

Hot Aisle and Cold Aisle Containment Strategies & Case Study



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Presenters:

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Agenda

- Introduction
- Airflow Management Strategies
- Aisle Containment
 - Cold Aisle & Hot Aisle
- Containment Case Study
- Q&A

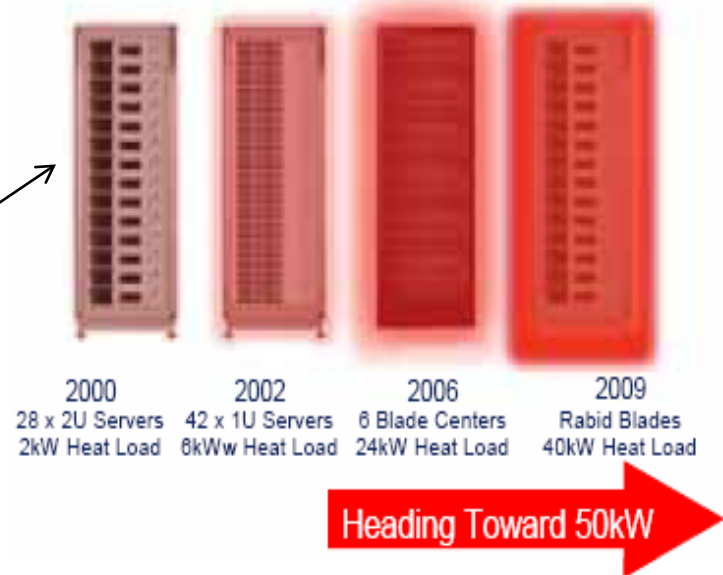


“Data centers worldwide now consume more energy annually than Sweden”
-- New York Times

Inefficiency + Demand

- Server utilization
 - 30% are comatose (Uptime Institute)
- Overprovision
 - SLAs
- Ownership
 - IT/Facilities disconnect
- Demand for data center services

