AEC Conference

“CHIPS FOR BRICKS™”

SUSTAINABLE DATA CENTERS

Presented by:

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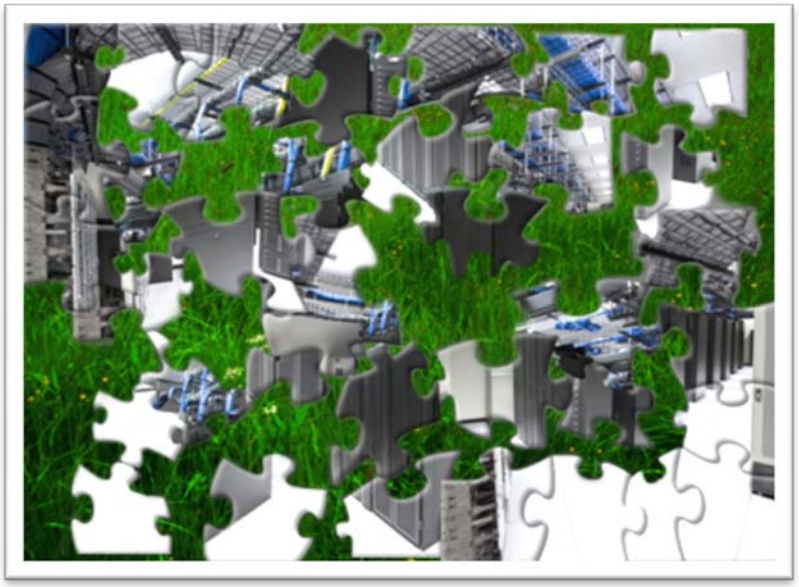
Green Data Centers II - 11/9/2010

The Challenge

Integrating The Digital & Physical

- **Outdated physical data center standards lead to:**
  - Excessive construction costs
  - Space utilization (reduced Digital area) and
  - Reduced budgets for IT equipment
- **Wasted energy**
  - Redundant systems operate at inefficient part load
  - Excess construction dollars equate to unnecessary manufacturing
  - Data Center energy use (PUE) becomes inefficient
- **Integration of Digital and Physical programs ensures:**
  - *Sustainable* data center performance
  - Impressive CapEx and OpEx reductions
  - Savings through facility optimization
  - Budgets were re-allocated to the digital program
- **Chips for Bricks™ reallocates budgets to the Digital program**

