersecurity, our members are transforming the digital capabilities of communities everywhere.

The stories herein about our members this year are a reminder of the valuable roles each play in the success of one another's organizations and in building the national fabric of the R&E networking community that we call "The Quilt".



Jen Leasure
President and CEO

Acknowledgements

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Cover photo (UTTC Graduation Plume) courtesy United Tribes Technical College, Bismarck, ND
United Tribes News photo (Dennis J. Neumann)

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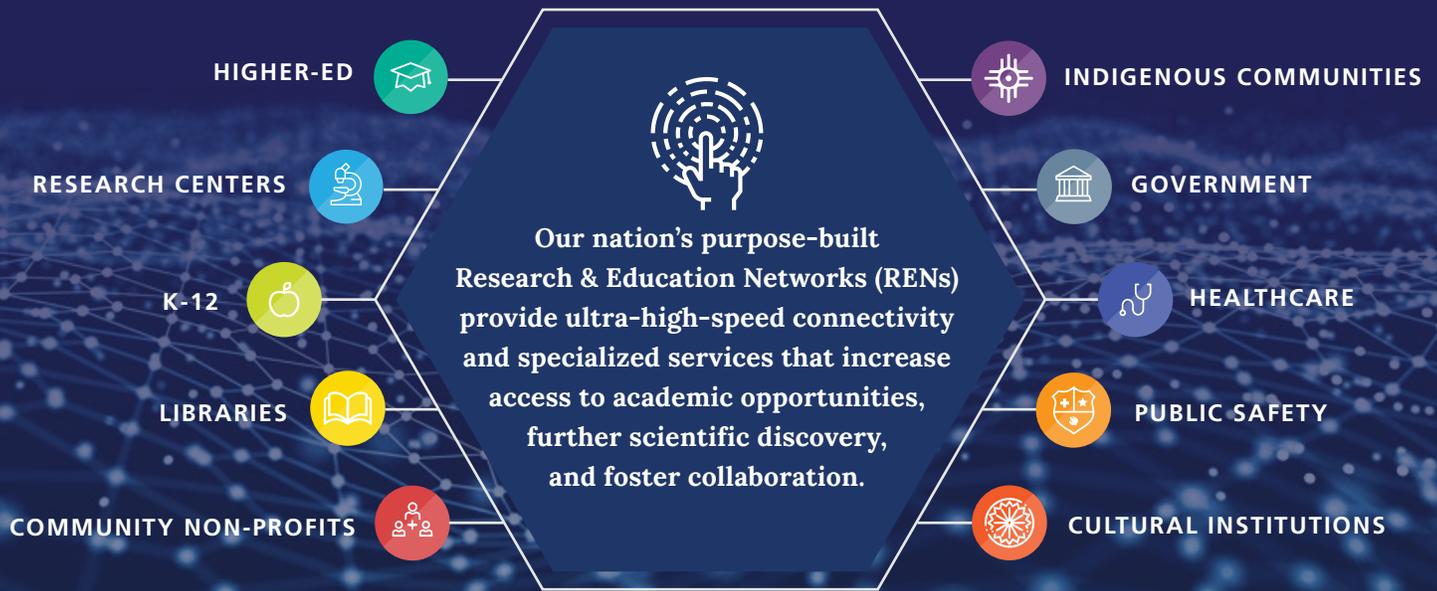
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Today's Non-Profit Research and Education Networks: Critical Infrastructure Powering Our Nation's Most Important Work



The Nation's RENs Provide Their 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.

Research & Education Networks 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 find one in your state or region, visit www.thequilt.net

Louisiana researchers use LONI to understand transmission of coronaviruses

Coronaviruses are a large group of viruses that can infect both humans and animals and may cause respiratory symptoms. In 2003, the SARS CoV (coronavirus), a member of this group, caused a severe acute respiratory disease syndrome (SARS) outbreak. Recently, another previously unknown coronavirus, named SARS-CoV-2, was discovered to be the cause of the outbreak of the COVID-19 disease. Since its first appearance in 2019, it has spread throughout the entire world, infecting more than 100 million people and killing more than 2 million.

The research group of Dr. Wu Xu, Professor at the Department of Chemistry at University of Louisiana at Lafayette, is performing studies to test hypotheses on how coronaviruses transmit amongst hosts and how certain drugs can inhibit the transmission. Dr. Xu has extensive experiences studying the mechanisms by which signal transduction pathways and gene regulation control cell growth, proliferation, differentiation, death, and disease. Currently, he and his research group are using computer simulations to learn how the structure of the virus allows its RNA to escape from the endosome to spread further and how drugs such as hydroxychloroquine can interrupt it by inhibiting the production of a key protease molecule, the findings of which will provide critical knowledge on 3-D protein structure for the pharmaceutical industries to accelerate coronavirus drug development

For such studies, the computational demands are very high – Dr. Xu



estimated it would take more than 250,000 CPU-core-hours, equivalent to more than three years of compute time on an 8-core desktop. This is why, Dr. Xu said, leveraging LONI (Louisiana Optical Network Infrastructure) computing resources, especially the QB2 and QB3 high-performance computing (HPC) clusters, is essential for his research as it greatly accelerates the computation and allows a timely contribution to be made to the fight to defeat COVID-19.

In a separate study, a group of Louisiana State University researchers led by Dr. Ka-ming Tam, research assistant professor at the LSU Department of Physics & Astronomy, compiled data from the most heavily affected U.S. states and calculated the change in the infection rate before and after social distance measures were imposed. Using LONI HPC resources, they were able to show a clear drop in

infection rates following public policy measures such as social distancing and stay-at-home orders. The group is currently working on another COVID-19 related project aimed to find out how the fatalities caused by COVID-19 have been affected by the reopening policies in different states, which will heavily rely on LONI HPC resources as well.

Dr. Xu and Dr. Tam are among the hundreds of computational science researchers in Louisiana for whom LONI HPC resources are irreplaceable. With the newly-added QB3 cluster, a system with 202 compute nodes that are equipped with the latest Intel Cascade Lake processors, LONI HPC users now have more than 17,000 CPU cores and 2.4 petabytes of storage. In the year of 2020 alone, 167 research projects consumed 55 million CPU-core-hours on LONI HPC clusters.

LONI is a state-of-the-art, fiber-optic network that runs throughout Louisiana, and connects Louisiana research universities to one another as well as Internet2, the national research and education network. As the premier high-performance computing and high capacity middle-mile fiber optic network provider for higher education and research entities in Louisiana, the technology assets include a 1,674-mile long system of fiber optics cables that provides subscribers with private and public cloud access at an improved level of service over a typical service provider and enhanced support for digital activities for teaching, learning, and administrative functions. The high-performance computing (HPC) service allows researchers to conduct and store highly complex experiments using compute powers specialized for highly intensive computational processing. This HPC service provided by LONI enables 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. www.loni.org

Indigenous tribes in Southern California join Pacific Wave

Fourteen Native American tribes in Southern California are now directly connected to the state-of-the-art International Internet Exchange, Pacific Wave, and its peering, high-performance scientific networks, and ever-expanding global connectivity. This new connection enables tribal libraries, scientific research facilities, and cultural preservation institutions to collaborate with partners across the state, the nation, and the world.

Tribal Digital Village, a tribal consortium-owned ISP in San Diego County, has connected to Pacific Wave's infrastructure on the West Coast. A joint project of CENIC and the Pacific Northwest Gigapop, Pacific Wave interconnects most international Asia-Pacific research and education networks, key U.S. western regional research and education networks, leading national-scale research networks, and major commercial research cloud services.

Tribal Digital Village Network was created by the Southern California Tribal Chairman's Association in 2001 to bring internet services to key community buildings and resource programs on reservations.

"Through this new connection to Pacific Wave, thousands of indigenous people will benefit from enhanced connectivity," said director of technology for the SCTCA and director of TDVnet, Matt Rantanen. "All of these tribes have facilities that are now connected to regional, national, and international partners in the research and education community and beyond. This collaboration is an important start to bring global indigenous people onto a platform where they can connect throughout the Asia-Pacific Region and share efforts to strengthen their communities. We all have very similar



Tribal Digital Village Network Connects to International Peering Exchange with Help from CENIC, Pacific Northwest Gigapop, Google, and AT&T

stories of hardship and oppression, and could greatly benefit from sharing our solutions to overcome these obstacles and strengthen our communities as a whole."

"Like the countries that Pacific Wave connects, Native American tribes are sovereign nations and therefore should have access to the international exchange and its accompanying domestic peering," said Louis Fox, Pacific Wave board director and president and CEO of CENIC. "California and the entire research and education community are beneficiaries of this partnership as it brings tribal libraries, scientific research facilities, and cultural preservation institutions onto the same networks as their peers, not just in the West, but across the United States, and around the globe; and it facilitates many other partnerships among schools, cultural institutions, governments, and health care organizations."

PNWGP and CENIC established the connection with TDVnet with help from

Google and AT&T. Google's Project Eagle Feather provided TDVnet with resources to enhance intra-tribal connectivity. AT&T provided a 10 Gbps circuit through their partnership with CENIC, which can be increased to multiple 10 Gbps or 100 Gbps circuits as demand increases, from TDVnet to a CENIC point of presence in San Diego. CENIC provided backhaul to Pacific Wave infrastructure in Los Angeles and Sunnyvale.

"Native Americans in tribal areas are among the least connected people in America," said Google vice president and chief internet evangelist, Vint Cerf. "This new interconnection, and the incontrovertible logic behind it, is a dramatic way to draw tribal communities into a rapidly digitizing world."

This partnership between Pacific Wave, private sector partners, and tribal communities has the potential to be replicated and extended throughout the West.