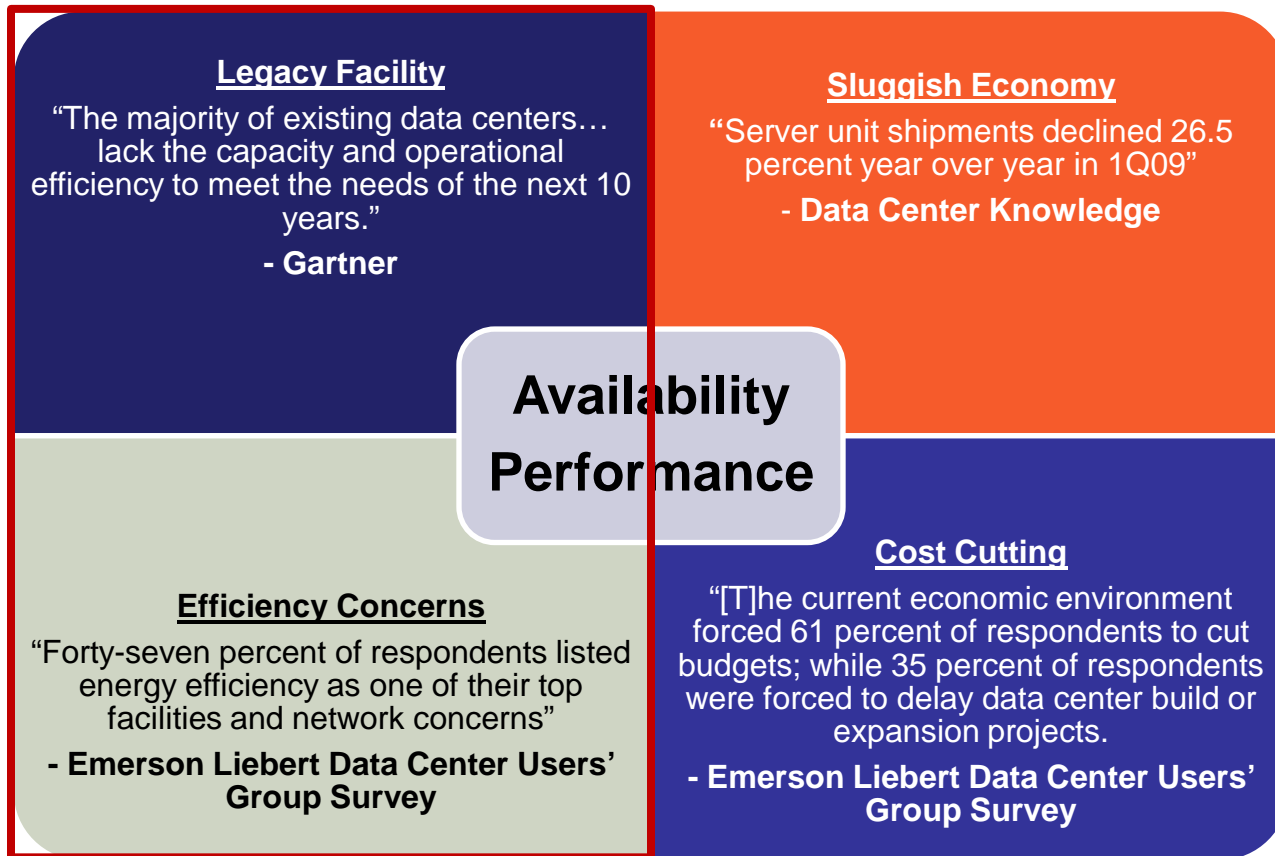
Power Requirements Continue to Grow



Source: Gartner



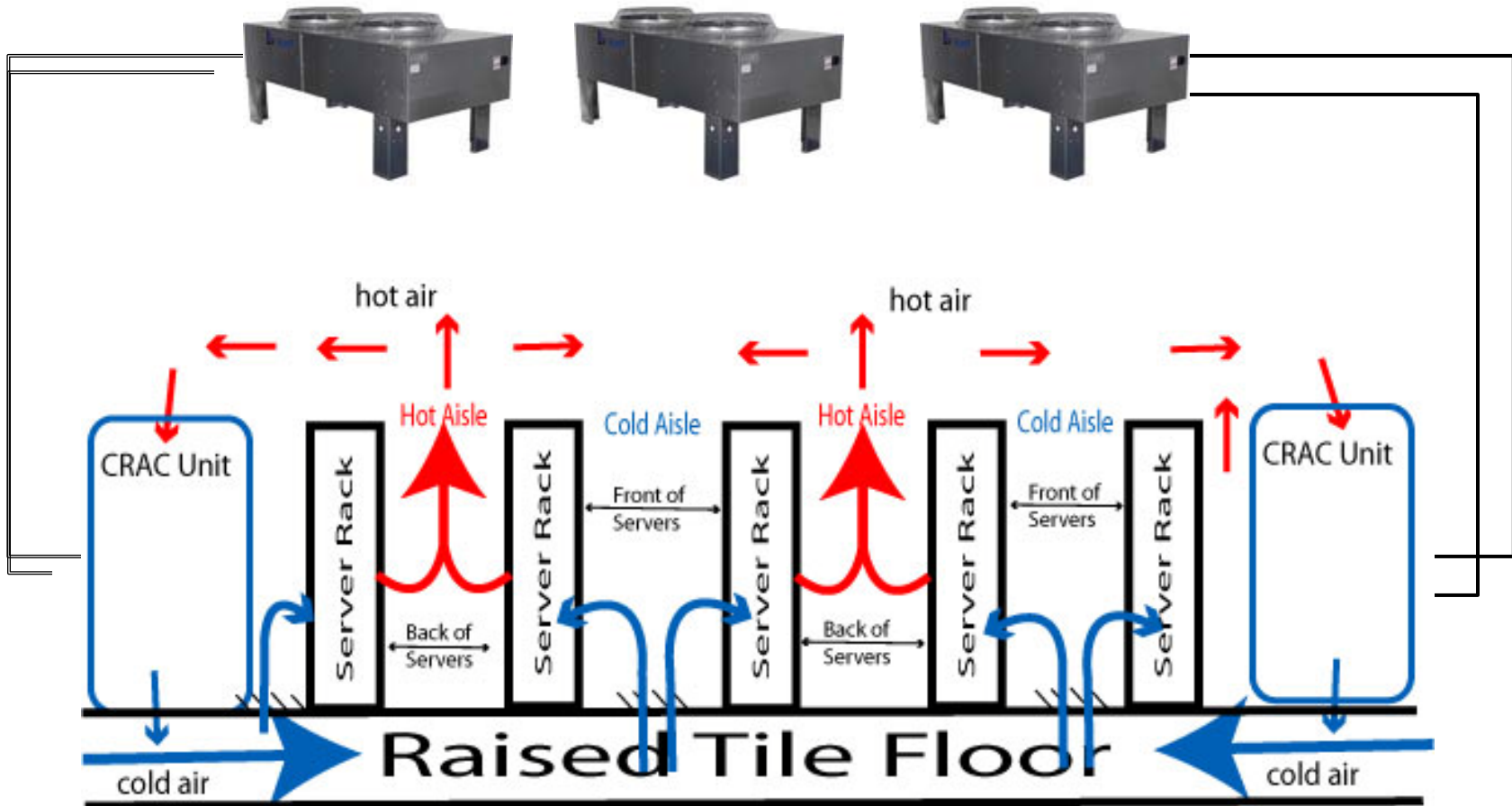
Data Center Dilemma



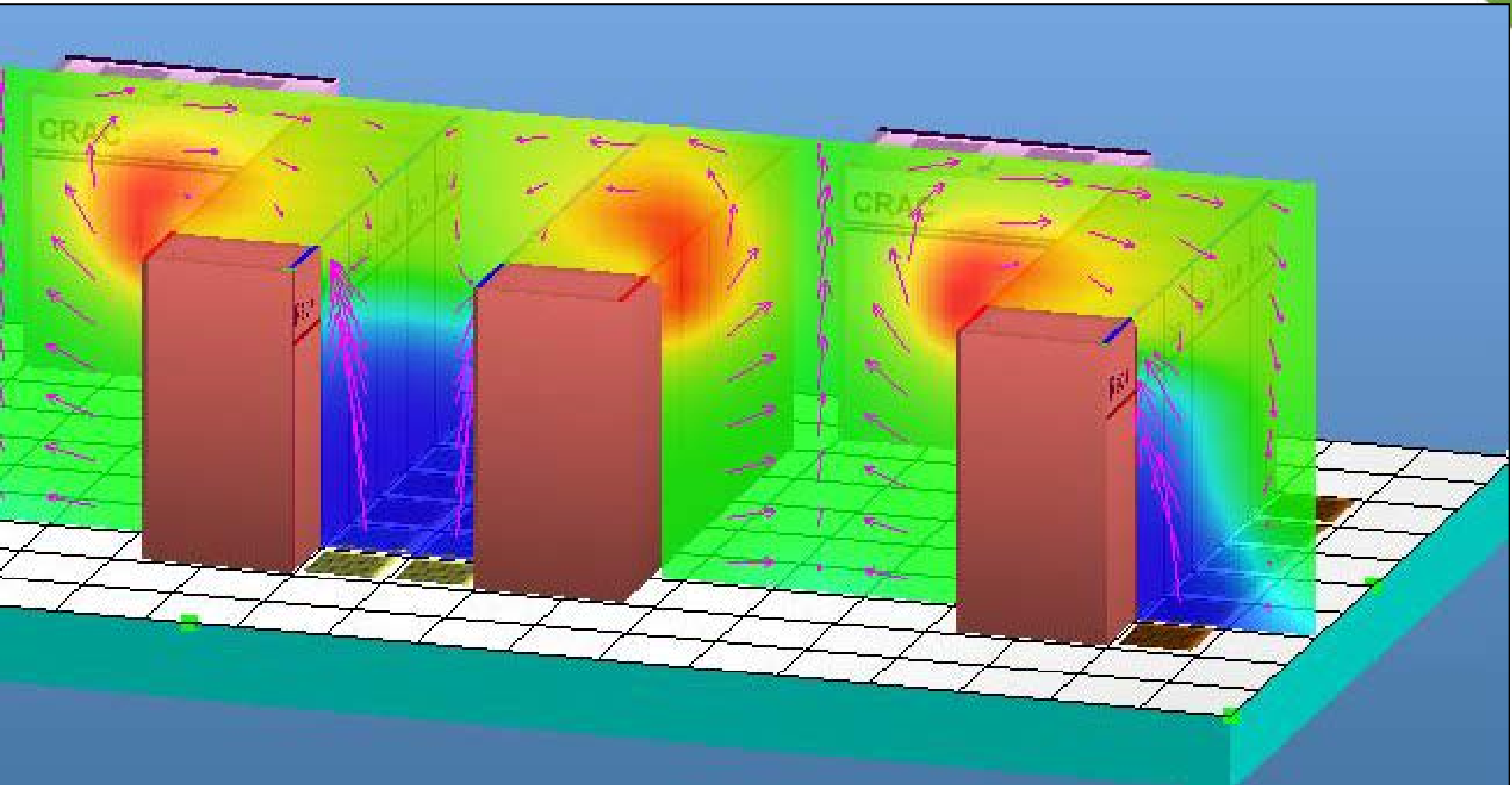


Airflow Management

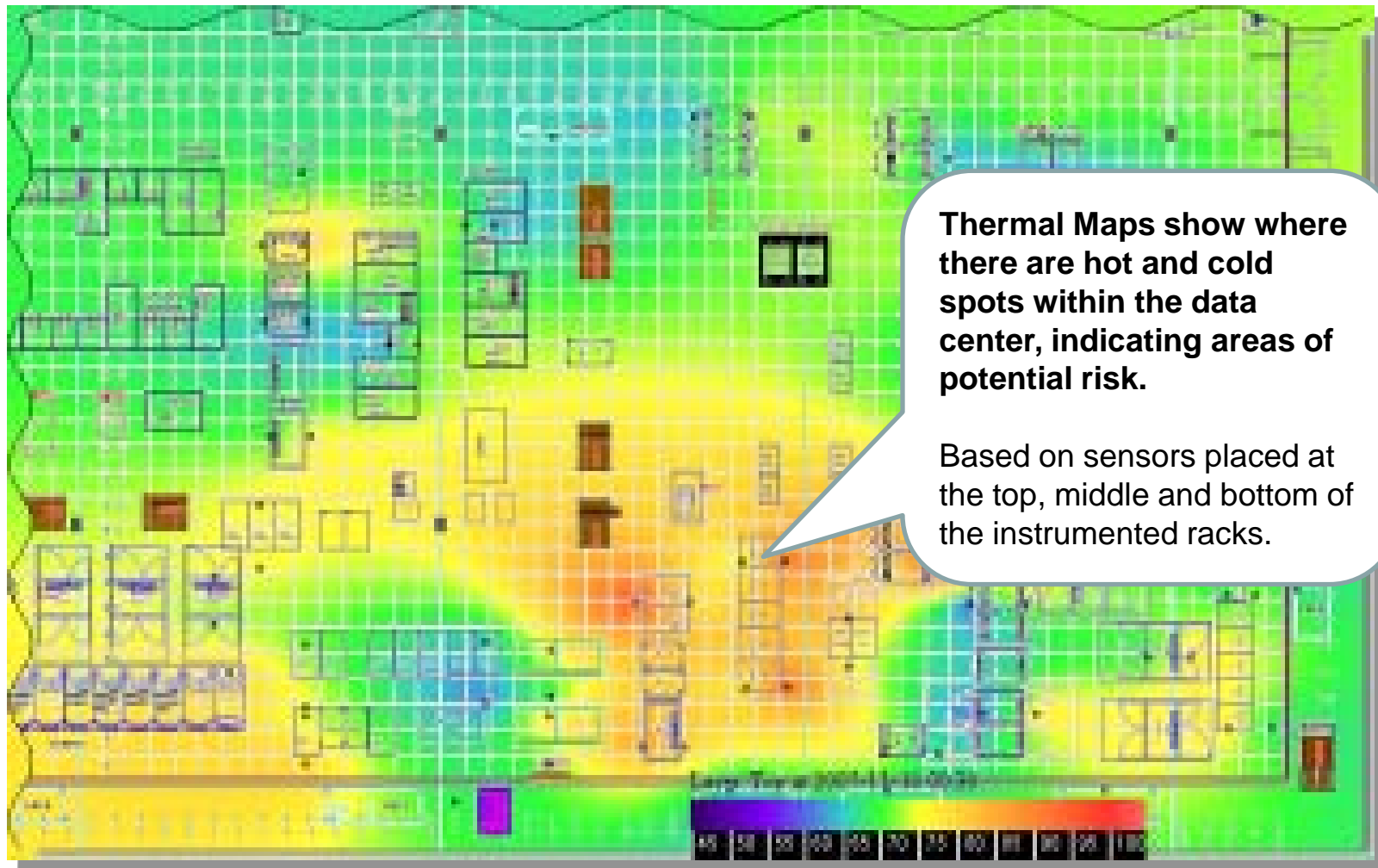
