CENIC
Connecting California

New Mexico
Legislative Education Study Committee

Louis Fox, President & CEO
September 23, 2020

CENIC is a 501(c)(3) with the mission to advance education and research statewide by providing the world-class network essential for innovation, collaboration, and economic growth.

- **Charter Associates**:

- California K-12 System
- California Community Colleges
- California State University System
- Stanford, Caltech, USC
- University of California
- California Public Libraries
- Naval Postgraduate School

CENIC
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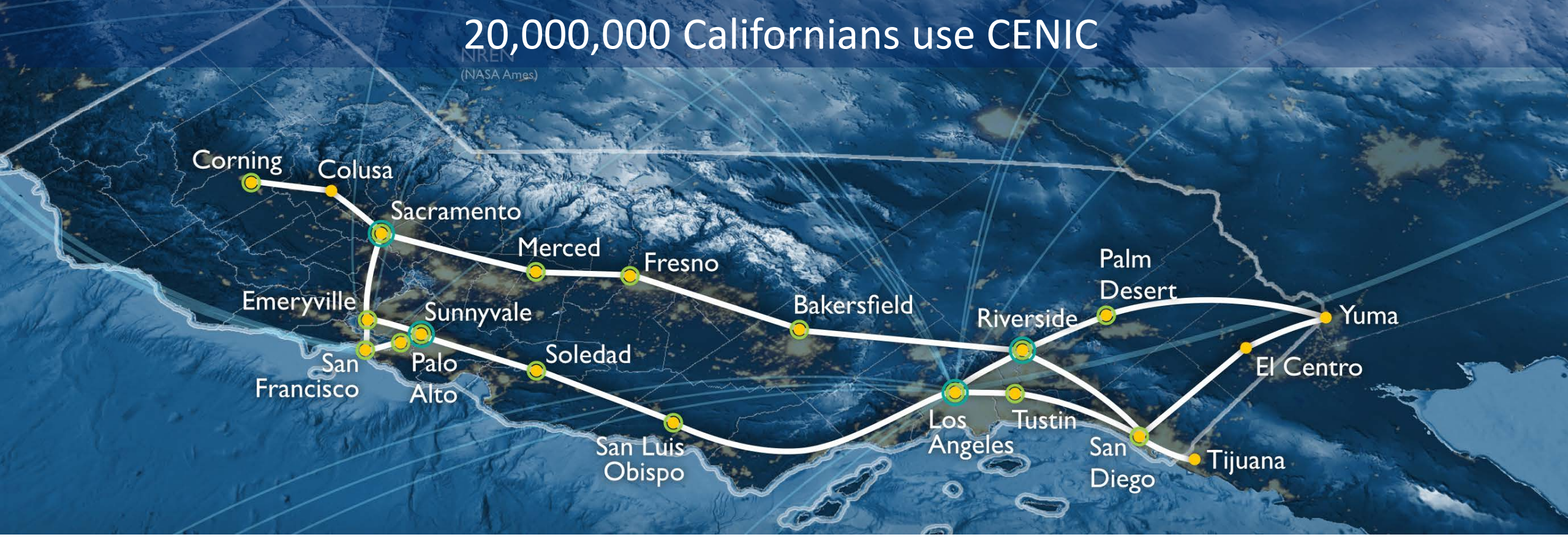
20,000,000 Californians use CENIC



- **8,000+** miles of long haul optical fiber In California
- **Members in all 58 counties** connect via fiber-optic cable or leased circuits from telecom carriers
- **Over 12,000 sites** connect to CENIC
- **A 501c3 non-profit** governed by it's members
- Collaborates with 800-1000 **private sector partners and contributes > $100,000,000** to the CA Economy
- **23 years** of connecting California

Responses to Questions from the NM LESC
1. History

- Chartered in 1997 as a 501c3 public benefit corporation
- Initiative was led by UC Office of the President and original charter members were UC, CSU, Stanford, Caltech, and USC
- Prior to 1987, and when the NSFNET had begun its process of privatization, California's large university systems – UC and CSU – had their own networks
- The creation of CENIC led to a consolidation of these networks into a single network the California Research and Education Network (CalREN), owned and operated by CENIC
- California's 114 Community Colleges joined CENIC soon thereafter, followed by public K12 (in the early 2000s) and public libraries (in 2014)
- CENIC has many other non-governing members – tribal networks, health care, scientific and cultural organizations, etc.
- CENIC also partners with other states in research networking, including WA, OR, HI, AK, CO, WY, and NM.
- Mission: leading-edge networks and services for research; broadband equity for all segments/constituents

