AFCOM
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Getting the Most Out of Your Data Center
Why Does it Matter?

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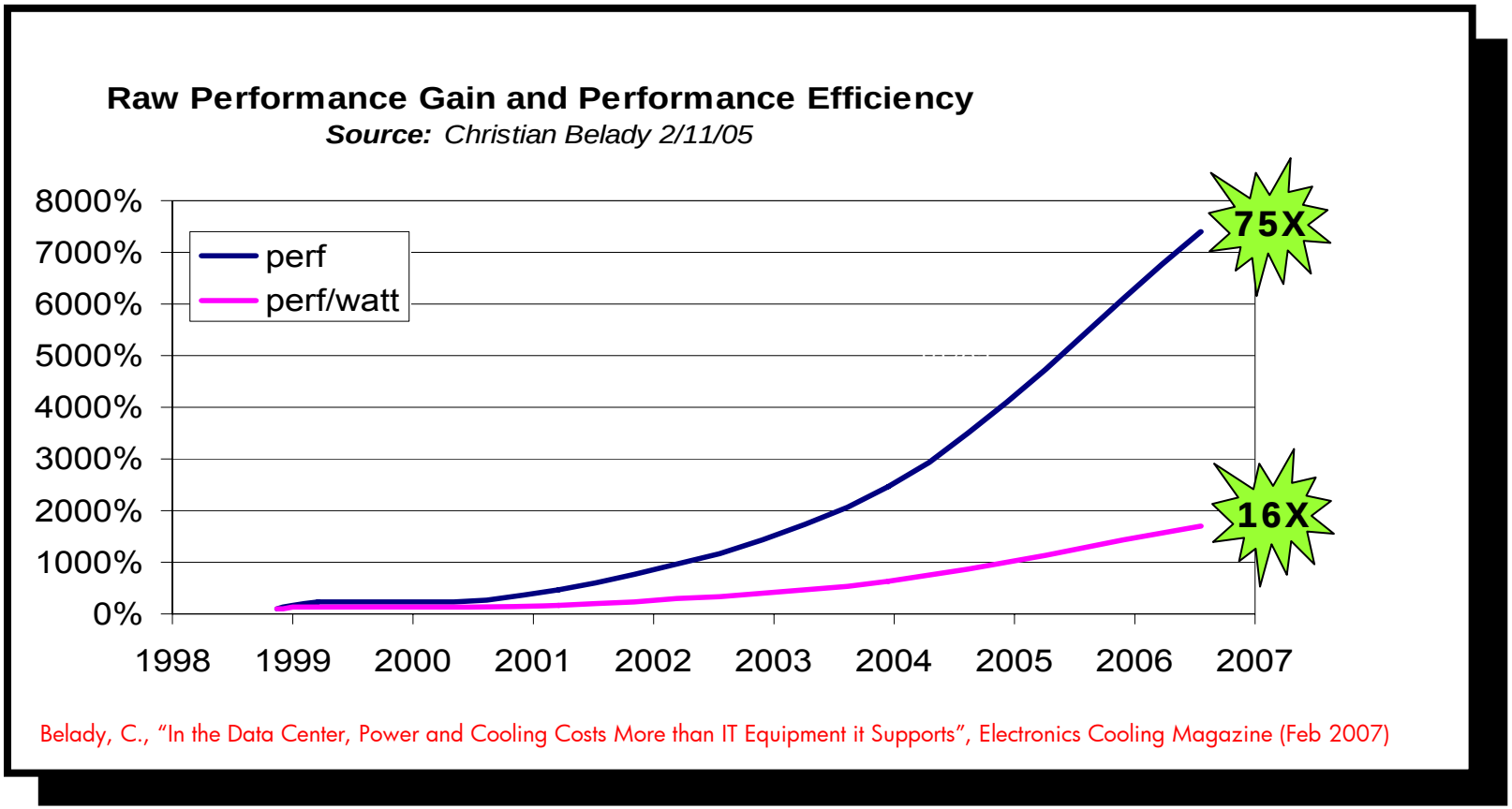
Hewlett-Packard Company

GET CONNECTED
People. Training. Technology.

