“From The Creation of CENIC to The CENIC-AI Resource”

CENIC Annual Retreat

July 15, 2025

Dr. Larry Smarr

Founding Director Emeritus, California Institute for Telecommunications and Information Technology;

Distinguished Professor Emeritus, Dept. of Computer Science and Engineering

Jacobs School of Engineering, UC San Diego

Website: https://lsmarr.net/

NRP NATIONAL RESEARCH PLATFORM

CENICAIR

CENIC ARTIFICIAL INTELLIGENCE RESOURCES

NRP Nautilus

CENIC Has Evolved Over 25 Years
Driven by NSF Grants, New Campus Tech, and Member Collaborations

NRP NATIONAL RESEARCH PLATFORM

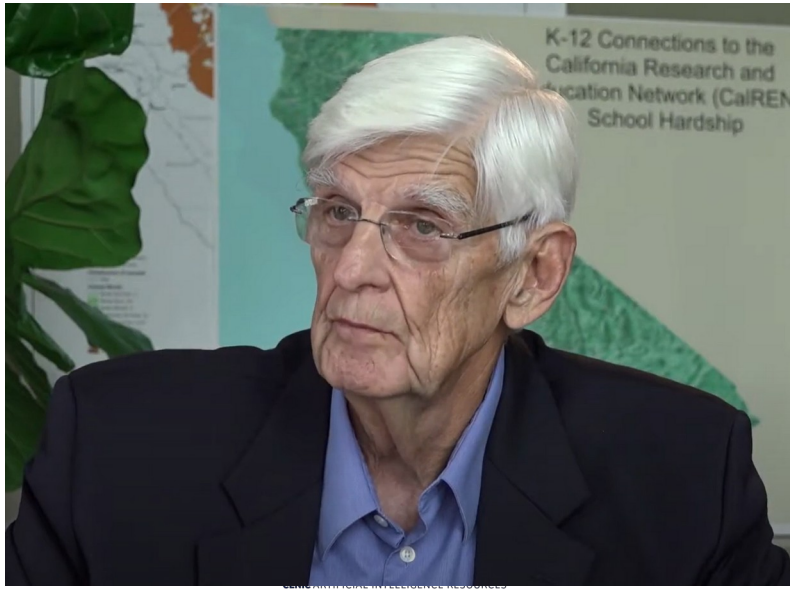
CENIC AIR
CENIC ARTIFICIAL INTELLIGENCE RESOURCES

NRP Nautilus

“Let’s Try to Go After Some of These High Performance Computing Grants
That NSF is Going to Award
and That is How CENIC Got Its Beginning”
-Tom West, CENIC CEO (1999 to 2004)

CENIC
20 YEARS OF CONNECTING CALIFORNIA

www.youtube.com/watch?v=AH5chxLb-VQ

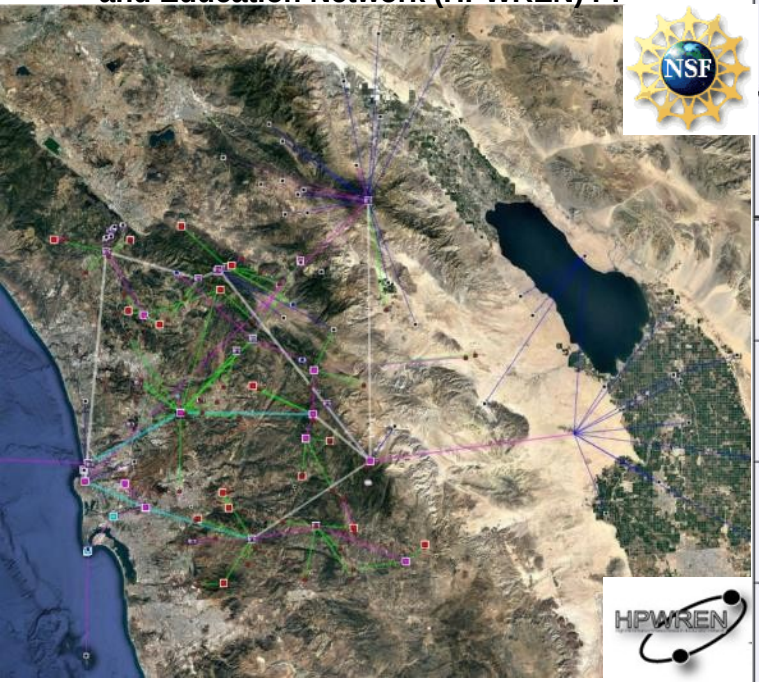


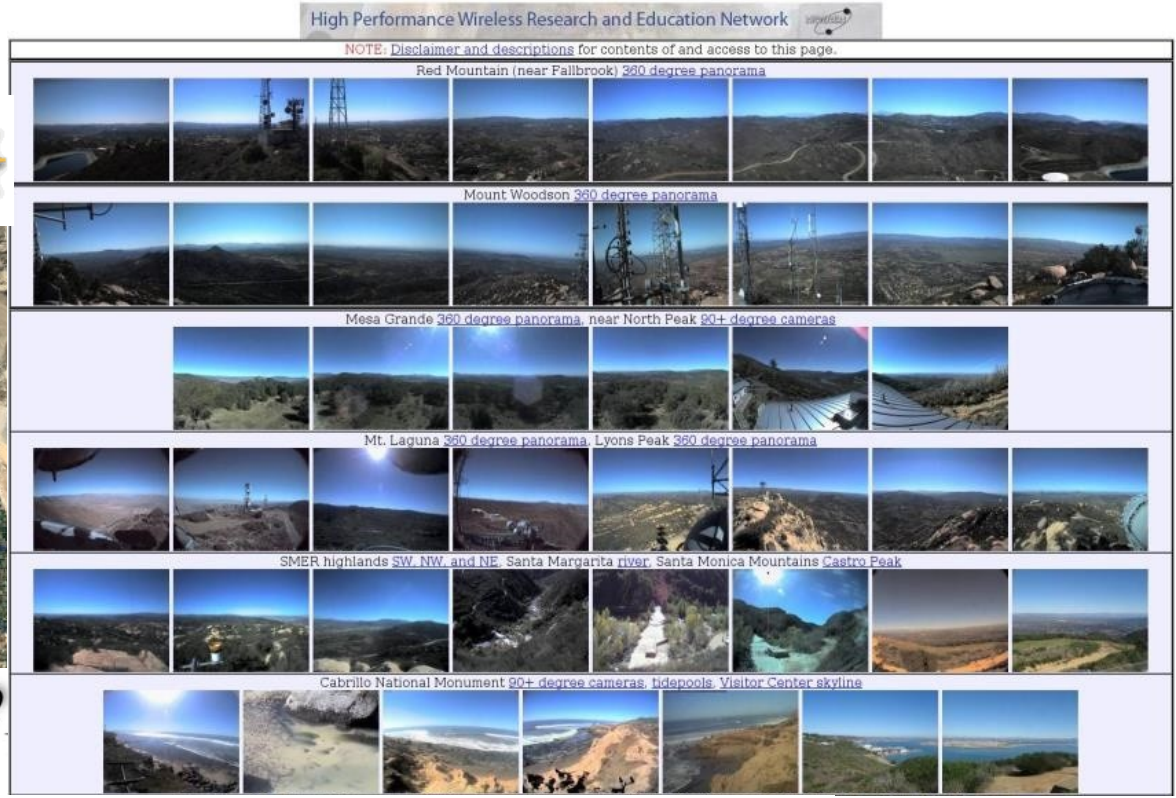
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2000-2012: HPWREN: NSF-Funded High-Bandwidth Wireless Network Cameras and Meteorological Sensors on Top of San Diego Mountains for Environmental Observations

