Perspectives on SDN

Roadmap to SDN Workshop, LBL

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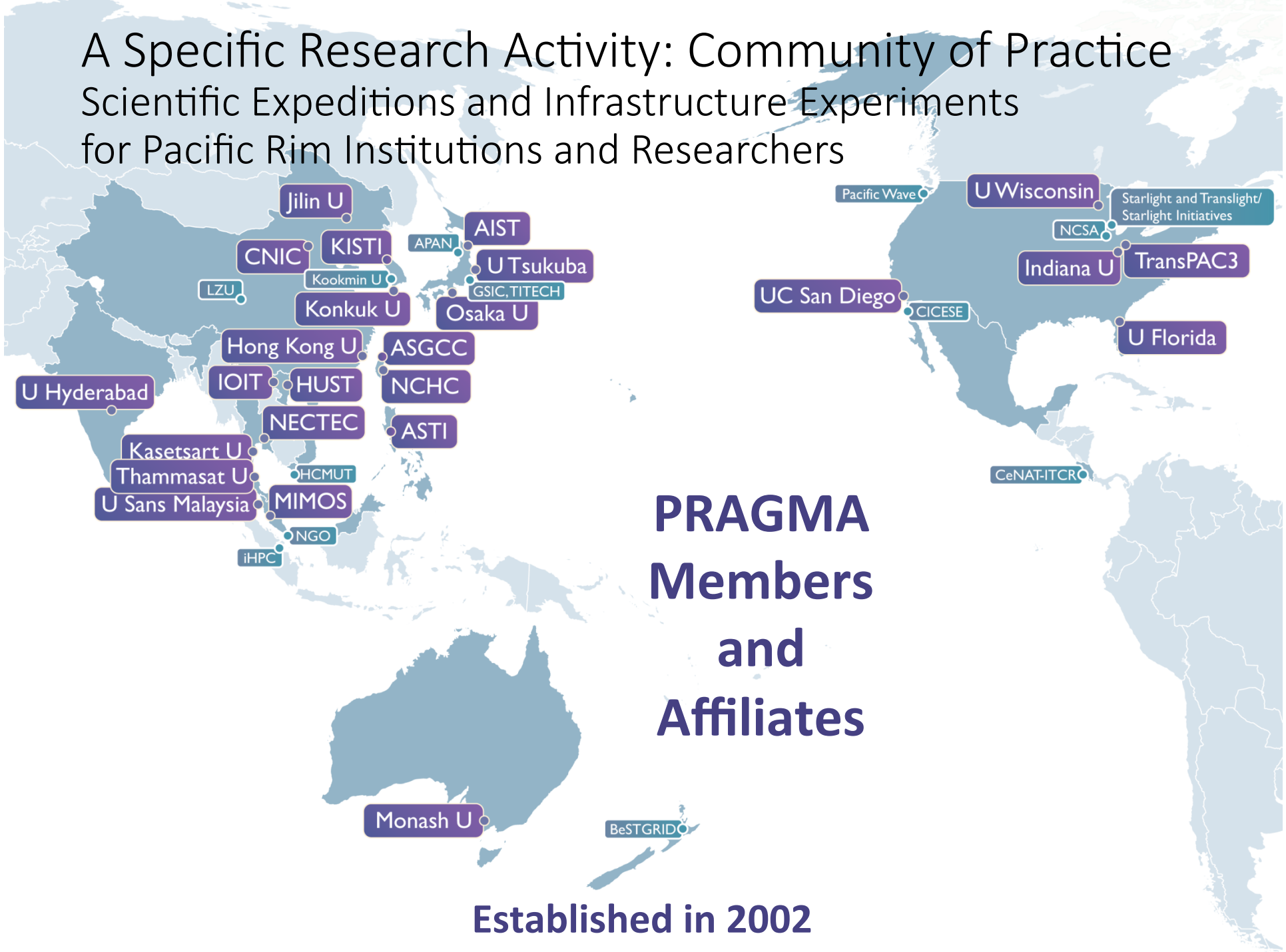
What motivates SDN activities @ SDSC/ Calit2?