The Challenge



The Real Challenge

Separated by a Common Language

IT Approach

- Tier 1 = Mission Critical
- Storage is a drive
- Architecture is a system

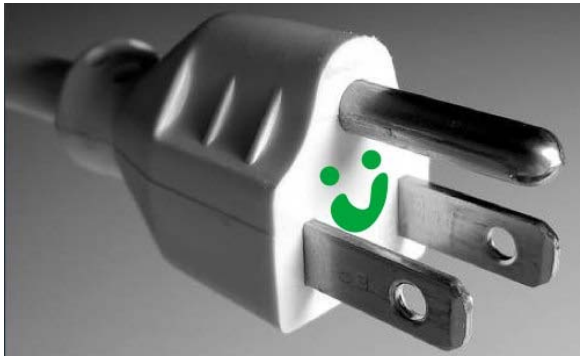
Facility Approach

- Tier 4 = Mission Critical
- Storage is a closet
- Architecture is a building

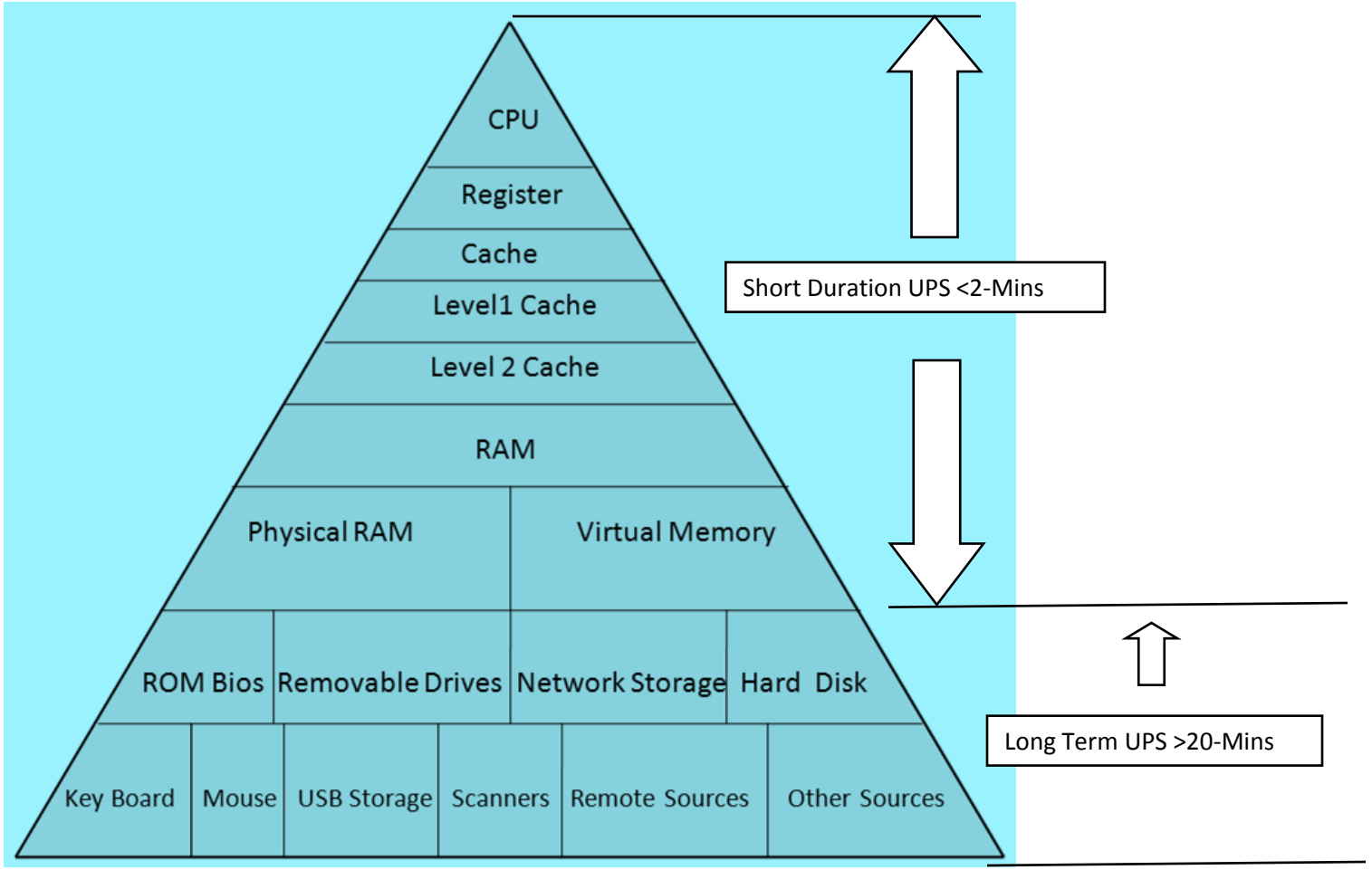
Integrating Digital & Physical

IT Game Changers Minimize Physical Requirements

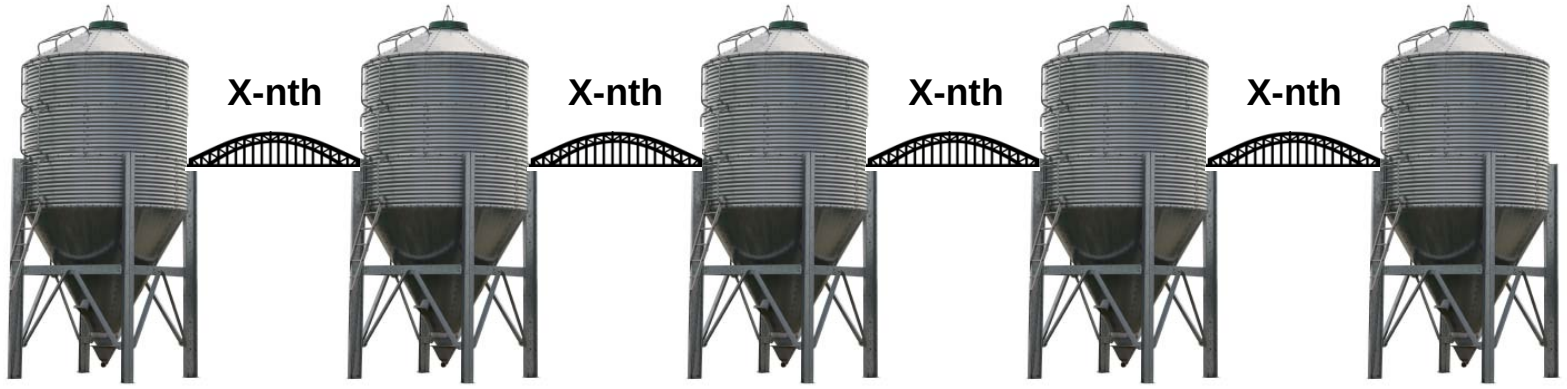
- Virtualization and cloud computing
- Storage area networks
- High-bandwidth accessibility
- IT costs less now



The IT Pyramid



Bridging Silo Management Gaps



Operational Mission | **IT Planning** | **Facility Engineering** | **Construction** | **Operations & Maintenance**

COLLABORATION MAINTAINS MISSION PURITY

Case Study #1

National Oceanic and Atmospheric Administration

- Supercomputer processing required new data center space
- Facility budgets impacted funding for supercomputer
- Physical program was “right-sized” to preserve IT procurement allocations
- Facility budget was originally $48 million
- Integrating Digital requirements reduced construction budgets $25-million
- Savings re-allocated to the Digital Data Center Program

Facility Costs	Savings Reallocated to Digital Data Center	Original Facility Budgets	Final Integrated Costs