Source: Hans Werner Braun, High Performance Wireless Research and Education Network (HPWREN) PI





NSF

HPWREN

NRP NATIONAL RESEARCH PLATFORM

UC San Diego

SDSC SAN DIEGO SUPERCOMPUTER CENTER

SCRIPPS INSTITUTION OF OCEANOGRAPHY

SAN DIEGO STATE UNIVERSITY

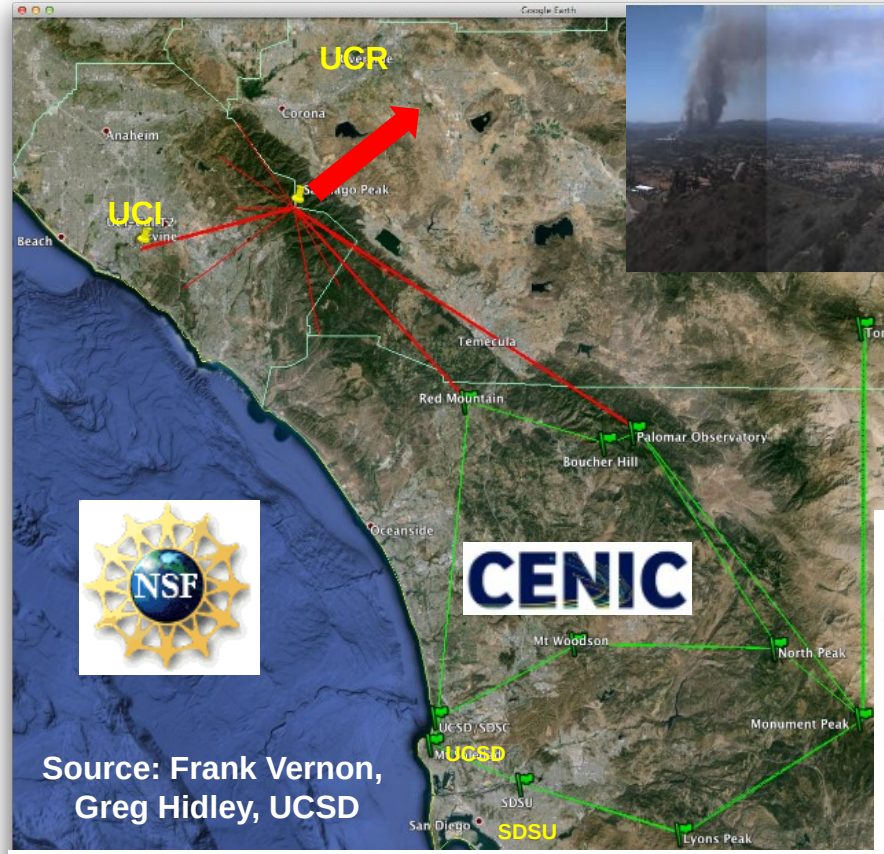
NRP Nautilus

2016-2022: PRP Upgrades HPWREN Data Servers, Connects Them With CENIC/PRP Optical Fiber Backbone

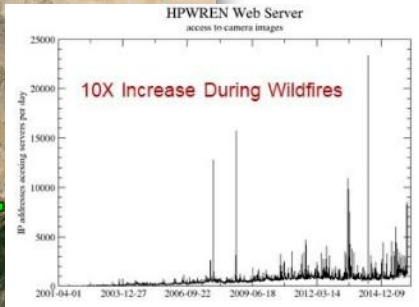
- **CENIC/PRP Connects UCSD and SDSU**
  - **Data Redundancy**
  - **Disaster Recovery**
  - **High Availability**
- **CENIC Extension to UCI & UCR**
  - **Data Replication Sites**



UCI Antenna Dedicated
June 27, 2017
Vint Cerf, Louis Fox, Ramesh Rao
Frank Vernon, Larry Smarr







NATIONAL RESEARCH PLATFORM

UC San Diego · SDSC San Diego Supercomputer Center · Scripps Institution of Oceanography · Calit2 · San Diego State University · utilus

NSF-Funded WIFIRE Uses CENIC to Couple Wireless Edge Sensors With Supercomputers, Enabling Fire Modeling Workflows



