CEN

Connecticut's Trusted Internet Partner

2022 Annual Report
Impacting Every Community

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From the Director

2022 was a year of continued membership growth for CEN as the premier middle mile network provider for Connecticut. CEN maintains leadership in support of anchor institutions enabling education, research, government, healthcare, cultural arts, and digital citizenry by providing superior network connectivity built on stability and state of the art offerings.

In this CEN Annual Report, you will find many of the exciting 2022 programs and initiatives developed and implemented by the CEN team in partnership with our members bringing technology solutions to complex communication challenges. One item that illustrates that partnership was the return of the in-person annual member conference where we come together to collaborate, share information, and celebrate each other's successes over the course of a year. In addition, we introduced the CEN Outstanding Leader Awards to recognize the exemplars who provide extraordinary leadership, energy, ideas, and achievements for the advancement and development of the CEN community and our foundational mission, vision, and values.

Economically, this year has been one of extended inflationary pressures and continued supply chain disruptions. CEN and its members have felt the pain of these challenges, and, nevertheless, have found paths to grow the membership, increase value, expand offerings, and maintain price stability. We are very proud of these accomplishments and are excited to explore future growth opportunities with our members.

In 2022 and beyond, the State of Connecticut and federal government have prioritized strengthening broadband infrastructure and access, and both are announcing and awarding new funding opportunities that will help support that goal. CEN is proud to play a substantial role in serving the State of Connecticut and empowering our increasingly connected state for success. We look forward to collaborating with the membership and making progress on strengthening Connecticut's cyberinfrastructure, democratizing network and Internet access, and bridging the digital divide throughout our state.

I would like to take this opportunity to acknowledge and thank CEN's staff, members, partners, advisors, and directors for their commitment, creativity, and dedication to working together to deliver solutions in 2022.

We appreciate your continued support.

Ryan Kocsondy

Ryan Kocsondy
Director - CEN

About CEN

CEN is Connecticut's premier provider of open access middle mile high-capacity Internet and network services. Rooted and established in service to community anchor institutions since 2000, CEN has been accelerating the progress of our member institutions by providing reliable, ultra-low latency, high-speed networking and security services. We are the provider of choice for organizations that demand exceptional value, performance, and highly personalized service.

Our Members Are Our Partners

CEN is organized and operated unlike any other Internet Service Provider in Connecticut. Our cost recovery (non-profit) model, pragmatic growth, and effective management have resulted in consistent member cost savings and cost avoidance, and those savings are passed on to the members in lower prices and larger feature sets. Unlike a typical for-profit vendor-customer relationship, CEN as a not-for-profit partner engages with our member organizations to determine the direction and design of CEN products and services, to develop community training and collaboration events, and to band together for increased purchasing power.

2022 Highlights

Extending the Value Proposition

For over 22 years, CEN has consistently delivered increasing value with price stability or price reductions for Internet access. In spite of significant inflation of underlying costs in 2022, CEN announced flat bandwidth tier pricing, long term agreement discounts, and a re-branding as the CEN DIA Bundle detailing the suite of services included at no additional cost to members.

Investing in the Future

Major projects were announced in 2022 as part of Connecticut's share of American Rescue Plan Act of 2021 (ARPA) awards, and their completion in the coming years will enable current and future members' higher utilization of this vital infrastructure. Investments totalling over $70M for network upgrades, public wifi expansion, community anchor and middle mile fiber circuits, and security platform enhancements are under way.

Modernizing Public Libraries

As a prime example of its commitment to Community Anchor Institutions (CAI), CEN in partnership with the Connecticut State Library has designed and implemented over $3.5M in fiber Internet connectivity projects for libraries across the state. In 2022, CEN and its member partners at the CoNnecticut State Library and Novus Insight, Inc. teamed together to launch the Library Internal Connections Project investing an additional $1.3M in public library infrastructure.

2022
By the Numbers

Mission Driven, Member Focused

$31M — Cost Avoidance	**99.99%** — Uptime
677 — Member Institutions	**364PB** — Data Transferred
1.9M — Citizens Served	**4.3Tb/s** — Backbone Capacity
848 — Event Attendees	**204** — DDoS Attacks Mitigated
90 — Advisory Council Members	**894** — Network Devices Managed
14 — Team Members	**24,340** — Active Ports

Products and Services

Tailored to the meet the needs of the Community

Welcome New Members!

Berlin Fire Department

Bethel Volunteer Fire Department

Bloomfield Center Fire Department

CSCU Facilities

Derby Neck Library

Dixwell Community Center Q-House

East Berlin Fire Department

East Lyme Public Safety Building

Housing Authority of Hartford

Kensington Fire Department

Lebanon Police Department

Lime Rock Park

Marlborough Senior Center

Morris Fire Company

Mystic Fire District

South Kensington Fire Department

Specialty Printing LLC

Stony Hill Volunteer Fire Department

The UConn Foundation

Town of Lebanon

Town of Sterling

Voluntown Public Library

Washington Volunteer Fire Department

Westbrook Public Library
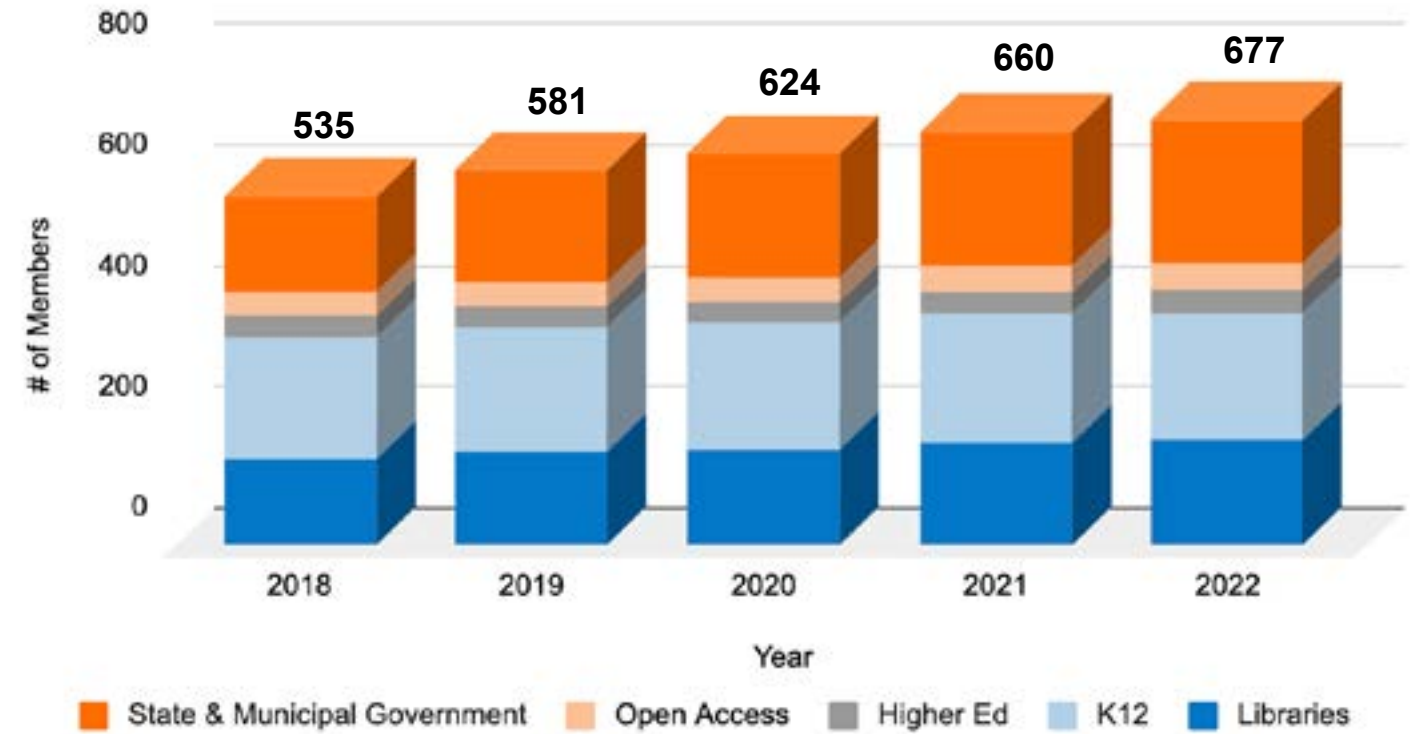
Windsor Locks Police Department