- Can SDN/Openflow simplify and/or improve network management tasks within/to the data center?
  - External Layer 2 connectivity depends on which research network is being utilized
    - Dynes (ESNet) and Internet2 AL2S (+ Coordination with CENIC, California's education network)
    - Must already deal with three different mechanisms
  - Internal networking to the center is multi-vendor (Juniper, Arista, Cisco, Mellanox)
  - Production, high-performance, NSF-funded systems will be hosting high-performance virtual clusters. Isolation via VLANs and Single Root I/O virtualization (SRIOV)
- Being utilized for experiments by particular research activities
- Overall: evaluation of technology, use for research. Not yet pervasive to be considered a solution

A subset of Activities Related to SDN

A Specific Research Activity: Community of Practice

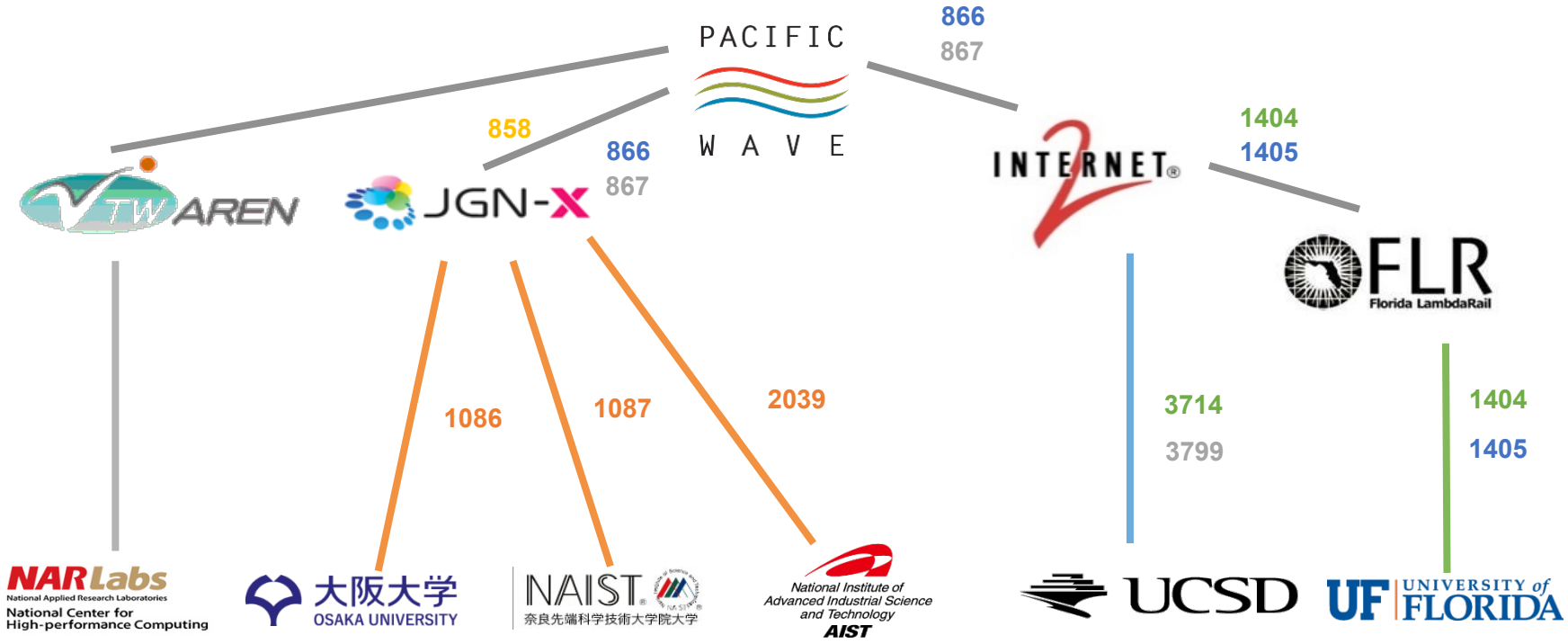
Scientific Expeditions and Infrastructure Experiments for Pacific Rim Institutions and Researchers



