“PRP, CHASE-CI, TNRP and OSG”

Welcome Talk
OSG/SDX Workshop
Qualcomm Institute, UC San Diego
June 5, 2019

Dr. Larry Smarr
Director, California Institute for Telecommunications and Information Technology
Harry E. Gruber Professor,
Dept. of Computer Science and Engineering
Jacobs School of Engineering, UCSD
http://lsmarr.calit2.net

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2015-2020: The Pacific Research Platform Connects Campus "Big Data Freeways" to Create a Regional End-to-End Science-Driven "Big Data Superhighway" System

Source: John Hess, CENIC



NSF CC*DNI Grant
$6M 10/2015-10/2020

PI: Larry Smarr, UC San Diego Calit2

Co-PIs:

- **Camille Crittenden, UC Berkeley CITRIS,**
- **Tom DeFanti, UC San Diego Calit2/QI,**
- **Philip Papadopoulos, UCSD SDSC,**
- **Frank Wuerthwein, UCSD Physics, OSG, and SDSC**

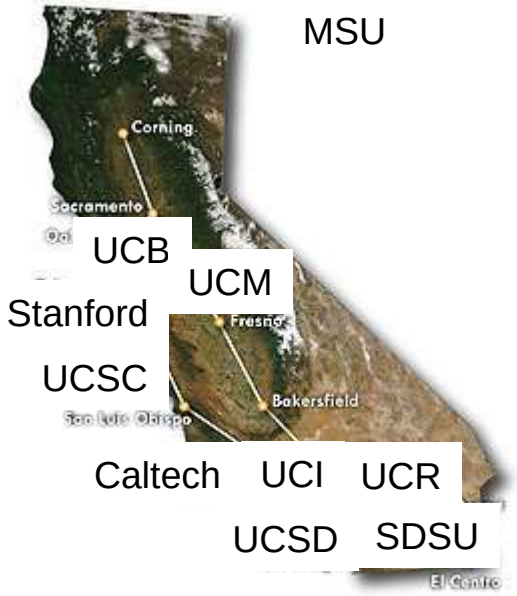
Letters of Commitment from:

- 50 Researchers from 15 Campuses
- 32 IT/Network Organization Leaders

NSF Program Officer: Amy Walton

SDSC CITRIS BANATAO INSTITUTE it²

2017-2020: CHASE-CI Adds Machine-Learning to the Data-Science Community Cyberinfrastructure



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

For the Period September 1, 2017 – August 31, 2020

SUBMITTED – January 18, 2017

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

NSF Program Officer: Mimi McClure

NSF Grant for 256 High Speed “Cloud” GPUs
For 32 ML Faculty & Their Students at 10 Campuses
To Train AI Algorithms on Big Data

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SDSC UC San Diego it²

2018-2019: National-Scale Pilot - Using CENIC & Internet2 to Connect Quilt Regional R&E Networks