Remote Heat Rejection



CFD Analysis

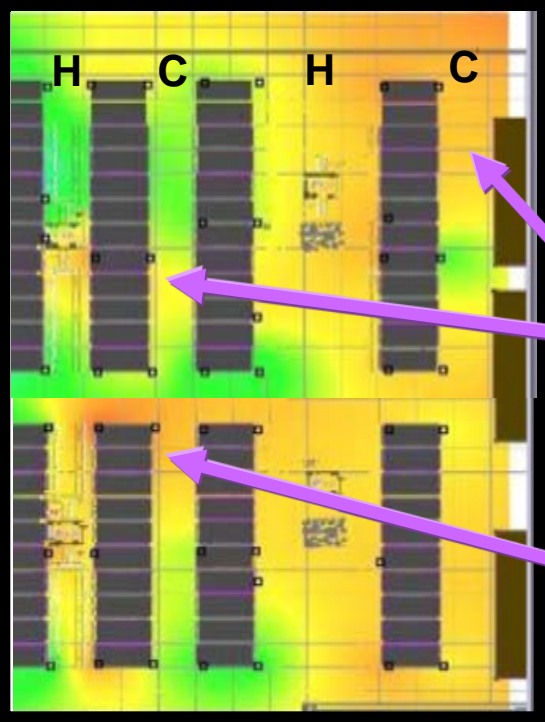


Thermal Imaging



Thermal Imaging – Baseline

Baseline



No Containment

High Degree of Air Mixing

High Inlet Temperatures





Solution Overview

Impact of Aisle Containment