Established in 2002

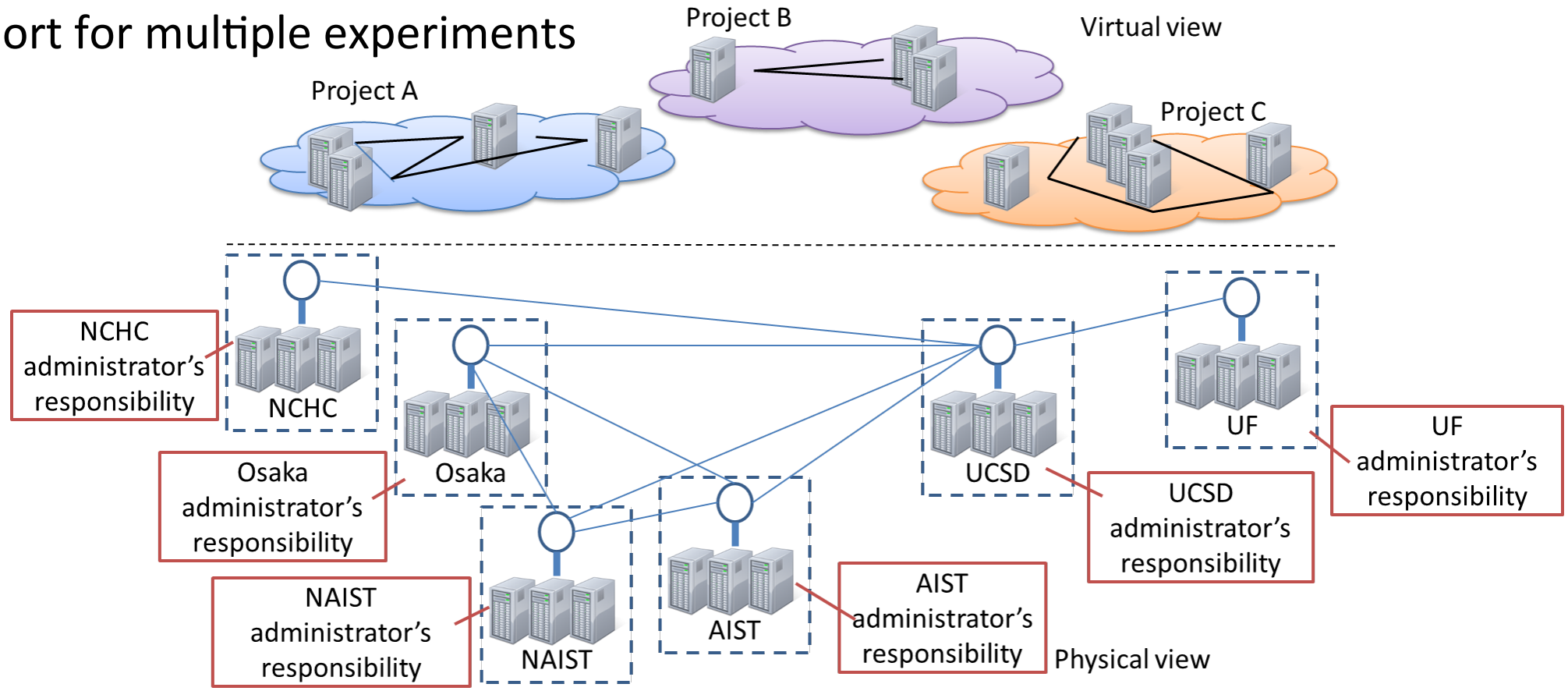
PRAGMA Experimental Network Testbed (ENT) Activities

- ENT Backbone
  - TWAREN connected through Pacific Wave
- OpenFlow Network Slicing
  - AutoVFlow deployed and tested (demo)