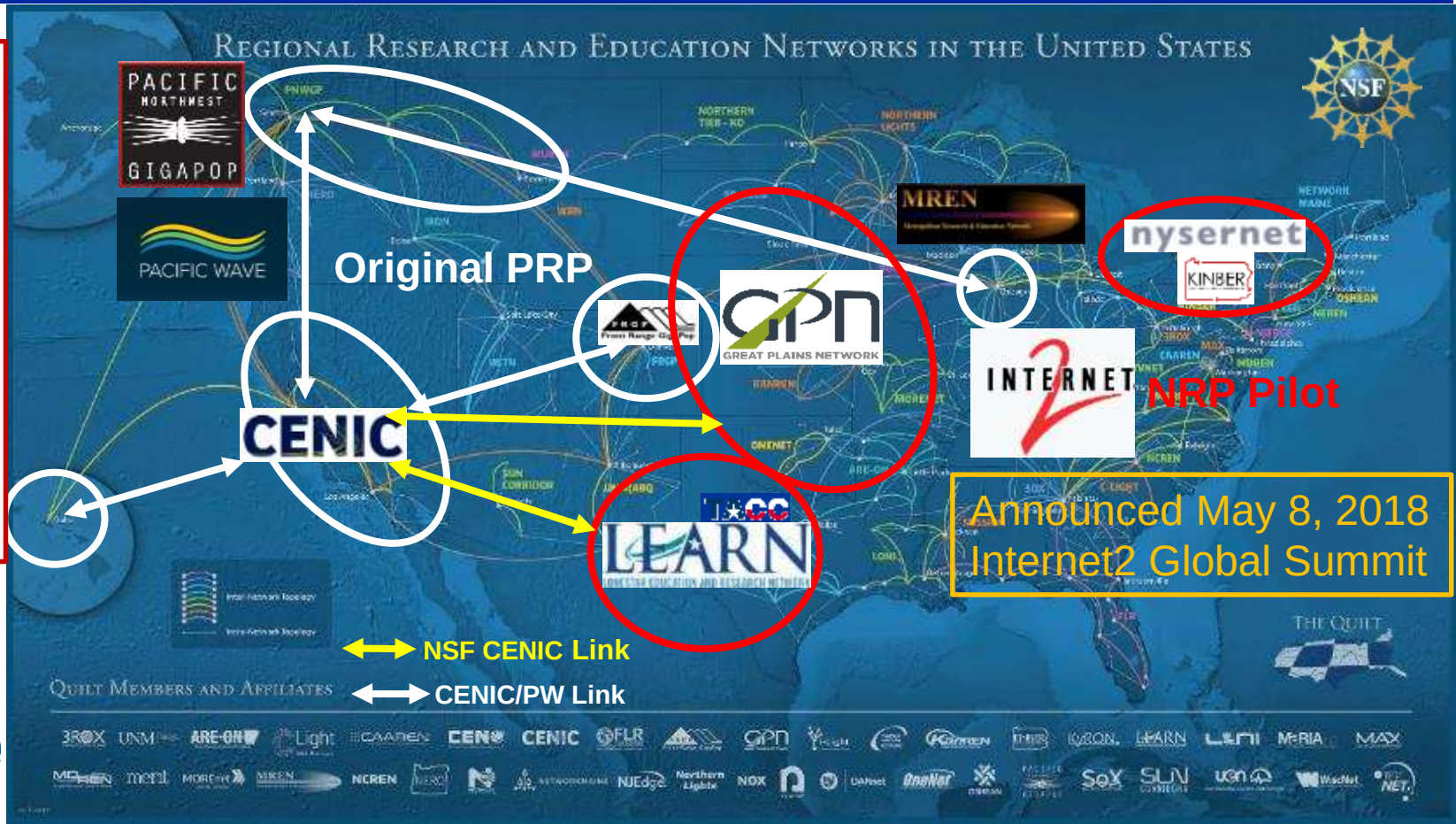
"Towards The NRP"
3-Year Grant
Funded
by NSF
$2.5M
October 2018

Program Officer
Kevin Thompson

PI Smarr
Co-PIs Altintas
Papadopoulos
Wuerthwein
Rosing

SDSC

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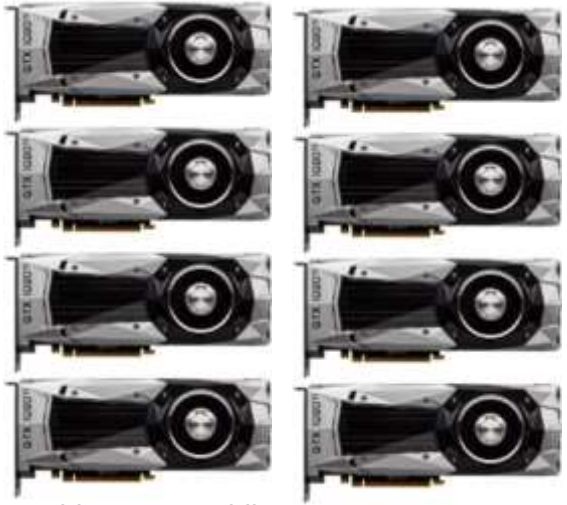