Windsor Public Library

Growing Our Community

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New Member Organizations

Member Growth

2022 was a year of continued growth and expanded value for the CEN membership. Membership has grown by over 17% since 2018, and in 2022, CEN welcomed 26 new members representing state and municipal organizations, police and fire departments, libraries, and open access businesses bringing the CEN membership total to 677 community anchors.

CEN Membership by Segment

The following diagram depicts CEN members out of the total entities in Connecticut per vertical.
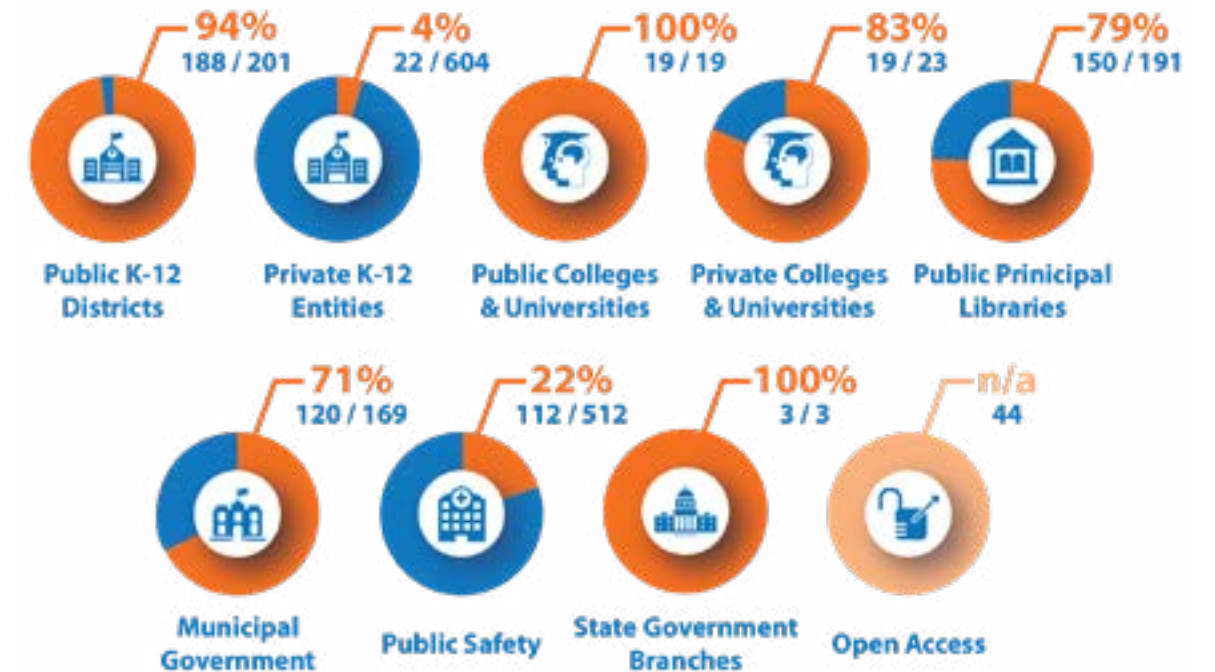
2022 CEN Membership

Our members are our partners

70 Audubon Street Association, Inc.
Achievement First Bridgeport
Academy Middle School
Achievement First Hartford Academy
ACMT, Inc.
Acton Public Library
Albertus Magnus College
American School for the Deaf
Amistad Academy Middle School
Andover Public Library
Andover School District
Ansonia Library
Ansonia Police Department
Ansonia Rescue Medical Services
Ansonia School District
Area Cooperative Educational Services (ACES)
Ashford School District
Asnuntuck Community College
Atwater Memorial Library
Avon Free Public Library
Avon School District
Babcock Library
Barkhamsted East Volunteer Fire Company
Barkhamsted School District
Beacon Falls Public Library
Beardsley & Memorial Library
Bentley Memorial Library-Bolton
Berlin School District
Berlin-Peck Memorial Library
Bethany School District
Bethel Public Library
Bethel School District
Bethlehem Fire Department
Bibliomation, Inc.
Bloomfield School District
Bolton School District
Booth & Dimock Memorial Library
Borough of Naugatuck
Bozrah School District
Brainerd Memorial Library
Branford Fire Department and EOC
Branford Police Department
Branford School District
Brass City Charter School
Bridgeport Public Library
Bridgeport School District
Bristol Public Library
Bristol School District
Brookfield Library
Brookfield Police Department
Brookfield School District
Brooklyn School District
Burlington Public Library
Burnham Public Library
CAE Simuflite Inc.
Canaan School District
Canterbury Public Library
Canterbury School District
Canton Public Library
Canton School District
Canton Springs Fire Department
Capital Community College

