

The California Research and Education Network

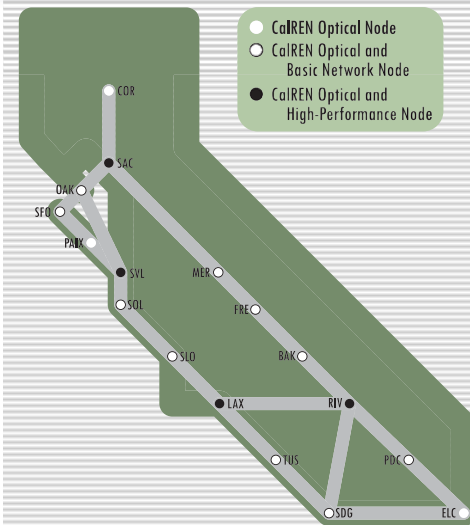
California's higher education and research communities leverage their networking resources under the umbrella of a nonprofit corporation known as CENIC, the Corporation for Education Network Initiatives in California, in order to obtain cost-effective, high-bandwidth networking to support their missions and answer the needs of their faculty, staff, and students. CENIC designs, implements, and operates CalREN, the California Research and Education Network, a high-bandwidth, high-capacity Internet network specially designed to meet the unique requirements of these communities, and to which the vast majority of the state's K-20 educational institutions are connected. In order to facilitate collaboration in education and research, CENIC also provides connectivity to non-California institutions and select industry research organizations with which CENIC Associates' researchers and educators are engaged.

CalREN consists of a CENIC-operated backbone to which schools and other institutions in all 58 of California's counties connect via leased circuits obtained from common carriers or CENIC or member owned fiber optic cable. In the map to the right, the CalREN backbone fiber network is shown in red, while blue circles indicate network connection points or circuit aggregation facilities.

CENIC is governed by its member institutions. These institutions also donate expertise through their participation in various committees designed to ensure that CENIC is managed effectively and efficiently, and to support the continued evolution of the network as technology advances.

Benefits of Joining the CENIC Community

- Highly reliable, high-speed Internet connectivity among schools and colleges in California.
- No commercial Internet costs when communicating with the educational institutions listed to the right and with hundreds of national educational institutions who belong to Internet2, National LambdaRail, and other organizations with whom CENIC has a network peering relationship.
- Connections to the National LambdaRail and Internet2 backbones, in southern California and Seattle.
- Significant cost savings on commodity/commercial ISP charges, realized as a result of peering arrangements with numerous commercial firms.
- A Network Operations Center (NOC) that understands educational institutions and is focused on meeting the needs of such organizations — ready to provide advanced network services 24 hours a day, 7 days a week, 365 days a year.
- A backbone designed in a "ring" architecture that eliminates single points of failure on the CalREN backbone to achieve high levels of reliability.
- The provision of consulting services to its members on the costs of installing fiber to their sites.
- Participation with other research and educational institutions on networking issues, via various CENIC-sponsored events.
- The provision of high-speed networking services to researchers when pursuing research opportunities such as those offered by the National Science Foundation (NSF) and the National Institutes of Health (NIH), which require access to advanced, high-speed networks like CalREN.
- National and global collaboration with other researchers and educators via highly reliable, uncongested Internet services through an optical backbone infrastructure resulting in the lowest latency network services to other major research and education institutions.



CENIC Charter Associates

California Community Colleges

112 California Community Colleges
The CCC Chancellor's Office

California Institute of Technology

Caltech Main Campus
Jet Propulsion Laboratory

California K-12 System

All 58 counties in California, served by a total of 72 node sites

California State University System

23 California State University campuses
The CSU Chancellor's Office

Stanford University

Stanford University Main Campus
Stanford Linear Accelerator Center
Stanford Medical Center

University of California System

10 University of California campuses
The UC Office of the President
Lawrence Berkeley National Laboratory

University of Southern California

USC Main Campus (University Park)
Health Sciences Campus
Information Sciences Institute

CalREN Associates

Arizona State University
Carnegie-Mellon University West
Chapman University
NASA Ames Research Center
Naval Postgraduate School
Nevada System of Higher Education
Pepperdine University
University of Arizona
University of San Diego
University of San Francisco
University of Pennsylvania, Wharton West



Internet2 • www.internet2.edu

Internet2 is a consortium of more than 200 universities and other institutions founded to develop the next-generation Internet, or Internet2.