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 nonprofit 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. www.cenic.org

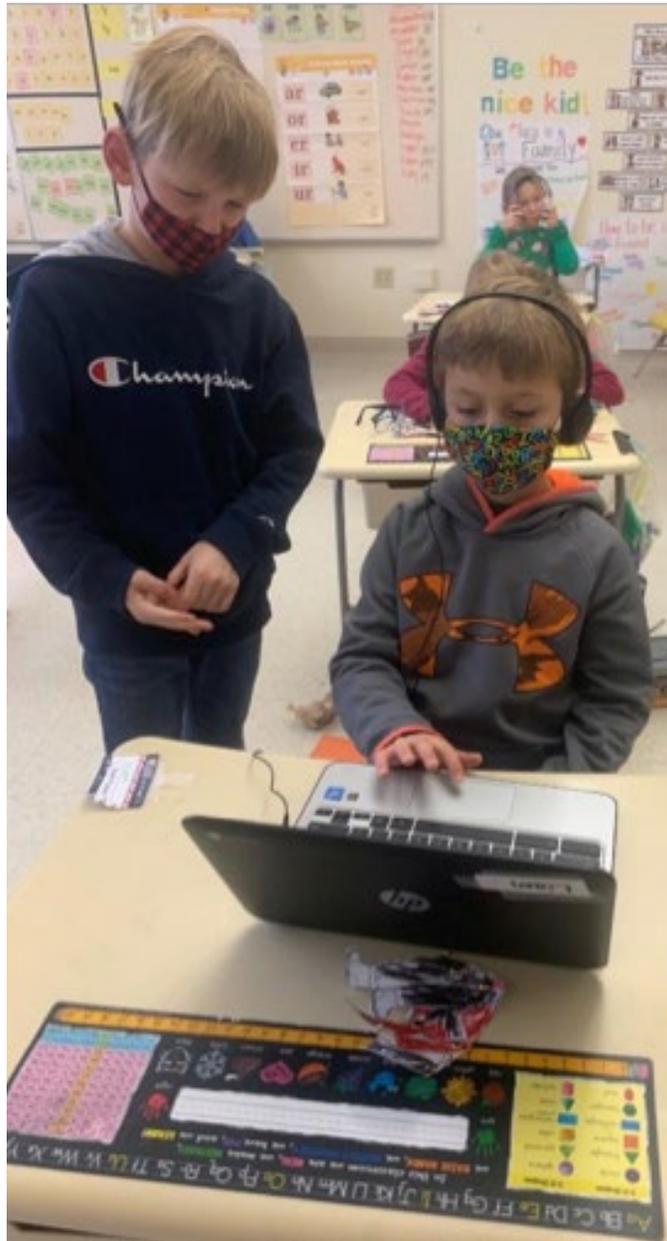
Networkmaine rapidly upgrades Internet in K-12 schools

Networkmaine, collaborating with the Maine Department of Education, continues to be successful in upgrading network connections at K-12 schools during the COVID-19 pandemic through the Maine School and Library Network (MSLN) project.

Remote learning and hybrid schedules have driven the need for additional bandwidth at schools, especially at the lower grade levels. Most school districts are using some form of hybrid learning where half of the student body is in the classroom and the other half participate remotely (a model necessitated by social distancing rules). Internet connections at approximately 301 K-12 schools are or will receive upgrades soon.

According to Jeff Letourneau, executive director of Networkmaine, COVID's effects on education systems in Maine and throughout the country are well-documented. He also added that many schools in the state have been connected at 100 Mbps or lower as their previous use of the internet didn't demand any more than that amount.

"The heavy usage of video conferencing has dramatically increased bandwidth consumption at schools, necessitating the upgrades to gigabit speeds," explained Letourneau. "As an example of



Remote learning and hybrid schedules are driving the need for additional bandwidth at schools, especially at the lower grade levels. To date, 112 K-12 schools in Maine have received upgrades through the MSLN Gigabit Upgrade with all upgrades scheduled for completion in spring 2021.

the increased dependency on remote-learning, even with many schools using Google Meet, subscriptions to our Zoom offering have gone from less than 150 prior to the pandemic to over 2,100 as of today."

Through MaineREN, Networkmaine provides Internet access, email, web hosting, and other technology services to almost 1,000 K-12 schools and libraries across the state. The MSLN Gigabit Upgrade project started in November 2019 with all upgrades to schools scheduled for completion this spring.

"NetworkMaine does a fantastic job supporting Internet access for Maine's schools," added Vince Vanier, technology coordinator for the Madawaska School Department. "We would be in a world of hurt without it."

Networkmaine was able to leverage E-Rate funding to bring bandwidth relief to Maine's K-12 schools.

Networkmaine is a unit of the University of Maine System providing Maine's Research & Education (R&E) community with access to high-bandwidth, low-latency connectivity and complimentary services that enhance their ability to successfully deliver on their missions. Created in 2009 by a memorandum of understanding, Networkmaine operates through a coordinating council which is comprised of the University of Maine System, the Maine State Department of Education, the Maine State Library, and the Maine State Government Office of Information Technology. The Networkmaine Council provides the public entities served with greater involvement in shaping the future of Maine's research and education network, MaineREN. www.networkmaine.net

Quantum computing and entangling MAX network with MARQI

The turn of the 20th century bore witness to the transformative power of the Internet. We are now at a 21st century inflection point, heralding (pun intended!) accelerated transformation with quantum technologies. Frontier advances can be realized with the potential of transporting quantum information (qubits) and classical information (bits) together on the same network by leveraging the massive global internet infrastructure – essentially entangling (pun intended!) classical Internet properties with the mysterious properties of quantum physics to create exponential capabilities of the next generation internet.

To investigate this potential, the National Science Foundation (NSF) recently awarded more than \$900,000 to a multi-institutional team led by University of Maryland (UMD), Award #2010695 NSF Convergence Accelerator Track C: Interconnecting Quantum Computers for the Next-Generation Internet. The team includes Edo Waks

(PI, UMD), Norbert Linke (co-PI, UMD), Tripti Sinha (co-PI, UMD/MAX), Dirk Englund (co-PI, MIT) and Saikat Guha (co-PI, University of Arizona).

The research goal of this effort is to enable trapped ion quantum computers to communicate over the internet. These are scalable quantum computing platforms with a built-in optical interface that makes them a reasonable choice for building repeaters and routers. The proposed quantum communications will be achieved by prototyping four deliverables: developing a high efficiency qubit interface, which will frequency-convert 493 nm photons from the trapped ion quantum computer to 1550 nm telecom frequencies and preserve the photon's quantum coherence; designing a chip scale Quantum Reconfigurable Optical Add-Drop Multiplexer (QROADM); defining and implementing protocol standards for a full-scale quantum internet; and building the Mid-Atlantic Region Quantum Internet (MARQI),

which will serve as the start-up testbed for trialing these technologies with the intent to scale in kilometer size as the investigated technologies mature. Future plans include commercializing quantum technologies.

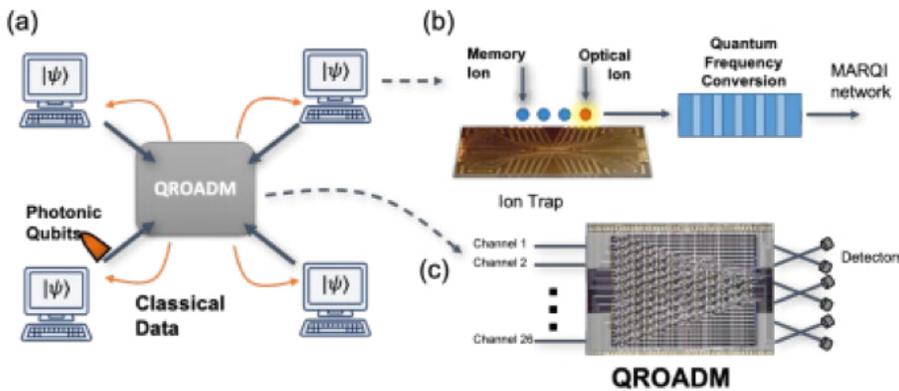
The team consists of experts from the fields of quantum computing, classical network architecture and design, photonics, and quantum communication. Additionally, it includes partners from the commercial private sector, startup companies, research labs, and DoD labs. A MARQI Advisory Committee brings together technology pioneers and industry thought leaders to guide and inspire the direction of the project to achieve convergence towards a fully functioning quantum internet.

Quantum networking has the potential to be incredibly transformational for many industries, including computing, telecommunications, cybersecurity, science, medicine and others.

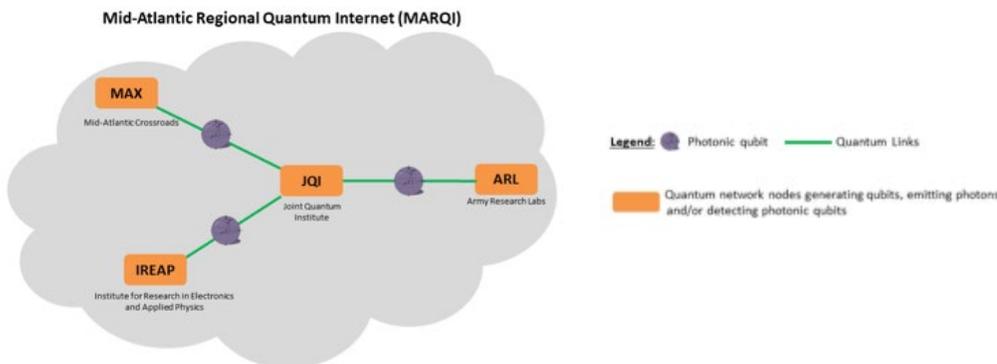
UMD PI, Edo Waks said, "this research will significantly enhance our understanding of fundamental physics to be able to apply the findings to accelerate quantum communications and a future quantum internet. "In particular," he added, "the security and anonymity of communications could be guaranteed by the laws of physics, with great impact for the fields of cybersecurity and secure communications."

"In realizing these technologies, the capabilities of the internet as we know it today are exponentially enhanced," said co-PI Tripti Sinha.