Capital Region Development Authority
Capital Region Education Council
Capital Workforce Partners
Capitol Region Council of Governments
CAS (Connecticut Association of Schools)
Case Memorial Library
Central CT State University
Chaplin Public Library
Chaplin School District
Charter Oak State College
Cheshire Academy
Cheshire Public Library
Cheshire School District
Chester Public Library
Chester School District
ChimeNet, Inc.
Choate Rosemary Hall
Christian Heritage School
City of Ansonia
City of Bridgeport
City of Bristol
City of Danbury
City of Derby
City of Hartford
City of Meriden
City of Middletown
City of Milford
City of New Britain
City of Torrington
City of Waterbury
Clark Memorial Library
Clinton School District
CMEEC
CNC Software
Colchester School District
Colebrook School District
Columbia School District
Columbia Volunteer Fire Department
Common Ground High School
Connecticut College
Connecticut Executive Branch
Connecticut Judicial Branch
Connecticut Legislative Branch
Connecticut Library Consortium
Connecticut Public Broadcasting Network (CPTV)
Connecticut Science Center
Connecticut State Library
Cooperative Educational Services (CES)
Cora J. Belden Library Rocky Hill
Cornwall School District
Coventry School District
Cragin Memorial Library
Cromwell School District
Cross Street Fire Station
CT Metropolitan Council of Governments
CT State Board of Education on behalf of CTECS
CT State Library - LBPH

CT State Library - Van Block
Cyrenius H. Booth Library
Danbury Fire Engine #25
Danbury Public Library
Danbury School District
Danielson Fire Department
Darien Library
Darien School District
David M. Hunt Library
Dayville Fire Department
Deep River School District
Derby Public Library
Derby School District
Digital Back Office
Douglas Library of Hebron
Douglas Library of North Canaan
Durham Public Library
E.C. Scranton Memorial Library
East Granby Fire & Rescue
East Granby School District
East Haddam School District
East Hampton Public Library
East Hampton School District
East Hartford Public Library
East Hartford School District
East Haven Public Library, Inc.
East Haven School District
East Lyme ECC Dispatch Center
East Lyme Fire Department
East Lyme Police Department
East Lyme Public Library
East Lyme School District
East Windsor School District
EASTCONN
Eastern CT State University
Eastford Public Library
Eastford School District
Easton Public Library
Easton School District
EdAdvance
Edith Wheeler Memorial Library
Ellington School District
Ellington Volunteer Fire Department
Enfield - Phoenix Ave. Fire Department
Enfield - Shaker Pines Fire Department
Enfield Police Department
Enfield Public Library
Enfield School District
Essex School District
Explorations Charter School
Fairfield County Regional Dispatch
Fairfield Public Library
Fairfield School District
Fairfield University
Farmington Libraries
Farmington School District
Ferguson Library Main Library
Fintech Village, LLC, c/o RM Bradley
Flanders Fire Department
Franklin School District
Gateway Community College - New Haven

Genie Innovations, Inc.
Gilbert School Trust
Glastonbury School District
Global Jet Services
Goodwin University
Goshen Public Library
Granby Public Library
Granby School District
Greenwich Library
Greenwich School District
Griswold School District
Groton Public Library
Groton School District
Grove School Inc.
Guilford Emergency Communications Center
Guilford Fire Department
Guilford Free Library
Guilford School District
Gunn Memorial Library
Haddam Volunteer Fire Company
Hall Memorial Library
Hamden Hall Country Day School
Hamden School District
Hampton School District
Hartford International University for Religion and Peace
Hartford Public Library
Hartford School District
Hartland School District
Harwinton Central Fire Department
Harwinton Public Library
Harwinton West Side Fire Department
Hayward Volunteer Fire Co. Colchester
HC2 Broadcasting
Hebron School District
Henry Carter Hull Library
Highville Charter School & Change Academy
Holy Cross High School
Hopkins School
Hotchkiss Library of Sharon
Housatonic Community College
Howard W Bracken Memorial Library
Howard Whittemore Memorial Library
Integrated Day Charter School
Interdistrict School for Arts and Communication
Internet2
James Blackstone Memorial Library
Janet Carlson Calvert Library
Kent Library Association
Kent Memorial Library Suffield
Kent School District
Killingly Public Library
Killingly School District
Killingworth Library
King School, Inc.
LEARN
Lebanon Fire Department
Lebanon School District

Ledyard Police Department
Ledyard Public Libraries
Ledyard School District
Levi E. Coe Library
Libraries Online, Inc. (LION)
Library Association of Warehouse Point
Library Connection Inc.
Licia & Mason Beekley Community Library
Lisbon School District
Litchfield Historical Society
Litchfield School District
Lucy Robbins Welles Library Newington
Lyme Academy of Fine Arts
Lyme Fire House
Madison School District
MakerspaceCT
Manchester Community College
Manchester Public Library
Manchester School District
Mansfield Fire Dept Station 207
Mansfield Public Library
Mansfield School District
Mark Twain Library
Marlborough Fire House #1
Marlborough School District
Meriden Police Department
Meriden Public Library
Meriden School District
Middlebury Fire Department
Middlebury Police Department
Middlebury Public LIbrary
Middlesex Community College
Middletown Library Service Center
Middletown Police Department
Middletown School District
Milford Police Department
Milford Public Library
Milford School District
Minor Memorial Library
Miss Porter's School
Mitchell College
Monroe School District
Montville - Chesterfield Fire Co
Montville - Mohegan Fire Co
Montville - Montville Fire Co
Montville - Oakdale Fire Co
Montville PSAP
Montville School District
Morris Public library
Morrison Healthcare
MTAPD District 8 Bridgeport Yard
MTAPD District 8 Stamford Station
Mystic & Noank Library
Naugatuck Police Department
Naugatuck School District
Naugatuck Valley Community College - Waterbury
New Britain Public Library
New Britain School District
New Canaan Library
New Canaan School District

New England Greens dba Vibrant Health LLC
New Fairfield EOC
New Fairfield Library
New Fairfield School District
New Hartford School District
New Haven Free Public Library
New Haven School District
New London School District
New Milford Police Deptartment
New Milford Public Library
New Milford School District
Newington Community Television
Newington School District
News12 Networks
Newtown School District
Niantic Fire Department
Norfolk Library
Norfolk School District
Norfolk Volunteer Fire Department
North Branford Fire Department
North Branford Police Department
North Branford School District
North Canaan School District
North Haven Memorial Library
North Haven Police Department
North Haven School District
North Stonington School District
Northwest CT Public Safety Communications Center Inc.
Northwestern Community College - Winsted
Norwalk Community College
Norwalk Police Department
Norwalk School District
Norwich Free Academy
Norwich Public Utilities
Norwich School District
Notre Dame High School
Novus Insight, Inc.
Oak Hill
Odyssey Community School
Old Lyme Fire Department
Old Saybrook School District
Oliver Wolcott Library
Orange Police Department
Orange School District
Orange Volunteer Fire Department
Otis Library
Oxford Public Library
Oxford School District
Paier College
Park City Prep Charter School
Plainfield School District
Plainville Public Library
Plainville School District
Pleasant Valley Fire Department, Barkhamsted
Plymouth Fire Department
Plymouth Police Department
Plymouth School District
Pomfret Public Library
Pomfret School
Pomfret School District
Poquonnock Bridge Fire Department Groton
Portland Public Library
Portland School District
Post University
Preston Public Library
Preston School District
Prospect Public Library
Prosser Public Library
Public Library of New London
Putnam Police Department
Putnam Public Library
Putnam School District
Quinebaug Valley Community College - Danielson
Quinebaug Valley Emergency Communications, Inc.
Quinnipiac University