Construction Savings	**$25,186,405**	**$48,307,823**	**$23,121,418**

Case Study #2

University of Michigan

- Mission digitized one of the largest hospital systems in the US
- Stakeholder facilitation to integrate Digital with Physical requirements
- Statistical evidence – reduce build costs while retaining
  - Capacity, availability and energy efficiency
  - Increased raised floor 25%
- Funds reallocated to IT systems

Facility Costs	Savings Reallocated to Digital Data Center	Original Facility Budgets	Final Integrated Costs
Construction Savings	**$7,937,000**	**$35,500,000**	**$27,563,000**
Post Construction	**$1,500,000**	**$1,500,000**	**$0**
Total Savings	**$9,437,000**		

Note: Construction savings used to build IT fiber back bone, during rather after construction.

Case Study #3

CITIGROUP

- Consolidation of 14 data centers 450,000 SF of raised floor
- Construction of three mega Data Centers $220 million each
- Live renovation, instead of mothballing one Data Center
  - Construction proceeded without disrupting processing
  - Energy efficiency improved to modern standards
  - Doubled capacity while increasing Fault Tolerance

Facility Costs	Savings Reallocated to Digital Data Center	Original Facility Budgets	Final Integrated Costs
Construction Savings	**$152,000,000**	**$220,000,000**	**$68,000**