Real-Time Meteorological Sensors

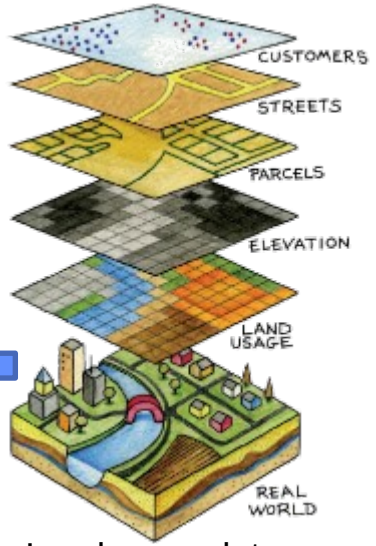
HPWREN

Fire Perimeter

Source: Ilkay Altintas, SDSC

WIFIRE

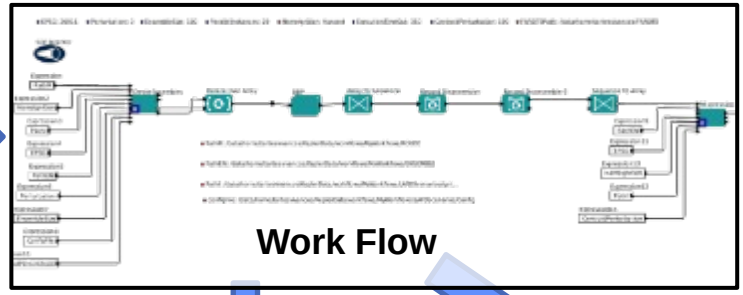




Landscape data

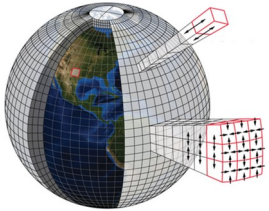
PRP

CENIC



Work Flow

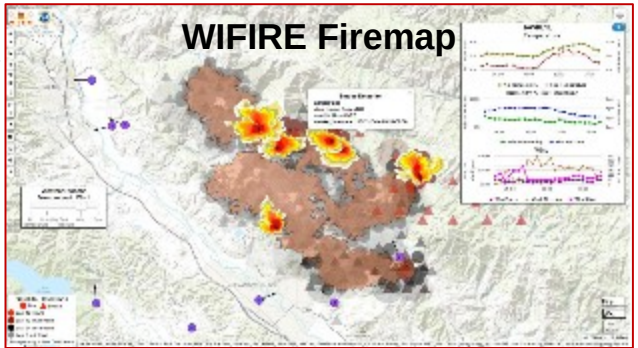
Weather Forecasts





SDSC



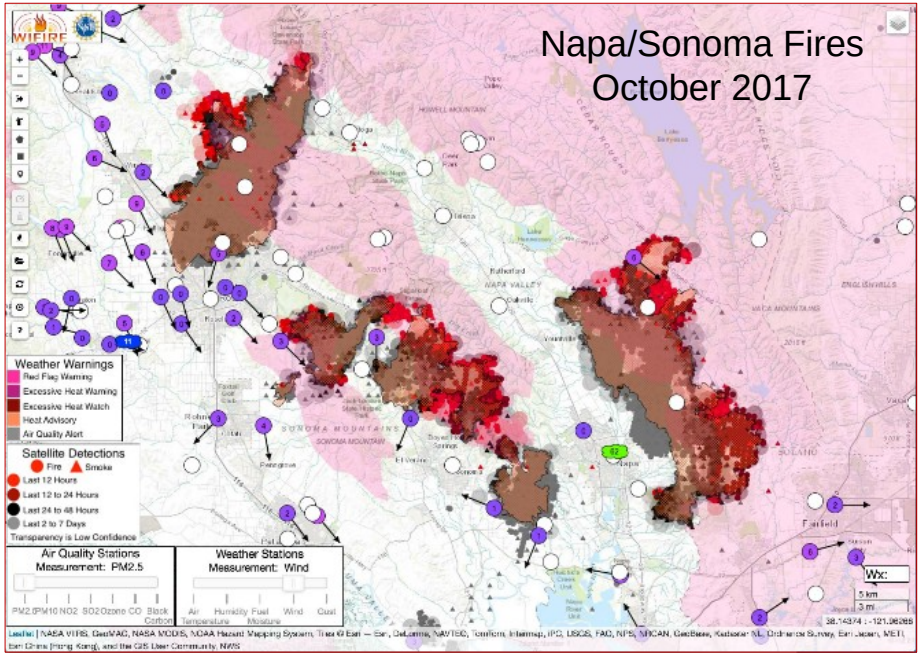


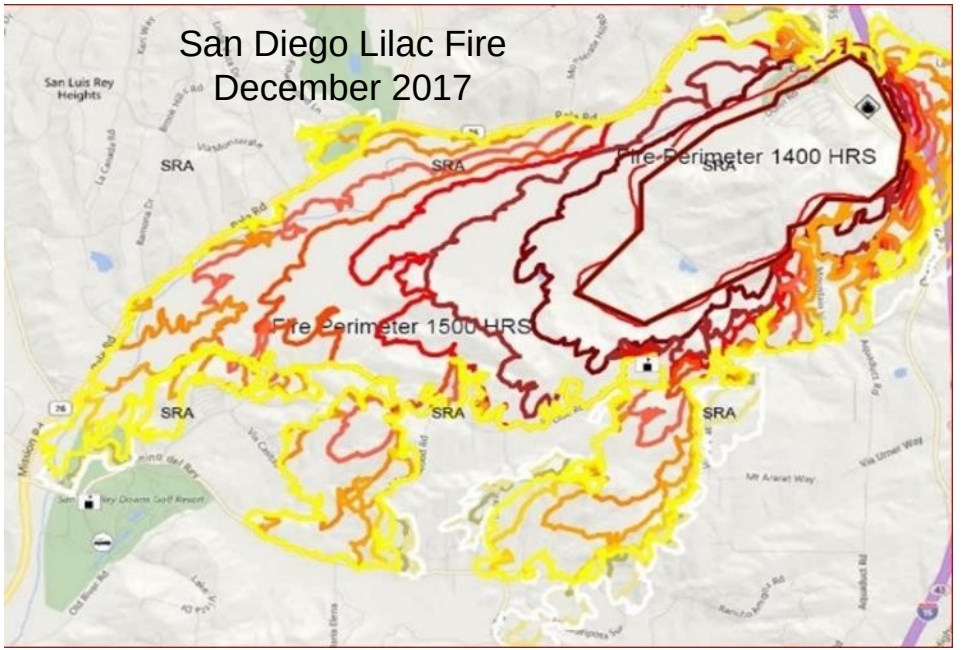
NSF

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WIFIRE's Firemap Was Heavily Used by Public For California Wildfires October 2017 through December 2017

800K+ unique visitors and 8M+ hits





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http://firemap.sdsc.edu

WIFIRE NSF

Ilkay Altintas, SDSC
WIFIRE PI

NRP Nautilus

2002-2009: The NSF OptIPuter ITR Grant- Can We Make Wide-Area Bandwidth Equal to Cluster Backplane Speeds?