Server Efficiency is Improving Yr/Yr

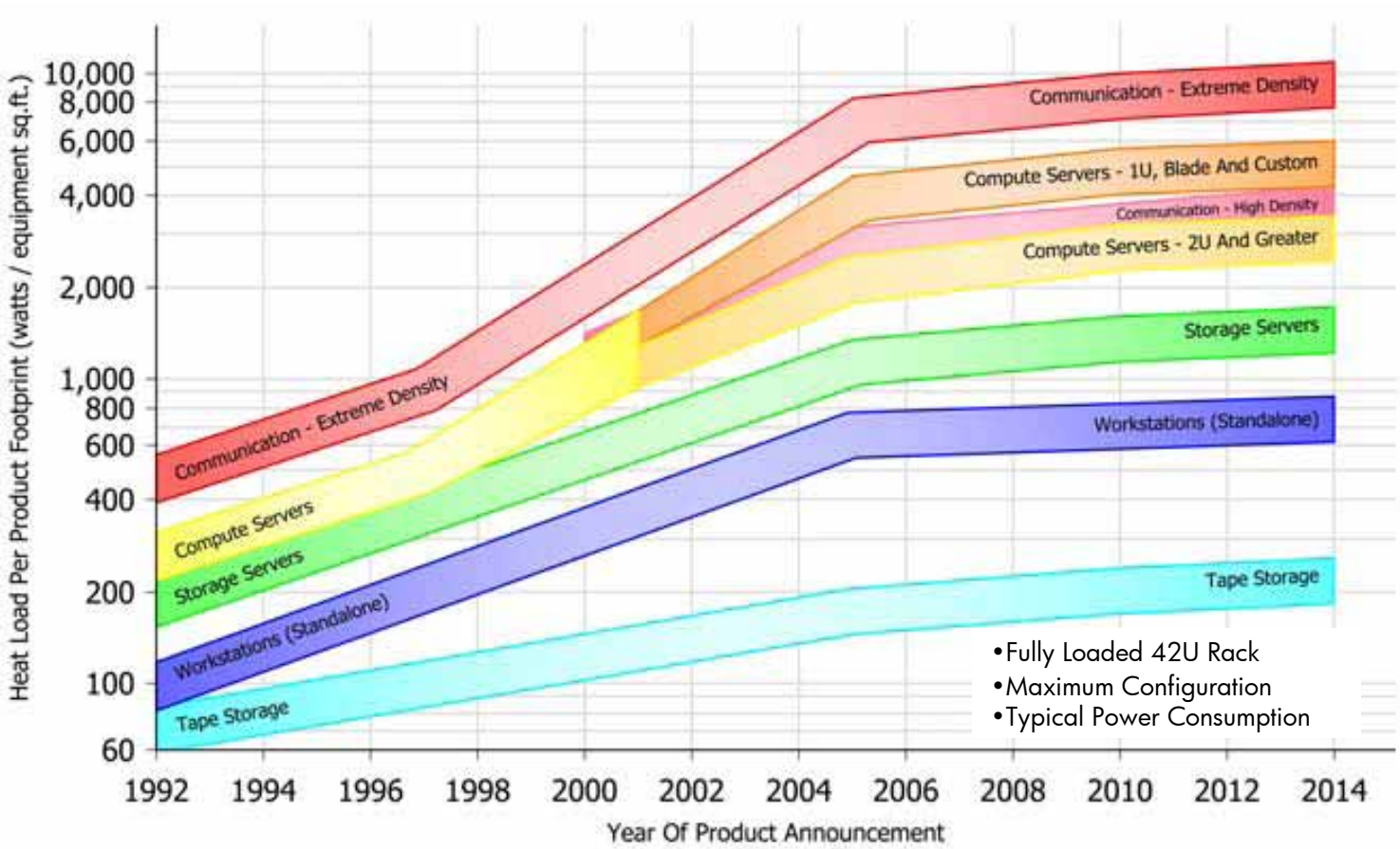
Example Server – Following Moore's Law

Performance/Watt doubles every 2 years



Belady, C., "In the Data Center, Power and Cooling Costs More than IT Equipment it Supports", Electronics Cooling Magazine (Feb 2007)

So What Is the Problem?...
Power Density is Going Up!

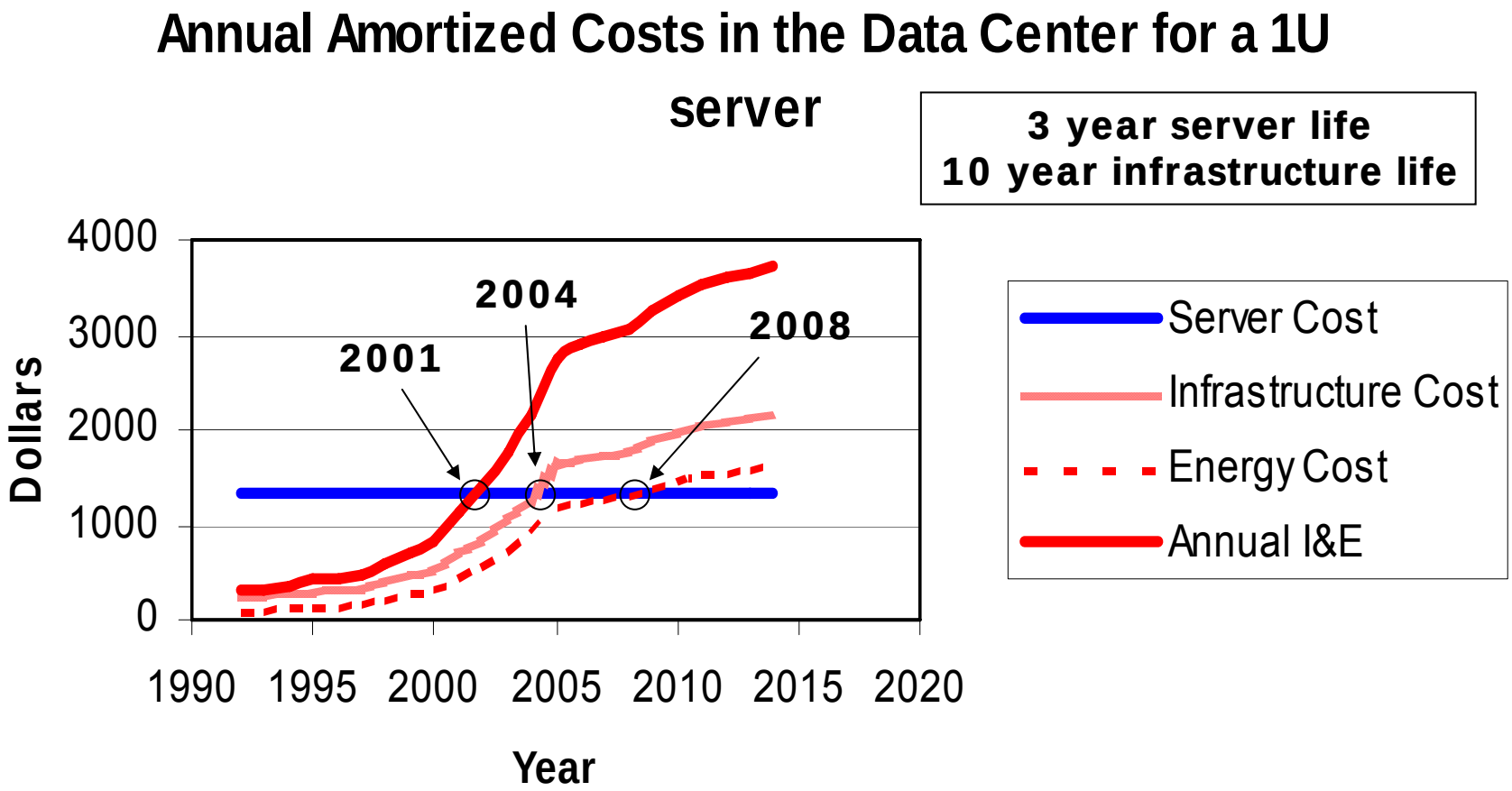


Datacom Equipment Power Trends
and Cooling Applications (ASHRAE)
purchase books at: http://tc99.ashraetcs.org/

So What?

