CENIC
CONNECTING CALIFORNIA

MEMBER SERVICES

CENIC provides cost-effective, high-bandwidth networking to support our **community members** — responding to the needs of their faculties, staff, students, and associated research groups — and to facilitate excellence in scientific, education, government, and private sector collaboration and innovation.

CENIC provides a full suite of network services over the **California Research and Education Network (CalREN)**, a high-capacity network with more than 12,000 miles of optical fiber.

Digital California (DC) Service

The Digital California service provides routed access to CalREN members, commodity peers, on-net cache resources, commercial ISPs, and R&E transit.

Technical Features & Benefits:

- 800 Gbps network backbone optimized for performance. Capable of handling the most demanding traffic patterns, minimizing dropped packets, jitter, and other underperformance characteristics of commodity networks.
- High-performance, low-latency direct access to cloud providers such as AWS, Google, and Azure, partner networks including Internet2, Pacific Wave, and Western Regional Network, and other online services such as Netflix, Twitch, and Akamai.
- Access to CENIC's extensive commodity peering infrastructure with over 8 Tbps of capacity in Los Angeles and San Jose.
- Highly reliable and cost-effective member connections.
- Direct access at 18 hub sites and various backhaul options to reach additional locations.
- Supports IPv4/IPv6 dual-stack and jumbo frames.
- Supports the full BGP internet routing table and static routing on member connections.

- Access to CENIC's DNS resolvers.
- Highly reliable connections to other research and education entities.
- Member connection speed options from 1 Gbps to 800 Gbps:
    - 800 Gbps at Los Angeles, Sunnyvale, and San Diego
    - 400 Gbps at all 800G locations plus Riverside, Tustin, Sacramento, and Emeryville
    - From 1 Gbps to 100 Gbps standard at all CENIC Layer 3 locations

Add-On Services:

AT&T Hosted Voice Solution (HVS)

CENIC has partnered with AT&T to provide the AT&T Hosted Voice-over-IP Solution (HVS) to our community. CENIC ensures that VoIP traffic is taking the shortest path from campus to AT&T by leveraging two direct peering links with AT&T while honoring Quality of Service markings set by campus.

AT&T HVS includes two types of services for CENIC associates:

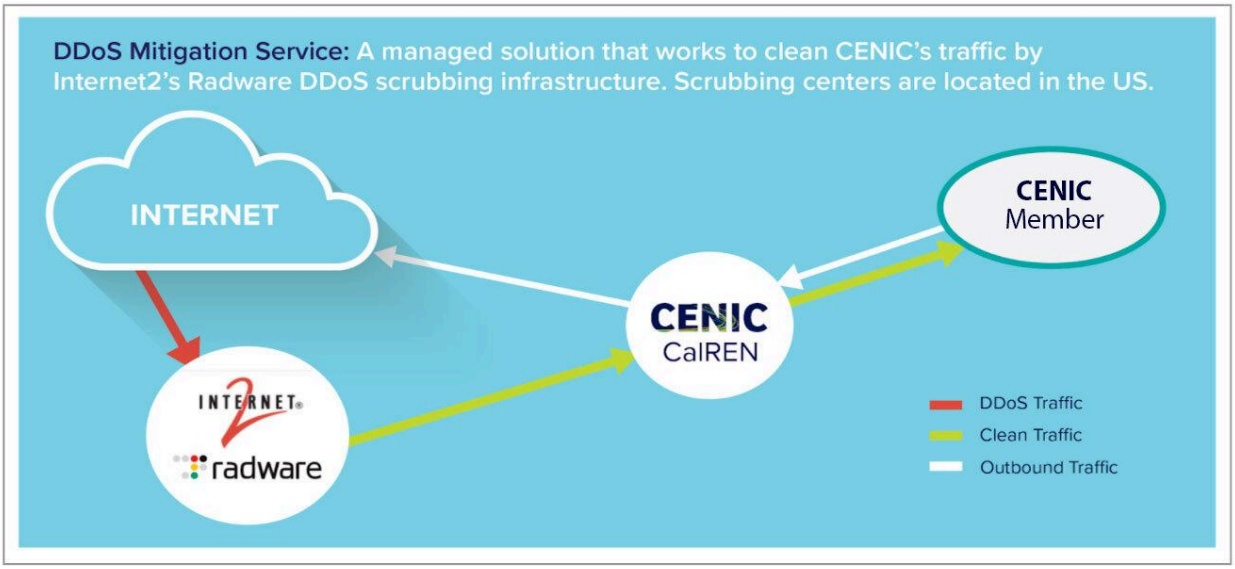
1. **SIP trunking:** A service that delivers integrated access for IP PBX, TDM PBX, or Key System environments, providing potential total cost benefits through the consolidation of voice and data—one provider, single transport, and management options.
2. **End station:** All phones connect to a PBX in the cloud, instead of connecting to a local PBX, and having that PBX connect to the cloud as with SIP trunking.

