

Information Technology and its impact on Energy & the Environment

A Case Study on Data Centers

Paul K. Wright

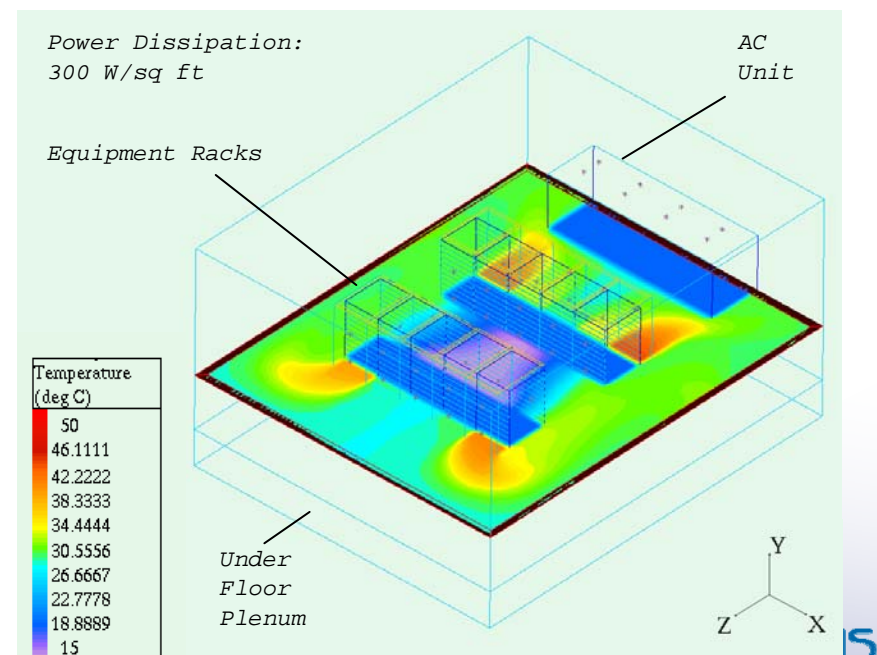
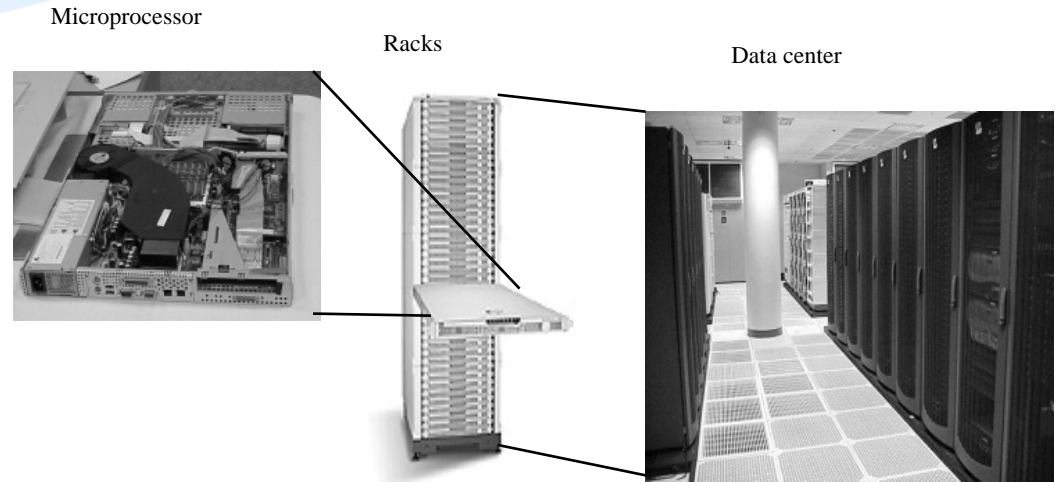
Acting Director, CITRIS

A. Martin Berlin Professor of Mechanical Engineering

With thanks to colleagues Professor Van Carey and David Auslander
and to Hewlett Packard