ENT Activities – International Openflow Testing: Control Plane

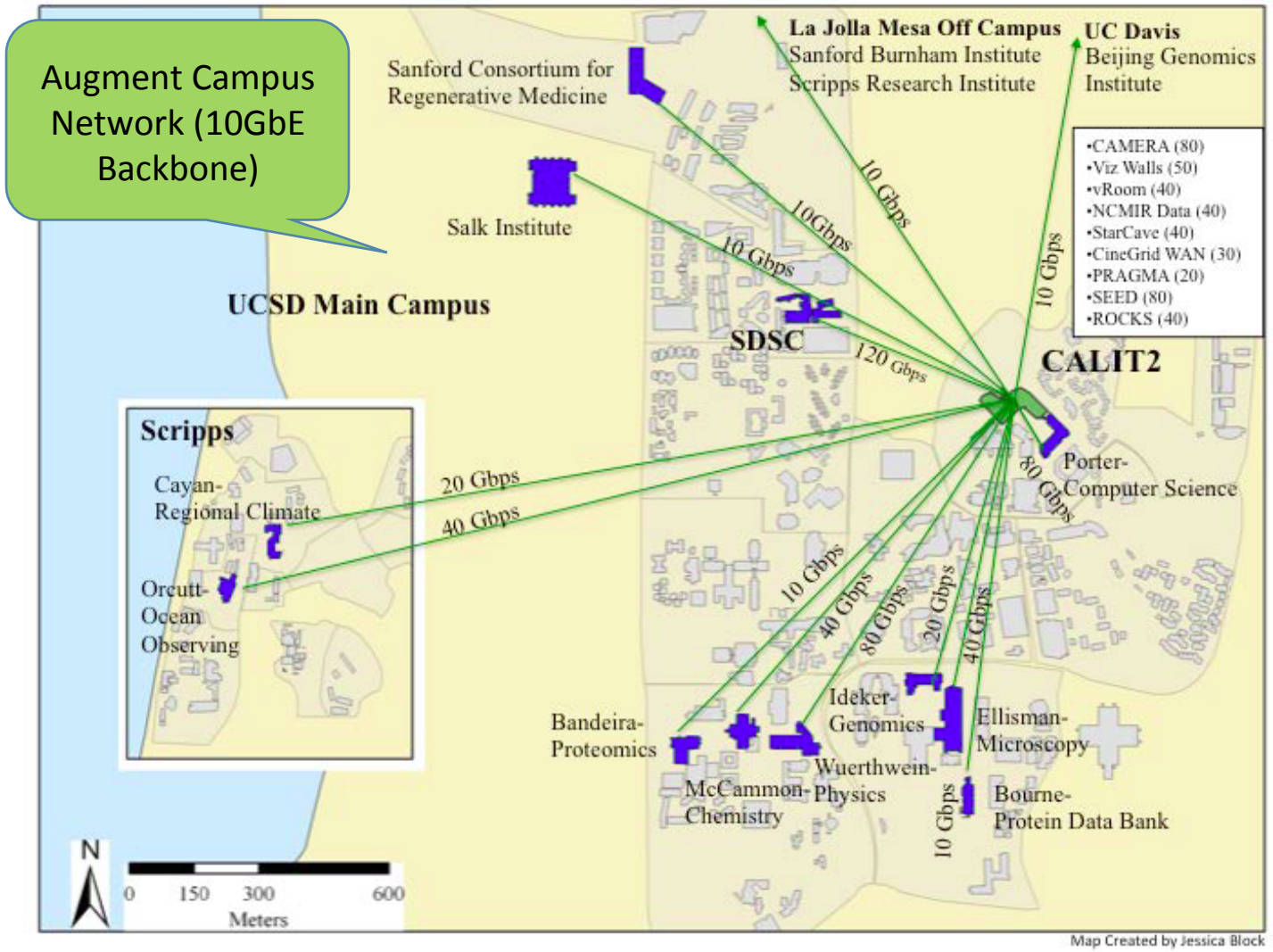
- Distributed implementation via AutoVFlow
- Support for multiple experiments