NSF ITR Grant
$13.5M
PI Smarr,
Co-PIs DeFanti, Papadopoulos, Ellisman





A 10Gbps "End-to-End" Global-Scale Research Lightpath Cloud


End User OptIPortal


Instruments



HD/4k Telepresence


HD/4k Video Cams


Campus Optical Switch

10G Lightpath



HPC

TeraGrid


Data Repositories & Clusters


HD/4k Video Streaming

evl electronic visualization laboratory

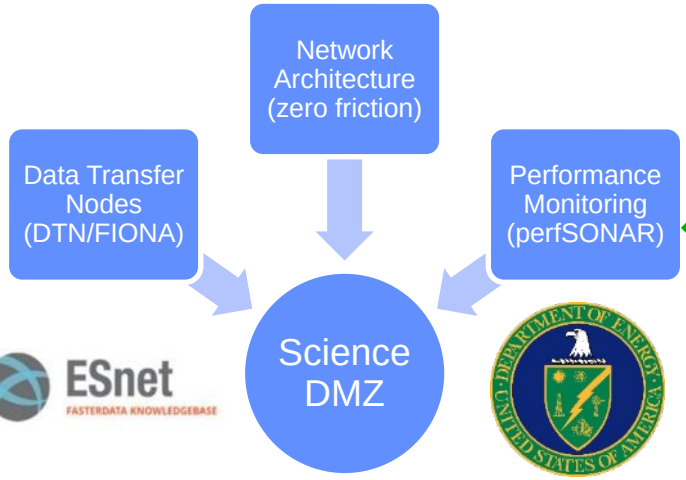
SDSC

it2

NRP NATIONAL RESEARCH PLATFORM

2010-2020:
NSF Adopts the DOE Campus Networking Model For Data-Intensive Research

Science DMZ Coined in 2010 by ESnet



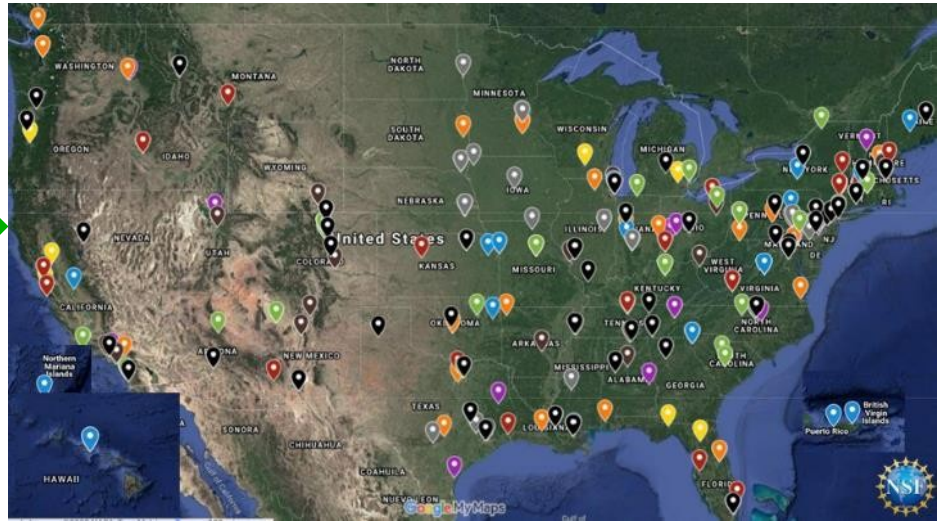
DOE

NSF

http://fasterdata.es.net/science-dmz/

Slide Adapted From Inder Monga, ESnet

NSF Campus Cyberinfrastructure Program 2012-2020



Has Made Over 340 Awards:
Across 50 States and Territories

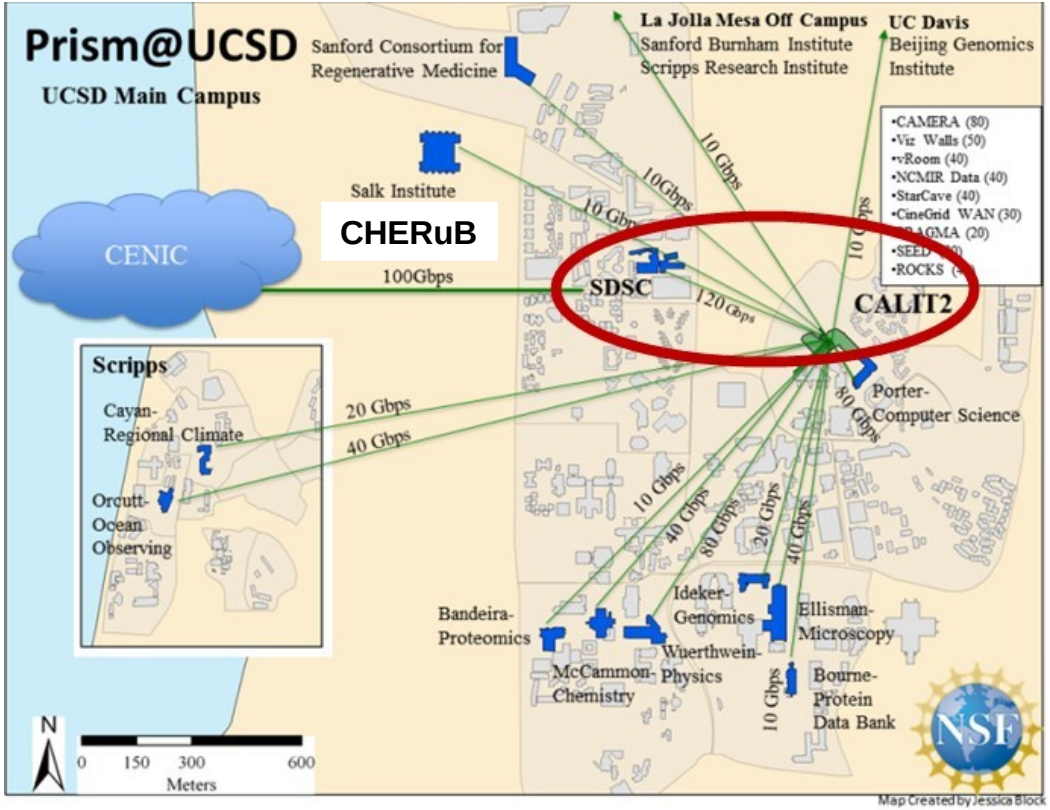
Slide Adapted From Kevin Thompson, NSF

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2013-2015: Creating a "Big Data" Optical Backplane on Campus: NSF Funded Prism@UCSD and CHERuB