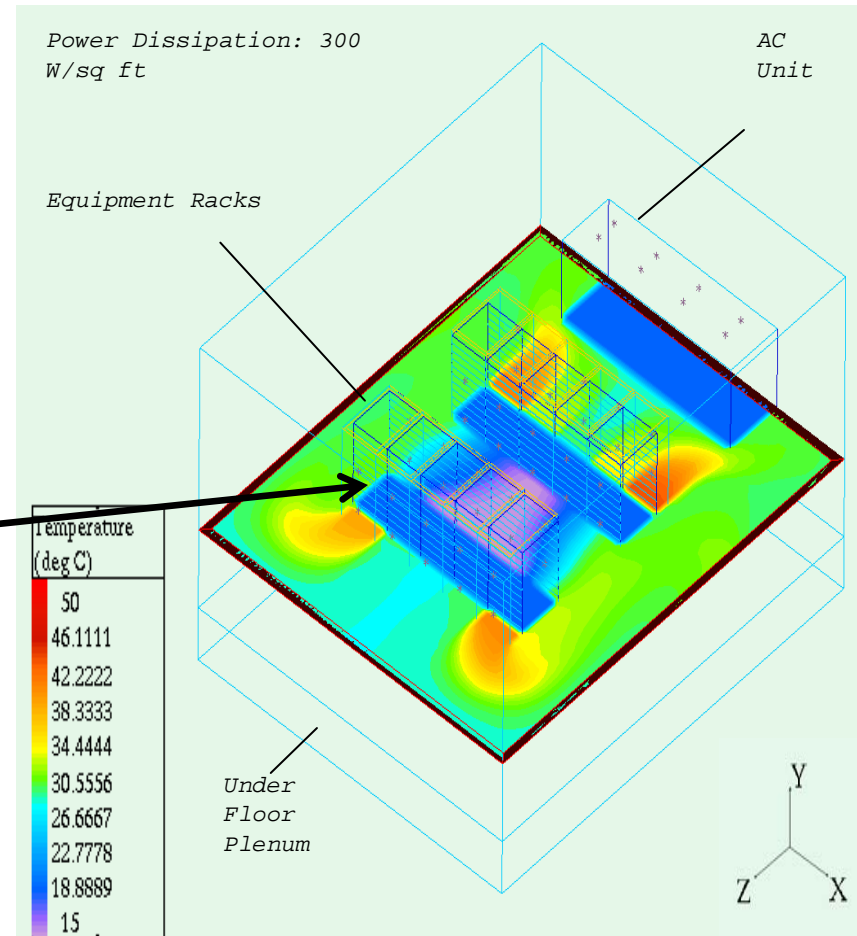
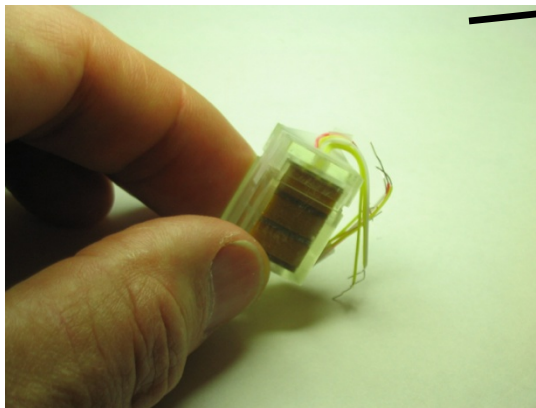
The challenge for Data Centers

- Energy cost of supercomputing becoming prohibitive
- 30 million servers in the world's data centers
 - ~ 3 MW each
 - Today need 14 power 1,000 megawatt plants
 - E.g. from Borderstep Inst.
 - Germany alone - enough energy to power two and a half million houses
 - Produce 6 million tons of carbon emissions