The MARQI network has the potential to provide technological innovation that will be useful for the research and education communities. MAX has an extensive regional footprint which provides ideal opportunities to expand the MARQI network to span a greater footprint in the Washington D.C., Northern Virginia and Baltimore region. In time, the research community will have the ability to directly access the computational and innovative capabilities of the MARQI network. www.maxgigapop.net



In the above: (a) Is a schematic of a quantum network interconnecting multiple quantum computers; (b) Is an illustration of a computing node composed of a trapped ion quantum computer that has both memory ions and optical ions. Optical ions emit photons that are shifted to telecom wavelengths and injected into the MARQI fiber network (c)



The QROADM performs a photonic Bell measurement on any pair of input channels.

FRGP continues to broaden the reach of R&E Networks

The Front Range GigaPoP (FRGP) is the lead Research and Education Network (REN) on two NSF CC* awards.

BiSON-West (BiSON) is a planning grant that is on a second year, no-cost extension. The grant's goals are to extend FRGP services to universities, colleges, and community anchor institutions (CAIs) on the Western Slope of Colorado where there are underserved populations and the geography is challenging. The “Nilch’ bee naa alkaa go ohoora doo eidii t’jii (Translation: Using air (technology) to learn and understand new things)”, award is led by Navajo Tech University (NTU) with the goals of connecting NTU to the FRGP. NTU’s second award helps other tribal colleges and universities to improve external connectivity. Both projects rely on FRGP’s innovative method of connecting traditional

education and homework gap projects. FRGP’s commitment to work with Tribal Colleges and Universities (TCUs) and small campuses, which will help them integrate into the broader R&E community, is especially important during the COVID-19 pandemic.

The pandemic arose in the midst of both of these projects as research and design were in progress. What became apparent very quickly was that last-mile infrastructure for telework and telelearning was critical. However, FRGP cannot provide services to commercial entities or residential users, and the awards did not encompass this scope. What evolved over the last year was a common design solution to create a “pre-aggregation” point to bring a broader user base with their blended traffic including residences, commercial

entities, and municipal networks to a point where commercial traffic could be routed to a commercial provider and eligible R&E traffic would flow to the FRGP.

The FRGP is collaborating on the design and implementation of the aggregation point and is working in partnership with the Northwest Council of Governments (NWCOG) and NTU to integrate the aggregation point into the FRGP.

NTU is further along in the design and implementation phase of their award and is actively working to bring schools, community centers (or Chapter Houses), other tribes with blended traffic (education, residential, and municipal) and connected communities to the aggregation point shown in Figure 1. See Figure 2 for the current design.

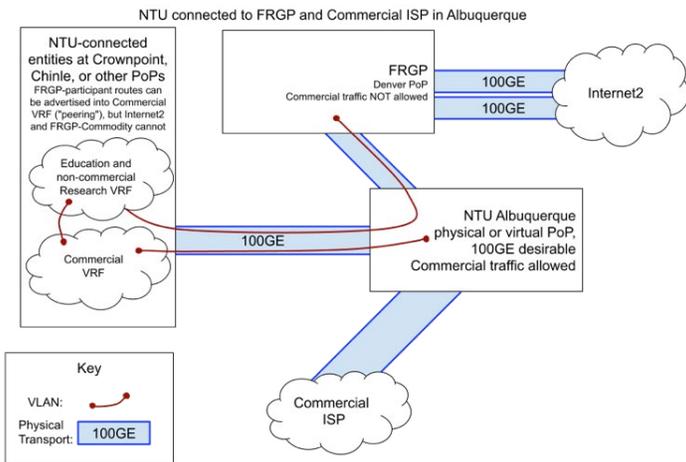


Figure 1: NTU Aggregation Point Design

BiSON-West is still in the planning stage and the team is working to secure funding and formalize support for the aggregation point. This effort does not fit cleanly in a traditional NSF CC* grant, so we are exploring state, federal, and private funding opportunities.

The FRGP hopes this new model will help to enable this new paradigm and broaden the reach and power of R&E networking.

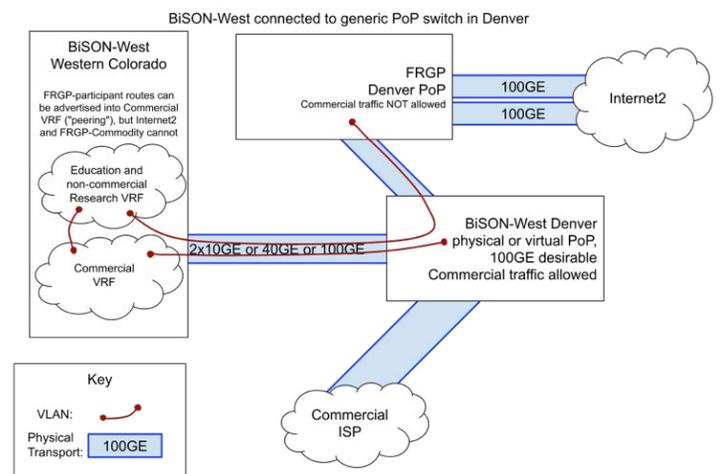


Figure 2: BiSON-West Aggregation Point Design

COVID has highlighted the importance of getting closer to the users at the edge wherever the edge may be. Connecting schools and other CAIs is not enough. As teleworking and telelearning have been required, embraced, and may become much more prevalent post-COVID, providing the option to work and learn from home or other non-traditional locations and making high-quality networking ubiquitous is critical. The value of accessing the R&E infrastructure directly, efficiently, and effectively has been spotlighted during the last year.

The Front Range GigaPop (FRGP) is a consortium of universities, non-profit corporations, government agencies, and secondary members (such as the UCAR Point of Presence) behind primary FRGP members who cooperate as part of a Regional Optical Network (RON) in Colorado and Wyoming in order to share wide area networking services including the commodity Internet, Internet2 and peering connectivity. www.frgp.net

SI-MORE-OFFN Award connects additional institutions to Oklahoma's Science DMZ

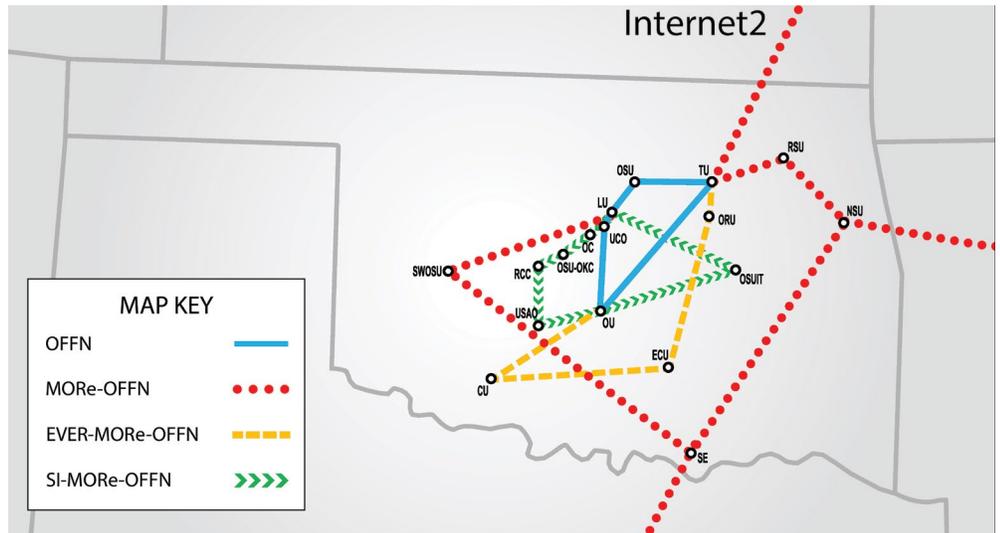
A grant awarded by the National Science Foundation (NSF) will expand research computing at five more Oklahoma colleges and universities. The Oklahoma State Regents for Higher Education (OSRHE) and OneNet received \$232,275 in funding for the Small Institution Multiple Organization Regional OneOklahoma Friction Free Network (SI-MORE-OFFN) through NSF's Campus Cyberinfrastructure (CC*) grant program.

Administered by NSF's Office of Advanced Cyberinfrastructure, the CC* grant program invests in campus-level cyberinfrastructure improvements for science applications and research projects.

The two-year grant award will connect Oklahoma State University Institute of Technology (OSUIT), Oklahoma State University-Oklahoma City (OSU-OKC), Redlands Community College (RCC), Oklahoma Christian University (OC) and the University of Science and Arts of Oklahoma (USAO) to Oklahoma's Science DMZ known as the OneOklahoma Friction Free Network.

OFFN is a 10 Gbps network ring that provides higher education institutions with a dedicated internet route that allows researchers to bypass slower traditional networks and transmit data at higher speeds. Three previous NSF grant awards to Oklahoma connected 12 research and regional universities to OFFN. This new award specifically targeted smaller institutions to expand their research and education initiatives.

"The State Regents are pleased to see more Oklahoma institutions added to the OFFN network," said Chancellor Glen D. Johnson. "These connections will enable new and diverse research collaborations for faculty at



these institutions. The grant also has a significant educational impact for college students by expanding STEM and cyberinfrastructure educational opportunities."

The project will make advanced cyberinfrastructure tools and services available to the five participating campuses and support a wide range of scientific disciplines. For OSUIT, those initiatives include Cybersecurity for Institutional Resources and Education, Data Science and Virtualization, and Programming with Software Defined Networking. At OSU-OKC, their Resilience Academy for Nurse Science Program will benefit. Programs at RCC benefitting from this grant include STEM Tutoring, Aquaponics Greenhouse Research, Hemp Research, and the Science and Nursing Lab Network. OC's Adaptive Cyber Defense initiative will benefit from this grant. And finally, the USAO's Stereochemistry, Thermodynamic Favorability, and Environmental Characteristics of Urban Areas initiatives will also benefit.

OneNet makes SI-MORE-OFFN

possible by providing the network that connects the colleges and universities. OneNet also provides access to Internet2, a nationwide network for education and research.

"OneNet is higher education's partner in research and education and ensures campuses have access to the networking and technology required to support scientific discovery and innovation," said Vonley Royal, OneNet executive director and State Regents' CIO. "Expanding access for researchers and faculty to networks like OFFN is vital to providing resources that enhance these initiatives for Oklahoma colleges and universities."