National LambdaRail • www.nlr.net

National LambdaRail (NLR) is advancing the research, clinical, and educational goals of members and other institutions by establishing and maintaining a unique nationwide optical network infrastructure that is owned and controlled by the U.S. research community.

Corporación Universitaria para el Desarrollo de Internet (CUDI) • www.cudi.edu.mx

The Corporación Universitaria para el Desarrollo de Internet (CUDI) is a Mexican nonprofit corporation composed of members from the public and private sectors. CUDI funds an advanced, high-speed network in Mexico and has agreements with a number of carriers that provide high-performance applications to higher education and research institutions. A high-speed link between CalREN and CUDI was established in 2000, upgraded to a 1 G link in 2005 with funding from the National Science Foundation.

EDUCAUSE • www.educause.edu

EDUCAUSE is the nation's leading professional organization for information technology in higher education. CENIC is a member of the EDUCAUSE Net@EDU program, which formed the Broadband Pricing Group (BPG) with CENIC as an active participant.

Association of Pacific Rim Universities • www.apru.org

The Association of Pacific Rim Universities (APRU) was founded with the goal of stimulating cooperation throughout the fields of teaching and research on issues of importance to the Pacific Rim community.

Internet Educational Equal Access Foundation • www.ieeaf.org

The Internet Educational Equal Access Foundation (IEEAF) is a public-private partnership whose goal is to obtain donations of unused communications and networking assets and international bandwidth to enable global collaboration in research and education. CENIC's participation resulted from a Memorandum of Understanding between CENIC and Geographic Network Affiliates.

CENIC also hosts periodic conferences in locations around California where researchers and educators come together for presentations, panels, and professional networking opportunities. Each year at its annual conference, CENIC presents its **Innovations in Networking Awards** to exemplary innovations that leverage the California Research & Education Network (CalREN) and have the potential to improve the way instruction and research is conducted. Awards are made in the categories of education, high-performance research, Gigabit and broadband applications, and network-centered experimental research.

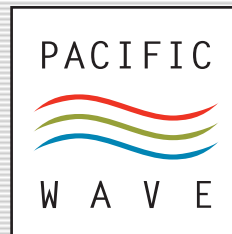
How Do I Connect to CalREN?

To learn how your institution can become a CENIC Associate, please contact CENIC at (714) 220-3454 or write to info@cenic.org. More detailed information can also be found on our website at www.cenic.org.

Global Possibilities

CENIC Enables Worldwide Collaboration

Pacific Wave (www.pacificwave.net) is a state-of-the-art international peering exchange facility designed to serve research and education networks throughout the Pacific Rim and the world. A joint project between CENIC and the Pacific Northwest Gigapop in collaboration with the University of Washington, Pacific Wave creates a new peering paradigm by removing the geographical barriers of traditional peering facilities. It enables any US or international network to connect at any of three locations along the US Pacific coast, as well as offers the option to peer with any other Pacific Wave participant, regardless of physical location.



By presenting a seamless, unified, international peering exchange facility at strategic Pacific coast locations, the Pacific Wave peering facility is a magnet for research and education partners throughout Canada, Mexico, South America, and the Pacific Rim.

Participant networks include:

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| Australia:
AARNet | Qatar:
Qatar Foundation | United States:
CENIC
DREN
ESnet
Google
Internet2
Los Nettos
Microsoft Corporation
NREN
National LambdaRail
Pacific Northwest
Gigapop
TransPAC2
Ultralight |
| Canada:
CANARIE | Mexico:
CUDI | |
| Central/South America:
redCLARA | Taiwan:
TWAREN | |
| Japan:
GEMnet
SINET
T-LEX
Softbank Telecom | Thailand:
Uninet/ThaiREN | |
| Korea:
KREONet2/KOREN | Singapore:
NUS-Gigapop | |



Via its connections to the NLR and Internet2 backbones and participation in the Global Lambda Integrated Facility (GLIF), CENIC enables collaboration with researchers and educators in Europe and the Western Hemisphere.