



Pacific Research Platform: The Future of Big Data Collaboration

From biomedical sciences to particle physics, today nearly all research and data analysis involves remote collaboration. In order to work effectively and efficiently on multi-institutional projects, researchers depend heavily on high-speed access to large datasets and computing resources.

To meet the needs of researchers in California and beyond, the National Science Foundation (NSF) has awarded a fivevear, \$5 million grant to fund the Pacific Research Platform (PRP). The PRP integrates Science DMZs, an architecture developed by the U.S. Department of Energy's Energy Sciences Network (ESnet), into a high-capacity regional "freeway system." This system makes it possible for large amounts of scientific data to be moved between scientists' labs and their collaborators' sites, supercomputer centers or data repositories, without performance degradation.

PRPGridFTF

A Regional Model for Multi-Discipline Data-Intensive Networking

The PRP, led by researchers at UC San Diego, and UC Berkeley, will enable fast and secure data transfers between researchers in over 20 universities. The PRP builds on the optical backbone of Pacific Wave, a joint project of CENIC and the Pacific Northwest GigaPOP (PNWGP) to create one large, seamless research platform that will encourage statewide, regional-even worldwide-collaboration.

The PRP will support a broad range of data-intensive research projects that will have wide-reaching impacts on science and technology worldwide. Cancer genomics, galaxy evolution research, climate modeling, and the creation of virtual reality gaming systems are just a few of the projects that will benefit from the PRP.

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Figure 1. PRPGridFTP Dashboard as of October 25, 2016 with 20 locations, New connections start as yellow and are improved to green over time. See http://prp maddash.calit2.optiputer.net/maddash-webui/index.cgi

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PRP partner sites move data at 6-14Gb/s disk-to-disk every day using GridFTP, several orders of magnitude faster than normal campus-to-campus data transfers.

In tests of new 100G hardware at the SC16 Conference in November 2016, PRP partners achieved 91Gb/s disk-to-disk between custom PCs inside the Caltech booth and 74Gb/s memory-to-memory between Stanford University and Salt Lake City.

Pacific Research Platform: Cyberinfrastructure for Big Data

The PRP's data-sharing architecture, with disk-to-disk 10-100Gbps connections, enables region-wide virtual co-location of data with computing resources. Today, dozens of top universities and research centers are doing work across ten major research areas, positioning the PRP to be a regional-scale model for a future nationalscale Big Data cyberinfrastructure.

Pacific Wave 100Gbps Research DMZ Backbone with PNWGP DMZ & CENIC's 100Gbps Network

CENIC PACIFIC WAVE

West Coast Participants:

LBNL

NCSA

Caltech UC Davis CENIC UC Irvine UC Merced ESnet UC Riverside NASA Ames/ NREN UC San Diego /SDSC NCAR/UCAR UC San Francisco Naval Post Graduate School UC Santa Barbara NERSC UC Santa Cruz San Diego State Univ UCLA USC Stanford UC Berkeley Univ. Washington/PNWGP

National and Global Participants:

AARNet, Australia Pacific Wave (CENIC + PNWGP) Chameleor StarLight Clemson Univ. Univ. of Chicago ESnet Univ of Hawaii System KISTI/KREONet, Korea UIC / EVL Montana State Univ. Univ. of Tokyo, Japan MREN Utah Universite UIUC/NCSA Northwestern Univ Univ. Amsterdam, Netherlands NSCC, Singapore Univ. of Utah Open Science Grid Univ. Washington/PNWGP



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Microbiome and Integrative 'Omics: UCSD, Caltech, UCD, UCSF Integrative Structural Biology Team: UCSF, UCSD/SDSC, LBNL/NERSC Microscopy Data Wormhole: UCSD, UCR, NSCC

Earth Sciences Data Analysis

Biomedical Data Analysis Cancer Genomics Hub/Browser:

UCSC, UCSD/SDSC; UChicago

Data Analysis and Simulation for Earthquakes and Natural Disasters: Pacific Earthquake Engineering Research Center (PEER) [UCB, UCSD, UCSC, UCD, UCLA, UCI, USC, Stanford, OSU, & UW] Climate Modeling: NCAR/UCAR California/Nevada Regional Climate Data Analysis: NCAR/UCAR, UCSD/SIO CO2 Subsurface Modeling SDSULUCSD/SDSC Drones & 3D Terrestrial Modeling: UCSD, UCM Wildfire Simulations & Situational Awareness UCSD. NCAR/UCAR

Particle Physics Data Analysis

UCSD/SDSC, UCI, UCR, UCSB, UCSC, UCD, Caltech, OSG

Astronomy and Astrophysics **Data Analysis** Telescope Surveys:

LBNL/NERSC, LLNL, UCB, UCI, UCSC, Caltech/IPAC/JPL Stanford/SLAC, UW **Galaxy Evolution:** UCI, UCSD, UCLA, UCSB, UCR, UCSC, LBNL/ NERSC, NASA Ames. Gravitational Wave Astronomy:

Caltech, LIGO Laboratory; UCSD, OSG

Scalable Visualization, Virtual Reality, and Ultra-Resolution Video

UCSD, UCI, UCLA, UCSC, UCB, UCD, UCM, USC, UIC, UHM, Jackson State II LIVA

High Performance Wireless R&E Network UCSD. SDSU. UCL UCR. UCSC. UCM

JupyterHub/Deep Learning

UCSD/SDSC. UCL UCB. LBNL. LLNL. UIC