See Kohei Ichikawa at this Workshop for more details

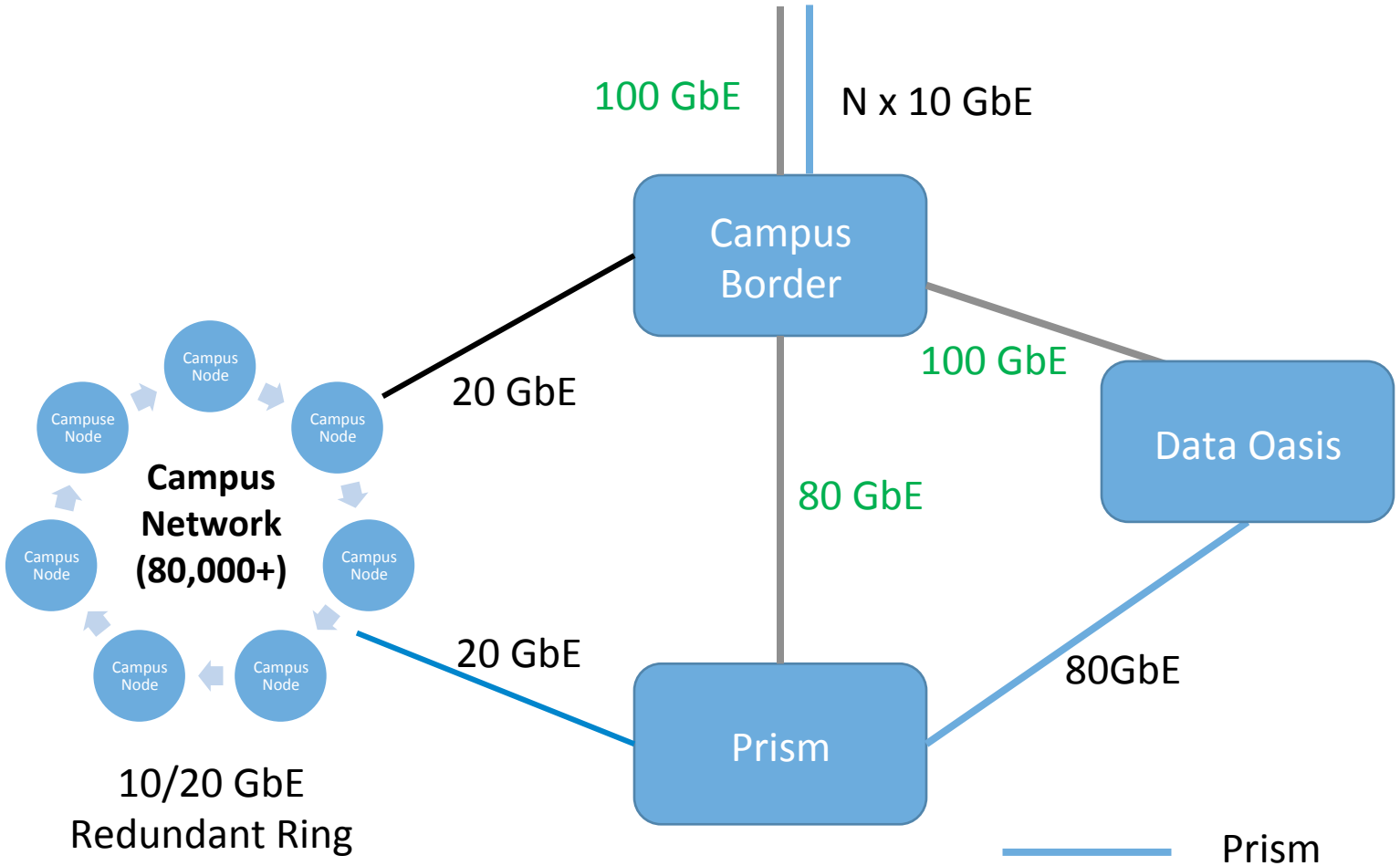
Prism@UCSD: Campus-scale DMZ. Openflow on some edge devices, but not enabled at core switch

- Climate Modeling
- Ocean Observing
- 3D Electron Microscopy
- Chemistry
- LHC Physics
- Proteomics
- Computer Science
- High Performance Computing
- High Performance data