Responses to Questions from the NM LESC
2. Funding

- Funding for the network came from CENIC's initial charter members
- CENIC was the first regional network to purchase IRUs (according to Level 3) and to light and manage it's own backbone network
- Current core funding:
  - Each "segment" – K12, CCCs, CSU, UC, Public Libraries – pays a common annual backbone fee through an aggregator (UCOP, CSU Chancellor's Office, CA Dept. of Education, CCC Chancellor's Office, CA State Library) with whom CENIC has a Master Service Agreement. Segments vary in how they budget for CENIC.
  - Other fees include a "Circuit Deployment Fee" for last mile connections (purchased from myriad providers); a "Pass Through Administration Fee; " and and a 3% annual membership increase (tied to CPI)
  - CENIC works closely with many private sector partners on a variety of infrastructure initiatives, with funding coming from state and federal competitive programs and subsidies

Responses to Questions from the NM LESC
3. Relationships and Partnerships

- CENIC works with nearly every telecommunications provider in California on last mile connections to schools, libraries, community colleges, health care organizations, and remote research sites (e.g., UC Agriculture and Natural Resources)
- CENIC works with fiber companies to procure dark fiber connections to research institutions and to extend and augment both metro and rural backbone components
- A critical relationship: over 100 ”settlement free peers” with whom CENIC exchanges traffic – commercial cloud and content providers; other telecommunications networks; regional, national, and international R&E networks
- Through the California Public Utilities Commission’s Advanced Services Fund, CENIC partners with private sector partners in building fiber infrastructure to communities with little or no access to broadband infrastructure; the CPUC is a key partner
- Other key partners: 19 community broadband consortia, the California Emerging Technology Fund, the California Broadband Council, numerous Tribal Nations, our seven university medical centers

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California Research and Education Network (CalREN)

Broadband Equity: Libraries, Schools, and Tribal Nations

- **Library Initiative:** Currently circa **1000 public libraries** have been connected in this multi-year initiative; an additional 200 will be connected. Libraries are now a Charter Associate of CENIC and part of CENIC's core membership and governance.

- **Broadband Improvement Grant Program: Over 450 schools** in some of the least well-connected rural region of the state now have enhanced connections, most at 1Gbps (or higher). To date: $76M 2016-19, and $7.5M for 2020. There are circa **10,000 connected schools**. There are complementary projects using wireless (LTE, CBRS, Fixed Wireless) to connect students at home to school districts.

- **Tribal Digital Village:** With support from Google and AT&T, **20 tribes** in California – schools, libraries, cultural organizations, health care, and tribal government – are now connected to CENIC and, from CENIC, to Pacific Wave. This was a testbed project to scale up to 100s of indigenous communities; additional projects are in process.

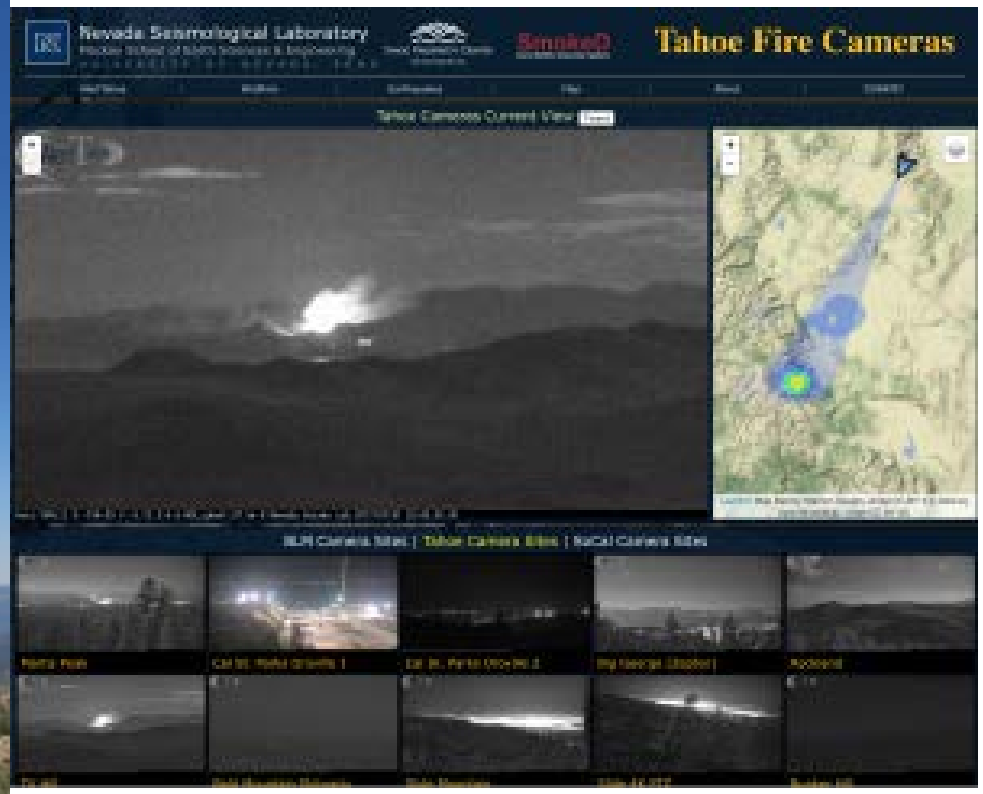
Broadband Equity:
Health Care, Government, and Public Safety

- **Health Care:** (1) Initiative with UC Davis Center for Health and Technology, enhancing connectivity to telehealth partners at inpatient hospitals, outpatient clinics, school-based medical therapy units; (2) Electronic Health Platform – using CalREN connections and peering for EHR/EMR, diagnostic services, insurance and billing, and back office applications.