- **Prism@UCSD, $500,000, Phil Papadopoulos, SDSC, PI; Smarr co-PI**

- **CHERuB, $500,000, Mike Norman, SDSC PI**

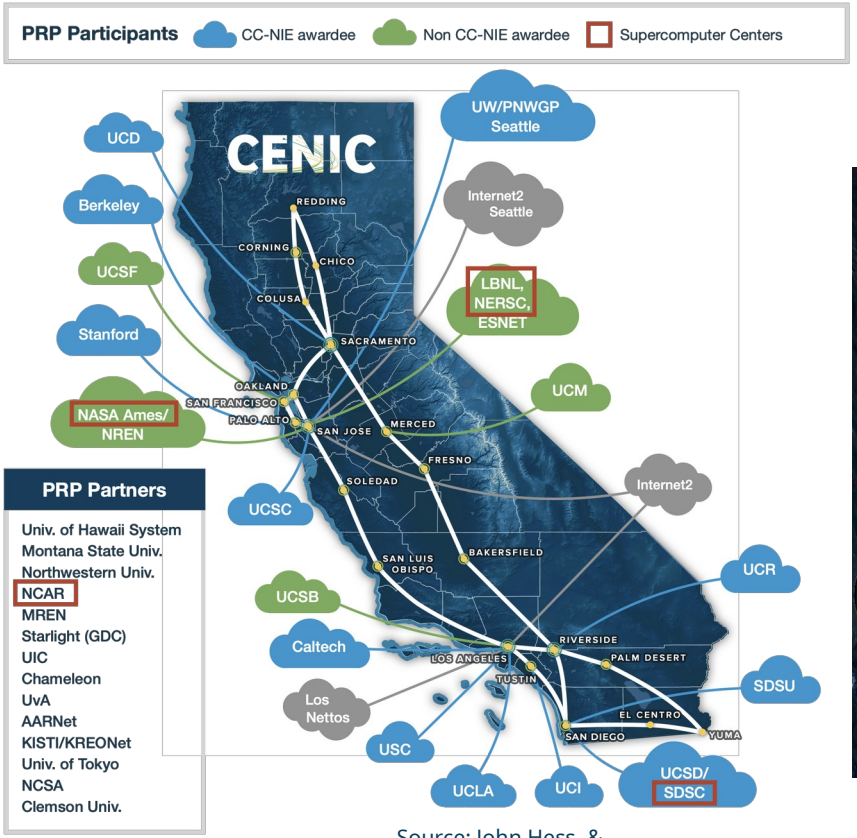
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2015 Vision: The Pacific Research Platform Will Build on CENIC to Connect Science DMZs Creating a Regional Community Cyberinfrastructure



Source: John Hess, & Hunter Hadaway, CENIC

NSF CC*DNI Grant
$6.3M 10/2015-10/2020
Extended – Ended Year 7 in Oct 2022

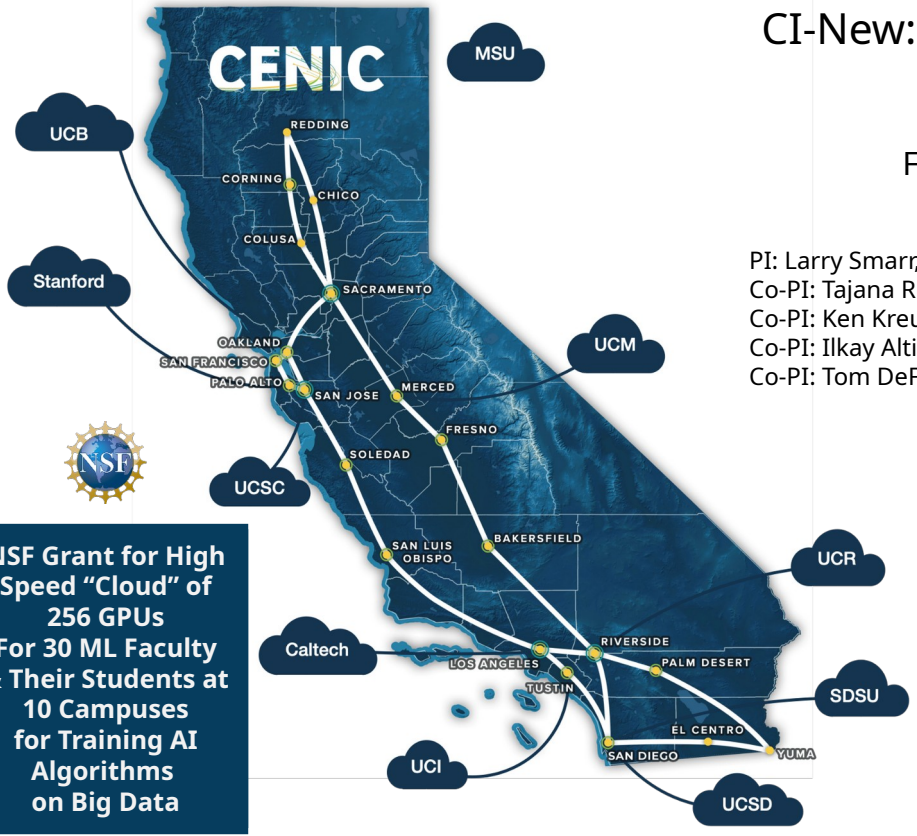


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2017-2020: NSF CHASE-CI Grant Adds a Machine Learning Layer Built on Top of the Pacific Research Platform



NSF Grant for High Speed "Cloud" of 256 GPUs For 30 ML Faculty & Their Students at 10 Campuses for Training AI Algorithms on Big Data

CI-New: Cognitive Hardware and Software Ecosystem Community Infrastructure (CHASE-CI)

For the Period September 1, 2017 – August 21, 2020

PI: Larry Smarr, Professor of Computer Science and Engineering, Director Calit2, UCSD
Co-PI: Tajana Rosing, Professor of Computer Science and Engineering, UCSD
Co-PI: Ken Kreutz-Delgado, Professor of Electrical and Computer Engineering, UCSD
Co-PI: Ilkay Altintas, Chief Data Science Officer, San Diego Supercomputer Center, UCSD
Co-PI: Tom DeFanti, Research Scientist, Calit2, UCSD