Phil Papadopoulos, SDSC, Calit2, PI

Prism in Relation to Other Campus Networks



See Tom Hutton at this Workshop

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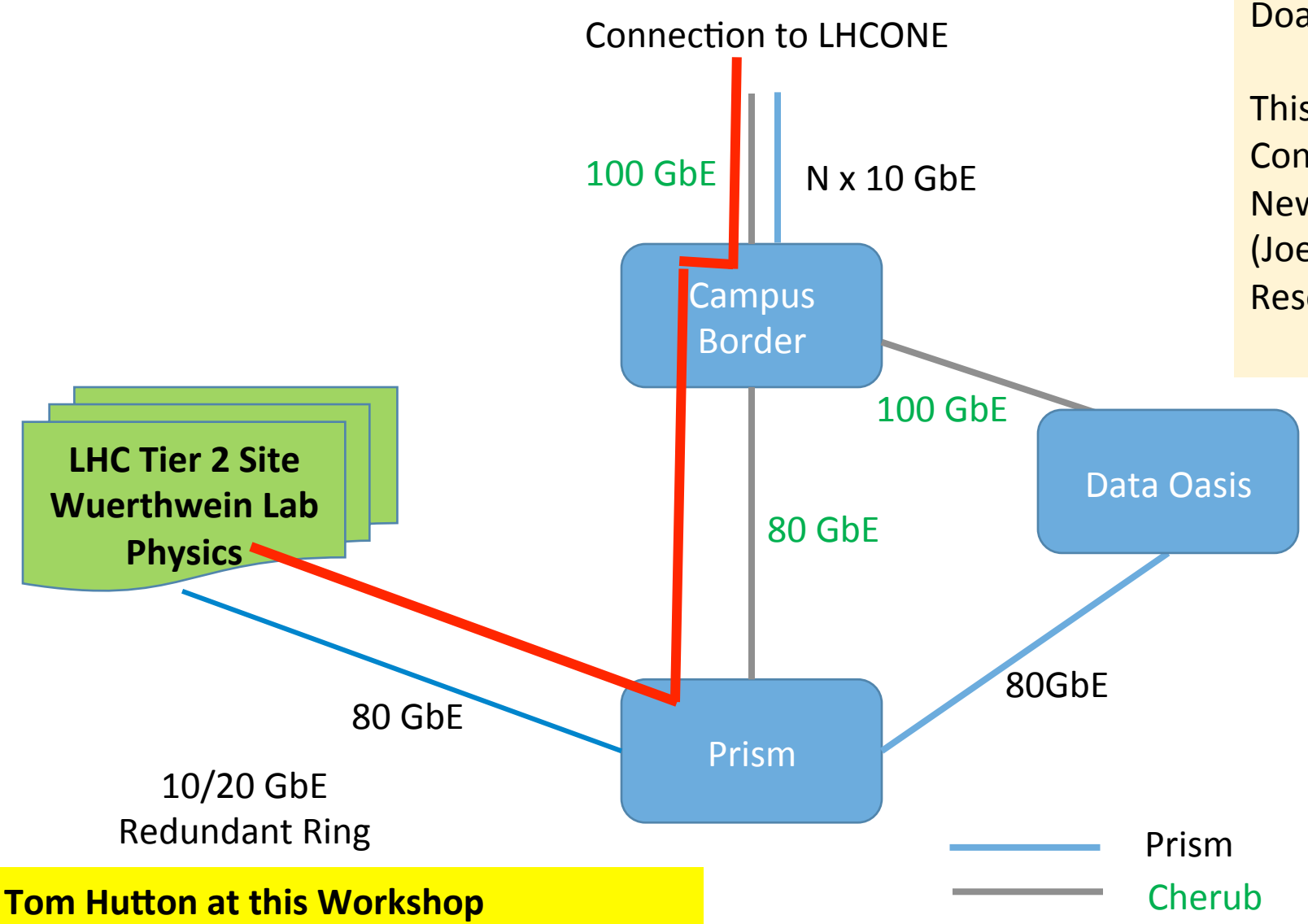


"wiring" to LHCONE crosses multiple administrative domains.
Doable, but not scalable

This is not the only usage: Connections to StarLight, New activitities with SDX (Joe Mambretti, PI), Pacific Research platform (PRP), …