Additionally, AT&T HVS services consist of:

- **Server-side equipment:** Supported by AT&T's partner Mitel, this equipment is located in Dallas, TX and Atlanta, GA and consists of two redundant BroadSoft softswitches, which accept calls and route them appropriately using the SIP protocol.
- **Client-side equipment:** CENIC refers our Associates to work directly with Mitel as needed, as this equipment is located locally onsite and includes SIP phones and session border controllers.
- **Network connectivity:** Supported by CENIC up to CENIC's network boundary or demarcation point.

Internet2 DDoS Mitigation Service (DMS)

An on-demand, cloud-based DDoS Mitigation Service (DMS) is available to CENIC members. Two service options are available to CENIC members: The *self-service solution* directly interacts with Radware for mitigation, while members who opt for the *managed-service solution* use CENIC's expertise and advanced tools to detect and handle mitigation with Radware on their behalf. Additional information is available at [CENIC's DDoS Mitigation Services page.]



High-Performance Research (HPR) Service

The High-Performance Research (HPR) service provides routed access to CalREN research and education participants, including other R&E transit customers, Internet2 R&E, ESnet, Pacific Wave participants, and DC members.

Technical Features & Benefits:

- 800 Gbps network backbone optimized for performance. Capable of handling the most demanding traffic patterns, minimizing dropped packets, jitter, and other underperformance characteristics of commodity networks.
- High-performance, low-latency, direct access to regional, national, and international research and education networks.
- Optimized for R&E traffic and data-intensive research applications.

- Direct access at six hub sites and various backhaul options to reach additional locations.
- Supports IPv4/IPv6 dual-stack and jumbo frames.
- Member connection speed options from 1 Gbps to 800 Gbps:
    - 800 Gbps at Los Angeles, Sunnyvale, and San Diego
    - 400 Gbps at all 800 Gbps locations plus Riverside, Tustin, Sacramento, and Emeryville
    - From 1 Gbps to 100 Gbps standard at all CENIC Layer 3 locations

Add-On Services:

Large Hadron Collider Open Network Environment (LHCONE)

The Large Hadron Collider Open Network Environment allows CENIC HPR members to connect to private LHC research sites and a global infrastructure for high-energy physics data analysis. The LHCONE is a dedicated network architecture inter-connecting participating high-energy physics sites and allowing those sites to pool their computing resources for more efficient distribution, storage, processing and analysis of HEP data. An acceptable use policy ensures appropriate and secure scientific use of the overlay network and protects connected sites. See LHCONE's TWiki for more information and eligibility requirements for becoming an LHCONE site.

Layer 2 Virtual Private Network Service - E-LINE

E-LINE is a private and seamless point-to-point Layer 2 service providing transparent connectivity between CENIC members and to cloud providers.

Technical Features & Benefits:

- Layer 2 Ethernet over private MPLS backbone.
- Simple and efficient way to extend a LAN enterprise network.
- Support for VLAN-based and port-based options.
- Fast provisioning.
- Fully transparent to pass control packets.
- Dynamic and explicit-path options (dynamic is recommended).
- Optional multi-chassis LAG support.

Layer 2 Virtual Private Network Service - E-LAN

E-LAN is a private and seamless point-to-point or point-to-multipoint Layer 2 service providing transparent connectivity between CENIC members and to cloud providers.

E-LAN Technical Features & Benefits:

- Layer 2 Ethernet over private MPLS backbone.
- Simple and efficient way to extend a LAN Enterprise network.
- Support for VLAN-based and port-based options.
- Fast provisioning.
- Fully transparent to pass control packets.
- Optional multi-chassis LAG support.

Layer 3 Virtual Private Network Service - IP VPN

IP VPN is a private and unencrypted point-to-multipoint Layer 3 service providing a separate virtual network between CENIC members and to cloud providers.

Technical Features & Benefits:

- Completely private network separate from your public internet connection.
- Support for point-to-point and point-to-multipoint options.
- Full control over IP prefix propagation.
- Layer 3 Ethernet service over private MPLS backbone.