The State Regents and OneNet will continue to partner with higher education institutions to grow the OFFN network. Plans for another NSF grant application to connect additional regional universities to the network are underway.

As a division of the Oklahoma State Regents for Higher Education, OneNet's mission is to advance technology across Oklahoma. OneNet serves colleges and universities, research centers, K-12 schools, libraries, tribal organizations, hospitals and clinics, non-profit organizations and local, state and federal governments. www.onenet.net

WVNET leads Kids Connect Initiative in West Virginia



West Virginia's K-12 schools last fall faced an educational dilemma – how best to continue educating students during a worldwide pandemic. As school districts shifted to remote education for their students, access to high-speed internet was not available to all learners in West Virginia, especially those in rural communities.

While the state's Broadband Enhancement Council has chartered several federally-funded projects to expand residential access to broadband connectivity, West Virginia's sparse populations in geographically-remote, rural communities have not been a priority for commercial ISPs. Also, with the exception of a few urban locations, the majority of the state's communications infrastructure is copper wire, requiring the installation of fiber-optic cable across the state's mountainous and rocky geography.

While providing universal broadband access across the state remains a challenge, the Kids Connect wireless network is an interim solution to provide connectivity to all K-12 students statewide, especially those who no longer have access to school-based computers due to COVID-19.

Using Federal CARES Act funds, the Kids Connect project was first conceived in late July and set forth on an aggressive schedule. West Virginia Network worked with the West Virginia Department of Education and the state's Office of Technology to purchase, install, connect, and advertise more than 900 wireless access points. These drive-up hotspots

were installed across the state at all public schools, higher education institutions, county libraries, and state parks. By the time the academic school year began in September, nearly all of Kids Connect hotspots were operational.

These hotspots allowed students to connect online to complete their school assignments from the comfort and security of their family car. Not only is this beneficial for families who don't have access to residential broadband, but it also helps those who are unable to afford broadband service at home. Yard signs and window decals identify the location of each of the hotspots, and a 24x7 help desk can help families find the closest hotspot or resolve any connectivity issues they may have.

While the program's primary focus is access for K-12 students, West Virginia higher education students also can access the network at any of the sites. The program has recently expanded its hotspot locations to include National Guard armories, DMV offices, and county boards of education.

For more information about the Kids Connect Initiative, visit <https://wvkidsconnect.net>.



West Virginia Network for Educational Telecomputing (WVNET) is a dynamic service organization providing telecommunications and computing services within West Virginia. Administered by the Higher Education Policy Commission (HEPC) and focused on state colleges and universities, WVNET also provides significant services to state and county governments, K-12 schools, public libraries and non-profit organizations. www.wvnet.edu

KanREN tackles rise in cybersecurity threats during pandemic

Last spring - as workplaces, medical offices and schools struggled in response to the COVID-19 pandemic by implementing a variety of online connectivity solutions - another threat lurked beneath the surface. At a time when almost every aspect of our lives became more dependent on online interaction, a surge in cybersecurity incidents followed close behind, casting a shadow over the silver lining offered by online work, health and education platforms.

During the early days of the pandemic, the FBI reported a 400 percent increase in complaints regarding cyber-attacks, hacking, video-conference hijacking, data breaches, and fraud. Cybersecurity experts were quick to diagnose the problem and begin working toward a solution, but providing access to necessary cybersecurity resources was and remains an uphill climb. Fortunately, some organizations have stepped up and met this challenge head on.

KanREN, Inc., the Kansas Research and Education Network, has been offering its member organizations world-class public service connectivity for nearly 30 years and has a long history of tackling networking challenges. In response to the current rise in cyber threats, the organization extended a suite of cybersecurity services to its members at no additional cost, which includes DDoS scrubbing, Akamai ETP DNS scrubbing, Nessus vulnerability scanning, and honeypot monitoring and notification. KanREN connected members and any K-12 institutions in Kansas that join KanREN immediately were granted access to this suite of tools.

According to Cort Buffington, KanREN's executive director, the move is simply a matter of "doing the right thing for the right reasons." KanREN's mission has always prioritized empowering its member organizations through connectivity and collaboration, so handling cybersecurity threats at no additional cost is "the right way to provide value, and support our community over the long-term." Buffington notes that "KanREN is committed to helping our members focus on educating students, not worrying about cybersecurity threats."

When many organizations observed a shift in the needs of their community during the pandemic, KanREN's response provided much-needed peace of mind for its members. This pivot towards providing stability and security for research and educational institutions during an already-vulnerable time allows these institutions to keep their focus on education.

Kansas remains one of a few states lacking a dedicated dark fiber "backbone" for educational and other community anchor institutions (CAIs), a cause that KanREN continues to support and advance. Its efforts to enhance the future of research and education institutions in Kansas

continue with a push to build more infrastructure capacity for data networking.

"Everything we do is based on a foundation of infrastructure," Buffington added. "If not now, when? If not us, who?" As these efforts continue, KanREN members can rest secure in the knowledge that they have a strong advocate for security, connectivity, and growth on their team."



KanREN brought "The Internet to Kansas" and continues to provide critical, world-class broadband services and support to the Kansas research and education community. As a 501(c)(3) organization established in 1992 by the public universities of Kansas, the Kansas Research and Education Network has a reputation as a forward-thinking advocate for its members through networking, connectivity, and innovation. KanREN has and continues to focus on advanced network services for all its members. www.kanren.net

ESnet supports speed everywhere through Data Mobility Exhibition

A big part of ensuring the success of science is ensuring that science data can be shared.

The advanced networking resources that move this data must be performant and ready to support data transfers when, where and no matter how transfers are used.

This is a complicated and fascinating challenge for many reasons.

Firstly, Data Transfer Nodes (DTN) and other networking systems are owned by individual institutions or labs. DTNs can be deployed with various equipment, local or remote storage configurations, and within different parts of the network. Second, most institutions have diverse and varied needs to transfer large amounts of data, meaning that DTNs and other resources may not be tested routinely for performance. And third, knowing how “fast a data transfer should be” is not an easy question to answer as capacity, flexibility, and general capabilities of networks are constantly changing and improving.

Unlike home or general internet uses, scientific workflows can require large amounts of burst-transfer capacity. Data being moved may be impossible to duplicate and even one underperforming link can cause the entire transfer to slow down.

The Energy Sciences Network (ESnet) has long been focused on developing ways to streamline network operational burdens on the scientific programs, researchers, and others they serve. Building on the successful Petascale DTN project and the Science DMZ design pattern, the Data Mobility Exhibition, or DME, was developed to improve the predictability of data

movement between research sites and universities of any size. The DME has been included in EPOC’s six main activities (EPOC is a joint effort of Indiana University and ESnet).

DME is a resource that enables the calibration of data transfer performance for a site’s DTNs to ensure that they are performing well by using ESnet’s own test environment, at scale. For instance, a 10 Gbps DTN should be capable of - at a minimum - transferring one terabyte per hour. As part of the DME, network engineers have a wide variety of resources available to analyze network

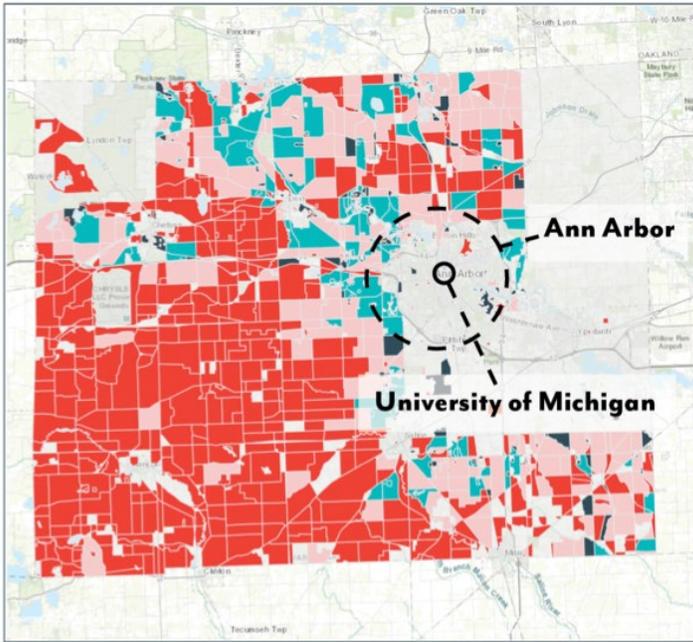
performance against ESnet’s standard DTNs, obtain help from ESnet (or EPOC) to tune equipment, and to share performance data and network designs with the community to help others.

DME is an easy, effective way to ensure network and storage resources are operating at peak efficiency! Quilt members can use the DME with their partners to better understand the performance that institutions are achieving in practice. DME information can be found at fasterdata.es.net. To date, 47 institutions have used this platform, many of which are associated with The Quilt.



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 (SC) 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 140+ research and commercial networks, enabling DOE-funded scientists to productively collaborate with partners around the world. www.es.net

Broadband data collection as a mechanism for community engagement in Michigan



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Geobase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

BROADBAND DENSITY:

AMONG SURVEY HOUSEHOLDS PER CENSUS BLOCK



Map is based on the survey results (and not a census of all the households in the area).

The map reflects the share of respondents who indicated having broadband. Using these numbers as indicators of the shares of all households (including those who did not respond) that have broadband must take margins of errors into consideration, which depend on the total number of responses and the total households in an area. At the county level, the margin of error is in the 1% range. For individual townships, the margin of error is in the 2.4%-7% range. Response rates at the level of some census blocks were low and therefore imply higher margins of error. See the full report for details.

Data gathering is an imperative first step in broadband planning and expansion efforts. However, collecting accurate information on a household level can be significantly more challenging for rural and less affluent communities.

The Michigan Moonshot has developed an engagement platform that leverages the support of community anchor institutions and outreach

Over the past year, the Michigan Moonshot has conducted a number of successful data collection engagements with higher education institutions and communities across the state. When money is available, efforts can be advertised through local media channels, such as direct mail, radio campaigns and news advertisements to solicit survey participation. However,

partners to increase the success of data collection efforts when budgets are limited. An ecosystem that empowers local groups to interact with their constituents has an exponential effect on citizen participation and awareness.