Rathbun Free Memorial Library
Realized Solutions Inc
Rectory School
Redding School District
Regional School District #1
Regional School District #10
Regional School District #11
Regional School District #12
Regional School District #13
Regional School District #14
Regional School District #15
Regional School District #16
Regional School District #17
Regional School District #18
Regional School District #19
Regional School District #4
Regional School District #5
Regional School District #6
Regional School District #7
Regional School District #8
Regional School District #9
Rensselaer Hartford Graduate Center RPI
Richmond Memorial Library
Ridgefield Library
Ridgefield School District
Riverton Volunteer Fire Department, Barkhamsted
Rockville Public Library, Inc.
Rocky Hill Fire Department
Rocky Hill Police Deptartment
Rocky Hill School District
Russell Public Library
Sacred Heart Academy
Sacred Heart University
Sacred Heart University (WSHU)
Saint Bernard School
Salem Free Public Library
Salem School District
Salisbury School District
Saxton B. Little Free Library
Scotland Public Library
Scotland School District
Scoville Memorial Library
Sea Research Foundation, Inc. (Mystic Aquarium)
Seymour Public Library
Seymour School District
Sharon School District
Shelton School District
Sherman Library Association
Sherman School District
Side By Side Charter School
Silas Bronson Library
Simsbury Fire Department
Simsbury Public Library
Simsbury School District
Sodexo
Somers Fire Department
Somers Library
Somers School District
South Central Regional Council of Governments
South Windsor Public Library
South Windsor School District
Southbury Public Library
Southbury Volunteer Fire Department
Southern CT State University
Southington Fire Department
Southington Police Department
Southington Public Library
Southington School District
Southwestern Regional Communications Center Inc.
Sprague Public Library
Sprague School District
St. Thomas More Catholic Chapel
St. Thomas More School
Stafford Fire Department 1, Station 145
Stafford Library

Stafford School District
Stamford School District
Sterling Public Library
Sterling School District
Stonington Free Library
Stonington Police Department
Stonington School District
Stratford Library Association
Stratford School District
Suffield Academy
Suffield School District
Taft School
Terryville Public Library
The Bridge Academy
The Bushnell
The Community Foundation for Greater New Haven
The Connection, Inc.
The Foote School
The Frederick Gunn School
The Gilbert School
The Hotchkiss School
The Jackson Laboratories
The Open Hearth
The Williams School
Thomaston Police Department
Thomaston Public Library
Thomaston School District
Thompson School District
Three Rivers Community College
Tolland Fire Department
Tolland Public Library
Tolland School District
Torrington Police Department
Torrington School District
Town of Andover
Town of Ashford
Town of Avon
Town of Barkhamsted
Town of Beacon Falls
Town of Berlin
Town of Bethany
Town of Bethel
Town of Bethlehem
Town of Bloomfield
Town of Bolton
Town of Brookfield
Town of Canterbury
Town of Canton
Town of Cheshire
Town of Clinton
Town of Colchester
Town of Colebrook
Town of Columbia
Town of Coventry
Town of East Granby
Town of East Hartford
Town of East Lyme
Town of Eastford
Town of Ellington
Town of Enfield
Town of Essex
Town of Fairfield
Town of Farmington
Town of Glastonbury
Town of Goshen
Town of Granby
Town of Greenwich
Town of Groton
Town of Guilford
Town of Haddam
Town of Harwinton
Town of Hebron
Town of Killingly
Town of Ledyard
Town of Litchfield
Town of Lyme
Town of Madison
Town of Manchester
Town of Mansfield
Town of Marlborough
Town of Middlebury

Town of Montville
Town of Montville WPCA
Town of Morris
Town of New Fairfield
Town of New Milford
Town of Newington
Town of Newtown
Town of Norfolk
Town of North Branford
Town of Old Lyme
Town of Old Saybrook
Town of Orange
Town of Plainville
Town of Plymouth
Town of Pomfret
Town of Portland
Town of Preston
Town of Prospect
Town of Putnam
Town of Redding
Town of Ridgefield
Town of Rocky Hill
Town of Roxbury
Town of Salem
Town of Salisbury
Town of Seymour
Town of Simsbury
Town of Somers
Town of South Windsor
Town of Southbury
Town of Southington
Town of Stafford
Town of Suffield
Town of Thomaston
Town of Thompson
Town of Tolland
Town of Tolland County Mutual Aid Fire Service Inc.
Town of Trumbull
Town of Vernon
Town of Voluntown
Town of Wallingford
Town of Washington
Town of Waterford
Town of Waterford Fire Departments
Town of West Hartford
Town of Weston
Town of Westport
Town of Willington
Town of Wilton
Town of Winchester
Town of Windham
Town of Windsor
Town of Windsor Locks
Town of Woodbridge
Town of Woodbury
Trailblazers Academy
Trinity College
Trumbull School District
Tunxis Community College
UCONN Health Center
Union Free Public Library
Union School District
United Way of CT
University of Bridgeport
University of Connecticut (UCONN)
University of Hartford
University of New Haven UNH
University of Saint Joseph
USCGA (US Coast Guard Academy)
Valley Shore Communications
Vernon School District
Voluntown School District
Wadsworth Atheneum Museum of Art
Wall Street Theater
Wallingford Police Department
Wallingford Public Library
Wallingford School District
Waterbury - Fire Station 11
Waterbury Police Department
Waterbury School District
Waterford Police Department

Waterford Public Library
Waterford School District
Watertown Fire Department
Watertown Police Department
Watertown School District
Welles-Turner Memorial Library
Wesleyan University
West Hartford Bloomfield Health District
West Hartford Public Library
West Hartford School District
West Haven Police Department
West Haven Public Library
West Haven School District
West Stafford Fire Department
Westbrook Emergency Management
Westbrook School District
Western CT State University
Weston Public Library
Weston School District
Westport Police Department
Westport Public Library
Westport School District
Wethersfield Public Library
Wethersfield School District
Willimantic Police Department
Willimantic Public Library
Willington Fire Department - Station 1
Willington Hill Fire Department
Willington Public Library
Willington School District
Wilton School District
Winchester School District
Winchester Volunteer Fire Department
Windham School District
Windsor Locks Public Library
Windsor Locks School District
Winsted Fire Department Station 1
Wolcott Police Department
Wolcott Public Library
Wolcott School District
Wolcott Volunteer Fire Department
Woodbridge School District
Woodbridge Town Library
Woodbridge Volunteer Fire Department
Woodbury Public Library
Woodstock Academy
Woodstock School District
XL Center
Yale University

CEN Strategic Plan 2019 – 2024

Mission

Empower our member institutions to execute their missions through technology, collaboration, and digital transformation with secure, reliable, and value-added advanced network and Internet solutions.