PRP Engineers Designed and Built Several Generations of Optical-Fiber Big-Data Flash I/O Network Appliances (FIONAs)

UCSD-Designed FIONAs Solved the Disk-to-Disk Data Transfer Problem *at Near Full Speed* on Best-Effort 10G, 40G and 100G Networks



Two FIONA DTNs at UC Santa Cruz: 40G & 100G
Up to 200 TeraByte Rotating Storage



Add Up to 8 Nvidia GPUs Per FIONA
To Add Machine Learning Capability



FIONette—
1G, $250
Used for
Training 50
Engineers in
2018-2019

Over 100 FIONAs Now Deployed on PRP

FIONAs Designed by UCSD's Phil Papadopoulos, John Graham, Joe Keefe, and Tom DeFanti

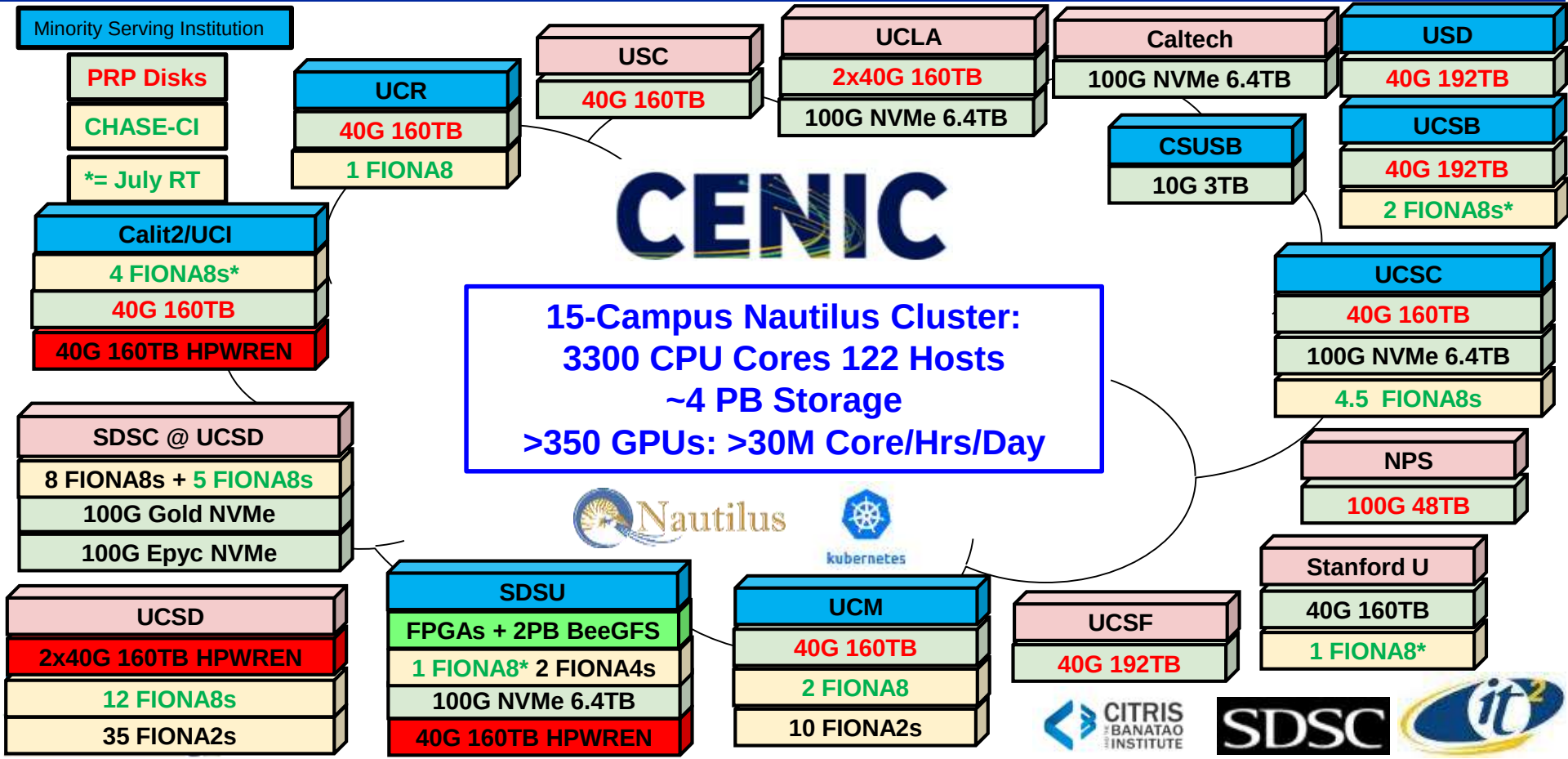
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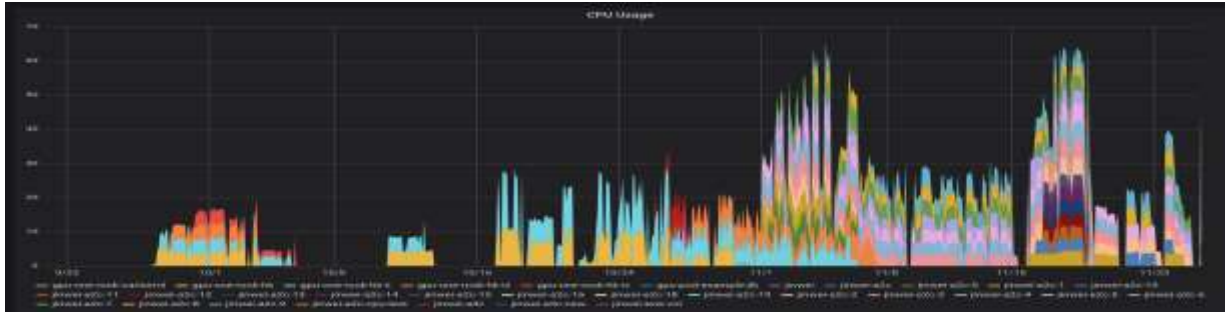
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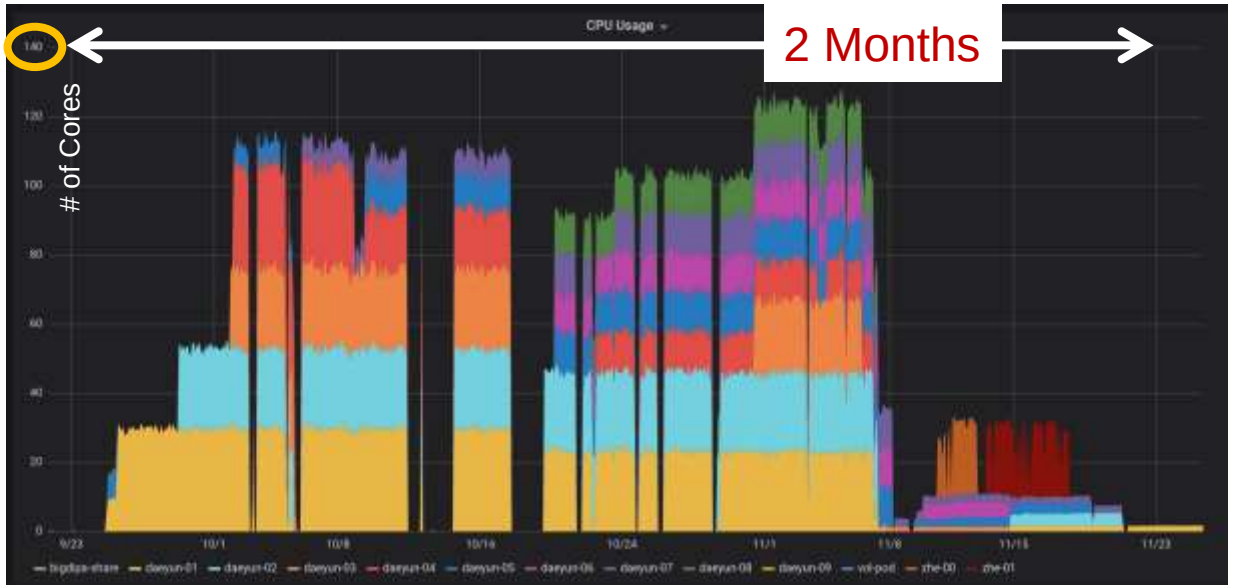
Connected by PRP's Use of CENIC 100G Network
PRP's Nautilus Hypercluster Uses Kubernetes to Orchestrate Software Containers