Many Michigan regions in the early stages of building community networks are facing similar challenges. Unreliable data sources, like FCC Form 477, could impede resource allocation to assist in broadband expansion efforts. The Moonshot's citizen science approach provides accurate connectivity and resident sentiment data which can be used by municipalities, broadband task forces, and county governments to support broadband planning efforts and grant applications.

in many of these regions, investment for resident outreach is limited. These funding challenges impede the ability of municipalities and task forces to promote surveying efforts and to communicate the importance of participation. To offset this obstacle, an outreach toolkit was developed to provide anchor institutions and outreach partners with ready-made communications like fliers, emails, social media posts, and website copy.

A current collection campaign in Berrien County, for example, has demonstrated early success with this approach. Members of the Berrien County Broadband Task Force (appointed by the county board of commissioners) identified nearly 200 groups and individuals who were willing to assist in community outreach and their undertaking is paying off. Early survey results are indicative of the strength of this syndicate method. Outcomes were similar in a Washtenaw County initiative that was completed in 2020 - this project saw plentiful participation by residents and provided a foundational step in the county's connectivity process.

In effect, the grassroots approach to data collection and engagement creates stronger relationships between public and private partners, anchor institutions, community organizations, broadband champions, elected officials and residents. Working together to solve the first steps of equitable connectivity has served to further these explicit goals while reinforcing bonds between those working to solve our shared challenges. Community-directed outreach is a mechanism for engagement that reinforces the conclusion that we're stronger together.

To learn more about Merit's data collection services, visit [MichiganMoonshot.org/Data](https://www.merit.edu/MichiganMoonshot.org/Data).

Merit is the longest-running research and education network in the United States. Since 1966, we have owned and operated more than 4,000 miles of fiber optic infrastructure in the state of Michigan. We are owned and governed by Michigan's public universities. We provide network, security and community services to our members, who are other nonprofits. www.merit.edu

EPOC trials Virtual Deep Dives to enhance cyberinfrastructure workflows

Research and Education (R&E) networks form the “circulatory system” for science.

Understanding scientific workflows, and creating technical solutions that are able to assist and adapt to the changing needs of science, remains a critical gap that must be addressed for network-enabled use cases.

The Engagement and Performance Operations Center (EPOC) is a production platform jointly led by Indiana University (IU) and the Energy Sciences Network (ESnet). By considering the full end-to-end data movement pipeline, EPOC is uniquely able to support collaborative science, allowing researchers to make the most effective use of shared data, computing, and storage resources to accelerate the discovery process.

A major component of the EPOC strategy has been to work with the regional networking community to better understand workflows for diverse

research teams in order to evaluate bottlenecks and potential capacity issues.

EPOC has partnered with Quilt members Front Range GigaPop, Great Plains Network, iLight, KINBER, LEARN, and OARnet to sponsor Application Deep Dives for campus environments. The outcome of these activities has been a better understanding of the scientific drivers, growth areas, and points of friction that exist today (and how they are likely to change over time). Campuses, regional partners, EPOC, and science communities receive a set of actionable items that can be addressed to better support the use cases.

With the pandemic-related travel restrictions, this work has shifted to a virtual approach for Deep Dives. This involves a video session to “train the trainers” - to get the local IT staff up to speed on the Deep Dive structured conversation approach so they can work with the individual science groups to fill out the application Case Studies. Once the Case Studies are collected, a series of “Focus Group” video calls are scheduled lasting no more than two hours so participants can walk through a subset of the Case Studies and try to pull out requirements. The full set of participants then update the Case Studies, combine the data and observations from the focus groups, and a written report is prepared,

reviewed, and then made public.

EPOC is working with the University of Central Florida for the first Virtual Deep Dive.

Researchers willing to participate through video chats have enabled EPOC to work with a larger set of new use cases in a more conversational tone. A recent example is working with an archeology and anthropology researcher who typically spends significant time in a remote international location conducting field work. They were able to have the time to think critically about prior workflow and determine that it was not as efficient as it could be through the use of advanced IT support. The old process included hand-carrying an entire summer’s worth of data back to the lab using removable media, which was then processed over a number of months. After talking with EPOC and the sponsors at UCF, the team is considering ways to use remote data transfers and integration with local computational resources, which in turn could facilitate a parallel workflow during the time of remote study and enable more flexible field work through the availability of partial results.

EPOC is continuing to work with The Quilt to stage Virtual Deep Dive events until such time as travel resumes. For further information, contact epoc@iu.edu or visit us at <http://epoc.global>.



EPOC

Engagement and Performance
Operations Center

Indiana University

Founded in 1820, Indiana University is one of the world’s foremost public institutions. With nearly 100,000 students and more than 20,000 employees statewide, IU continues to pursue its core missions of education and research while building a foundation for the university’s enduring strengths in teaching and learning, world-class scholarship, innovation, creative activity, community engagement and academic freedom. Bloomington is the flagship campus of the university, and each one of IU’s seven campuses is an accredited, four-year degree-granting institution. www.iu.edu

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 (SC) 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 140+ research and commercial networks, enabling DOE-funded scientists to productively collaborate with partners around the world. www.es.net

OSHEAN works with Ocean State Libraries for Take IT Outside Initiative

OSHEAN Inc., a leading non-profit internet service provider (ISP) with cloud and security services for anchor institutions across the State of Rhode Island and surrounding region, and Ocean State Libraries (OSL) have been awarded \$85,000 from Rhode Island Gov. Gina Raimondo and Rhode Island Commerce for the Take It Outside Initiative. The funds will go directly to

support the ongoing effort to provide free, public outdoor Wi-Fi to all public libraries across the state.

OSL and OSHEAN are among 41 organizations awarded funds that are committed to encouraging and increasing outdoor commerce in the state to reduce the transmission rate of COVID-19. The free public Wi-Fi project kicked off earlier this year

when the teams worked together to launch the service at the Warwick Public Library. Library patrons and community members can now access high-speed, secure wireless internet at any time of day or night from the library's parking lot.

Furthermore, with the expansion and formalization of distance learning into school curriculums across the state, the funds awarded to OSL and OSHEAN remain critical in expanding free public Wi-Fi to other communities across Rhode Island.

"The pandemic overall has exposed what many service providers already knew. There are still many households who do not have reliable Wi-Fi access," said Dave Marble, CEO at OSHEAN. "We're really excited to be doing our part to help those in need during these unprecedented times by partnering with our colleagues at Ocean State Libraries to provide this free service to increase access and opportunity for all."

The Take It Outside grant will fund the remaining 40 sites that will be set up to offer free, outdoor Wi-Fi access. In addition to support from the Take It Outside grant, installation will be collaboratively provided with donations of time, support and resources from the teams at Intellibeam, the Information Technology Disaster Recovery Center (ITDRC), OSHEAN, and OSL.

OCEAN STATE
—LIBRARIES—

WELCOME TO OCEAN STATE LIBRARIES PARKING LOT WI-FI

The Ocean State Libraries parking lot Wi-Fi made possible in collaboration with the following

OSHEAN
Technology of tomorrow, today

RHODE ISLAND FOUNDATION

INFORMATION TECHNOLOGY
DISASTER RECOVERY CENTER

Funded in part by a grant from the Rhode Island Foundation

About Ocean State Libraries (OSL)

Ocean State Libraries (OSL) is a consortium of Rhode Island's 48 public libraries and St. George's School. OSL coordinates a statewide catalog of library materials, digital content and future-ready technology services for its member libraries so they may better serve their patrons and communities. Through their library's membership in OSL and OSL's partnership with the Rhode Island Office of Library & Information Services, library patrons have access to over six million books, movies and more, all available at or through their local public library.

About OSHEAN

For 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 a next-generation technology infrastructure and solutions to member institutions and the communities they serve, OSHEAN empowers healthcare 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. To learn more about how OSHEAN drives progress for the regional community and beyond, visit www.oshean.org

OARnet enables expansion of broadband access through Ohio Pilot Project

The Ohio Academic Resources Network (OARnet) has pushed Ohio forward for more than 30 years with advanced networking and technology solutions serving the government, education, health care and public broadcasting communities.

Ohio is awash in innovation in response to COVID-19, as illustrated by a pilot project to deliver affordable internet wirelessly to students and families in one rural school district, all enabled by OARnet's flexible and ultra-fast, fiber-optic network. Funded by Ohio's K-12 Broadband Connectivity Grant and the Federal CARES Act, the initiative will help provide affordable high-speed internet access to students of Riverside Local Schools, a population largely underserved by broadband.

"The great news about this project is it's not only serving the school and the students, but it's serving the local community as well," said Ohio Lt. Gov. Jon Husted. "They are going to have access to high-speed internet in all of these small rural towns, places that never had access before, because we've created new partnerships with the private sector, the not-for-profit sector, and the government sector."

The pilot project will install new fixed wireless technology on existing structures and use the school's OARnet connection to broadcast to surrounding communities. The installation is expected to bring broadband access to approximately 600 households in three surrounding towns.

Households within range will connect to high-speed internet inside their homes through a partnership with PCs for People, a national non-profit organization that wipes all data, refurbishes, and then distributes digital devices to low-income households. Service is offered at rates as low as \$15



per month with estimated speeds of 50 Mbps download and 5 Mbps upload, twice that of the federal definition of high-speed internet, with no contract and no monthly equipment fees.

The school district is subsidizing the upfront cost of routers to help many low-income households, providing an important opportunity for students to do their schoolwork remotely and families to work from home.

While projects like this illustrate the power of flexibility for research and education (R&E) networks, scalability and security are equally as important. In a test of both, OARnet provided connectivity for the first 2020 Presidential Debate held in Cleveland at the Health Education Campus shared by Case Western Reserve University and the Cleveland Clinic. This followed a successful Democratic primary debate at Otterbein University in Westerville, with connectivity provided by OARnet.