Vision

CEN will serve as the trusted partner through which Connecticut's digital and human networks connect, collaborate, and share resources to realize the full potential of digital learning, research, and citizenry.

2019 - 2024 Strategic Goals

Goal 1: Provide Value
Expand the service portfolio to provide value and enhance Internet and network capabilities at scale, heighten security, and increase the overall knowledge and understanding of those technologies and services.

Goal 2: Ignite innovation
Empower members through a suite of services tailored to their needs that encourage excellence and innovation.

Goal 3: Foster Collaboration
Engage the local membership and national R&E community to provide technical and functional network services that serve the specific needs of CEN member communities.

Goal 4: Promote Advocacy
Pursue activities to enhance brand awareness such that members and policy decision makers are engaged in activities to help articulate CEN's value proposition and impact public policy initiatives.

Goal 5: Enhance Core Resources
Pursue opportunities to leverage, develop, and enhance CEN's core technology and human resources for the foundational success of the program in pursuit of member needs.

Goal 1: Provide Value

As a member-driven, public enterprise, CEN and its community members have worked together for more than 20 years to provide much more than commodity Internet access. With a primary focus on providing value to Connecticut research and education organizations, the results of the CEN member-driven model include: a network designed for performance and scale, a DIA product bundle tailored to member needs, a locally focused support team providing service 24x7, and a community of IT professionals collaborating across multiple forums for the betterment of Connecticut students, families, educators, towns, and cities.

Three examples of CEN's unique value proposition stand-out in 2022: member cost avoidance, price stability, and integral security services.

Member Cost Avoidance

CEN Service	Member Cost	Alternative Member Cost	Member Cost Avoidance
Internet Access*	$7,614,960	$11,582,288	$3,967,328
DDoS Protection**	$122,000	$23,987,712	$23,865,712
Web Filtering***	$253,365	$2,020,000	$1,767,000
Student Safety****	$518,026	$1,458,568	$940,532
Total	$8,508,351	$39,048,568	$30,540,572

Alternative Cost Source Information
*Connected Nation, 2022 data from MA, NY, RI
**Microsoft Azure DDoS protection pricing
***Member quotes and vendor price list
****Securly product pricing and subscription analysis
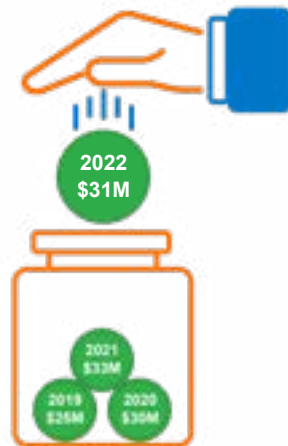
CEN member cost avoidance is assessed by comparing the cost of CEN services provided to members to the alternative cost if purchased separately and individually. It is the buying power of the CEN member consortium and the network's economies of scale that create this tremendous value and savings totalling over $31M in 2022 for organizations across every CT community.

Price Stability and Value Add

Nowhere is CEN's value proposition more evident than the comparison of CEN's Dedicated Internet Access (DIA) product to that of other Connecticut Internet providers. CEN's unique cost recovery business model and consistent member growth make possible an unmatched package of competitive pricing, custom tailored services, and larger feature sets compared to other for-profit Internet providers. In 2022, this package of features and services, the CEN Dedicated Internet Access (DIA) Bundle, was offered at the same or lower price points across all bandwidth tiers for the current and subsequent fiscal year. This was accomplished in spite of significant inflation of CEN's underlying costs for equipment and services.

Donna Quirk
Cybersecurity Analyst, Fairfield Public Schools

"CEN has given us the ability to expand our portfolio of products to better achieve our goals of access and security. We would not be able to afford these services individually. They have allowed us to lower our costs from updating EOL equipment and using instead, CEN bundled resources and services. CEN support has always been top notch and never disappoints. They truly exemplify their commitment to their constituents."

Security Services Included

CEN's DIA Bundle includes several security services at no additional cost to members. These include protection from crippling DDoS attacks, Child Internet Protection Act compliant web filtering, and Domain Name System (DNS) firewall service. CEN's Managed Firewall Service is available at an additional cost and further bolsters a member's security posture.

The effectiveness of CEN's robust security package, specifically the combination of the DDoS Protection and Managed Firewall Service, was illustrated by its defense of the East Haven School District in late 2022. Attacked 39 times over 3 months, the CEN carrier grade security package ensured there were no school district disruptions.

Randel Osborne
Technology Director, East Haven Public Schools

"In mid-December we received multiple notifications of a DDoS attack on our network over a series of several days. In all instances, the attack and mitigation went unnoticed among our users, and no loss of services were reported. CEN provided clear communication and excellent support during this instance, and the CEN Managed Firewall solution proved invaluable in keeping our critical systems operational."

DDoS Mitigation Summary Review

CEN has made a significant investment in the DDoS platform responding to a 60% growth of volume passed through the system. Therefore, the platform can handle greater and more significant DDoS attacks.

Year	Number of TMS Mitigation	Volume of Traffic Passed by TMS	Volume of Traffic Dropped by TMS	Volume of Largest TMS Mitigation	Rate of the Largest TMS Mitigation	Duration of Longest TMS Mitigation
2022	242	40.36 TB	22.93 TB	18.32TB	29.75 Gbps	58d 7h 42m
2021	537	25.41 TB	59.74 TB	6.00 TB	38.42 Gbps	150d 2h 20m
2020	844	20.84 TB	45.83 TB	6.49 TB	19.99 Gbps	88d 10h 47m
2019	978	2.18 TB	12.04 TB	3.74 TB	20.03 Gbps	2d 17h 54m

Goal 2: Ignite Innovation

Igniting innovation means partnering with our members to design and implement solutions to problems and needs that, otherwise, may not be possible without the power of this community. In 2022, three CEN projects demonstrated the power of leveraging the network infrastructure, public-private partnerships, and community anchor facilities to reduce the digital divide, expand broadband access, and enhance school safety.

More Robust Library Networks

Increasing the capacity of public libraries to provide virtual programming is an integral component in their community's effort to reduce digital inequity. CEN, with leadership from the Connecticut State Library, Inc., developed a category of grant funding and service award, Fiber to the Libraries—Internal Connections or FTTL-IC. FTTL-IC has provided library awards for two project stages: (1) network assessments and (2) internal local area network upgrade. With an investment of over $1.25M in more than 50 libraries, and a partnership with Novus Insight will enhance the performance and security of libraries' CEN connected networks, providing patrons faster and more reliable access to library resources and programs.