Major CHASE-CI Usage by UCI Over PRP to UCSD CPUs/GPUs

Cognitive Anteater Robotics Laboratory (CARL) supervised by Prof. Jeff Krichmar





UCICompVis Group supervised by Prof. Charless Fowlkes

Demo Last Night From Data Think Tank Lab

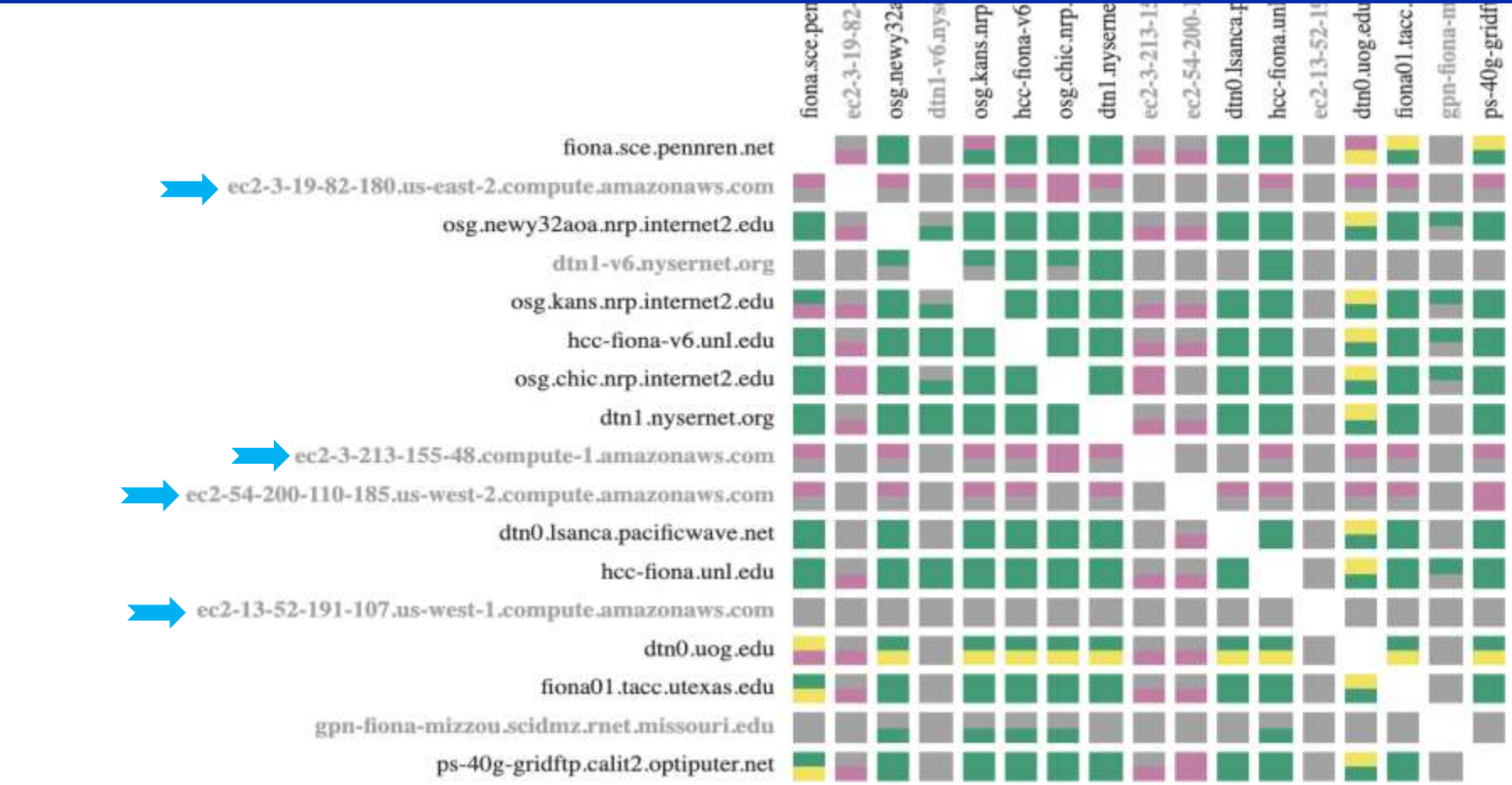
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OSG Data Federation Built on 9 Data Caches to Reduce Network Traffic and Hide Data Access Latencies