COVID-19 has created unprecedented challenges but

OARnet has thrived. Early in the outbreak, OARnet provided emergency bandwidth increases for 62 clients - including higher education, K-12 ITCs and large urban districts, state and local government agencies, and a research center - collectively more than doubling the available bandwidth for these clients.

More recently, OARnet worked with the Ohio Department of Higher Education to secure Governor's Emergency Education Relief funding to increase bandwidth from 1 to 10 Gbps for 40 institutions and to double the commercial internet subscriptions for all 87 OARnet higher education clients. A similar effort is now in the planning stages for K-12 clients.

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. www.oar.net

CEN supports members through the challenges of 2020



Connecticut Education Network (CEN) provides more than a network of vital infrastructure and digital connectivity. It is a network of people and organizations extending into each and every Connecticut community, connecting anchor institutions (CAI) that serve all citizens. In 2020, as the COVID-19 pandemic accelerated a global shift to remote applications, our members provided insight on how CEN could assist in a time of crisis. CEN utilized its leadership role to solve problems and provide resources to our membership community in numerous ways.

Trusted Advisor

Early in the pandemic, CEN participated in the Governor's Rapid Broadband Deployment Group to accelerate bridging of the digital divide for CT's students and underserved citizens. This resulted in the Everyone Learn's Initiative, providing funding for 150,000 Chromebooks to K-12 students, home broadband connections through cellular and cable providers, and walk-up/drive-up Wi-Fi hotspots operated by CEN in partnership with our members. The governor later introduced broadband legislation to more permanently address the digital divide

issues through universal service, new connectivity standards, and improved conditions for greater broadband investment.

Member Collaboration

Working closely with our advisory councils, CEN hosted town halls to help members adapt to the crisis and quickly transformed our in-person conference into the virtual CEN UNconference series. The UNconference included member-focused sessions on topics such as: Keeping Students Safe at Home, No-Cost Cyber Security Tools and Resources, Data Privacy and Contact Tracing, Network Recommendations in the Age of COVID-19, and more.

1:1 & Student Safety

CEN partnered with Securly and iboss to provide K-12 and library members options for CIPA filtering and student safety. Supporting 1:1 student-to-device initiatives became reality almost overnight and now span every grade level. Securly provides full visibility into student's online activity, coverage and security wherever the device is in use, and scans in real-time AI-based notifications for nudity, bullying, self-harm or violence. The iboss cloud

services, extended to members at no additional charge, provides CIPA compliant safeguards, students-at-risk monitoring, and remote classroom management.

Extended Bandwidth

With the sudden shift to remote work and learning, Connecticut K-12 schools, colleges, and universities had to quickly transform their teaching and learning models. With many schools choosing to run a hybrid classroom schedule, bandwidth demands increased substantially. CEN's Bandwidth Bonus Program provided K-12 members with more bandwidth quickly to meet these demands with minimal impact on their operating budgets.

Membership Growth

CEN continues to expand its membership base and connectivity services for existing members. In 2020, membership grew by 26 to 649, or 4.2 percent, over 2019. Additionally, 20 new connections were built to serve new locations for existing members.

CEN, the nation's first all-optical research and education network, delivers reliable, high-speed Internet access, data transport, and value-added services to its members drawn from K-12, higher education, libraries, state government and municipalities throughout Connecticut. CEN's statewide fiber-optic network connects more than 1.8 million citizens in support of Connecticut's workforce and economic development. www.ctedunet.net

NJEdge turns to digital transformation to close the digital divide



Concerned with making “every citizen digital”, Edge in New Jersey is working to provide ultra high-speed broadband access for all, and can be viewed as a catalyst for bringing the benefits of an innovative, digital economy and society to the region.

Edge lies at the very heart of this economic development initiative, continuing to address the digital divide – a prerequisite for the region’s continued economic and social development – and to provide researchers and students across the region with access to world-class connectivity and services.

Edge’s continued role involves leading the way and acting as an innovator while continuing to deliver services and solutions not easily found elsewhere. While research and education networks are designed not just to support, but also to stimulate research, innovation and flow of content, the ability to allocate resources for deploying new services for users and add value through services is more important than ever. Edge’s Science DMZ, now a vital portion of our segmented optical fiber network topology, allows institutions to connect to an environment tailored to the needs of higher performance science driver

applications. With this investment, Edge can now adequately support the science driver areas vital to advancing technology transfer programs, accelerating research, and providing direct access to Internet2 routes. Moreover, the Science DMZ supports direct 400 Gbps access to cloud storage and other network devices that integrate into a unified whole to provide a foundation for state, regional, and national research collaborations.

One prominent term today with regard to technology strategy, value, and return-on-investment is digital transformation. This term is no longer ambiguous and now refers to how institutions in the education, health care, and government sectors are changing the way they operate. Digital transformation represents a foundational change in how an organization delivers value and marks a radical rethinking of how an organization uses technology, people, and processes to fundamentally change performance and outcomes. With respect to how institutions now need to operate in the new century, digital business transformation is the process of exploiting digital technologies and supporting capabilities to create a

robust new digital business model.

We know digital transformation means a fundamental rethinking about what we do with technology in organizations.

Core components for success include big data, cloud computing and the Internet of Things (IoT) as firmly established trends in the digital transformation sphere, and must form an integrated strategy for forward-looking organizations. With thought leadership provided by Edge, digital transformation across the entire institution works together to put the student, faculty, researcher, alumni, patient, or citizen experience first. Further, the institution develops the ability to combine data from the new digital processes to decide on and power its next transformation.

In this economic reality where entire industries are disrupted, actionable intelligence is the new currency. As the educational, health care and government sectors become more competitive, digital transformation is now becoming a necessary means of survival as our new digital world requires institutions to adapt and adopt digital technologies, methodologies, and mindsets.

The premier source of networking, cyber infrastructure, technology solutions and services to advance research, education, and economic development. Connect with Edge at www.njedge.net.

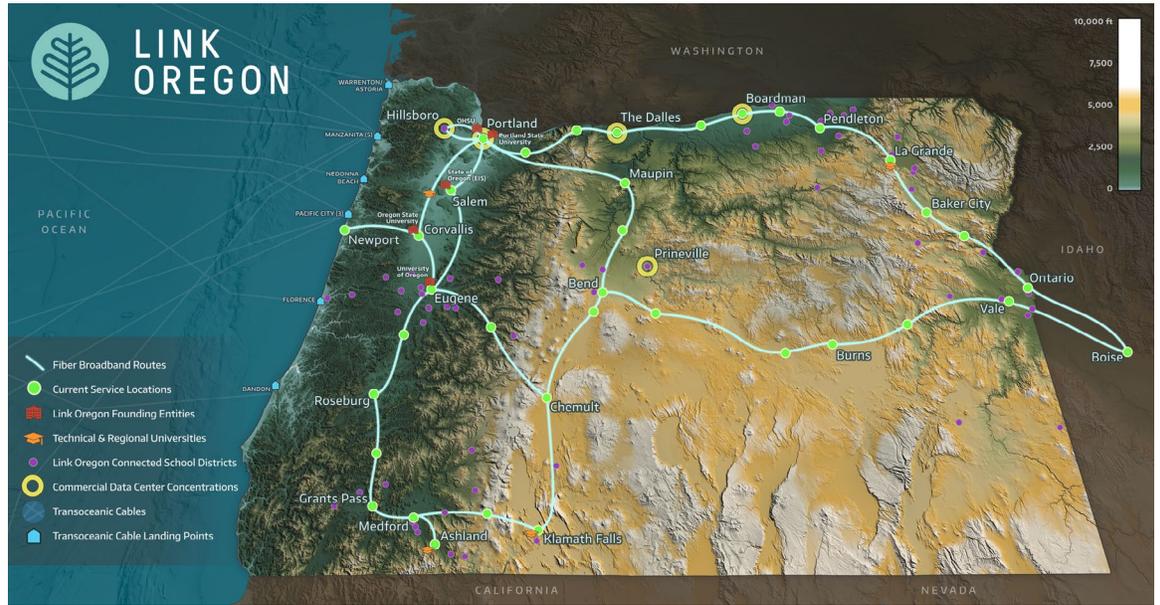
Link Oregon serves key role in response to COVID crisis

Link Oregon was just beginning its third year when the pandemic struck. This statewide, facilities-based broadband network provider—for the public and non-profit sectors in Oregon—responded to the crisis in multiple ways.

From the earliest days of the pandemic, Link Oregon's leadership responded by taking a firm stance on protecting the team and our member community, ensuring we had technology in place to work effectively from home, developing a clear personal protective equipment (PPE) policy, and making PPE available to staff whose responsibilities required in-person contact with colleagues, members, and vendors.

As conscientious co-workers, we were communicating daily at first and then regularly (via Zoom and Slack), attending to our own and to our members' health and safety, and continuing to carry out our network service and expansion work. We also positioned ourselves as a conduit for our member community on information related to the pandemic by posting on our website resources on public health, telehealth, education, and other impacted service domains.

We are a consortium of and for our founding members—the four Oregon research universities and the State of Oregon Enterprise Information Service—and remain committed to carrying out the missions of these institutions as their connectivity needs and those of their constituents were being amplified by the pandemic.



Link Oregon is also a community-focused, member-based, technology organization intent on providing reliable, cost-effective middle-mile broadband connectivity to the education, health care, research, Tribal, and remote state government offices located across our geographically diverse state. And, while Link Oregon does not work to solve residential internet connectivity issues directly, our providing fast and reliable internet to the public and non-profit sectors and serving as an anchor tenant stimulates broadband investment to communities and enables better knowledge sharing across communities.

We sought guidance from other research and education networks who are models for success, including UETN, CENIC, and others. We convened with colleagues, broadband leaders, and state librarians in Washington and California whose governors had signed the Western States Pact to ensure that the reopening of public and commercial services would be conducted safely.

Representatives from Colorado, Nevada, and Utah joined us later as well. We continue to share ideas on broadband deployment and emerging funding opportunities.