- Application growth > Server Performance Growth
  - Data Centers are not shrinking
  - Utilization in many servers less than 20%
- #1 Issue data center managers are facing
  - How do you manage this density
  - Run out of power before they run out of space
- Energy Costs are Rising
  - US/England ~ $0.10/kWh
  - Japan/Germany/Italy ~ $0.20/kWh
- Energy and Infrastructure costs are becoming a bigger piece of the TCO
  - this is a result of higher Power density and higher energy costs

Infrastructure Costs and Energy Costs are Higher than Server Costs



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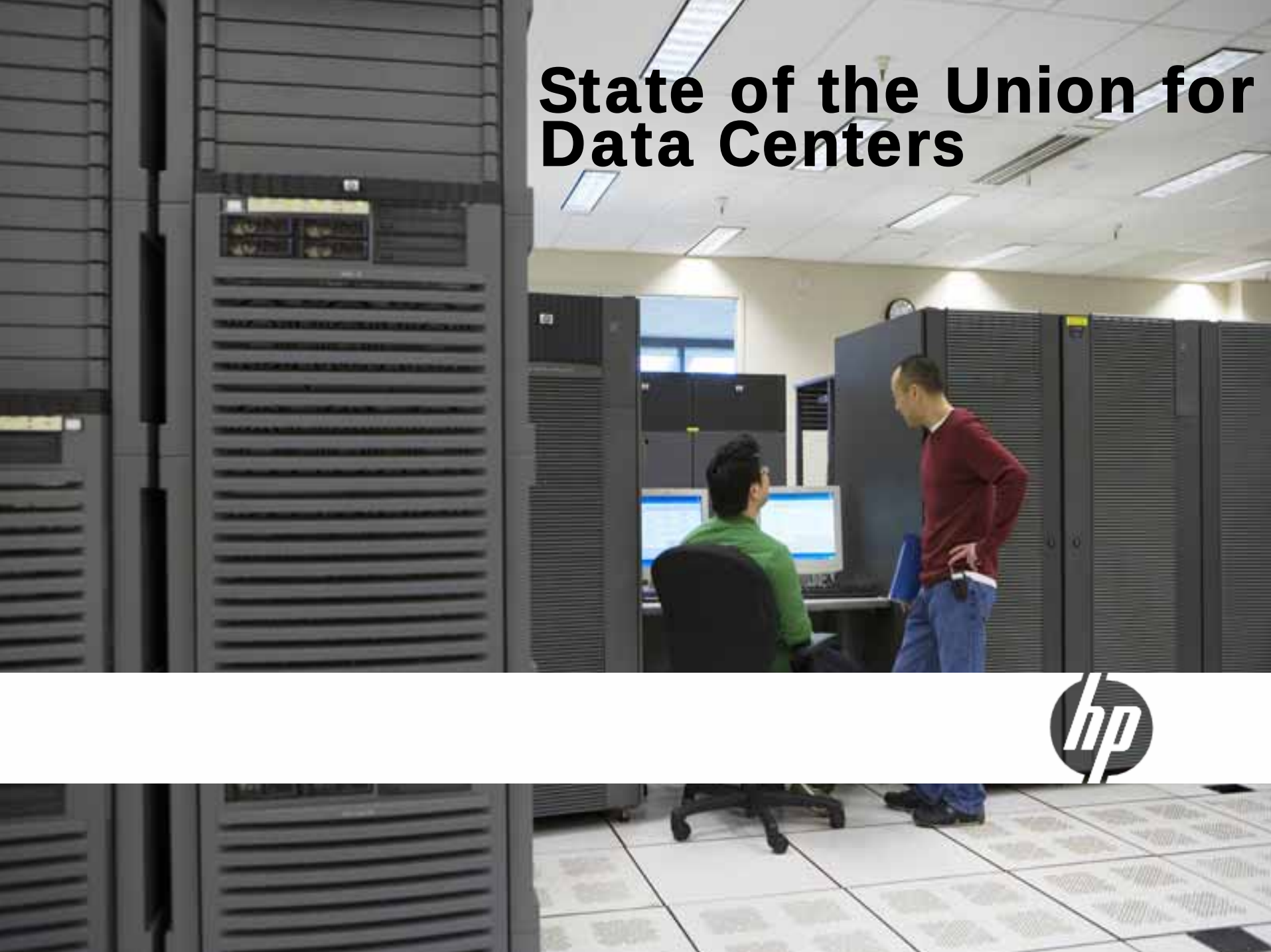
State of the Union for Data Centers



Datacenters today…

- Are like a Car with V8 engine
  - With the best spark plugs
    - But its out of tune
      - With only one cylinder firing
      - with the wrong differential
        - running with no air in the tires
        - with a chain link drive

Here are some real life examples…

If you don't measure it you won't improve

Case 1 – We have plenty of space but we are out of power…

If you don't measure it you won't improve

Case 1 – We have plenty of space but we are out of power…

Case 2 – We Fixed the cooling and your servers are still failing…

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Case 3 – We know who screwed up the data center…

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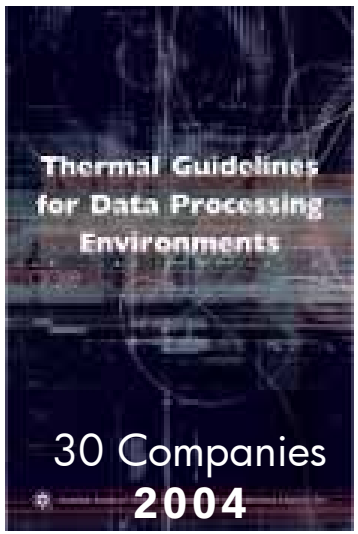
Case 3 – We know who screwed up the data center…

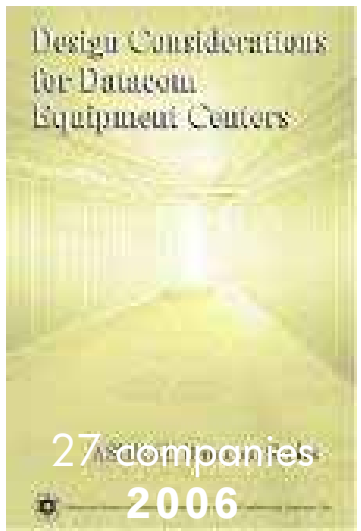
Case 4 – We followed best practices but the data center is uncomfortable…