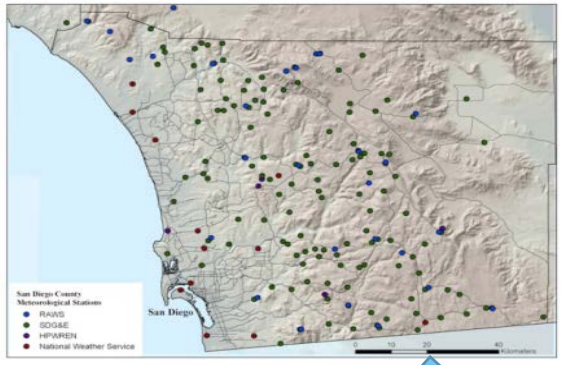
- **Government:** (1) LA, San Francisco, Sacramento network peering for access to big data for research; (2) Peering with the State of California's network for CENIC members o access the state's multi-tenant data center and cloud; and (3) prospective municipal fiber-sharing agreements.

- **Public Safety:** UCSD High Performance Wireless Network (HPWRN); WIFIRE; AlertWildfire, and GeoLinks proposed statewide integrated camera/sensor networks for "CALINKS" (next slides)

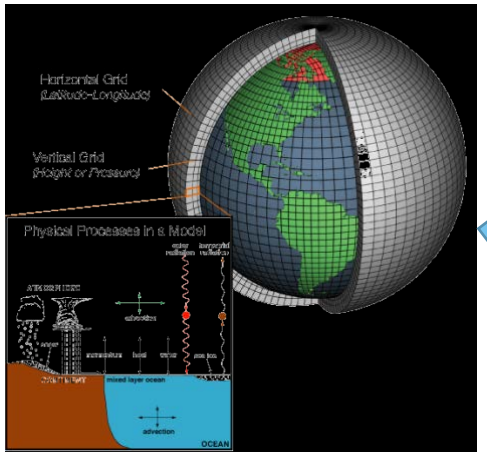
