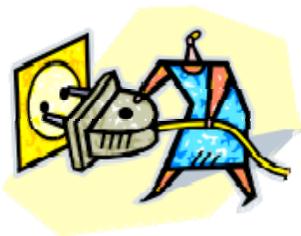# DOE Best Practices Workshop
# Power Management
San Francisco, Sept. 28-29, 2010

Facilities – Session 1A

Power Distribution and Cooling Configurations

Facility-to-Rack

Breakout Report

Breakout Participants

- Kathye Chavez (Co-Lead)
- Dave Martinez (Co-Lead)
- Helmut Breinlinger
- Jason Budd
- Matthew Campbell
- James Craw
- Christopher DePrater
- Thomas Durbin
- Ladina Gilly
- Alan Goodrum
- Rick Griffin
- Mark Hartzell
- John Hutchings
- Doug Kelley
- Pete Kulesza
- John Parks
- Dave Prucnal
- Terri Quinn
- Greg Rottman
- Bryan Webb
- Ryan Wright
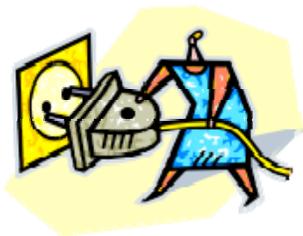
Agenda

- *Participant sign-in*
- *Introductions*
- *Discussion Format*
  - *Focus on the session summary topics*
  - *Gather information on:*
    - *Experiences – novel or interesting approaches*
    - *Best practices related to the area*
    - *Status of (de facto) standards*
    - *Gaps looking forward – what are the power-management challenges in this area*
    - *Hardware or facility interfaces to improve (things we buy instead of build*
    - *Evolve or start over for future systems? – is there a natural evolutionary path in this area to support future systems, or are there issues and projected requirement such that a complete new start is needed*

- *Review of session summary*
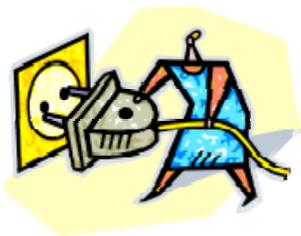
Discussion Format

Open sharing of experiences & ideas to gather topical information on:

- *Experiences – novel or interesting approaches*

- *Hardware or facility interfaces to improve (things we buy instead of build_ -- what things can the DOE HPC community work together to influence so they fit our current & upcoming requirements better*

- *Issues shared with large commercial data centers – are the problems shared and what opportunities exist for collaboration*

- *Best practices related to the area*

- *Other key findings*

- *Do standards (formal or de facto) need to be improved or developed*

- *Evolve or start over for future systems – is there a natural evolutionary path in this area to support future systems, or are there issues and projected requirements such that a complete new start is needed*

- *Issues shared with large commercial data centers – are the problems shared and what opportunities exist for collaboration*

- *Gaps looking forward – what are the power-management challenges in this area*
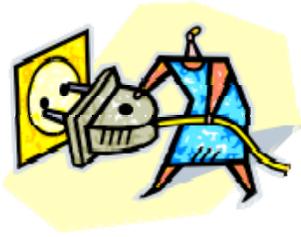
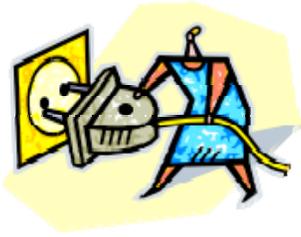# Power Distribution and Cooling Configurations Facility-to-Rack

Power

Types of voltage – supplying higher voltage directly to the racks?

- Want to go 480V/240V to the racks
- Or 480V/415V with autotransformers to 240V
- Some 208/100V to the disks (minimal use)
- DC not feasible at time

- Note: Safety and harmonics are major concerns with increased voltage

- Experiences new or interesting?

- Status of standards (de facto)?

- Gaps looking forward?

- Hardware/facility interfaces

- Evolve to new systems or start over?

- Commonalities or collaborations with large commercial data centers

- Other key findings?

Power Distribution and Cooling Configurations Facility-to-Rack

Power

Overhead vs. underfloor

- Mix of use
- Proponents of overhead is use of underfloor air plenum
- Prefer not mix of chilled water piping & power under floor
- Legacy systems, most, still have mix under floor
- Most feel safer under the floor
- Aesthetics is a decision factor

- Experiences new or interesting?

- Status of standards (de facto)?

- Gaps looking forward?

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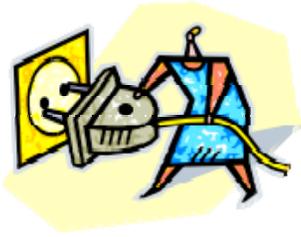
- Other key findings?