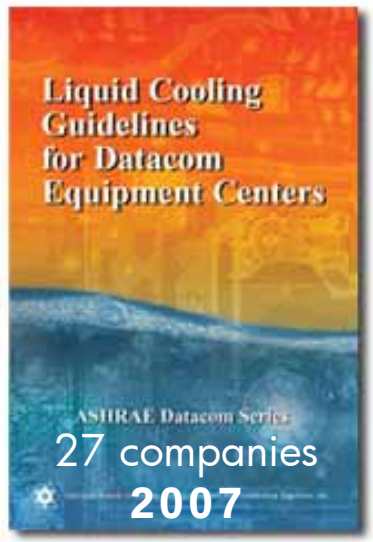
Metrics, standards and guidelines

Commoditization of the data center

- Why standardize?
  - Low cost "Plug and Play" environment
  - Helps lower over-provisioning
- Emerging standards
  - **Power** – UPTIME's Fault Tolerant Spec – Defacto Standard
    - *certified platforms: rp7XXX, rx7XXX, rp8XXX, rx8XXX and Superdome*
    - *view spec at: http://www.upsite.com/TUIpages/tuifault_spec_2-0.html*
  - **Efficiency** – EPA, SPEC and Green Metrics and Guidelines
  - **Cooling** – ASHRAE's 3 Published Books + 1 pending
    - *purchase books at: http://tc99.ashraetcs.org/*





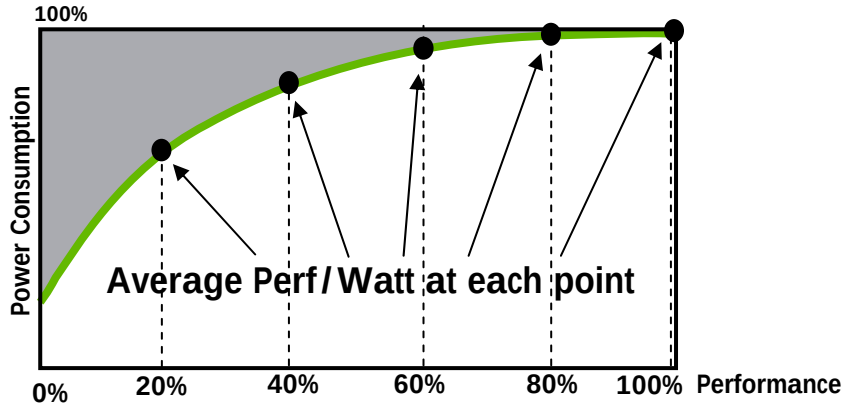


Emerging efficiency metrics

Server efficiency - April 2006[1]

Industry used this work as foundation for:

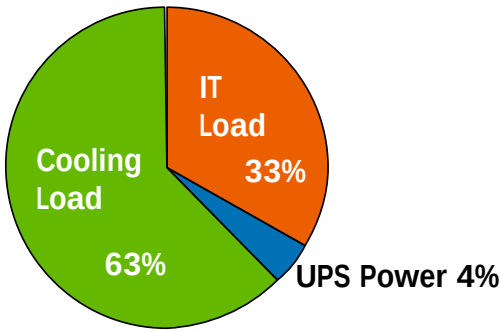
- Energy Star Paper[2]
- SPEC Power Benchmark

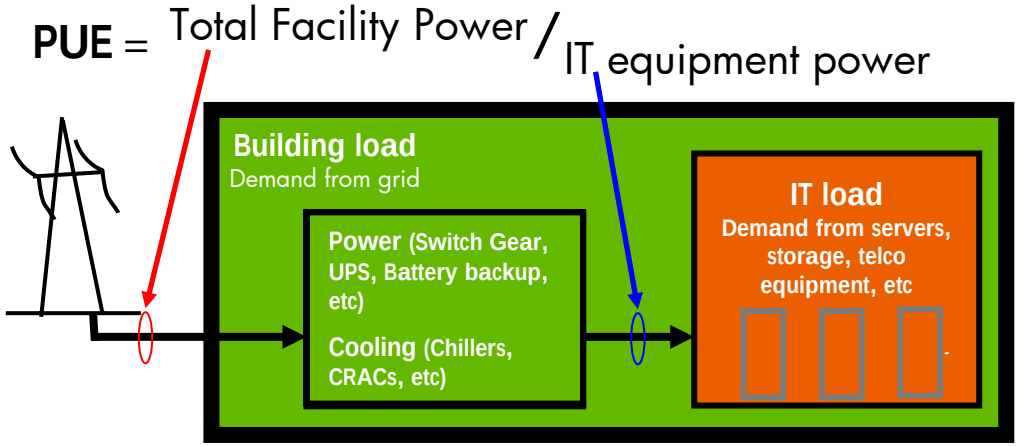


Data center efficiency – April 2006[3]

PUE has been adopted by:

- ASHRAE
- Green Grid





Sources: [1] http://thegreengrid.org/pdf/Efficiency_slides_for_General_Distribution_Final.pdf
[2] http://www.energystar.gov/ia/products/downloads/Finalserverenergyprotocol-v1.pdf

[3]Malone, C., C. Belady, "Metrics to characterize Data Center & IT Equipment Energy Use,"Proceedings of 2006 Digital Power Forum, Richardson, TX (September 2006)

Address http://www.thegreengrid.org/

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What's New

IN THE SPOTLIGHT:

The Green Grid Announces Consortium to Address Energy Efficiency in Data Centers
>>more

The Green Grid Launches Membership Drive
>>more

White Paper: Download New Papers on the Opportunity for Power Efficiency in the Data Center
>>more

The Green Grid is a consortium of information technology companies and professionals seeking to lower the overall consumption of power in data centers around the globe. The organization is chartered to develop meaningful, platform-neutral standards, measurement methods, processes and new technologies to improve energy efficient performance of global data centers.

Membership to The Green Grid is open to those companies and information technology professionals with an interest in helping to support the movement to improve data center power consumption improve overall efficiency.