HPWREN, AlertWildfire, WIFIRE & CENIC


Nevada Seismological Laboratory
Tahoe Fire Cameras

Fire Weather Monitoring and Prediction in WIFIRE

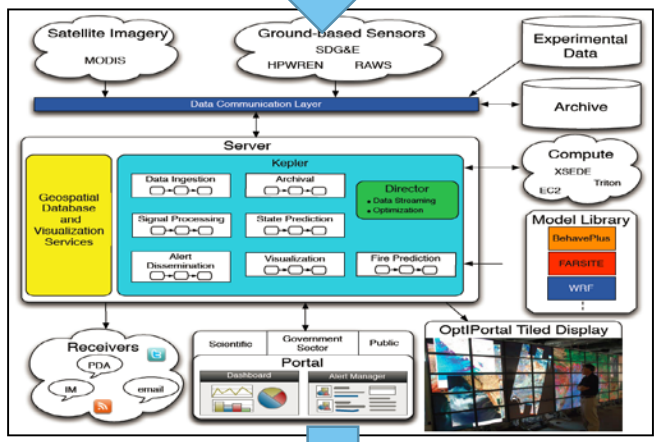


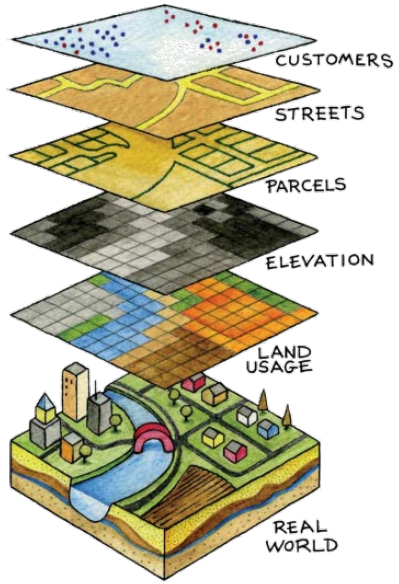
Real-time sensors



Weather forecast

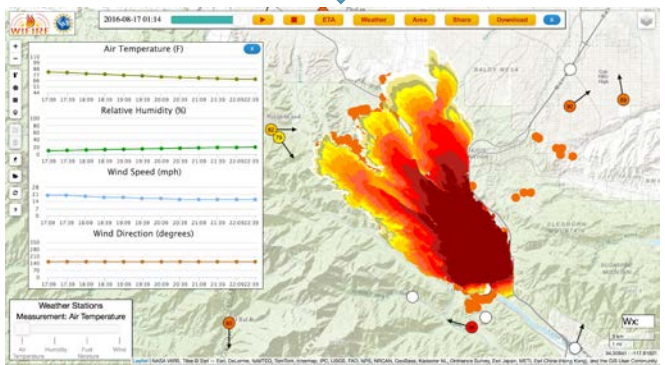
Fire perimeter





Landscape data

Monitoring & fire mapping



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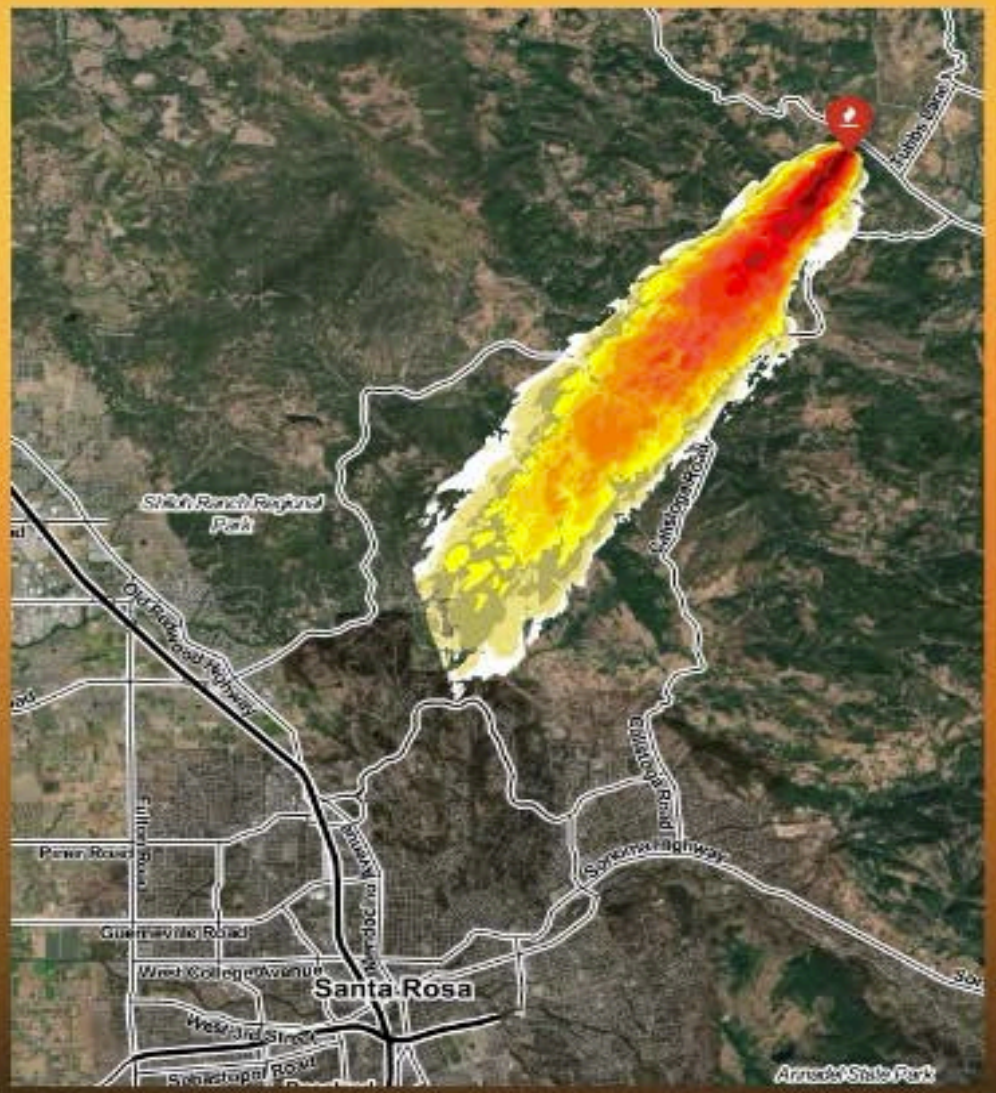
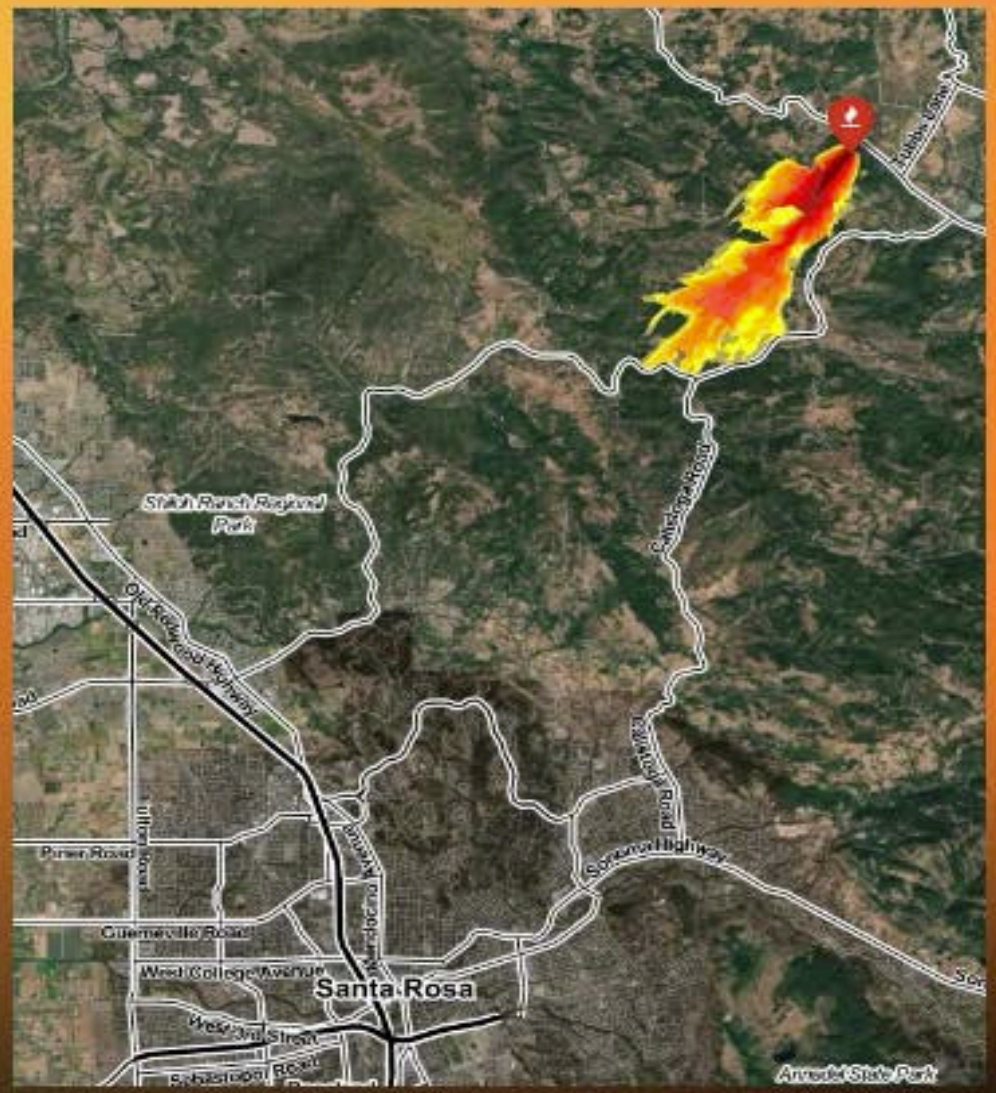
TUBBS FIRE, SONOMA COUNTY, 2017