Power Distribution and Cooling Configurations Facility-to-Rack

Power

Conditioned vs. non-conditioned power

• Unless using autotransformer 480/240V most feel that power conditioning will not be a problem in the future
Utilization of line to load side transformer should take out most harmonics
• Segregation of mechanical and computer loads at the transformer level

• Experiences new or interesting?

• Status of standards (de facto)?

• Gaps looking forward?

• Hardware/facility interfaces

• Evolve to new systems or start over?

• Commonalities or collaborations with large commercial data centers
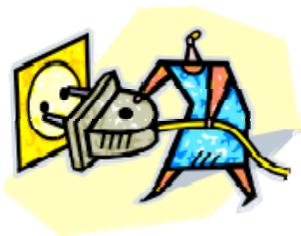
• Other key findings?

Power Distribution and Cooling Configurations Facility-to-Rack

Power

UPS still a requirement for most data centers?

•Not in HPC environment with exception of disks and start up nodes
•UPS being replaced by flywheel/generator use
•UPS is costly for benefit
•Must also have mechanical systems on UPS or not viable for larger systems

• Experiences new or interesting?

• Status of standards (de facto)?

• Gaps looking forward?

• Hardware/facility interfaces

• Evolve to new systems or start over?

• Commonalities or collaborations with large commercial data centers
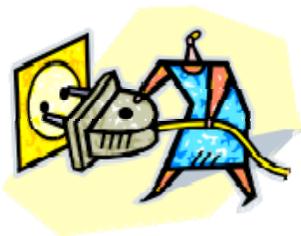
• Other key findings?

Power Distribution and Cooling Configurations Facility-to-Rack

Cooling

Direct (water or refrigerant based) vs. indirect (air cooling)

- Trading pump energy for fan energy
- Inefficient to cool entire plenum or room volume
- Who drives decision for indirect or direct cooling, vendors or their customers? Chicken vs. egg
- Not unreasonable to ask vendors to deliver a complete product (computer, cooling etc.) and we simply hook into it
- Is the perfect system a balance between the two?

- Experiences new or interesting?

- Status of standards (de facto)?

- Gaps looking forward?

- Hardware/facility interfaces

- Evolve to new systems or start over?

- Commonalities or collaborations with large commercial data centers

- Other key findings?
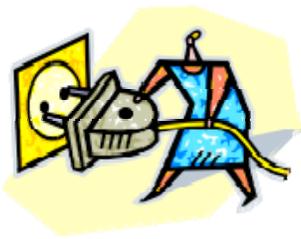
Power Distribution and Cooling Configurations Facility-to-Rack

Cooling

Utilization of hot or cold aisle containment

- Cold aisle containment is marginally more efficient
- Hot aisle containment is easier to control thus more efficient
- Fire codes can be a constraint
- Hot aisle can use volume of room to help cool
- Dilemma – still use all air handlers at 40% or turn some off, what is ROI in that state?

- Experiences new or interesting?

- Status of standards (de facto)?

- Gaps looking forward?

- Hardware/facility interfaces

- Evolve to new systems or start over?

- Commonalities or collaborations with large commercial data centers
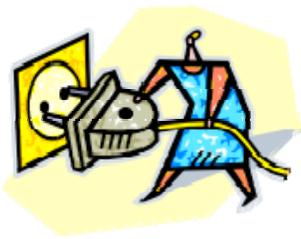
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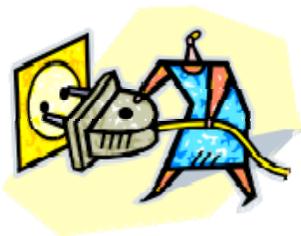# Power Distribution and Cooling Configurations Facility-to-Rack

Cooling

Is the utilization of tower water/air side economizers effective in the data center?

• *what is the limitation (if any) of kW to rack where it is no longer effective?*

- If using tower water raises temp of room would it affect fan speed in the computer racks equaling a net gain
- Critical to all discussion is having a baseline of current condition and metrics of change results
- Humidity is a major factor that can change the effectiveness
- Should hold vendors to ASHRAE standards for humidity and temp control
- Need effective method to capture and utilize waste heat generation

- Experiences new or interesting?

- Status of standards (de facto)?

- Gaps looking forward?

- Hardware/facility interfaces

- Evolve to new systems or start over?

- Commonalities or collaborations with large commercial data centers

- Other key findings?

Final Thoughts, Comments, Questions?

Power Distribution and Cooling Configurations from Facility-to-Rack

- Need to resolve IT managers vs. Facilities organizations and independent decision making
- Trend to provide energy efficient data center will be surpassed by need to reduce carbon footprint and prove sustainability
- Raised floor vs. non-floor not yet ready to abandon raised floor

- Experiences new or interesting?

- Status of standards (de facto)?

- Gaps looking forward?

- Hardware/facility interfaces

- Evolve to new systems or start over?

- Commonalities or collaborations with large commercial data centers

- Other key findings?