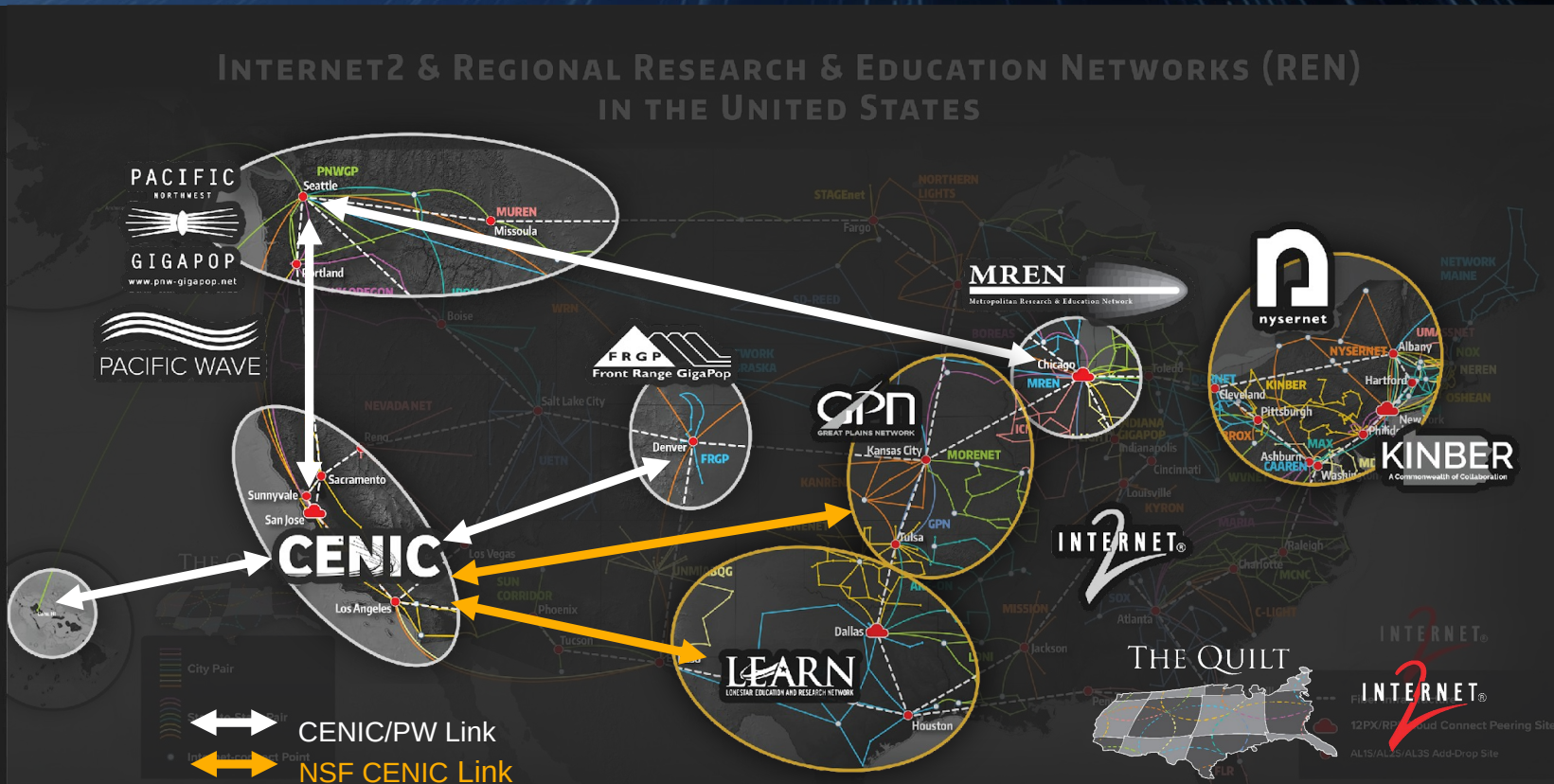
JACOBS SCHOOL OF ENGINEERING
SDSC UC San Diego
QUALCOMM INSTITUTE

NRP NATIONAL RESEARCH PLATFORM
CENICAIR CENIC ARTIFICIAL INTELLIGENCE RESOURCES
NRP Nautilus

2018-2021: Toward the National Research Platform (NRP) - Using CENIC & Internet2 to Connect Quilt Regional R&E Networks

"Towards The NRP"
3-Year Grant
Funded By
NSF $2.5M
October 2018

PI Smarr
Co-PIs Altintas
Papadopoulos
Wuerthwein
Rosing
DeFanti



SDSC

NATIONAL RESEARCH PLATFORM

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2023 - The National Research Platform Emerges From the Pacific Research Platform

NRP NATIONAL RESEARCH PLATFORM

NEWS GRANTS TECHNOLOGY COMMUNITY JOIN / CONTACT



Professor Frank Würthwein

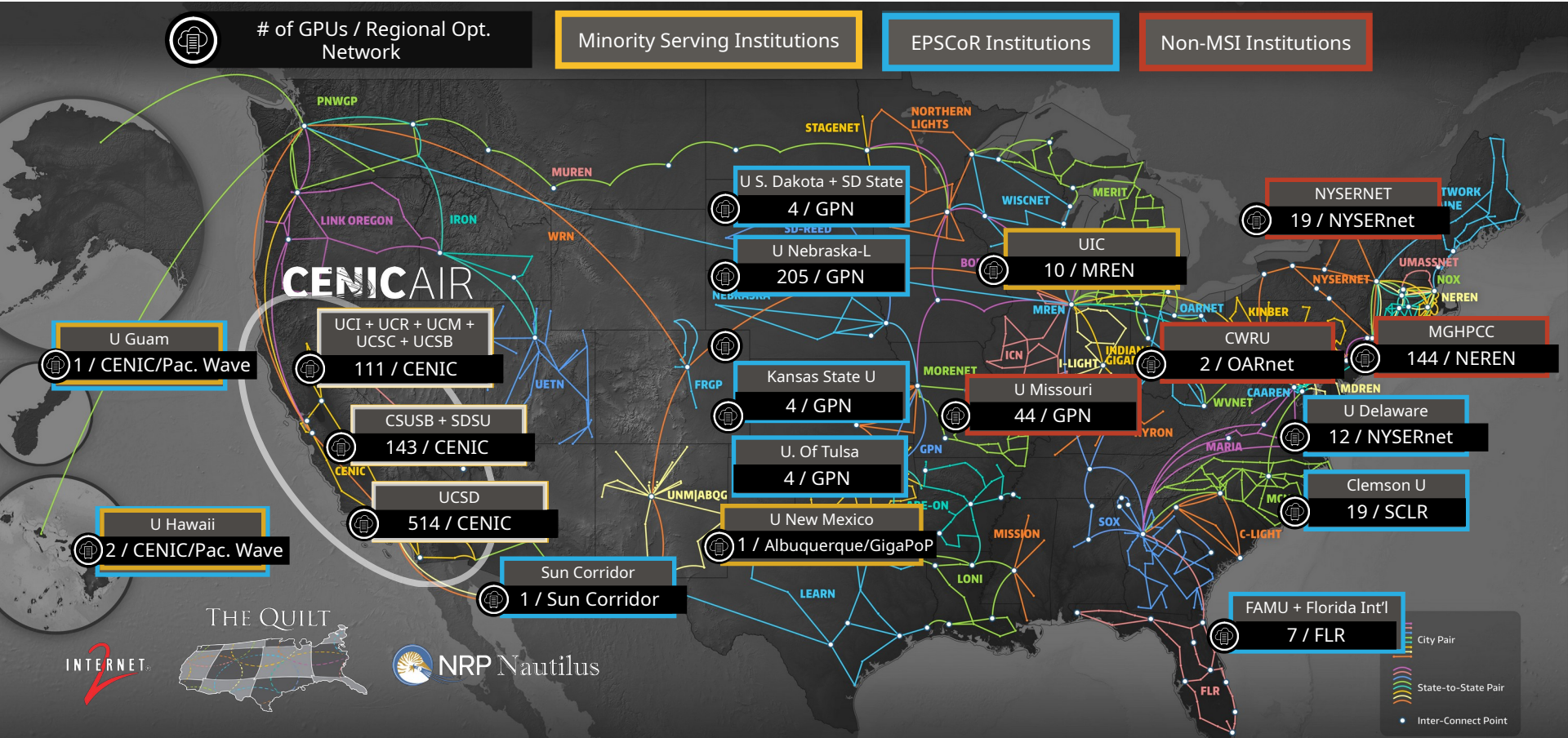
- Director - SDSC
- Distributed High-Throughput Computing Lead - SDSC

