Liquid Cooling Commissioning Lessons Learned Lawrence Livermore National Laboratory (LLNL)

Supercomputing 2013

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LLNL's Liquid Cooled Systems

- Sequoia
  - IBM Blue Gene*/Q machine
  - 98,304 nodes
  - 1,572,864 cores
  - 20 PF, 3rd on Top 500 ranking – June 2013
  - 96 racks
  - 91% liquid cooled
  - 30 gpm at 62 F
  - 9% air cooled
  - 1700 cfm at 70 F
- Vulcan
  - IBM Blue Gene*/Q machine
  - 24,576 nodes
  - 393,216 cores
  - 5 PF, 8th on Top 500 ranking – June 2013
  - 24 racks
  - 91% liquid cooled
  - 30 gpm at 62 F
  - 9% air cooled
  - 1700 cfm at 70 F

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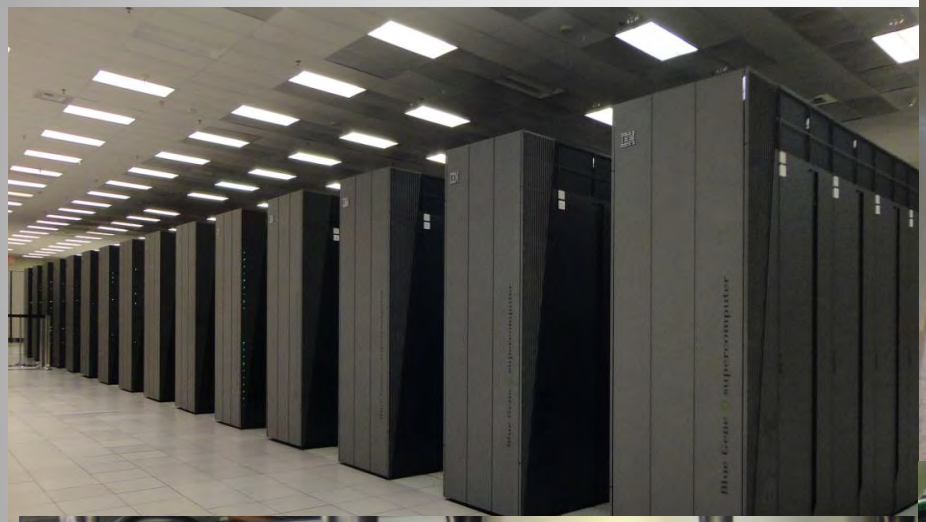
Sequoia/Vulcan



Lessons Learned - Case Study#1 Water Quality Issues

- Water quality requirements are specified by the vendor
- Requirements were inconsistent in documentation
  - Resistivity and conductivity were in direct conflict with one another
- Vendor was unsure of correct requirement
- Demineralized water (DW) was determined to be the correct source and was used to flush and fill the system
  - The facility only has a 1” DW line available
- City water (CW) was ultimately used to flush and fill the system and is currently the water used in the system
- These issues resulted in schedule delays and unforeseen additional rework

Lessons Learned - Case Study#2 Water Utility Source Issues

- LLNL has 2 sources of CW, Hetch Hetchy water and Zone 7
- Hetch Hetchy is a direct clean water supply from Yosemite National Park
- Zone 7 is a local ground water source and is undesirable
- Approval to start Vulcan construction was delayed and schedule was condensed
- Annual maintenance of Hetch Hetchy coincided with flush and fill of Vulcan system
- Contingency plan was to utilize portable tanks and pump skid filled with Hetch Hetchy water
- Contractor finished construction early
- System was filled with direct Hetch Hetchy and portable tanks were not needed.

Questions

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