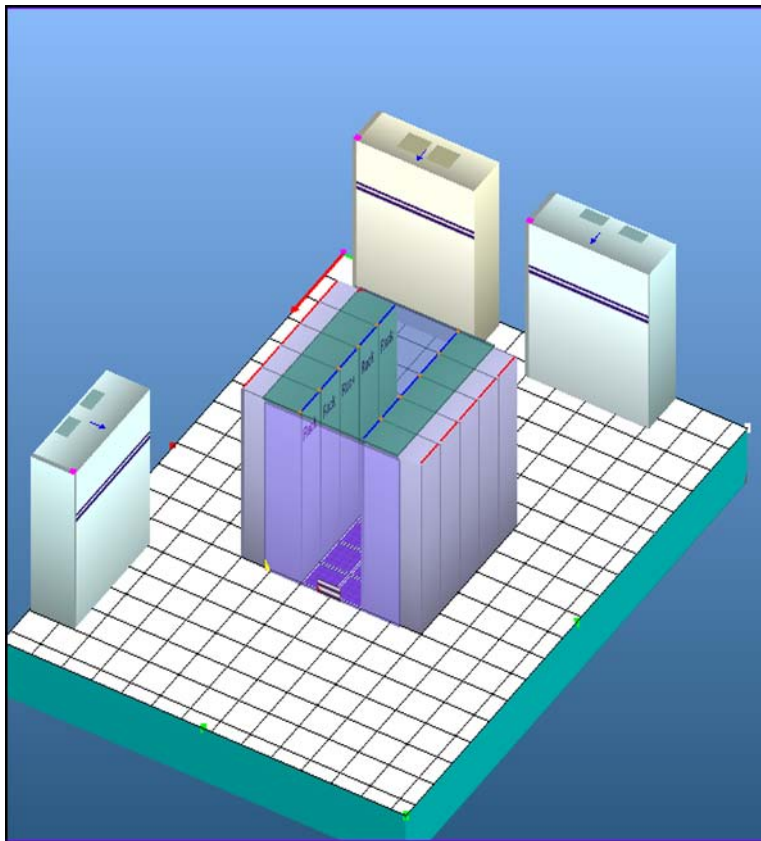


Cold Aisle Containment (CAC)



- Cold air directed to server inlet; hot air dispersed into room
- Mixing eliminated
- Conventional cooling units (CRACs) installed outside the containment area

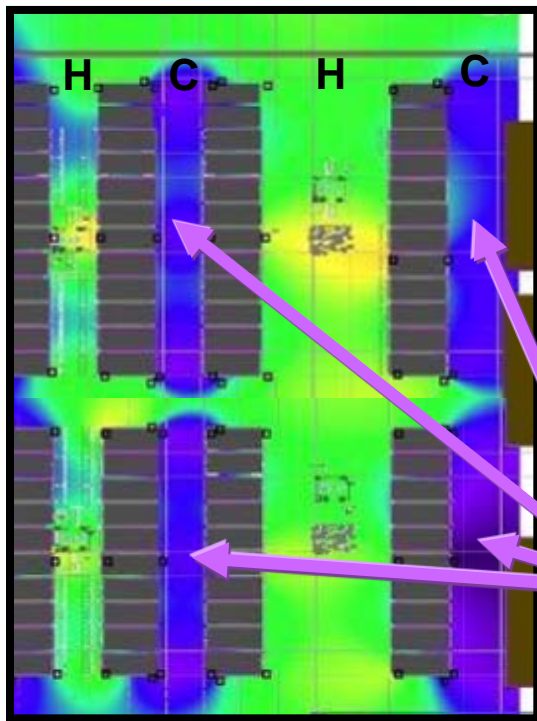
Cold Aisle Containment Advantages



- Focused on air supply to the racks: the only ASHRAE standards exist there (temperature and humidity)
- Addresses the prevalence of existing raised floor environments
- Capacity and efficiency gains for existing environments