Principal Public Libraries Connected

Year	Connected Libraries
2016	77
2017	118
2018	132
2019	135
2020	142
2021	146
2022	150
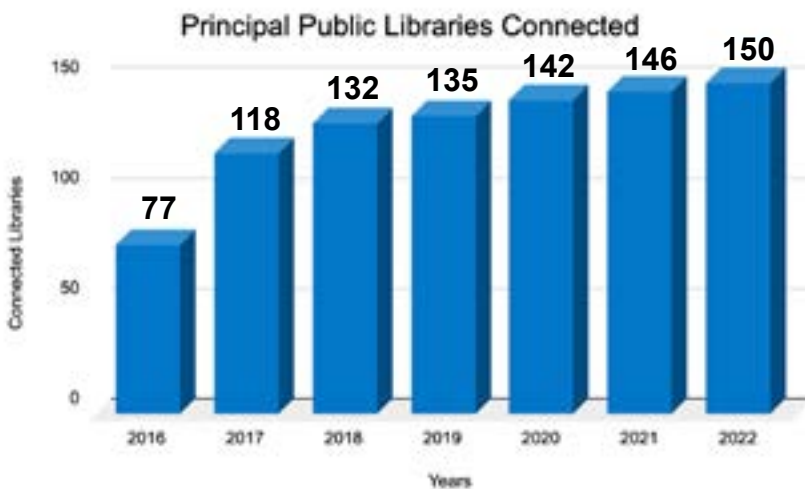
Dan Salazar
Chief Executive Officer, Novus Insight

"Throughout the FTTL-IC project, the Novus team has visited dozens of libraries across the state. What has struck us the most is the vital role these libraries play as a hub in their communities, a place to learn, convene, and communicate. This project is modernizing the libraries in ways that will make CEN an even more valuable resource for patrons and staff needing internet connectivity. In addition to the enhancements allowing for higher volumes of traffic, they will also enable libraries to withstand the unexpected surges in network use that occur during community-impacting outages or events."

Expanded Public Wi-Fi

From early 2021 through 2022, the Everybody Learns WiFi Initiative (ELI) helped tens of thousands of students and adults connect to free, high-quality WiFi through the pandemic and beyond to engage in remote learning, telehealth, and state and municipal services. The program's success hinged on the trusted CEN community partnerships and is a testament to the community's willingness to step up and help during a crisis. Over 150 members participated in the program working with CEN technicians to offer free CEN grade Internet access in public spaces across the state. The program showed consistent user growth every month reaching a peak of over 90,000 unique clients accessing over 90TB of data in the last 6 months of 2022.

Public Wi-Fi Usage 2021 - 2022

Time Period	Total Data Transferred	Total Unique Clients	Avg Clients/Day
Jan-Jun 2021	6.48 TB	16,334	226
July-Dec 2021	22.66 TB	54,784	1,173
Jan-Jun 2022	28.17 TB	69,890	2,523
July-Dec 2022	36.36 TB	90,241	2,769

The success of the ELI program has paved the way for the successor public WiFi program, Community Wireless Phase 2. Under Governor Lamont's ARPA Investment Plan, in 2023, CEN will launch the Community Wireless Phase 2 Project offering municipal entities the opportunity to build wireless Internet access services in their communities. Phase 2 will target underserved and economically disadvantaged groups and communities of color. This project will be managed utilizing a grant structure allowing community entities to partner and propose solutions utilizing CEN as their Internet provider.

Physical School Security

CEN and its partner Public Safety Data Network (PSDN) have collaborated to enhance school security for its members by providing a dedicated fiber optical connection from the member school to the member's police department, providing a direct connection for the real time monitoring of security cameras. This circuit can be subsidized for the member, when qualified, saving the member the cost of an expensive fiber build and Internet access fees. The estimated cost savings for each member is thousands of dollars per year. The number of participants has grown on average 52% per year since its inception in 2015.

For a school system, keeping students and faculty safe from outside threats is of the utmost concern. Today, schools must make difficult choices on where to spend their budgets identifying and procuring security technologies like cameras, scanners, door locks, radios and ID cards. CEN members can focus on other top security items since the fiber circuit can be 100% subsidized when qualified.

Alan Merly
Director of Technology, Naugatuck Public School

"Having this video connection has been a great benefit for our district and police department. It has provided real-time access to video footage that can be used to aid investigations. With instant access to live video feeds, officers have the ability to respond more quickly to potential emergencies and other critical situations. Additionally, the video connection has helped reduce costs for the district by eliminating the expense of hardware and infrastructure that would have otherwise been needed. We feel this connection will significantly enhance the response and effectiveness of law enforcement efforts in the event of a crisis."

Goal 3: Foster Collaboration

The CEN community culture is built on collaboration thereby ensuring that the sum of all member achievements is far greater than what could be accomplished on a smaller scale. In 2022 this was illustrated in CEN's collaborative projects with its vendors on sustainability, with its members on improved network security, and with both vendor partners and member organizations in the annual member conference.

Enviromental Partnerships

CEN promotes the Governor's carbon reduction initiatives by adopting recycling best practices and also by working with CEN's 3rd party partners. By replacing inefficient hardware platforms, partnering with vendors who have established carbon reduction programs, replacing on premise hardware with more carbon neutral cloud based platforms, and participating in Connecticut statewide best practices will all contribute to a cleaner environment. Some examples of what our partners are pursuing are shown below.

CEN Partners Take Action

Cisco has a goal of 30% reduction in Scope 3 emissions from purchased goods and services, upstream transportation and distribution, and use of sold products by 2030 (compared to fiscal 2019).

Indiana University's Global Network Operations Center, GlobalNOC, is now receiving $4.25 million annually — a new record — for services as part of its 10-year agreement with the National Oceanic and Atmospheric Administration.

Crown Castle continues to invest in upgrading lit towers to more energy efficient LED lighting, and beginning in 2022, they are sourcing renewable energy which amounts to more than 60% of our 2021 annual electricity consumption.

F5 commits to reduce its Scope 1 and 2 emissions 50% by 2020

ConvergeOne continues to focus in this space and has reduced our footprint by 50% in locations; from 116 sites to 54. We have gone to Energy Savings "LED" lighting with motion sensors to not waste energy and installed Power Stations at several locations for electric cars. All facilities follow strict recycling rules and use waste partners.