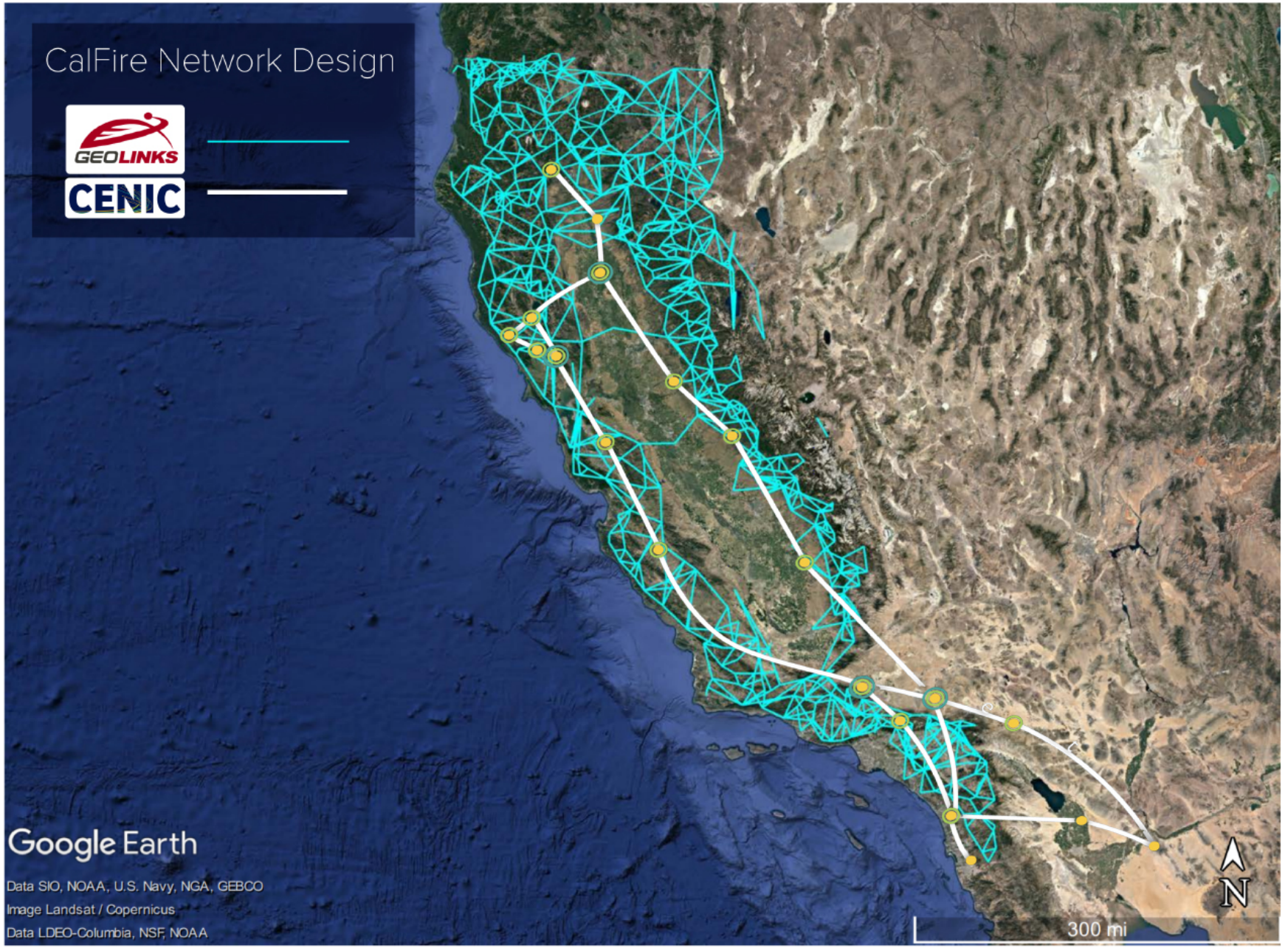


LATE DECTECTION AND PUBLIC NOTICE:
20 LIVES, 5000+ STRUCTURES LOST



WITH EARLY DETECTION IN PLACE:
NO LIVES LOST, 526 STRUCTURES LOST