CAC: Existing Data Center

After Containment



Cold Aisles Contained

No Change to CRAHs

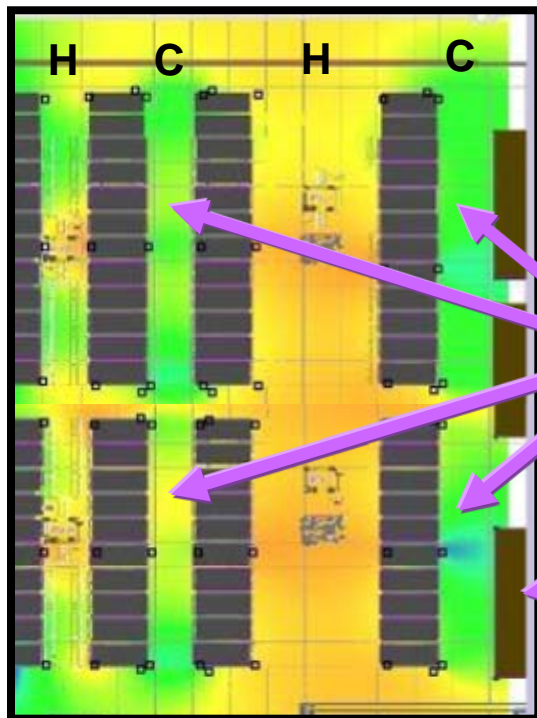
Overcooled





Existing Data Center- With Control

With Control



Controlled CRAHs with possible higher set points,
Lower Fan Speeds and
Increased Water Supply Temperatures

ASHRAE Inlet Temperatures

Increased Return Temperatures



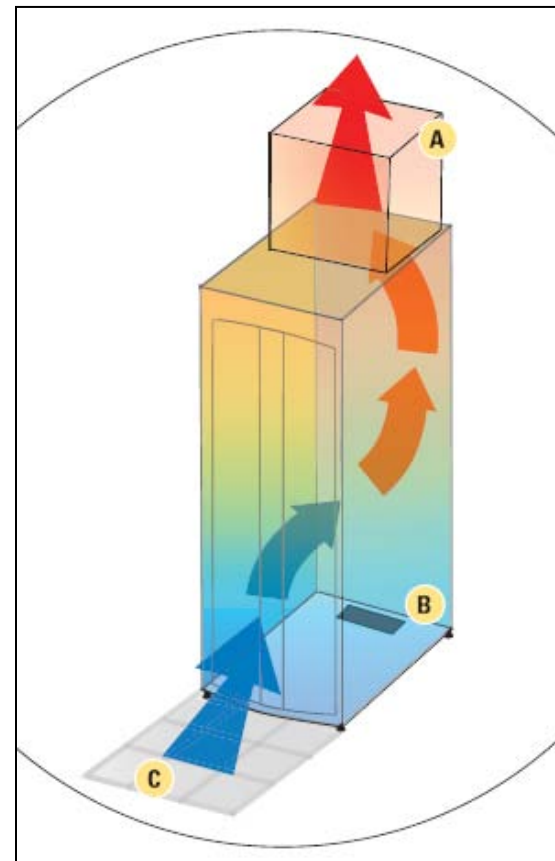
Hot Aisle Containment (HAC)



- Seen above with modular CHW InRow air conditioners
- Increased return temperature to cooling coil to maximize efficiency
- Can be accomplished with false/drop ceilings and “chimney cabinets”

Hot Aisle Containment Advantages

- Contains hot aisle; rest of data center akin to server inlet temp
- The “room volume” of cold air is available in case of cooling failure
- Independent of raised floor variables.
- Capture server exhaust air at its hottest point