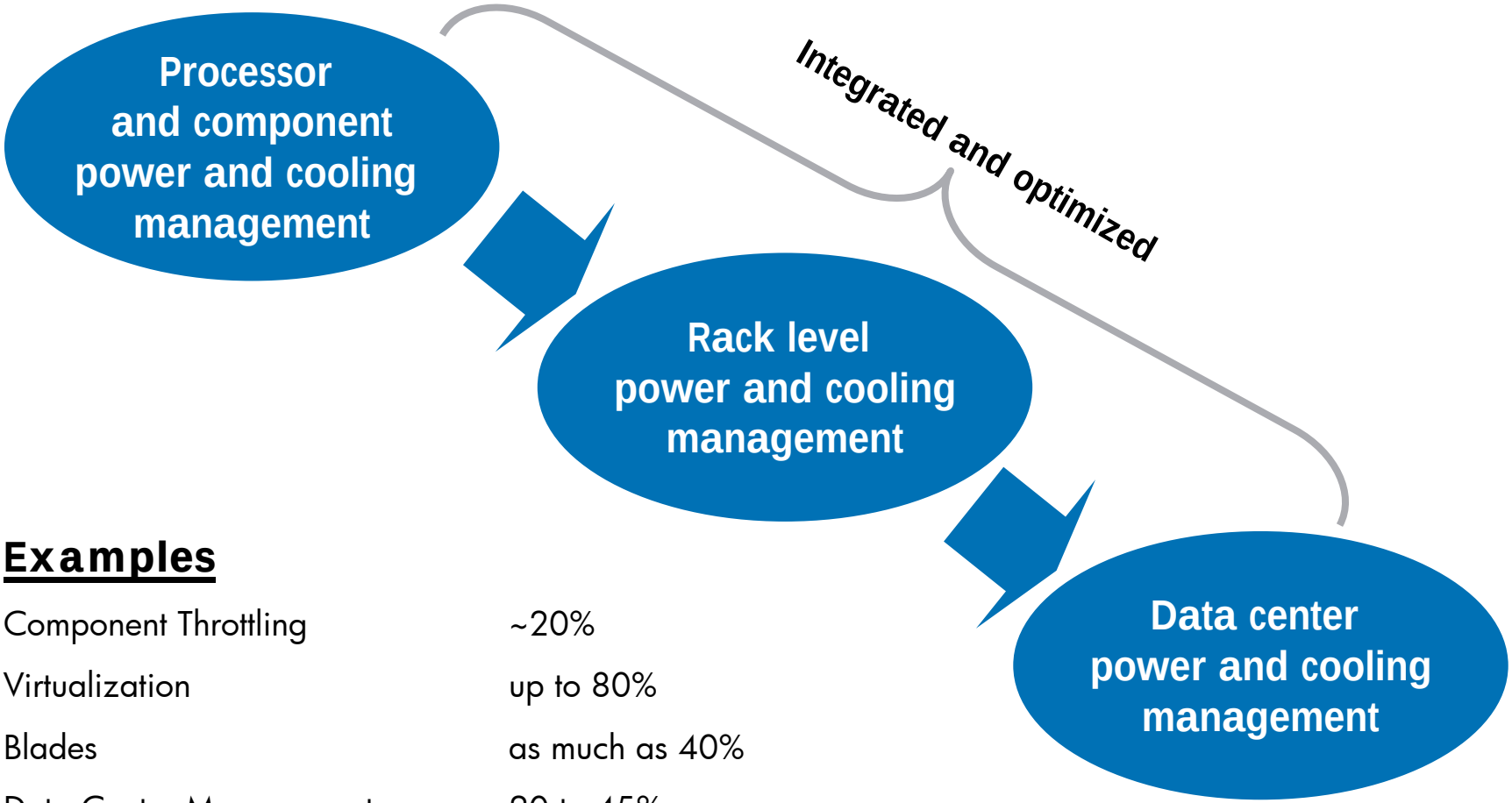
Board Members

AMD, APC, DELL, hp, IBM, intel, Microsoft, Rackable Systems, SPRAYCOOL, Sun, vmware

Trends and technologies that help

P & C resource management everywhere

Goal: drive TCO down by eliminating over-provisioning



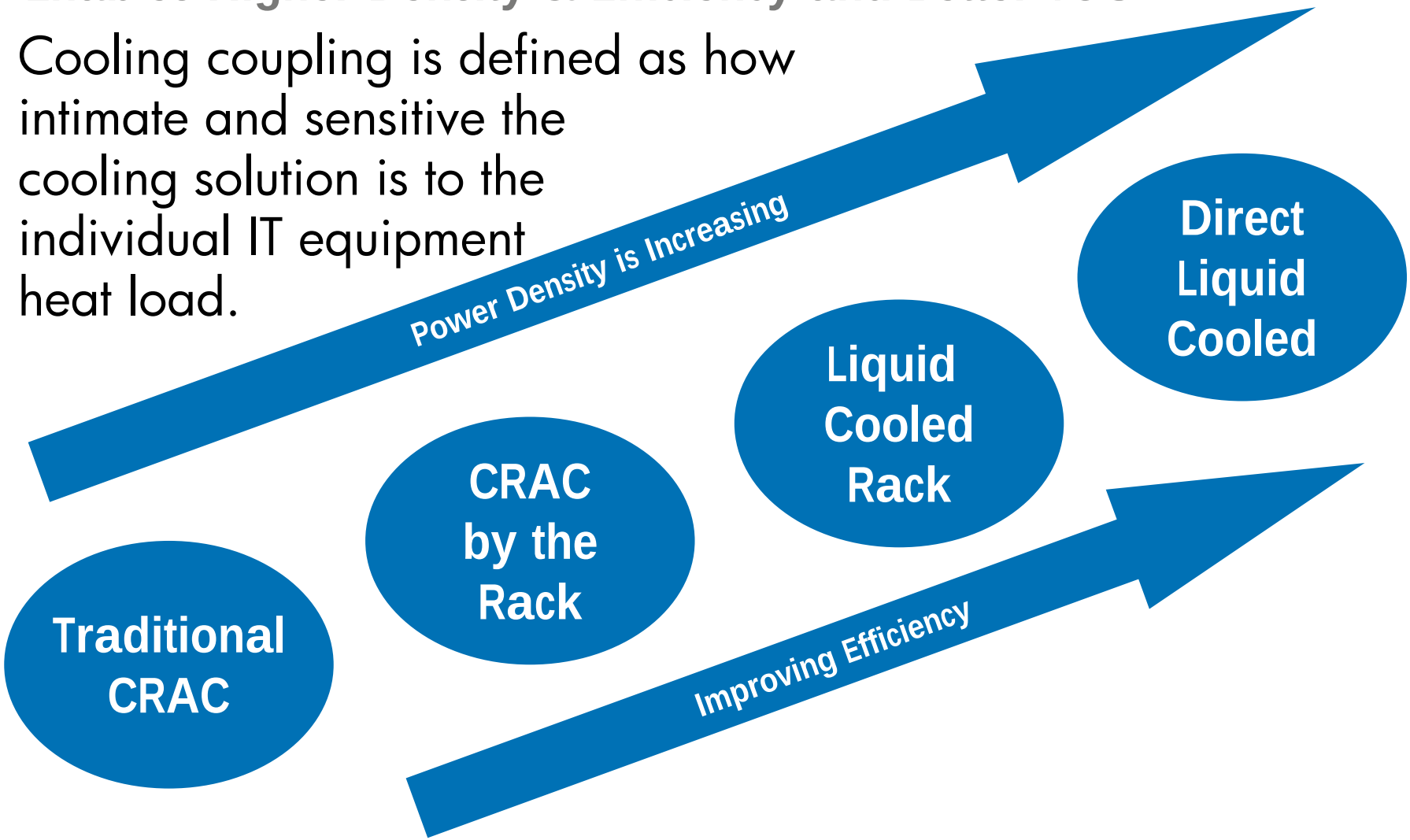
Examples

Component Throttling	~20%
Virtualization	up to 80%
Blades	as much as 40%
Data Center Management	20 to 45%