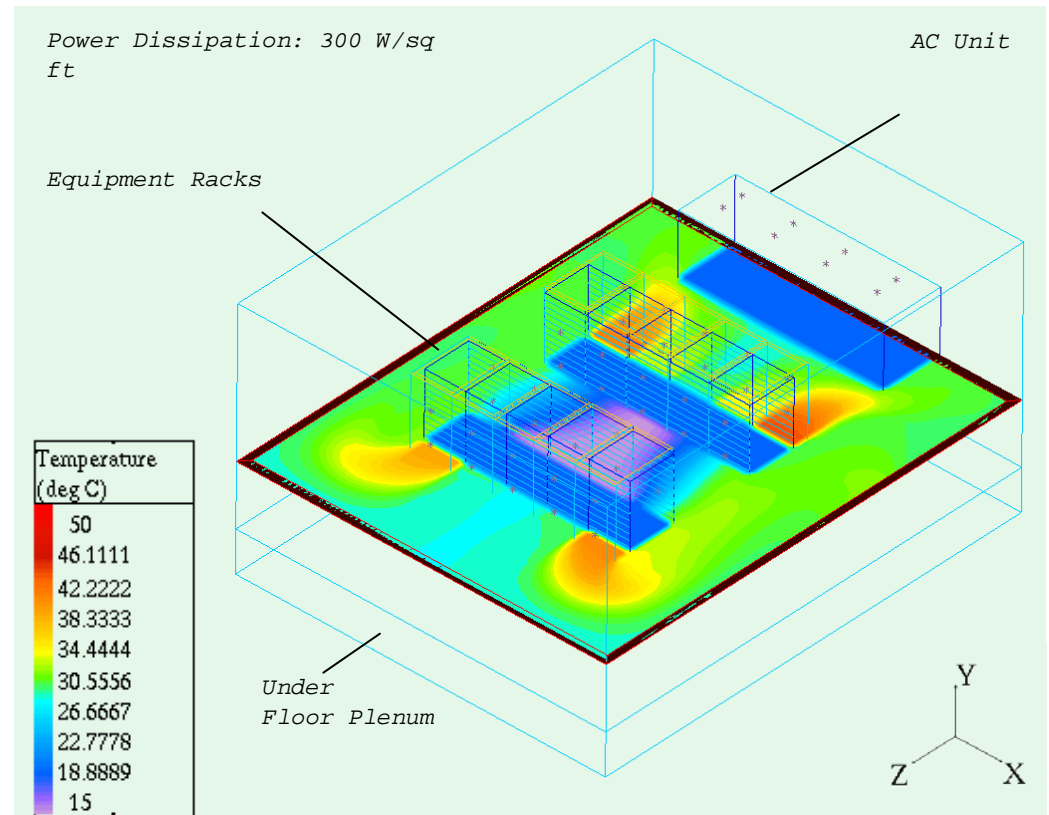
Wireless Sensor Networks @ CITRIS

- Deployment of micro sensors (wireless nodes)
- “Micro-climate” and use at each of the blades in the server farm



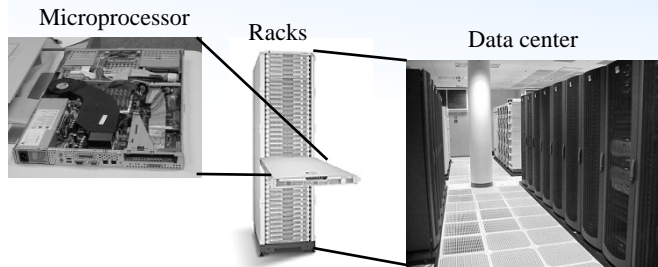
Business Impact: Asset Management

- **Energy aware design and control**
- **CITRIS HP redesign and sensing saves up to 45% of cooling power use**
- **Saving ~\$400K/yr in typical center**



With thanks to colleagues Professor Van Carey and David Auslander

Efficient data-centers/buildings



Key Challenges

Growing consumption of power

~ 2 MW each, 10x for future Centers

Energy cost of supercomputing becoming prohibitive

Cooling consumes half

Energy efficient operation

Reduce cost and carbon footprint

Sustainability: minimize lifecycle energy resources (energy) consumed

CITRIS HP Data-center Research Energy aware design and control

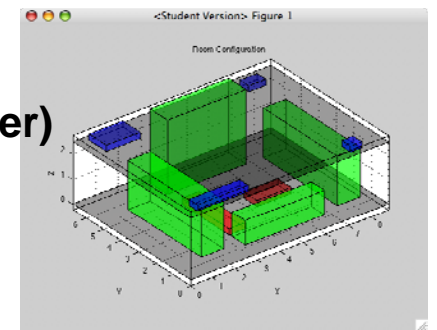
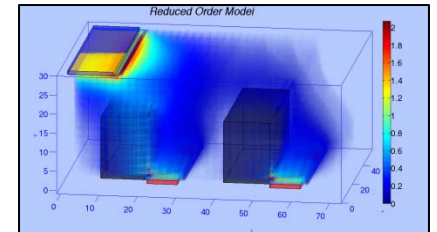
Hewlett Packard redesign saved up to 45% of cooling power use (saving ~\$400K/yr in typical center)

High Performance Buildings

LBL History of important work in refrigerators windows, DOE2, modeling, lighting, safety

Energy Free Home

Bring together experts from campus, LBNL, industry, government to change technology, practice and policy on a national scale.



Backup

- Example
- Borderstep Institute for Innovation and Sustainability
- Data centers in Germany alone use
 - Enough to energy to power two and a half million houses
 - Produce 6 million tons of carbon emissions