# San Diego Supercomputer Center

**Data Center & Grid Integration** 

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at the UNIVERSITY OF CALIFORNIA; SAN DIEGO

### **Outline**

- Who We Are
- Data Center Stats & Context
- Energy Efficiency Underway
- 2 Grid Integration Projects



New air handler for cooling newest 800kW HPC resource, Comet





# **SDSC in Brief**

- Established as a national supercomputer resource center in 1985 by NSF
- Became a UCSD Organized Research Unit in **1997**
- World leader in dataintensive computing and data management







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#### SDSC = HPC + Data Science



Gordon data-intensive supercomputer

- Major UC San Diego data center at SDSC
- HPC biggest power draw in computing
  - Gordon 1/3 Petaflop, ~300 kW
  - Comet 2 Petaflops, 800 kW





# Data Center

- 19,000 sq ft
- 24/7 'remote hands'
- Compliance-ready
  - HIPAA, FISMA, PCI
  - Two factor authentication, cages, security team
- Network
- 100Gbps (CHERuB layer 2 only): via CENIC to PacWave, Internet2 AL2S ESnet
- 20Gbps (each): CENIC HPR (Internet2), CENIC DC (K-20+ISPs)
- 10Gbps (each): CENIC HPR-L2, ESnet L3, Pacwave L2, XSEDENet



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#### Headroom: Power and cooling as important as racks

	Capacity	Utilized	Headroom
Racks	512 (=72%)	367*	145
Power	6.3 (13 to bldg)	2.5	3.8
Cooling capacity (MW)	4.25	2.5	1.75
UPS (total) (MW)	3.1	1.5	1.6
UPS/Generator MW	1.1	0.5	0.6

\*Includes Comet and UCLA Health



# **Energy Efficiency**

- UC San Diego generates 92% of its own power (natural gas co-gen plant)
- Data Center draws 2.5 MW/hr
  - External customers pay utilities
  - Utilities 60% of total co-location cost to customers
- Solar-power on roof (65kW)
- Cooling is great(est) opportunity for savings
- PUE 1.3 (expect decrease next audit)
- Efficiency measures decreased chilled water usage by 80-90%



#### **Traditional Data Center Cooling**



Old approach, mixing hot and cold

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#### **Containment Approach**



- SDSC retrofitted existing data center to contain heat.
- Expanded space built with 'hot/cold' aisles.





## **Optimize for Price and Outages**

- BMW Battery Storage
  project
  - Old Fiat EV batteries from EU
  - 5 kW (very small), scales to 100 kW
  - Shipping container

#### Concept

- Charge storage at night, cheapest \$0.05/kW/hr
- Discharge at peak demand, \$20/kW/hr





# Load Shedding

- Local utility (SDG&E) program for lower rates with load shed opt in
- Office building participates, Datacenter does not
- Current SLAs for colo customers do not include load shed options (people use us for reliability)
- HPC systems (XSEDE and campus) run at about 90% utilization
  - XSEDE demand at 600% of available cycles—too disruptive to cut availability
  - Technically challenging to move user applications to identical resource
- Working to improve ability to power up and down those 10% of idle nodes



# **Direct Current (DC) Project**

- Computing is powered by AC, but arrives as DC
- Conversion from DC  $\rightarrow$  AC, loss of ~22% power
  - Great savings potential
- Requires retrofitting of equipment
  - No UL Tested Available (Yet)
- Test 2015 storage arrays and compute nodes
- Proposal hope retrofit HPC resource, benchmark





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# MORE INFORMATION...





# **HEAD2HEAD DATA WARFARE @SCI4** SAN DIEGO SUPERCOMPUTER CENTER at the UNIVERSITY of CALIFORNIA, SAN DIEGO

**Booth 1333**