Data Security Training

The CEN community collaborated in 2022 to prepare and share its Data Security Training series encompassing privacy, breach, and retention. This mission critical topic was raised by the Wallingford School District and the program was developed by CEN's Engagement and Development Advisory Council. Data security experts from the Connecticut State Library, Berchem Moses and Shipman Goodwin Law Offices, and CliftonLarsonAllen LLP provided member IT, administrative, and executive staff vital updates on data privacy and retention responsibilities, cybersecurity threats and safeguards, and best practices in all areas. The importance of these topics was reflected in the member registrations, over 300, the largest for any CEN virtual training event.

Data Privacy — **120** Registered

Data Breach — **99** Registered

Data Retention — **124** Registered

9th Annual Member Conference

The CEN Member Conference returned to an in-person event at the Connecticut Convention Center. The 2022 Member Conference featured new elements including poster sessions and a lunchtime keynote in addition to the traditional format. Participation exceeded expectations as illustrated by these results:

2022 CEN Member Conference By The Numbers
May 11, 2022 | Connecticut Convention Center

Attendees: **515**
Sessions: **33** Parallel Sessions | **10** Poster Sessions
Sponsors: **43**
Speakers: **2** Keynote Speakers | **113** Session Speakers

R&E Network Consortium Benefits

Purpose-built Research & Education Networks (RENs) provide ultra-high-speed connectivity and specialized services that increase access to academic opportunities, further scientific discovery, enable state and municipal government services, empower telehealth services, and foster collaboration amongst the community of anchor institutions and our citizens. CEN as part of TheQuilt and Internet2, collaborate with like minded mission-driven and member focused organizations who also deliver value through partnership, robust services, consortium contracts, and sharing of information locally, regionally, and nationally.

Goal 4: Promote Advocacy

In 2022, CEN advocated for the statewide community by promoting outstanding individual achievements and by successfully soliciting additional funding to further strengthen the network and the Connecticut communities served. Individual CEN community members were recognized with two awards, the Internet2 Community Anchor Program (CAP) Scholarship and the CEN Outstanding Leader Awards (COLA). Advocating for the entire community, CEN's awards from the American Rescue Plan Act (ARPA) total over $70M, providing investment for continued growth in the network's capacity, resiliency, and reach across the state.

Excellence in Education

Continuing its participation from 2021, CEN promoted the annual CAP Distance Learning Scholarship Program in association with Internet2. The program awards scholarship recipients free, interactive, distance learning experiences for their K-12 classrooms through the Center for Interactive Learning and Collaboration.

Michelle Bibeault is the Media Technology Integration Specialist at Eastford Elementary School. For Michelle, the Digital Citizenship: Handle Technology With Care program offered the school's kindergarten and first-grade students a jumpstart on how to use technology safely and responsibly – ultimately leading them to become good digital citizens.

CEN is proud to congratulate the 15 scholarship recipients in 2022 from CEN member organizations!

Teacher Name	School Name	City & State	Level(s)
Anne Halloran Tortora	Saint Bernard School	Uncasville, CT	8-12th
Betty Ann Lapena	Ridge Road Elementary School	North Haven, CT	1st Grade
Carla Destefanis	North Haven High School	North Haven, CT	Highschool
Claire Cloukey	Mary E. Griswold School	Berlin, CT	3rd Grade
Dawn Primo	Mary E. Griswold School	Berlin, CT	3rd Grade
Charles Kernan	Eastford Elementary School	Eastford, CT	5-8th Grade
Ellie Mulligan	North Haven Middle School	North Haven, CT	Special Education Program
Gary Pflomm	Polk	Oakville, CT	5th Grade
Julie Prescott	Chippens Hill Middle School	Bristol, CT	8th Grade
Lisa Waslyean	Mary E. Griswold School	Berlin, CT	3rd Grade
Louise Morrison	Thompson Middle School	North Grosvenordale, CT	6th Grade
Lynn Erickson	Stafford Elementary School	Stafford Springs, CT	1st Grade
Megan Dill	Eastford Elementary School	Eastford, CT	4th Grade
Michelle Bibeault	Eastford Elementary School	Eastford, CT	Kindergarten & 1st Grade
Rihiannon Scioscio	Mary E. Griswold School	Berlin, CT	3rd Grade

Stephanie Stenberg
Director, Internet2 - Community Anchor Program

"This program also highlights the importance of nonprofit state and regional research and education networks, which do so much more than provide schools with lightning-fast internet connections. Their mission-driven service means that connected schools get hands-on network help and a community of interest to share resources with other connected schools, libraries, museums, and institutions."

Community Leaders

In 2022, the CEN Outstanding Leader Awards were established to recognize any individual from a CEN member organization who has provided extraordinary leadership, energy, ideas, and achievements for the advancement and development of the CEN community, its products and/or services, and/or its foundational mission, vision, and values. Nominated by their peers, the 2022 awards were presented to 8 recipients at the Annual Member Conference:

- Matthew Ross, Farmington Public Schools
- Rebecca Osleger, Town of Suffield, Suffield Public Schools
- Nicholas Caruso, Connecticut Association of Board Educators (CABE)
- John Elsesser, Town of Coventry
- Scott Roberts, Town of South Windsor
- Tom Dillon, Commission for Educational Technology (CET)
- Karen Warren, Wesleyan University
- Dick LeFave, D&L Partners LLC, CEN Advisor
- Jeromy Nelson, Regional School District 15

The 2022 CEN Outstanding Leaders represent a diverse group contributing to the community's successes from home organizations in higher education, public education, municipal governance, and commission advisory roles.

Dick Lefave
D&L Partners LLC

"I very much appreciate this recognition from CEN as it represents a total team effort, I value the professional excellence of the CEN organization and the benefit it brings to the Citizens of Connecticut."

Investments in the Network

Governor Lamont and the CT Legislature passed funding to expand CEN programs (CT PA22-118 as amended by PA 22-146).

- Everybody Learns Wi-iFi Expansion
- Grant funding for municipalities and libraries to connect to CEN
- CEN Next Generation Infrastructure upgrades
- Grant funding for charter schools to connect to CEN

+$73M

Beginning in 2023, CEN will play a significant role in meeting the Governor's objectives by executing these projects. In total they represent a substantial opportunity for transformative investment in digital equity through expanded access to high speed Internet combined with a comprehensive and critically necessary infrastructure update to the CEN network to expand capacity for new member attachments and to bolster resiliency.

Goal 5: Enhance Core Resources

CEN's consistent growth in membership and network utilization necessitates proactive planning and growth in the CEN team, the network assets, and its services. 2022 accomplishments reflect significant achievements in all three areas with members reaping the benefits in unmatched level of network performance and personalized service.

CEN Team Growth

In 2022, the CEN team grew by nearly 20% with the addition of a Fiscal Manager, Peter Correia, two Associate Network Engineers, Christian Hitchcock and Christopher Tingley, and a Project Management Fellow, Radu Nedelcu. Multiple searches are also underway to recruit a Financial Assistant, Network Security and Automation Engineer, and Project Manager.