Common Threads

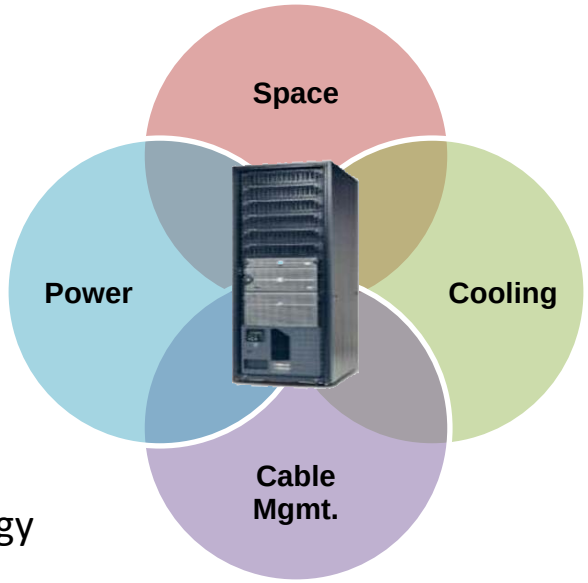
Case Study Findings: Redundancies & More

How much redundancy is too much?

Common Threads

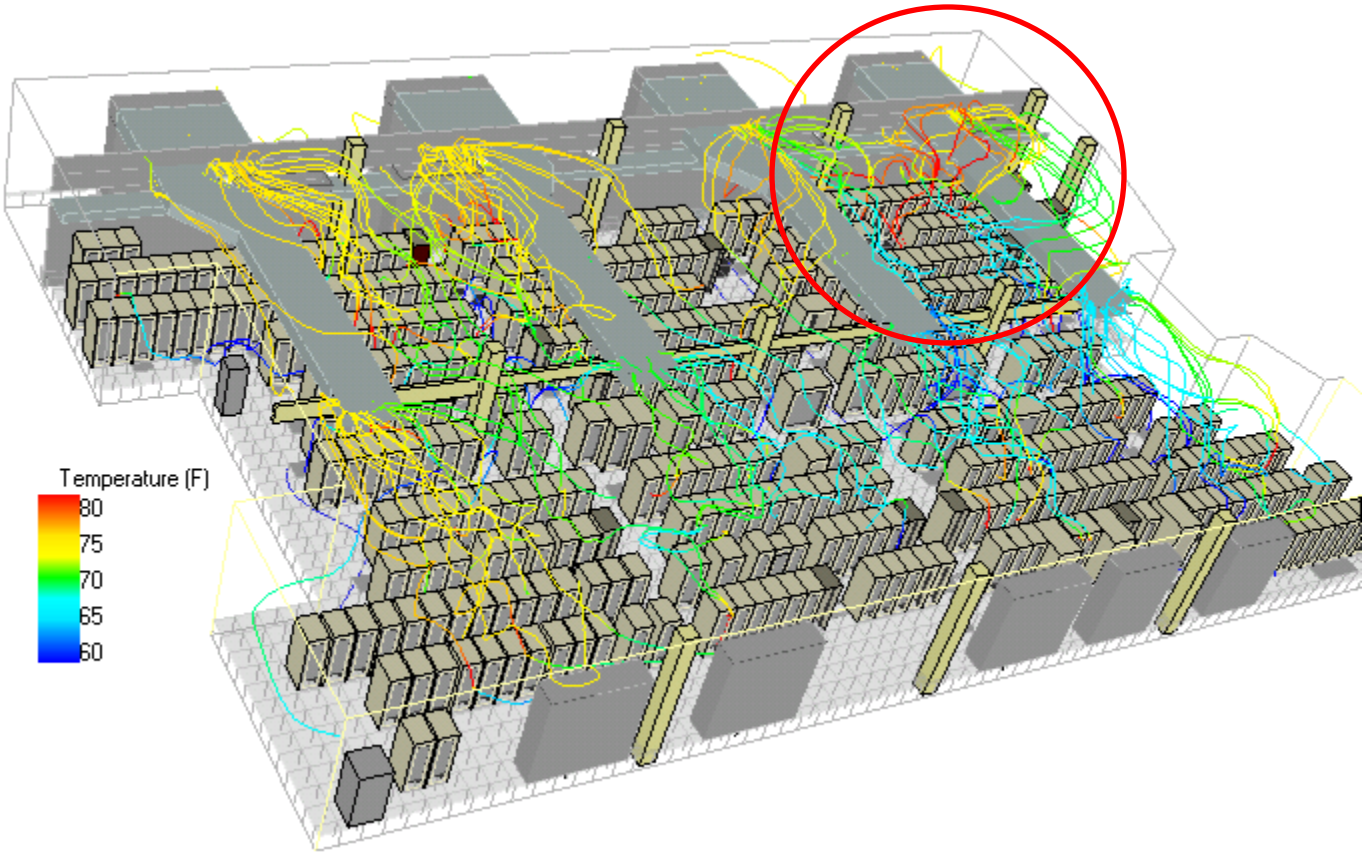
The Junction

- Enclosures essential for complete integration
- Integral to full DC systems design
- All resources meet at the enclosure
  - Power
  - Cooling/Airflow