Closely coupled cooling emerging

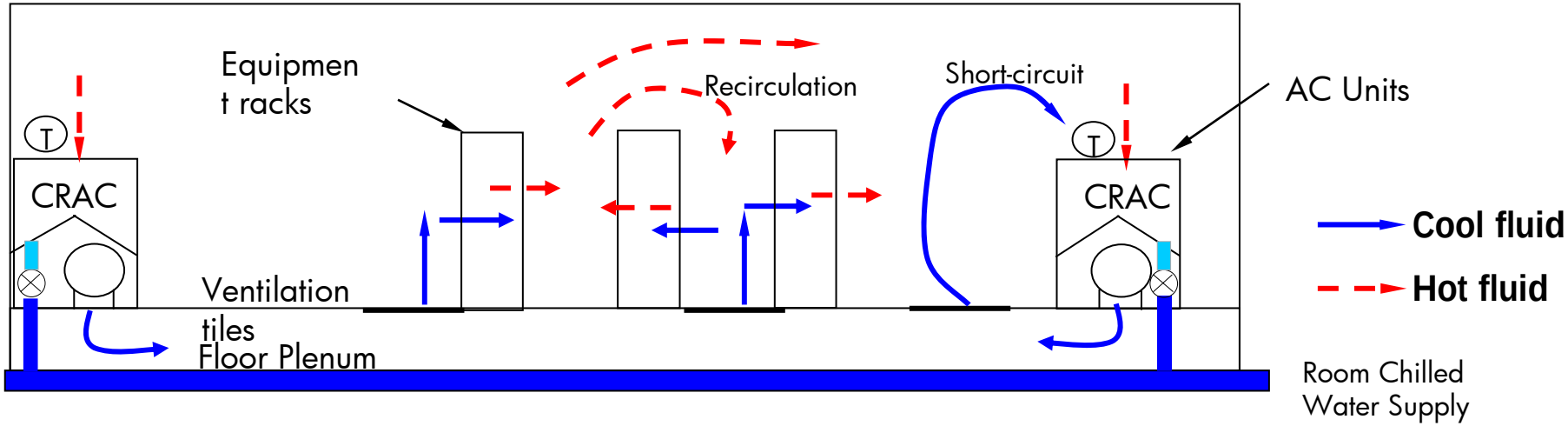
Enables Higher Density & Efficiency and Better TCO

Cooling coupling is defined as how intimate and sensitive the cooling solution is to the individual IT equipment heat load.

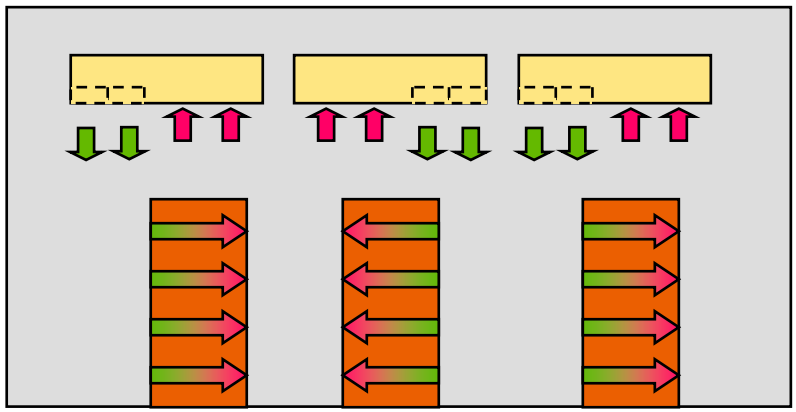


Example of how closely coupling helps

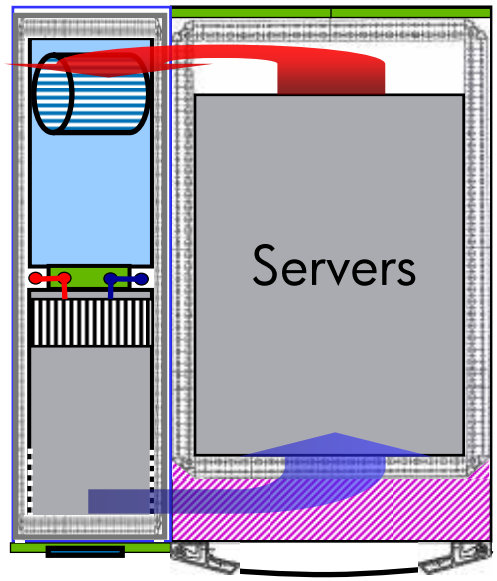
BEFORE – Lots of Mixing of hot and cold air stream