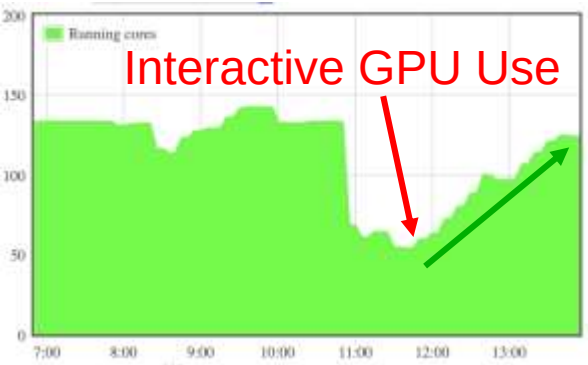
~200,000 Cores of Compute Federation Across 100 Compute Elements



Testing Data Movement with GridFTP Moving 10GB Files Between AWS Locations and the TNRP-Pilot Sites



The IceCube Science Program
Spans Fundamental Physics to Observational Astronomy



IceCube GPU Needs
Exceed Availability by 10x

=> Backfilling GPUs
for Interactive Use on PRP
From OSG with
Batched IceCube Simulations

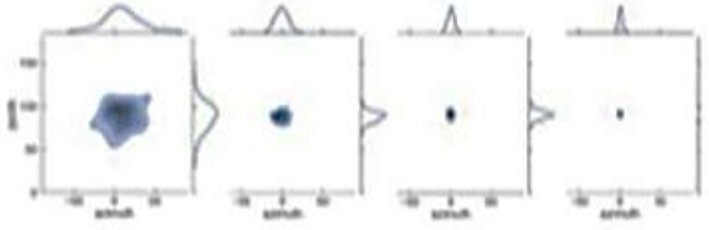
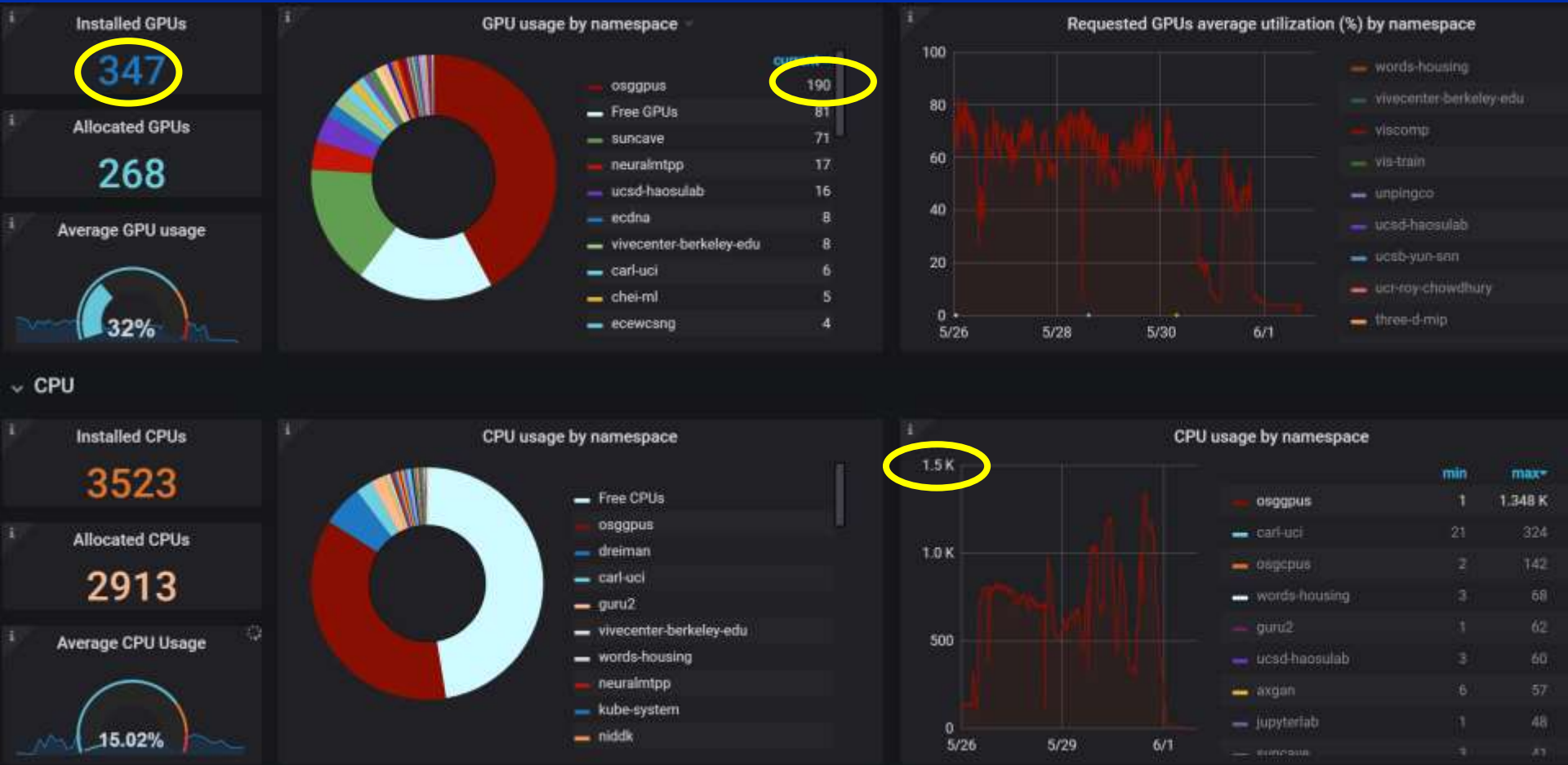


Figure 4. Possible improvements to angular resolution with better understanding of ice model