  - Cabling/networking
  - Monitor/control/security/structure
  - Raising the temperatures, with control, saves energy



Common Threads

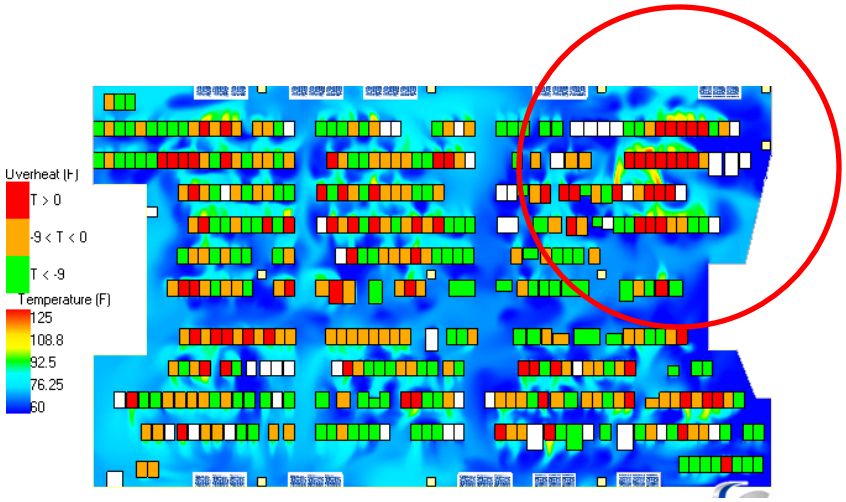
CFD Modeling Results



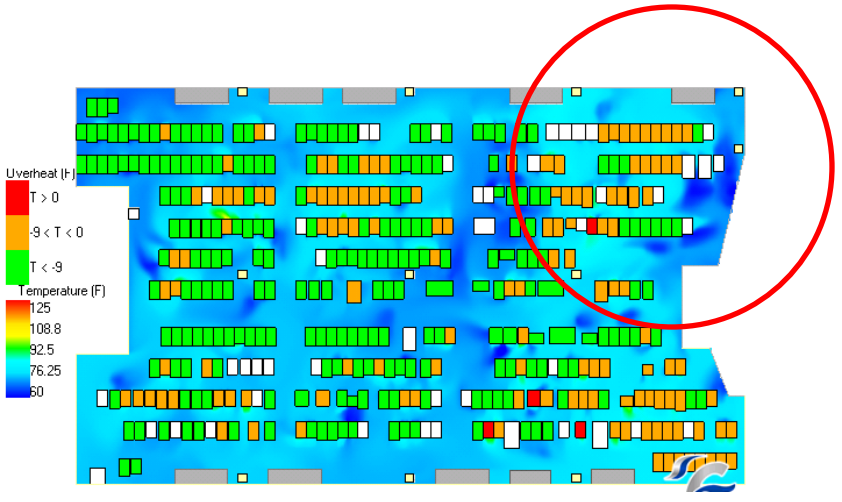
Courtesy AFCO Systems, Farmingdale, NY

Common Threads

Effect Of Enclosures



Hot-spots in an inefficient, too cold Data Center.