BETTER (CRAC by the Rack)
Slight Mixing



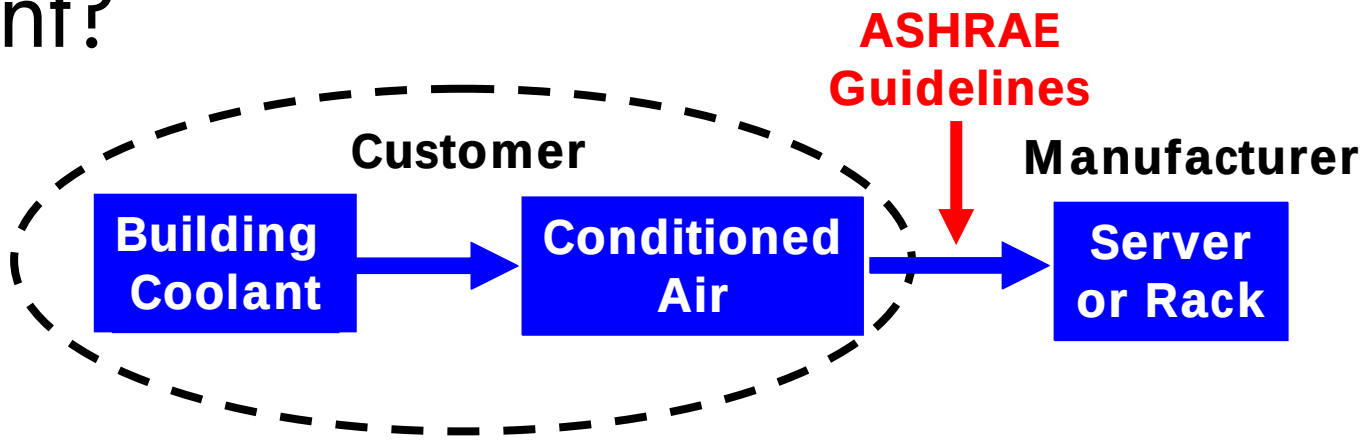
BEST (Liquid Cooled Rack)
No mixing



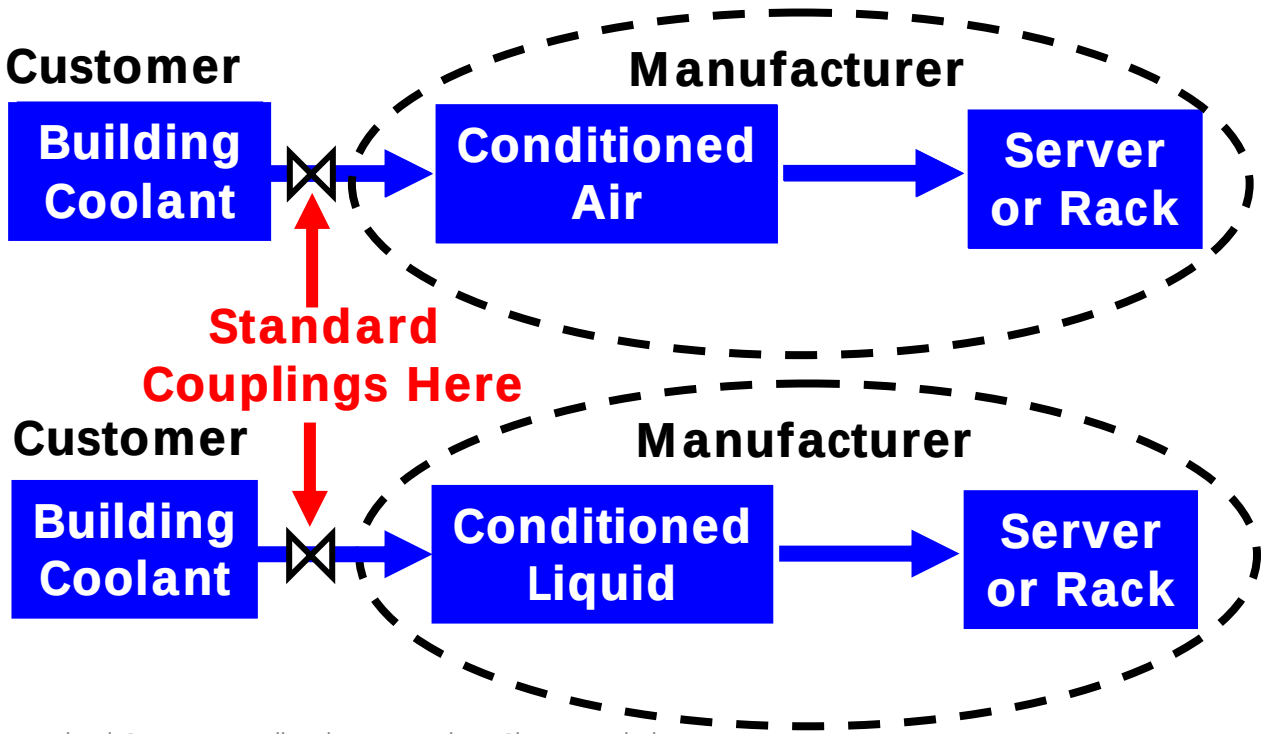
Source: C. Belady
Uptime Conference 4/24/06

How does this change the current environment?

Today's Air Cooled Data Center



Tomorrow's Air Cooled Data Center



Improving data center efficiency

(Decrease over-provisioning)

Business Case for Improving

- Save Energy – Be Green!
- Lowers Cost for Computation
- Kill your competition with efficiency and lower cost structure.
- Use metrics to track your improvements
  - Measure the right thing….
  - Benchmark against your industry
  - Validate your suppliers claims

Steps to eliminating overprovisioning in the data center…

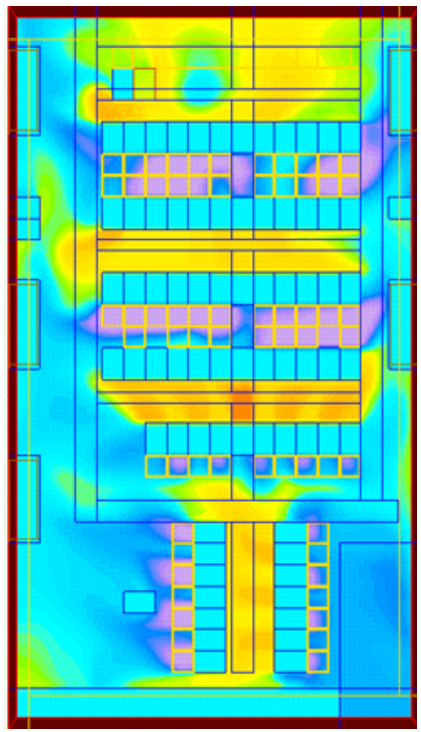
STEP 1 — Use Power Management Technologies and/or Virtualization

STEP 2 → **STEP 3** → **STEP 4**

Best Practices

- Hot Aisle/Cold Aisle
- Matching Server Airflows
- Eliminate Gaps in Rows
- Use longer rows
- Use Cabinet Blanking Panels
- Orient AC units perpendicular to hot aisles
- Seal cable cutouts
- Use 0.8m to 1.0m High Floors
- Use High and Low Density Areas
- Consider economizers
- Use CFD Modeling