Ryan Kocscondy — Director
Rick Cheung — Team Lead & Senior Network Engineer
Rafael Morales — Network Engineer
Mike Pennington — Network Engineer
Christian Hitchcock — Associate Network Engineer
Christopher Tingley — Associate Network Engineer
Bradley Tudisca — System Administrator
Ray Carcano — Optical Engineer
Paul Tarsa — Member Services Manager
Wendy Rego — Member Services Specialist
Rachael Collard — Member Services Specialist
Deanna LaVoie — Marketing & Communications Coordinator
Dick LeFave — Consultant
Peter Correia — Finance Manager
Molly Zipkin* — Financial Assistant
Radu Nedelcu — Project Manager

*Moved to another organization by year end

In 2022, CEN actively recruited, hired, and trained UConn students in three areas. These students played an integral role in day-to-day operations. CEN would like to thank and acknowledge the following 2022 students:

Daneya Alvarez
Karthick Kumaran
Jeevan Vishwanadhuni
Krishna Priya Dirisala
Kajol Anand

Sindhura Kolusu
Sai Sreevani
Kayla Tolliver-Van Wright
Harshitha Pulichinth
Maggie Dougan

Network Expansion and Improvements

2022 was a remarkable year for network capacity building, service improvements, and resiliency additions. All of the upgrades noted below are designed to improve service levels for the members and to ensure that their growing needs for bandwidth and services are proactively met.

• Hub sites' Uninterruptible Power Supplies (UPS) upgraded
• Content filtering capacity improved by 50%
• Backbone core links at large hub sites augmented by 90%
• Diverse path to New York City resources added
• DDoS and InfoBlox platforms upgraded
• Faster cache appliances installed
• Peering resources expanded

Member Network Traffic Utilization
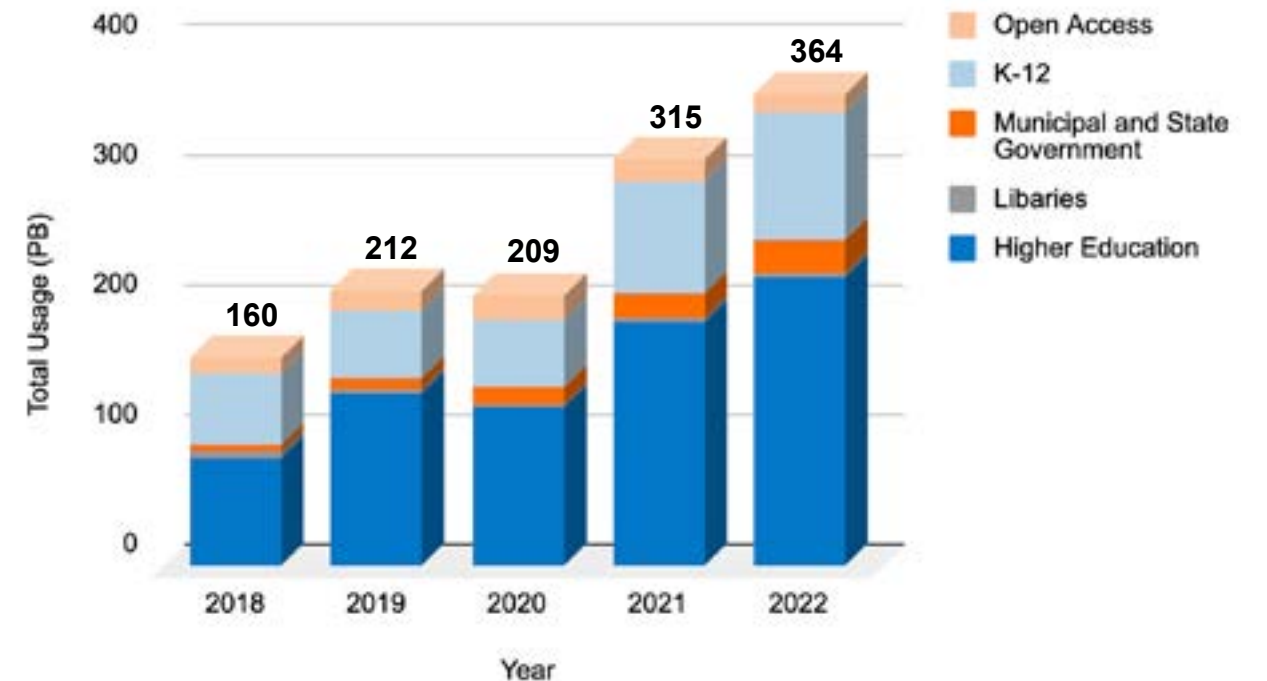
Service Level Upgrade

Indiana University's GlobalNOC has been an integral part of the CEN Network Operations Center (NOC) and support team for nearly 10 years. The GlobalNOC is a mission driven, non-profit, partner organization focused exclusively on Research and Education communities like CEN. Their partners include many of the best regional, national, and international network organizations in the world.

In early 2022, CEN expanded its services with GlobalNOC to provide supplemental Tier2 engineering support. This new arrangement will maintain service level objectives (SLO) targets to the CEN community while freeing up CEN engineers to perform more irregular work, projects, pursue training, and serve as subject matter expertise (SME) and Tier3 and escalation support.

2023 Outlook

In 2023, CEN will continue to provide a predictable and improved value proposition with increasing advances in technology products and offerings to our members. Technical staff will begin the execution of the NextGen CEN network, transforming the core CEN cyber infrastructure platform to deliver friction free broadband network access to all CEN members for many years to come. We will raise the bar on minimum access options, ensure speeds and feed continue to be layered for peak performance, add resilience, and build Connecticut's first N x 400 Gbps backbone network. I want to call out our diverse base of incredibly talented members, employees, and students for their stellar devotion to turning the boldest ideas into reality. We take our responsibility to our members, their customers, our employees and the wider community very seriously. We focus on enabling digital inclusion and transformation not just across our offerings, but also in the communities in which we work.

Acknowledgements

CEN Leadership would like to formally acknowledge and thank:

- The CEN staff for their dedication, creativity, and diligent work
- CEN Membership for their loyalty, creativity, feedback, and perseverance
- CEN Advisory Council members and their co-chairs, Karen Skudlarek, John Mercier, Matt Ross, and Jonathan Garbutt
- The Commission (CET) for their leadership and advocacy on behalf of the program
- Mark Raymond, CIO for the State of CT, and Michael Mundrane, VP & CIO for UConn, who serve as trusted advisors to the program
- Doug Casey for his thoughtfulness, leadership, and advocacy
- Governor's office and the legislature who are critical and integral to CEN's long-term success
- Dick LeFave for his volunteer efforts, advocacy, and cheerful support of CEN