Link Oregon has intensified network expansion efforts across southern and eastern Oregon with the help of a \$8.4 million grant from the Federal CARES Act, allocated by the State of Oregon. We are close to completing this expansion project, after which Link Oregon will have established 50 access locations statewide and enabled interconnectivity with Seattle, Boise, and the San Francisco Bay Area (Sunnyvale).

The pandemic clearly demonstrated the lack of sufficient broadband in many areas and broadband's importance to every community across the state. Link Oregon is proud to have a key role in solving our state's broadband challenges, and we look forward to continuing to deliver for Oregon's public and non-profit sectors in response to the pandemic and for the long-term benefit of all Oregonians.

Link Oregon is a federally tax-exempt 501(c)(3) Oregon non-profit organization, a consortium of the State of Oregon through its Enterprise Information Services and the state's four research universities—Oregon State University, OHSU, Portland State University, and the University of Oregon. We provide high-speed, resilient, middle-mile fiber broadband connectivity to our state's public and non-profit sectors. www.linkoregon.org

MCNC leads digital equity innovations in North Carolina

Digital equity, community champions, real-time resources, growth mindset, helping neighbors – MCNC continues to serve North Carolina’s technology needs at an unprecedented pace.

For 40 years MCNC has connected and protected communities with high-speed Internet and networking technologies. Over those four decades, MCNC has built-out its fiber network, NCREN, to more than 4,000 miles to reach many unserved and underserved areas all while continuing to stress that the growing “digital divide” or “homework gap” would pose significant social and economic challenges in the state. Citizens today must be able to sustain remote work, virtual school, telehealth visits, and day-to-day living. What the pandemic has revealed is that digital equity and inclusion are all-encompassing – where people require not only reliable broadband connectivity but secure access to services, support, and skills on how to use it.

As concerns over COVID-19 grew last year, MCNC assembled an online Knowledge Center to communicate with clients and took swift steps to ensure networking and security services remained available. Like most of the country, MCNC went to a largely work-from-home arrangement and made sure staff had the necessary equipment to support clients remotely. MCNC also implemented safety protocols for staff as well as new activities for virtual employee engagement.



“COVID-19 revealed compassion and courage as well as innovation and creativity,” said MCNC president and CEO Tracy Doaks, who became the ninth chief executive of the organization in August 2020. “MCNC is ready to once again demonstrate just how important reliable, fast and affordable Internet is today, and how the right investments can lead to digital equity innovations that drive economic and social growth in North Carolina.”

In that same spirit, MCNC completed important projects associated with funding from the federal CARES Act.

The Rural College Broadband Access Project was a major step in extending high-speed connections for the North Carolina Community College System. The \$12 million endeavor improved the technology infrastructure at 20 of the state’s most rural campuses. Additionally, Cyber Hygiene Assessments for 50 Local Education Agencies (LEAs) were completed in just 14 weeks. This work addressed cybersecurity from both a technology

and behavior level, provided vital and timely information to those LEAs, and allowed for MCNC’s Secure Application Access service to be accessible at no added cost.

MCNC’s client community equally demonstrated high levels of commitment to their stakeholders. The MCNC Champions campaign was created to recognize those going above and beyond to serve their organizations and communities under trying circumstances. MCNC also worked with the Food Bank of Central and Eastern North Carolina to set up a Virtual Food Drive.

MCNC understands the link between broadband and socio-economic growth. With regions ranging from rural to urban, mountains to coastal, each unique community welcomes an active collaborator like MCNC to help shape their digital foundation.

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 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. www.mcnc.org

I-Light meets Indiana's networking needs during COVID

Networking in the time of COVID-19 challenged all of us over the course of the past year. The sudden transition from working in-person to being collaborative and productive remotely while staying safe and socially distanced was a major adjustment—and we in research and education (R&E) networking have had to tackle a slew of unique and unprecedented hurdles as each unfolded.

For the I-Light network team, our focus throughout the pandemic has been on member engagement and support. We've worked tirelessly to ensure our community's needs are met and that our services remain top quality.

First and foremost, I-Light's duty was to get connectivity out to our 40-plus member institutions' students, staff, and faculty as the coronavirus forced everyone to learn and work remotely. I-Light staff assisted in the acquisition, inventory, and distribution of more than 260 Wi-Fi hotspots throughout the State of Indiana. A second avenue for supporting connectivity was expansion of the Eduroam world-wide wireless access service to more of our members. Eduroam allows our members to use the network infrastructure of participating institutions so that their students, faculty, staff, and researchers can work remotely without the need for guest credentials. I-Light is fortunate to have resources within our staff who manage our EBS, eduroam, and wireless connectivity for our members—and that has helped us be nimble in a time when our world has been challenged in rapidly changing ways.

I-Light also has supported our members in public media by enabling EduCast datacasting, which allows K-12 students in Indiana who lack reliable internet access to learn at home through their local public broadcasting station. The datacasting technology sends computer-based files over a television broadcasting signal. Through this project, I-Light has helped bridge the digital divide among Hoosier families.

To create more opportunities for collaboration within our community, we formed a Network Advisory Council (NAC). This group is made up of volunteers from our member institutions and I-Light's network leadership. The goal of the NAC is to help identify the needs of our members and to allow our members to have a voice in regard to the direction the network grows. The NAC represents each vertical our network supports across its private, public, community colleges and universities and provides a conduit for members to help our leaders steer the network in

a direction that best supports each of our member institutions.

I-Light also recently started holding monthly town halls to connect to our members on a regular, ongoing basis. The town halls provide members with further opportunities to collaborate with each other and to let the I-Light leadership in on what they need from us.

Finally, after health and safety risks drove us to cancel our 14th annual Member Meeting in the spring, I-Light decided to bring our community together in a virtual realm. Over two consecutive half-day sessions in November 2020, I-Light members met via Zoom for panels and discussions about issues, trends, and COVID-19 responses—as well as to reconnect and catch-up.

The challenges that we have all faced during the pandemic have been nothing short of trying. As has been reinforced for all of us at I-Light, community is the essential key to both how and why we persevere in what we do within R&E networking.



I-Light, a unique collaboration among Indiana colleges and universities, state government, and private sector broadband providers, is a high-speed fiber optic network that connects Indiana member sites to state, national, and international research and education communities. www.ilight.net

Illinois invests in ICN, future of the state's workforce

It's been a year since Illinois Gov. J.B. Pritzker's capital budget included \$20 million to strengthen the Illinois Century Network (ICN). This critical investment has ensured that Illinois remains competitive in the national and global economy with a highly-educated workforce.

The ICN provides internet and intranet connectivity for thousands of sites statewide. It ensures high availability for cloud based content, disaster recovery services, data, video and audio communications. The ICN owns or leases approximately 2,100 miles of fiber throughout Illinois and interconnects with multiple regional, public and private networks. To build the workforce of tomorrow, it is necessary that K-12 and higher education students and faculty have access to first-class digital tools such as the ICN's secure and reliable high-speed broadband network.

The \$20 million investment provides support for important network capacity upgrades and capability enhancements such as 600 Gbps backbone links that enable flexible provisioning. This allows ICN to support big data transfers between university researchers, their scientific instruments, and fellow research collaborators within Illinois, across the country, and the world. The upgraded network backbone supports multiple 100 Gbps links and the ability to flexibly provision data transfers separately and securely over unique waves (light frequencies).

The funding also enhances secure internet access for K-12 students through a dedicated centralized firewall. This means students participating in 1:1 device programs can access as much internet as required for their digital learning objectives and be assured that it is "clean" as the centralized firewall

keeps K-12 student data separate and secure from other network traffic via a dedicated virtual private network. Lastly, the investment allowed for upgrades of network interconnects providing direct access to cloud exchanges for ICN connected institutions so that confidential student information never has to be transferred over the public internet.

Owning and operating its infrastructure, from the fiber in the ground to the routers and switches at ICN points of presence, and having full control over its purchase decisions, allows ICN to provide services specific to its customer groups, such as K-12 and higher education. ICN's customer focus and ability to provide unique and targeted services to Illinois' community anchor institutions helps ensure Illinois remains at the forefront of the national and world economy.



"Engineering the ICN for our kids is incredibly motivating. We're always striving to ensure Illinois students have the best possible learning experience when accessing the Internet, whether for research or distance learning," - ICN network architect, Frank Walters

The Illinois Century Network (ICN) began in 1997 with the recommendation from the Higher Education Technology Task Force to create a single, statewide educational network. The ICN became reality in May 1999 with the signing of the legislation called the Illinois Century Network Act. The ICN has evolved into a 2,000-mile, high-speed broadband network serving K-12 and higher education, public libraries and museums, state and local government and commercial service providers. www2.illinois.gov/icn

CASA Radars use LEARN connectivity to shorten weather response windows



Collaborative Adaptive Sensing of the Atmosphere (CASA) is a University of Massachusetts Amherst Engineering Research Center featuring a network of Doppler radars that offers early detection of impactful weather. CASA radars originally were deployed in southwestern Oklahoma, where extreme weather such as tornadoes occur often. When the 10-year grant was completed, the CASA radar system was moved to the Dallas-Fort Worth (DFW) area where it could be used in a heavily populated area to increase its impact. The data from these sensors requires large amounts of bandwidth, provided in part by connectivity through LEARN.

Data generated from CASA radars is used nationally for research

and modeling, including operationally by the NWS Fort Worth/Dallas forecast office and the National Oceanic and Atmospheric Administration (NOAA).

“There were issues getting data from all those sensors into a working environment and making it available, explains Douglas Rhue, Regional Networking and Program Manager for the National Weather Service’s (NWS) Southern Region Headquarters (SRH). “SRH has a partnership with LEARN and has been on the board for as long as I can remember. Since we are members of (and connected to) LEARN, we were able to get LEARN access for the CASA radars.”

There are seven CASA radars deployed around the DFW area, including two on the LEARN network at the University of Texas at Arlington (UTA) and at the University of North Texas (UNT), where it is ported across the friction-free LEARN backbone to academic compute clouds at the University of Houston (UH) and at Texas A&M University. In addition, LEARN has enabled access to Internet2’s advanced Layer 2 services, which allows CASA to dynamically provision computing resources and bandwidth prioritized to meet the user needs as weather changes.