Designed for Growth and Inclusion

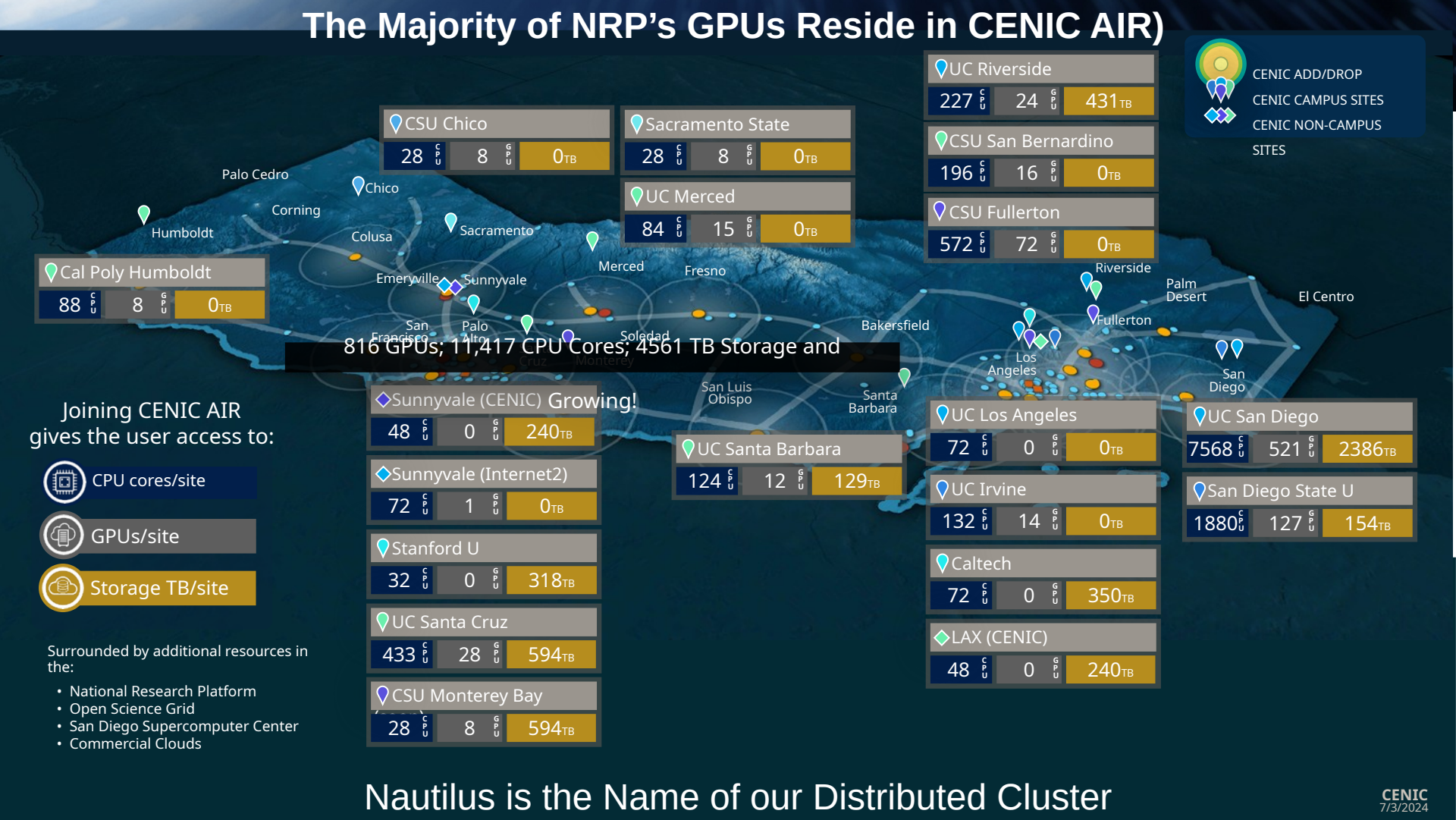
The National Research Platform (NRP) is a partnership of more than 50 institutions, led by researchers and cyberinfrastructure professionals at UC San Diego, supported in part by awards from the National Science Foundation.

https://nationalresearchplatform.org/

The National Research Platform
Is Anchored in in the CENIC AI Resource (CENIC AIR)



The Majority of NRP's GPUs Reside in CENIC AIR)



Joining CENIC AIR gives the user access to:

- CPU cores/site
- GPUs/site
- Storage TB/site

Surrounded by additional resources in the:

- National Research Platform
- Open Science Grid
- San Diego Supercomputer Center
- Commercial Clouds

Nautilus is the Name of our Distributed Cluster

CENIC
7/3/2024

SDSU Is the Lead Campus for the Jan 2024 CENIC-Connected Technology Infrastructure for Data Exploration (TIDE) NSF Grant