CFD

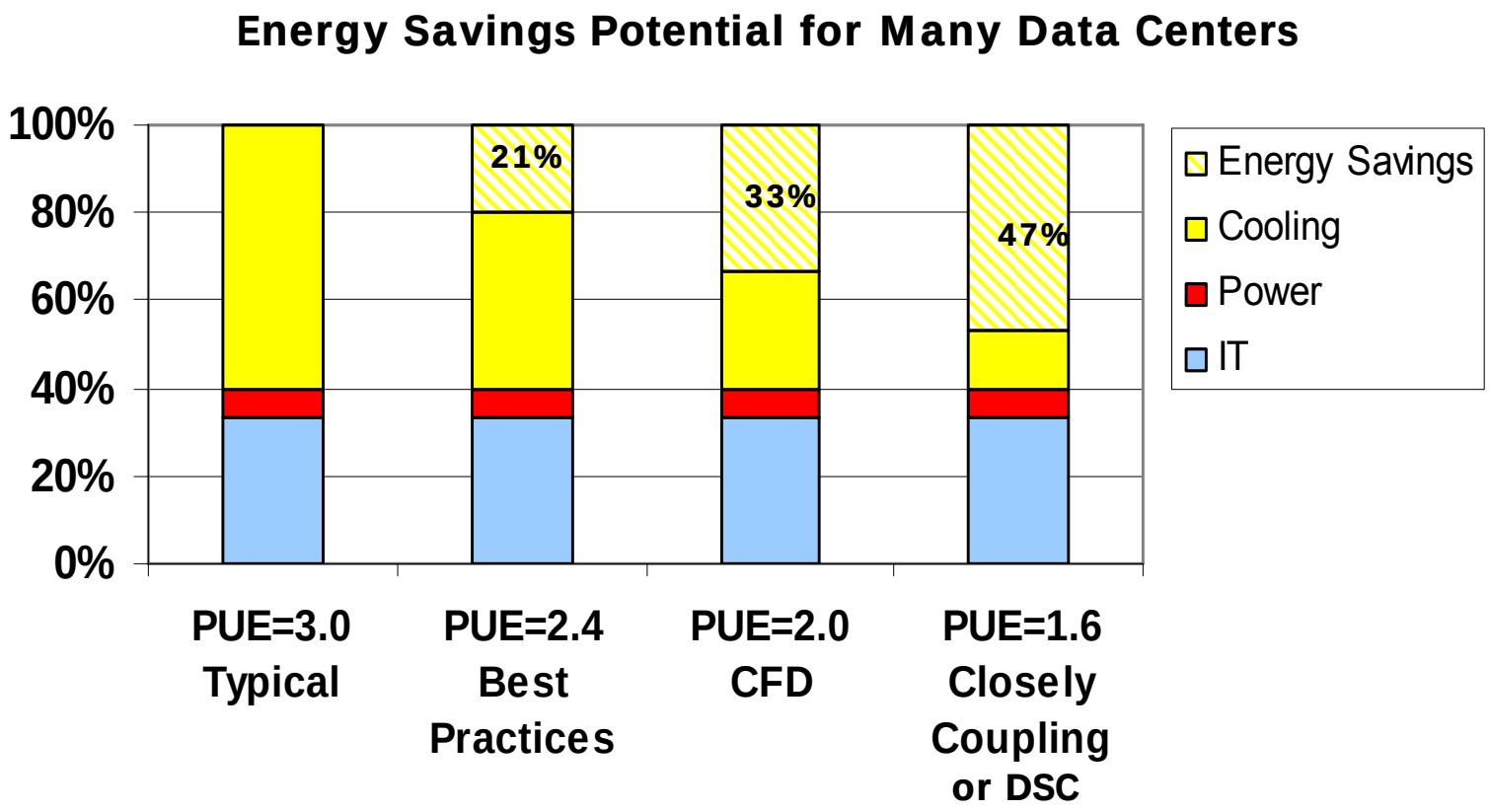


Closely Coupling

Local Cooling or Control

Belady, C., "How to Minimize Data Center Utility Bills", Line56 (September 5, 2006)
http://www.line56.com/articles/default.asp?ArticleID=7881

Potential impact of best practices, CFD and closely coupled solutions on a typical data center



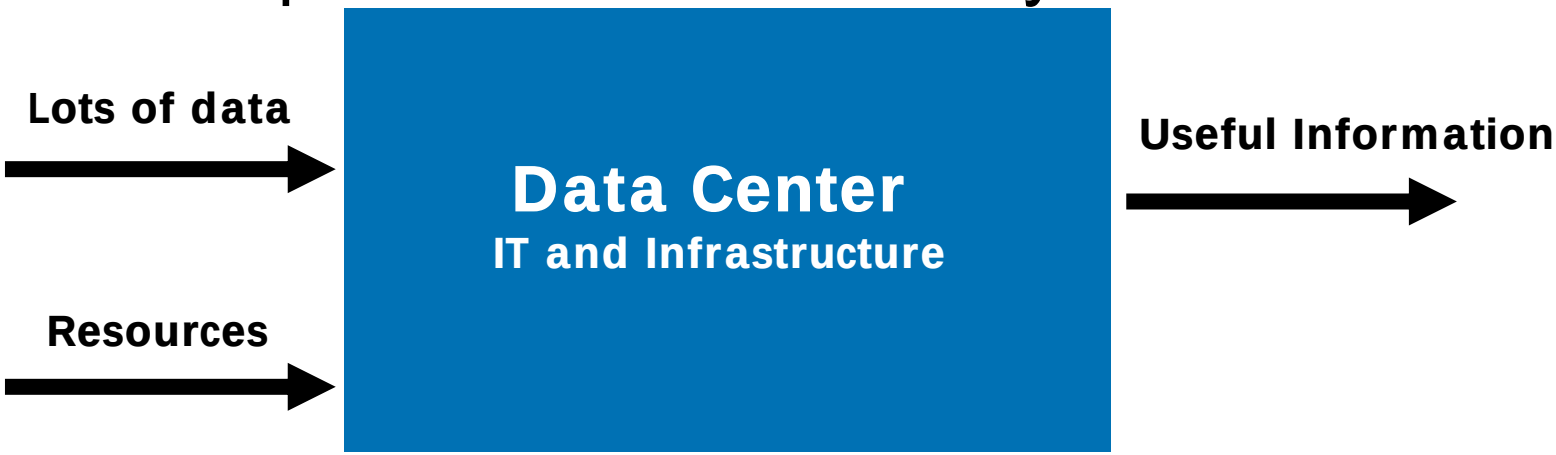
Malone, C., C. Belady, "Metrics to characterize Data Center & IT Equipment Energy Use," Proceedings of 2006 Digital Power Forum, Richardson, TX (September 2006)

Optimization can make significant impact to profit margin

Summary:
Its All about TCO

Final Message

What matters is Lowest TCO of the complete data center Ecosystem



This Environment is not static

- how we navigate these trends and integrate these trends is how will determine our TCO and ultimately our ROI

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Thank You!

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People. Training. Technology.