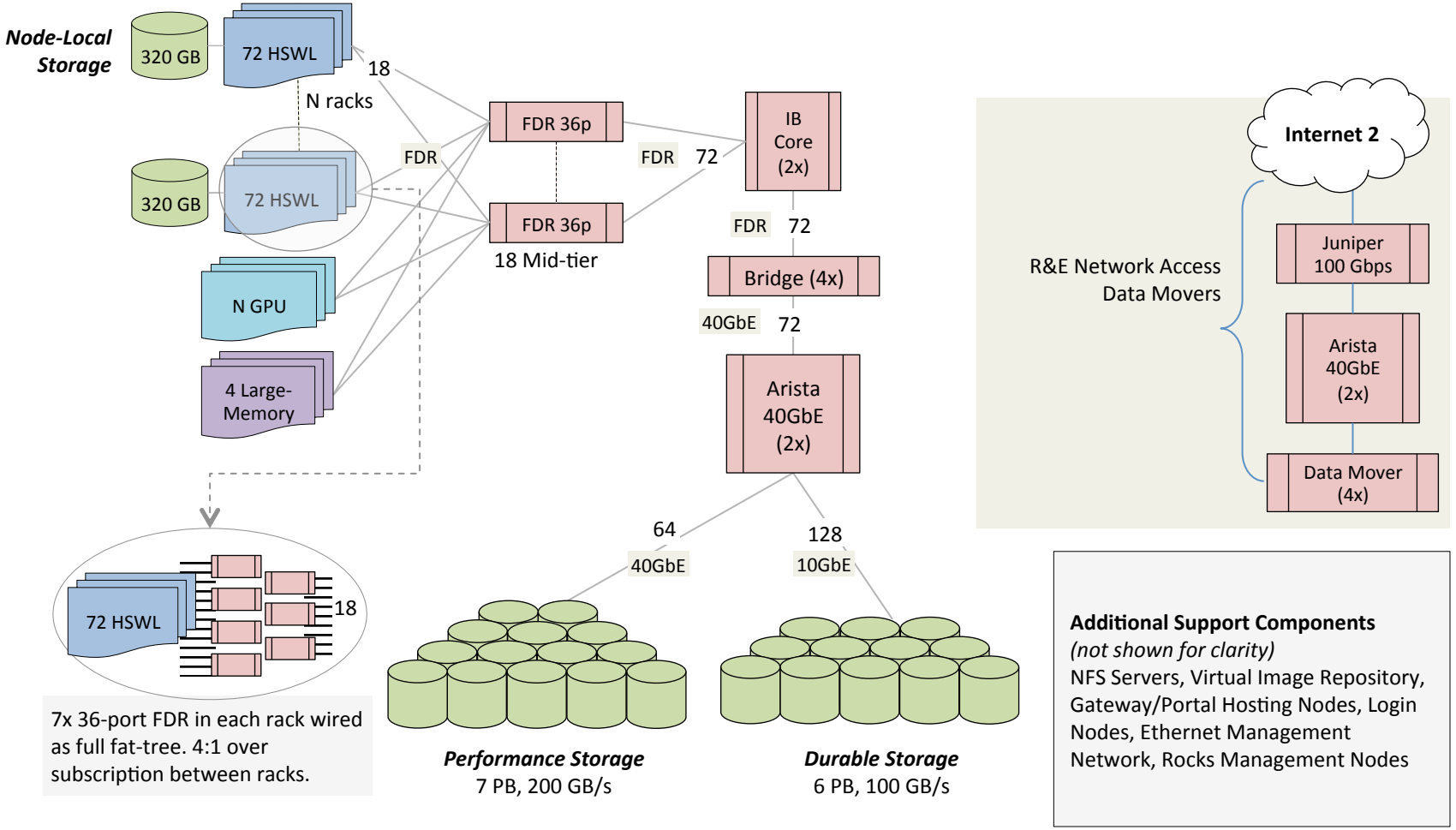
See Tom Hutton at this Workshop

HPC for the 99%

R. L. Moore, C. Baru, D. Baxter, G. Fox (Indiana U), A Majumdar, P Papadopoulos, W Pfeiffer, R. S. Sinkovits, S. Strande (NCAR), M. Tatineni, R. P. Wagner, N. Wilkins-Diehr, M. L. Norman