The major impact of CASA radars in the DFW area are the weather alerts. The end users, primarily North Central Texas Council of Governments (NCTCOG) subscribers, receive images

queried with data to show wind fields, precipitation and other network products that help cities identify and respond to flash floods, hail, high winds, tornadoes, and other weather phenomena.

A phone app allows for community members in the DFW area to receive warnings on their phone of potential bad weather in their area. Eric Lyons, lead systems engineer and lead of Radar at UMass, explains that a member of a community that is subscribed can customize current locations and get targeted app updates and warnings; they can even choose when to get alerted, such as rainfall over a certain amount or a tornado within a certain radius of their home or office.

“The data from this app is used by social scientist researchers in a variety of ways. They do surveys, test verbiage and see people’s reactions,” adds Lyons. “If they received a flood warning, did they avoid the flooded area? Did it affect traffic? Having LEARN at UNT and UTA is tremendously helpful. LEARN gives a number of options for data processing compared to most sites, where the last mile connection is usually a bottleneck. With LEARN we can do so much more with the high-speed connectivity.”

Bandwidth to the SRH increased 10 times in summer 2020. While each radar sensor has a dedicated connection, they all converge on the LEARN network. Closes Rhue, “without connectivity from LEARN, I don’t think we’d have nearly the success we’ve had with the CASA radar system.”

The Lonestar Education and Research Network (LEARN) is a consortium of 41 organizations throughout Texas that includes public and private institutions of higher education, community colleges, the National Weather Service, and K-12 public schools. The consortium, organized as a 501(c)(3) non-profit organization, connects its members and over 500 affiliated organizations through high performance optical and IP network services to support their research, education, healthcare and public service missions. LEARN is also a leading member of a national community of advanced research networks, providing Texas connectivity to national and international research and education networks, enabling cutting-edge research that is increasingly dependent upon sharing large volumes of electronic data. www.tx-learn.net

CARES Act Funding plus UETN equals positive impact for Utah's telehealth and education



Technicians working on an installation for Wasatch School District to provide WiFi internet access using CBRS band of radio frequency.

This past year has been a challenge for everyone, not least for teachers and school districts trying to walk the line between keeping students safe and ensuring their learning is kept on track during the pandemic. The Utah Education and Telehealth Network (UETN) is one organization that was able to meet this challenge and solve problems in new, exciting, and accelerated ways.

UETN is a network that connects Utah school districts, schools, and colleges and universities, and rather than feeling daunted by beginning distance learning, they took the opportunity to innovate, collaborate, and connect. One of the reasons for UETN's success was its receipt of funding from the federal CARES Act. The Coronavirus Aid, Relief, and Economic Security Act provided \$22 trillion in economic stimulus to support people, businesses, and organizations in managing the fallout from the COVID-19 pandemic. UETN used a portion of Utah's CARES funding to not only respond to the public health needs in the state but also to the resulting shortcomings of an education community facing a whole new environment of learning.

"The CARES Act made it possible to think outside the box," says Kat Shimizu, UETN Project Manager of Enterprise Systems and Software Development. "It allowed us to pull in technology and services we only dreamed of."

She goes on to praise everyone involved in the success saying, "We have so many IT heroes who worked day and night, traveled to all parts of the state, navigated through stress, and completed 152 projects in the last half of 2020. And of course, we can't thank the IT staffs from our school districts and academies enough!" Among their accomplishments were extending classroom connectivity with Zoom and Cisco Webex licenses, increasing network capacity, and extending student access with upgraded Wi-Fi and CBRS. And, as Shimizu notes, virtually all Utah students and educators are benefitting from these improvements.

Projects that benefited students, teachers, and the overall health of the state include:

K-12 Improvements

Providing enhanced Wi-Fi infrastructure and supporting improvements for home internet for rural and underserved communities.

High School Coursework

Enhancing online coursework availability including college prep and readiness courses, Summer Bridge, and English as a Second Language classes.

Higher Education Improvements

Lending laptops and hotspots, updating software and providing equipment protection, and ensuring institutions including technical colleges are prepared for COVID's health and education challenges.

Professional Development

Giving teachers the training they need to excel at remote teaching.

State Telehealth Network

Enhancements

Ensuring the telehealth network platform is sound, firewalls and anti-malware are robust, and data prevention is solid.

Network Enhancements

Upgrading equipment, improving security monitoring and data backup measures, and providing interactive video conferencing.

Software Contracts

Forging relationships with innovative software vendors to offer applications that support online and hybrid learning.

With such a variety of groundbreaking efforts, Shimizu notes that collaboration between UETN Tech Services, Accounting, and 130 Local Education Agencies (LEAs) was not only required but an absolute treat to see in action. Now participants can only look forward to what exciting projects will be completed in 2021!

Everyone had to pivot in 2020 and stretch themselves in ways to meet unprecedented challenges, especially when reinventing where and how learning occurs. Shimizu notes that the volume and breadth of the groundbreaking collaboration efforts in 2020 between UETN and 130 Local Education Agencies (LEAs) were a true testament to the foundation of trust and partnerships developed by UETN since its inception.



Murray students join Utah Governor Spencer Cox in ceremonial launch of the CBRS WiFi project at the district board room.

MREN collaborations helping create next-gen networks for data intensive science

Each year, with its international, national and regional partners, the Metropolitan Research and Education Network (MREN) collaborates with SCinet to create a national testbed for the annual ACM/IEEE International Supercomputing Conference for High-Performing Computing, Networking, Storage, and Analysis. Because of the pandemic, this year's conference, SC20, which had been scheduled to take place in Atlanta, Ga., was virtual and SCinet did not develop a testbed. Consequently, MREN and its research partners designed, implemented and operated an alternative SC20 international testbed as a platform for demonstrations and experiments showcasing data intensive science applications and technologies. The testbed incorporated sites in Ottawa, Washington D.C., Baltimore, Chicago, New York City, and Salt Lake City.

For SC20, MREN and its research partners used this national testbed to successfully stage 26 large-

scale demonstrations. Increasingly, science research requires gathering, analyzing, and transporting extremely large volumes of data, including high-capacity, single end-to-end 10-100 Gbps data flows that are transported among sensor sites, instruments, analytic sites, HPC centers, and data repositories. Techniques demonstrated included innovative methods based on Software Defined Networking (SDN), Software Defined Exchanges (SDXs), Data Transfer Nodes (DTNs), Network Services Interface (NSI), transport protocols, measurements, the P4 programming language, and dynamic L2 and L1 provisioning.

Demonstrations this year included: advanced services for Petascale science; dynamic capabilities of the NSF StarLight International SDX; programmable dynamic WAN networking; the Global Research Platform; advanced services for the High Energy Physics, specifically,

the Large Hadron Collider Open Network Environment; DTN-as-a-Service; geophysics; multi-100 Gbps WAN services, including Disk-to-Disk transfers across WANs; P4 data plane programming; and dynamic systems provisioning across WANs. MREN also assisted in organizing an event at SC20: "Supercomputing Forum for Experiments and Demonstrations Showcasing Innovations in Large Scale Data Intensive Science Transport Over WANs."

In 2020, MREN also supported a demonstration at the Supercomputing Asia Conference 20, which resulted in an innovation award presented to the StarLight consortium and the International Center for Advanced Internet Research (iCAIR) at Northwestern University.



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 is also creating a regional MREN Research Platform (MRP) and participating in developing a National Research Platform (NRP). www.mren.org

MOREnet celebrates 30 years during a year to remember

In 1991, MOREnet was asked to link together 13 Missouri public colleges and universities in order to share research using the electronic interchange later to be named the World Wide Web or Internet. In 1992, the connection was extended to two-year public, as well as private, higher education institutions.

Over the next decade, MOREnet grew rapidly and was soon providing both a connection and required training as well as a Membership Service Package, offering technology services to complement the broadband connection. By 1993, there was a collaboration between the Missouri Department of Elementary and Secondary Education, the Secretary of State's Office, the Missouri Office of Administration and the Department of Higher Education, for MOREnet to begin delivering secure, reliable and robust internet connectivity and technology services to all of our member organizations.

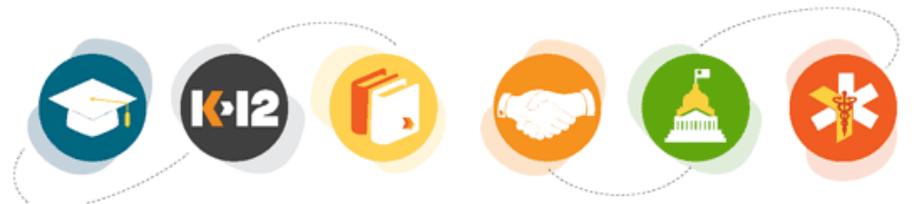
MOREnet's robust and secure fiber backbone and network access is routinely and continually enhanced to ensure it is always ready to support the demand and performance needs for all connected members. What started with a 56 Kbps network has become a 100 Gbps backbone with the groundwork laid to meet future demands and support capacities of up to 1 Terabit per optical path. To see the timeline of events leading to that growth, check out the Information and Impact publication on our website.

Today, just 30 short years later, MOREnet is a proud technology partner to a member-driven consortium serving 728 organizations in Missouri's academia and public sector. We know how important a forward-thinking, service-oriented business model is to advance the technology needs of our members.

We believe our organization's endurance can be credited to not only a better broadband connection, wrapped in essential services, but also a better human connection. Some experts say that employee longevity can be an indicator that an organization is growing and staying relevant, as length of service allows team members to develop a complex understanding of the market, products and services. At MOREnet, we're pleased to share that 43 percent

of our workforce has been at the job over 20 years! We believe having a workforce of experienced employees who can easily solve complex problems means first-class customer service, and the most relevant and trusted products available for our members.

We couldn't be more proud of the MOREnet team and their dedication to supporting our members and our mission. Here's to the next 30 years!



The Missouri Research and Education Network (MOREnet) is a member-driven consortium providing 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. MOREnet serves more than 700 members across Missouri. www.more.net

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