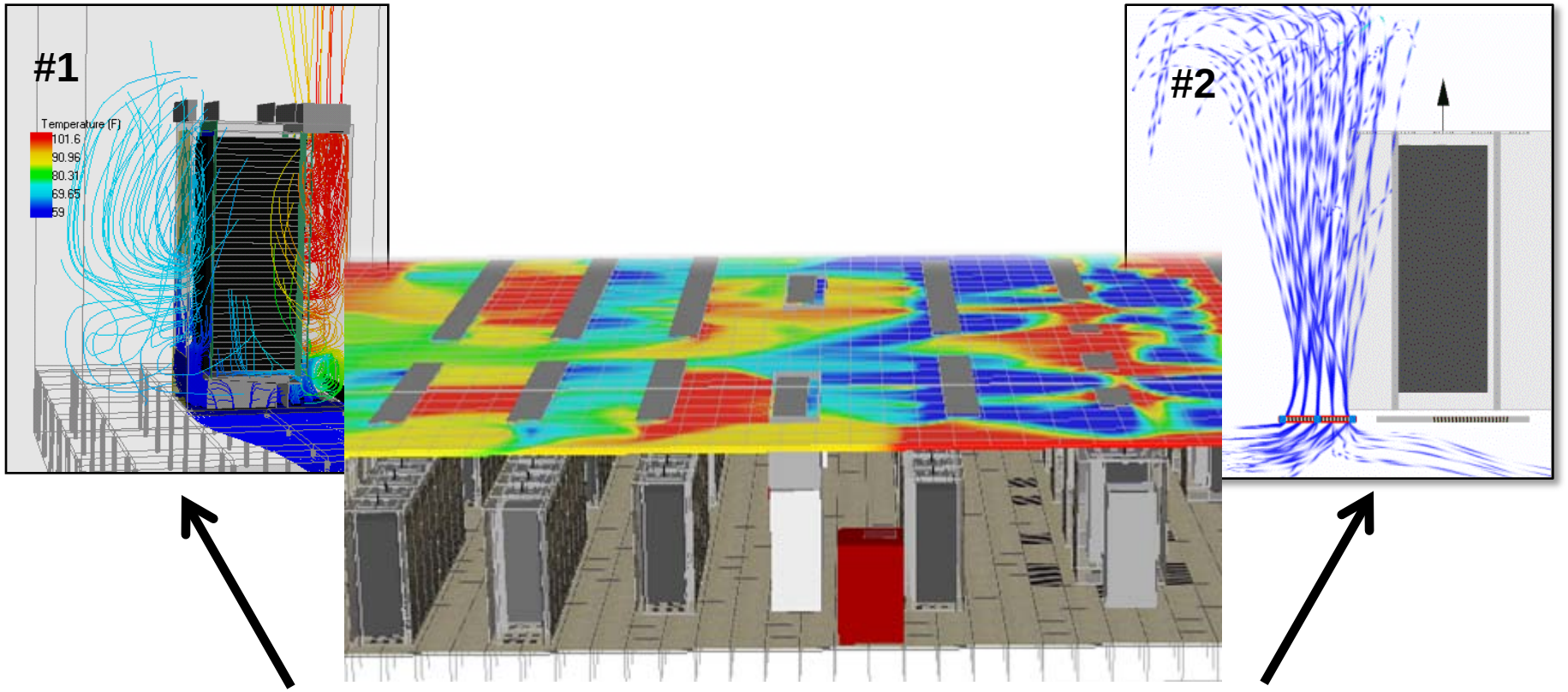


Engineered enclosures manage cooling distribution.

Different Outcomes ... Same Facility

Common Threads

Same Room – Two Cooling Methods



Effective Thermal Management
Engineered Enclosures

vs.

Wasted Capacity, Energy & Cooling
Typical Hot/Cold Aisles

Note: Cold (blue) air returning to the ceiling is wasted capacity, yellow/red is expected

Courtesy AFCO Systems, Farmingdale, NY

A Problem Well Defined Seeks Its Own Solution