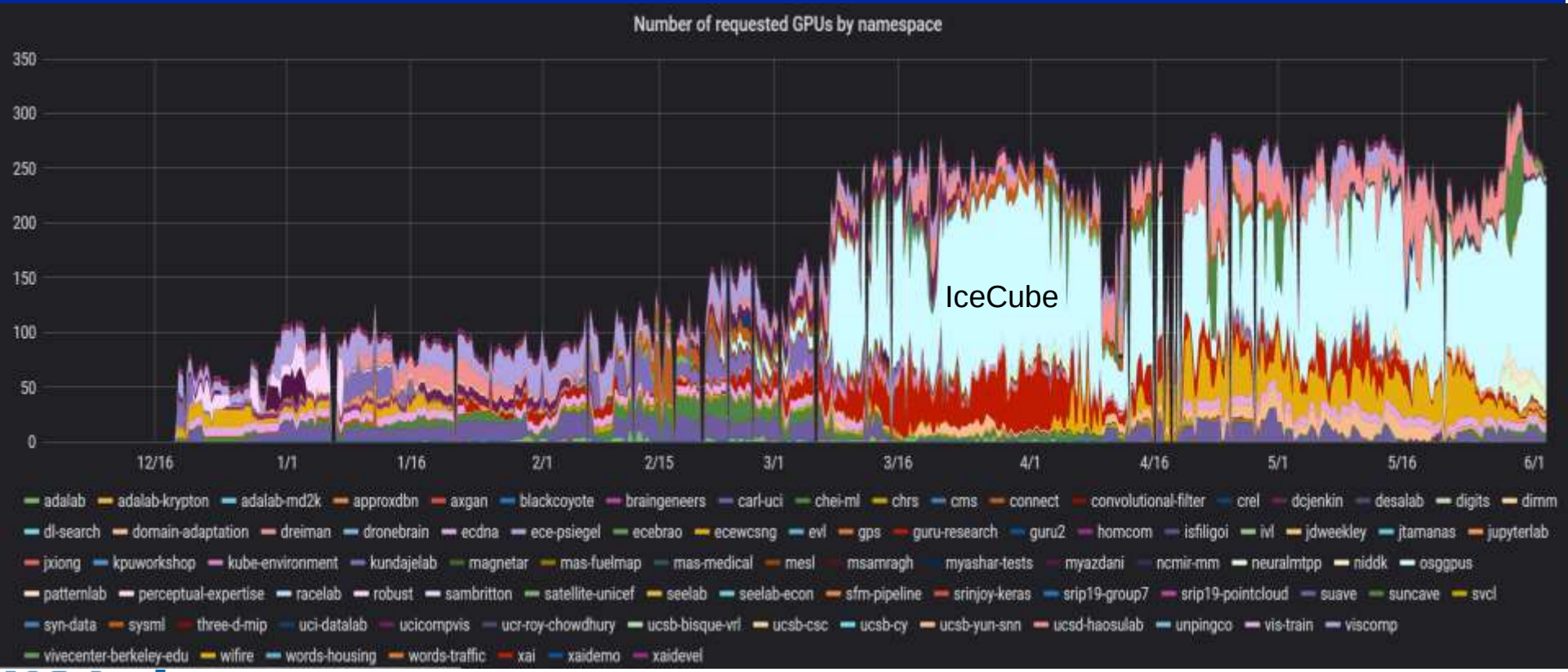
GPU Simulations Needed *to Improve Ice Model*.
=> Results in Significant Improvement in Pointing Resolution
for Multi-Messenger Astrophysics

IceCube

OSG IceCube Usage on PRP (Dark Red Segment) Last Week: Using 190 GPUs + 1348 CPU-Cores



Number of Requested GPUs Has Gone Up Six-Fold This Year!



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Upcoming Workshops





The NRP workshop (9/24-9/25) will be co-located with the NSF CC* and CICI PI workshop (9/23-9/25) and the **Quilt meeting** (9/25-9/26) with some shared sessions.

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PRP/TNRP/CHASE-CI Support and Community:

- US National Science Foundation (NSF) awards to UCSD, NU, and SDSC
  - CNS-1456638, CNS-1730158, ACI-1540112, ACI-1541349, & OAC-1826967
  - OAC 1450871 (NU) and OAC-1659169 (SDSU)
- UC Office of the President, Calit2 and Calit2's UCSD Qualcomm Institute
- San Diego Supercomputer Center and UCSD's Research IT and Instructional IT
- Partner Campuses: UCB, UCSC, UCI, UCR, UCLA, USC, UCD, UCSB, SDSU, Caltech, NU, UWash UChicago, UIC, UHM, CSUSB, HPWREN, UMo, MSU, NYU, UNeb, UNC,UIUC, UTA/Texas Advanced Computing Center, FIU, KISTI, UVA, AIST
- CENIC, Pacific Wave/PNWGP, StarLight/MREN, The Quilt, Kinber, Great Plains Network, NYSERNet, LEARN, Open Science Grid
- Internet2, DOE ESnet, NCAR/UCAR and Wyoming Supercomputing Center

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And Developing: Indiana University's EPOC