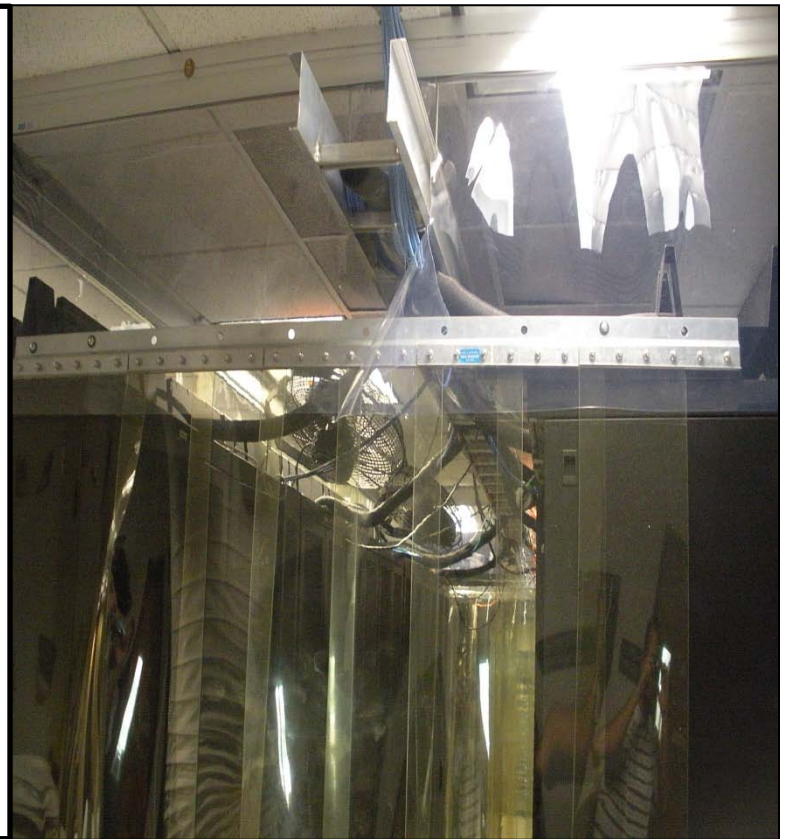


“Curtain Containment”

Cold Aisle



Hot Aisle



CAC:

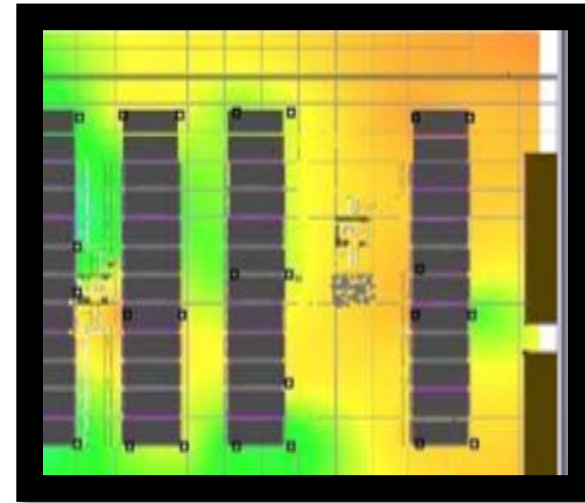
- “Strip Door” at aisles
- roof above

HAC:

- “Strip Door” at aisles
- ceiling return for heat removal

Shared Advantages

- Eliminates mixing through airflow management
- Allows “tuning” of airflow: CFM supply to match CFM demand
- Promotes warmer return temperatures to computer room air conditioners
- Provides better supply temperature control
 - Mid 70s supply temperature
 - No hotspots



Map Legend:





The Wild Card: Your Data Center



- Uniformity of racks and aisles?
- Rack manufacturer offer containment solution?
- Ceiling plenum for hot aisle containment?
- Raised floor clear or full of obstructions?





HAC Curtain Case Study

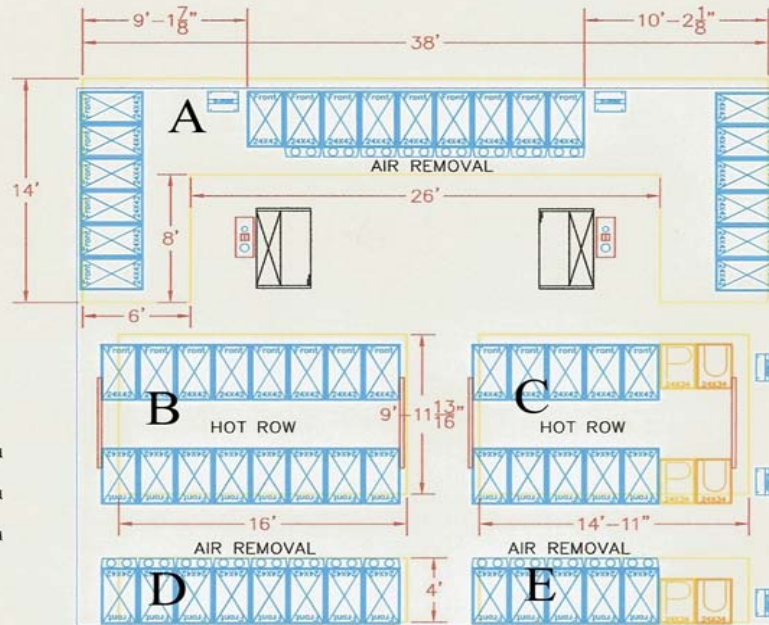
INTRODUCTION

- An electronics manufacturer, with an extensive IT portfolio, wanted to optimize a lab environment
- Labs contained a variety of IT equipment: blades, 1U servers, switches
 - Arranged in hot aisle/cold aisle but not all uniform
 - Everything overhead: cold air supply and hot air return
- Plagued by airflow challenges
 - Supplemental exhaust fans installed on top of cabinets
 - Rear door air removal unit used to channel higher density exhaust directly into the plenum
 - Portable AC units throughout the floor