Proposed CALinks Network Utilizing GeoLinks' Fixed Wireless and CENIC's Optical Fiber Backhaul.



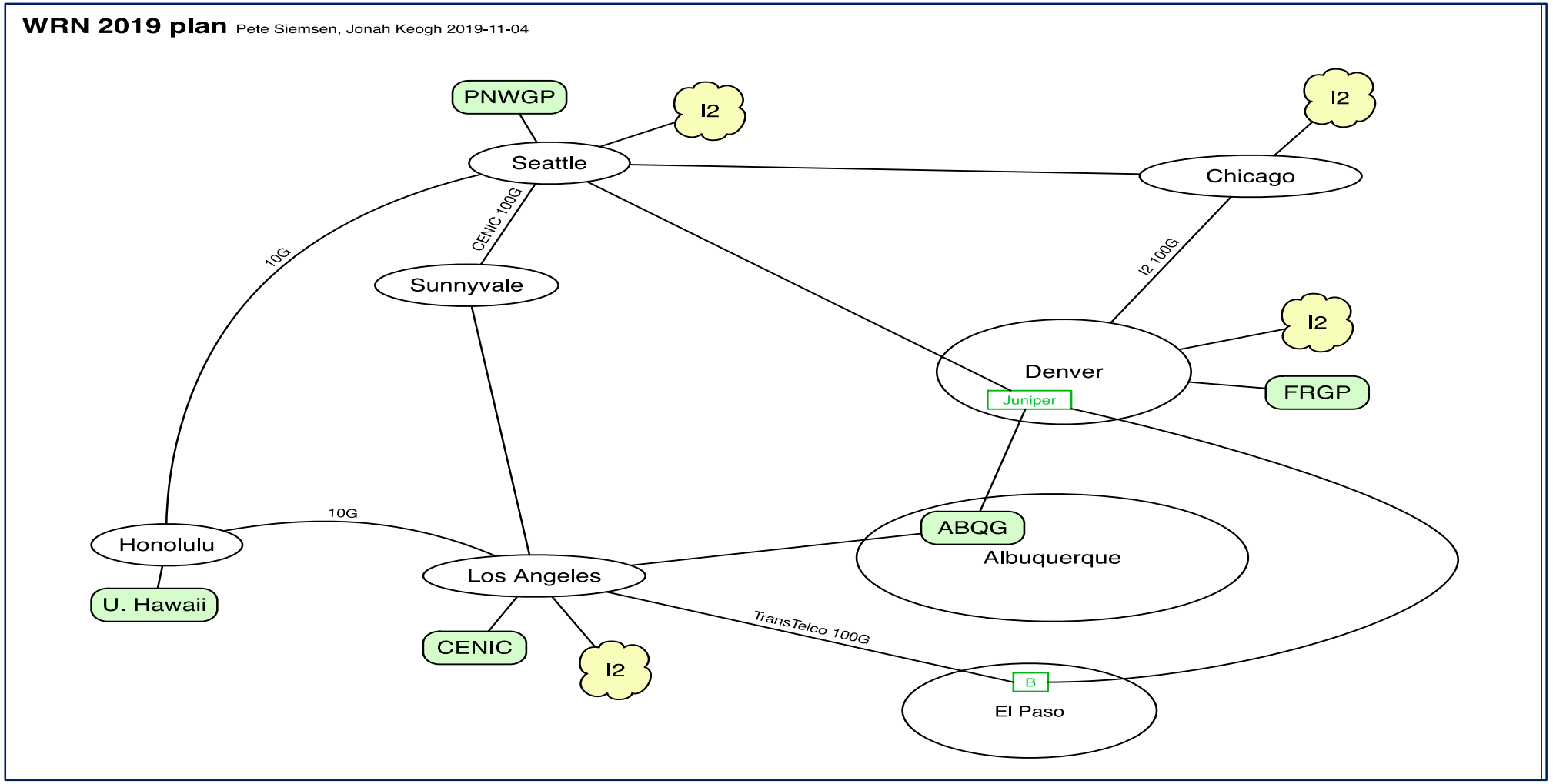
RECAP: What Technologies Can Broadband Support?