Optical Services

Optical Point-to-Point Circuit

A dedicated 10 Gbps or 100 Gbps point-to-point optical circuit, provisioned over a customer-specific metro segment and/or a CENIC optical backbone.

Technical Features & Benefits:

- Dedicated and private Layer 1 connections.
- Support for LR4 and SR4 client handoffs.
- Available bandwidth options: 10 Gbps and 100 Gbps.

Optical Spectrum Service

Optical Spectrum Service is a dedicated point-to-point wavelength allocated and provisioned over a customer-specific metro segment or a CalREN optical backbone. This service must be used by a CENIC member in conjunction with their own qualifying customer-managed pair of transponders or DWDM optics.

Technical Features & Benefits:

- Dedicated and private Layer 1 connections.
- Service allocations in up to 150 GHz increments
- Any higher-level protocols (Ethernet, SONET, etc) are supported
- Allows CENIC members to leverage the CalREN optical backbone and customer-specific metro segments while managing their own coherent transponders or DWDM optics.

Other Member Services

CENIC RPI - RPI service provides CENIC members with a dedicated private connection to external peers at select major peering points.

Technical Features & Benefits:

- Secure and dedicated connections.
- Support for 1, 10, and 100 Gbps.
- Leverages current investment in CENIC infrastructure.
- Allows CENIC members to connect directly to any commercial providers at major peering peering points.
- Meant to be combined with Layer 2 and Layer 3 VPN services.

Hosted CENIC Cloud Connect Services

CENIC has partnered with AWS and Oracle to establish fast and resilient interconnects in Los Angeles and San Jose to support the AWS Hosted Direct Connect circuits and Oracle Hosted FastConnect circuits. This allows our members to establish geographically diverse AWS Hosted Direct Connect and Oracle Hosted FastConnect in California circuits, which were previously unavailable.

Technical Features & Benefits:

- Shared and geographically diverse connections
- Support for up to 10 Gbps per Hosted connection
- Cost-efficient
- Meant to be combined with Layer 2 VPN Services to extend the service to the campus network

Experimental Service (XD)

Experimental Service covers experimental and developmental connections that leverage bleeding-edge technologies for network and other research projects.

Internet2 Services

Internet2 AL2S

Internet2's Layer 2 Service delivers a strategic advantage for leaders in research and education by providing effective and efficient point-to-point Ethernet technology.

AL2S allows users to create their own VLANs on the Internet2 AL2S backbone. Static or Dynamic, point-to-point or multipoint, intra-domain or inter-domain, AL2S puts control of the backbone VLANs into the users' hands for the creation of purpose-built private VLANs using infrastructure already in place.

Internet2 Cloud Connect

Extend your data center to the cloud with a dedicated network connection to AWS Direct Connect, GCP Partner Interconnect, and/or Microsoft Azure ExpressRoute using the combination of your regional network and the Internet2 high-speed national network. Four geographically diverse connection points ensure the best performance.

The Cloud Connect service provides institutions with a Cloud Connect Portal for researchers and campus IT staff to deploy shared direct connection infrastructure on their own with the ability to support private direct connections to AWS Direct Connect, Google Cloud Partner Interconnect, and Microsoft Azure ExpressRoute.

Internet2 RPI

RPI provides a low-cost option to regional networks that they can use for themselves or extend to their members. RPI allows dedicated, private, regional-controlled access to any vendor-provided services offered at one or more of the peering exchanges. This could serve as a primary connection or redundant connection to the service.

Internet2 InCommon & NET+ Services

Eduroam

Provide your faculty, students, and staff with seamless access to global roaming Wi-Fi. Eduroam users can open their laptops and be connected (at participating organizations) on any eduroam network worldwide.

DocuSign

Ensure your institution's faculty, staff, and students can easily review and sign documents electronically. Internet2 NET+ collaboration with DocuSign provides the tools to eliminate paper and save time by streamlining and automating document signing and sending processes. Unlimited envelopes are included in the enterprise-wide subscription, which is a unique benefit of the NET+ program.

LastPass

LastPass is a password manager and single sign-on solution that makes it easy to log in to every web account while following best practices for password security. Through the custom-developed, affordable Internet2 NET+ LastPass packages, colleges and universities can offer school-sponsored password management to every person on campus.

For more information on Internet2 services:
https://internet2.edu/services/service-catalog/