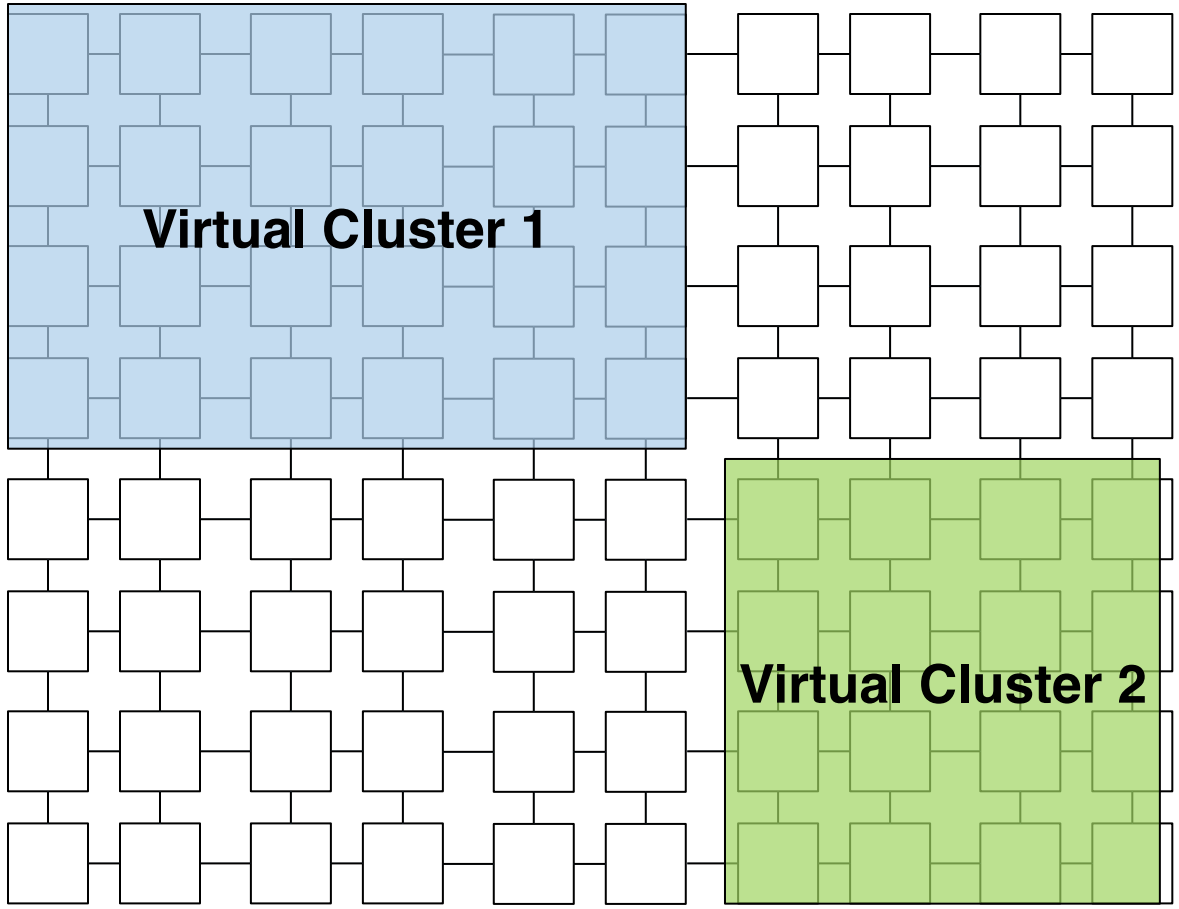
UCSD/SDSC (except as noted)

Comet Architecture (1944 Compute Node)



Notable: Bridging IB Fabric to Ethernet. All nodes are potential 40GbE Sources

Virtual Clusters – Overlay Physical Cluster with User-Owned High Performance Clusters



Isolation of Virtual Clusters

- SRIOV (Single Root I/O Virtualization) for Independent Infiniband Subnets
- Standard VLANs to isolate private Ethernet broadcast domain
  - Virtual cluster nodes can PXE-boot from their virtual frontends

Ethernet switches are openflow enabled: reticent about using this for first revision of production.

Takeways

- Activities range from computer science experimentation (actively using openflow) to isolation of virtual clusters (using VLANs, evaluating Openflow)
- A variety of activities utilize Layer2 connectivity options provided by ESNET/Internet2
  - Is there any unification of mechanism on the horizon?
- New Activities (not detailed in this talk) push on high-performance data at distance
- Openflow is really still in the “experimental” networking bin
  - Not in existing network equipment, new purchases are often capable
  - Core equipment lasts 5+ years, it will take a while to be pervasive.
- Personal view: terrific potential, need to be careful to not reinvent capabilities already existing (Routing is a good thing)