- Fire Cameras both stationary and those equipped for AI/Machine Learning and early detection capabilities
- PTZ Thermal Imaging Cameras for better visibility in heavy smoke conditions
- Moisture sensors for fire modeling and risk analysis
- Weather stations for modeling and risk analysis with air quality sensors
- Two-way radio systems (for use by firefighters and other emergency personnel).
- Deployable WiFi hotspots
- Wireless uplinks for quadcopter drones, manned aircraft, and large UAV's
- Internet/private network access to all rural, unconnected, or under connected fire stations or CAL FIRE destination

RECAP: How can these technologies aid in early detection and disaster recovery?

- Spot fire ignition points and confirm facts following 9-1-1 calls
- Have “eyes” and access to real-time data and video streams allowing emergency personnel to make informed and appropriate dispatch decisions about which resources are best for any given situation
- Support tracking of all field assets (trucks, personnel etc.) via software systems such as Technosylva, iCode, and others
- Transfer data and intelligence to any location where sophisticated software coupled with human evaluation can be used to determine rate and direction of fire spread
- Enhance the state’s communication capabilities enabling:
  - Firefighters in remote areas to communicate on scene
  - Increased multi-agency and multi-location collaboration
  - Timely public notification
  - Real-time high definition video feeds and fire modeling via handheld devices in the field