SDSU San Diego State University · Cal Poly Humboldt · CSUN California State University Northridge · SDSC · CENIC · California State University San Bernardino · California State University San Marcos · Channel Islands California State University · Stanislaus California State University

- **A CSU Resource for Research & Education:**
  - **NSF CC* Regional Computing Award for ~$1M**
    - **$800 for a New Computational Core**
    - **$200 for Students to Help Onboard and Support Users**
  - **Federated with NRP Nautilus**
  - **First New NSF Resource in CENIC-AIR**



616 CPU Cores · 73 GPUs · 14.592 TB RAM

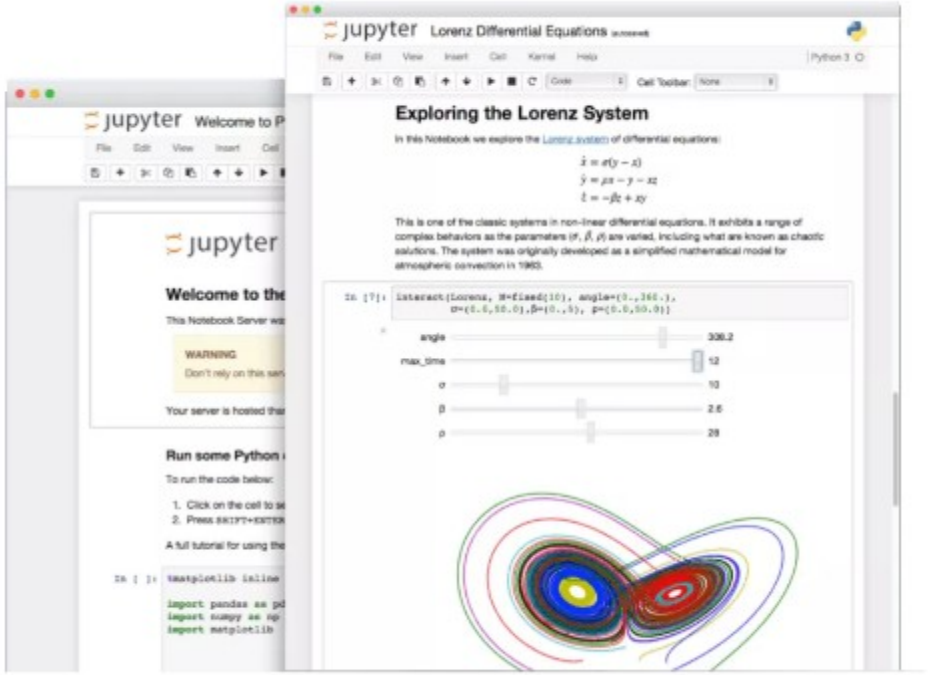
CENIC 2024 Innovations in Networking Award

NRP National Research Platform · CENIC AIR CENIC Artificial Intelligence Resources

Source: Jerry Sheehan, TIDE PI

NRP Nautilus

Jupyter Notebooks
Have Become The Popular Method of Sharing Computational Documents



Jupyter Notebook: The Classic Notebook Interface

The Jupyter Notebook is the original web application for creating and sharing computational documents. It offers a simple, streamlined, document-centric experience.

Try it in your browser | Install the Notebook

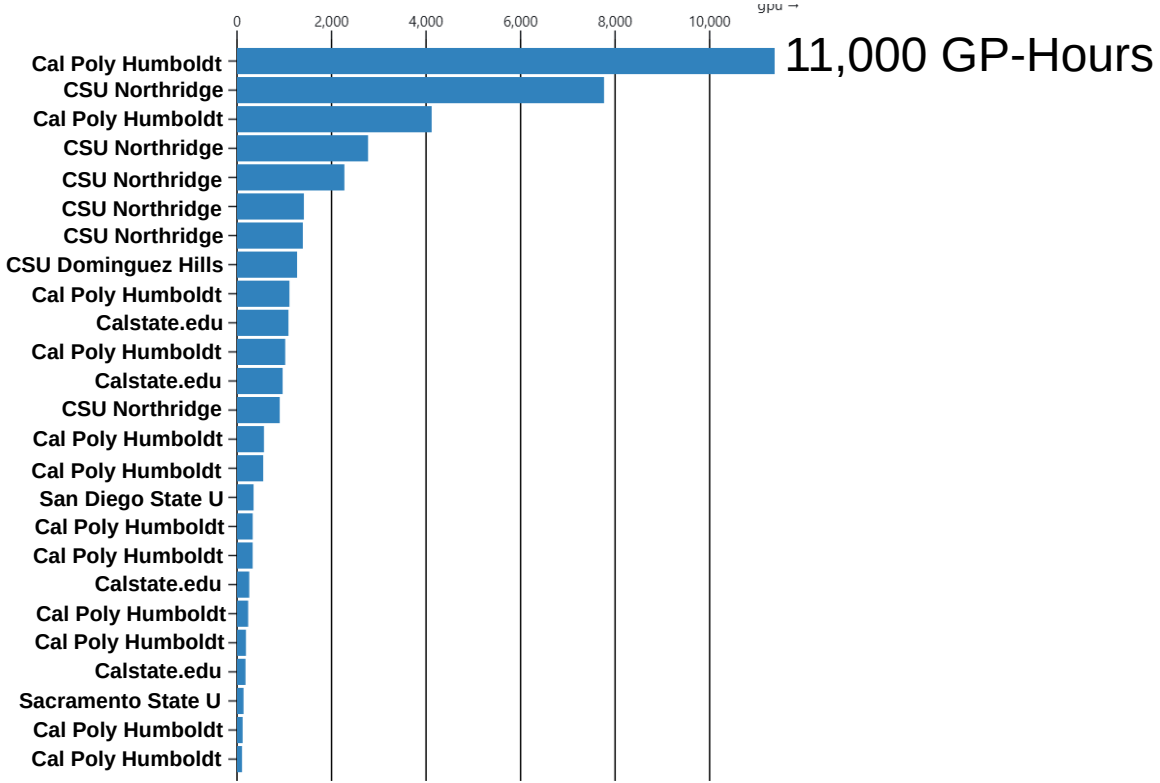
jupyterhub is the Multi-User Version of the Jupyter Notebook



Largest SDSU TIDE jupyterhub
CSU GPU Users

July 1, 2024 to June 30, 2025

Each Bar is
a User
at the
CSU Campus
Named



11,000 GP-Hours

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