Western Regional Network



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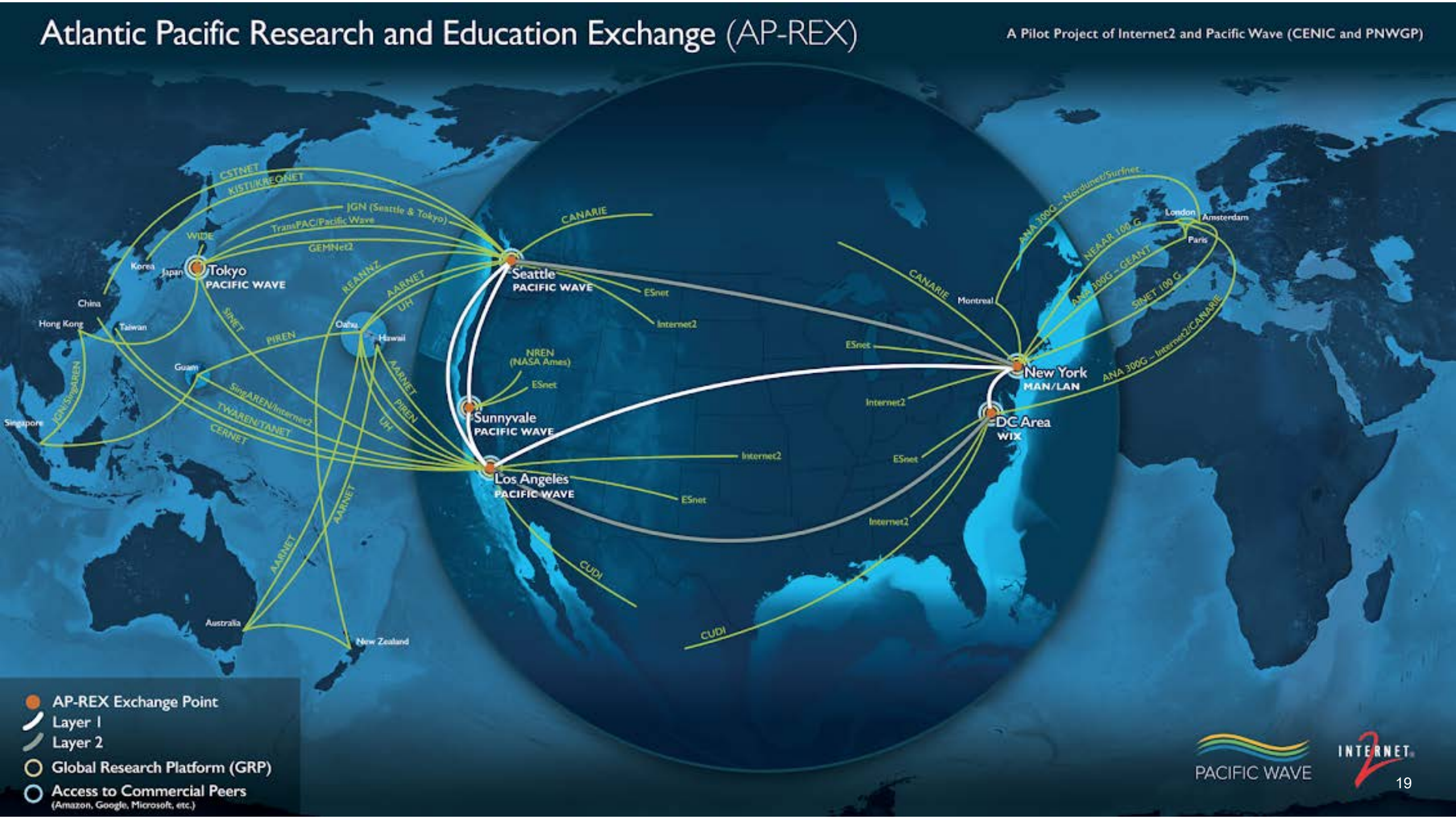
PACIFIC WAVE
NATIONAL & INTERNATIONAL PEERING EXCHANGE
Pacific Wave is a project of CENIC & PNWGP
CSTNET
KISTI/KREONET
JGN (Seattle & Tokyo)
TransPAC/Pacific Wave
GEMNet2
WIDE
Korea
Japan
China
Taiwan
Hong Kong
SINET
JGN/SingAREN
Guam
SingAREN/Internet2
PIREN
CERNET
Singapore
AARNET
UH
REANNZ
TWAREN/TANET
PIREN
UH
AARNET
Oahu
Hawaii
AARNET
Australia
REANNZ
New Zealand
PACIFIC WAVE BACKBONE
CANARIE
PNWGP
Vancouver
Seattle
ESnet
Internet2
DREN
CENIC
NREN (NASA Ames)
ESnet
San Francisco Bay Area
Los Nettos
CENIC
DREN
Los Angeles
Tijuana
FRGP
Denver
UltraLight (Caltech)
Albuquerque
ABQG
El Paso
Transtelco
CUDI
Mexico
StarLight
Chicago
Kansas City
Tulsa
Internet2
Dallas
Houston
Nordic Countries
United Kingdom
Netherlands
Europe
CERN
JANET
SURFnet
GEANT
ESnet
SPEEDS/POPS
10 Gbps
100 Gbps
CURRENT
FUTURE
CEV: 03-12-19-01
Pacific Wave POPs
Pacific Research Platform (PRP)
PRP Science DMZ Fabric
Software Defined Network
Commercial Peering Points
(Amazon, Google, & Microsoft)
WESTERN REGIONAL NETWORK
States served by WRN members:
- ABQG: New Mexico GigaPoP
- CENIC: California
- FRGP: Colorado and Wyoming
- PNWGP: Washington, Montana, Alaska, Oregon & Idaho
- UH: Hawaii
With support from the National Science Foundation


Atlantic Pacific Research and Education Exchange (AP-REX)
A Pilot Project of Internet2 and Pacific Wave (CENIC and PNWGP)
CSTNET
KISTI/KREONET
JGN (Seattle & Tokyo)
TransPAC/Pacific Wave
GEMNet2
WIDE
Korea
Japan
Tokyo
PACIFIC WAVE
China
Hong Kong
Taiwan
SINET
PIREN
REANNZ
AARNET
UH
Oahu
Hawaii
Guam
SingAREN/Internet2
TWAREN/TANET
CERNET
JGN/SingAREN
Singapore
Australia
New Zealand
CANARIE
Seattle
PACIFIC WAVE
ESnet
Internet2
NREN
(NASA Ames)
Sunnyvale
PACIFIC WAVE
Los Angeles
PACIFIC WAVE
CUDI
Montreal
ANA 300G – Nordunet/Surfnet
London
Amsterdam
Paris
NEAAR 100 G
ANA 300G – GEANT
SINET 100 G
ANA 300G – Internet2/CANARIE
New York
MAN/LAN
DC Area
WIX
AP-REX Exchange Point
Layer 1
Layer 2
Global Research Platform (GRP)
Access to Commercial Peers
(Amazon, Google, Microsoft, etc.)
PACIFIC WAVE
INTERNET2

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THANK YOU

www.cenic.org

Louis Fox
President & CEO, CENIC
lfox@cenic.org
614.220.3455