Turned to 42U to explore cooling optimization and containment solutions

Containment Installation

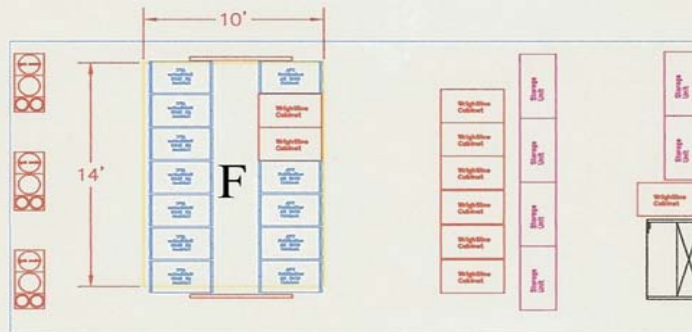
Lab A



Project Notes:

- Backs of cabinets; assume ~102" material, unless otherwise specified
- Fronts of cabinets; assume ~25" material, unless otherwise specified
- Sides of cabinets; assume ~25" material, unless otherwise specified

Lab B



Containment Installation



Cold Air Supply



Exhaust Fans



Containment attached to ceiling with fuseable link



Installation Continued

Containment
Curtains



Supplemental
Rack Air
Movement

Portable AC



Following Installation

ENERGY SAVINGS

- (21) rack “air removal units” turned down to their minimum CFM (400): decrease in 33,600 CFM
- Exhaust fans (used to force heat out of the room) completely turned off
- (4) portable air conditioners simply moving air; no compressor activity

RELIABILITY

- Inlet temperature stabilization; hotspots eliminated

COMFORT COOLING

- Without air mixing, lab working environment is much more comfortable

NOISE CONTROL

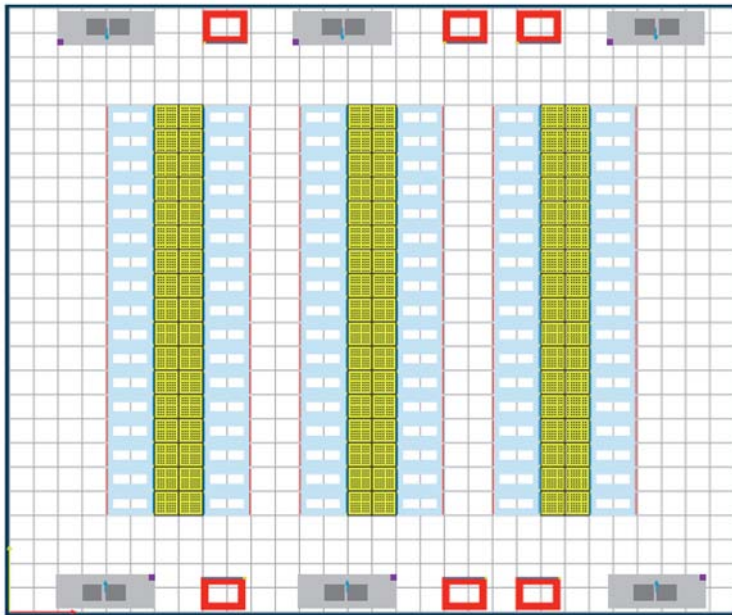
- Offices, which surround the lab perimeter, aren't subjected to the maximum CFM from the air removal units



CAC: New Build

Conventional Approach

New Build



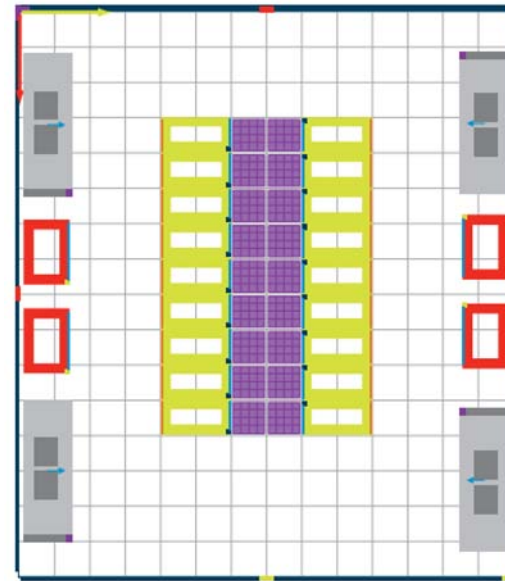
Modeling CAC vs traditional install approach

Scenario: 306 kW load installed using traditional design

Qty (102) 3kW racks, Load = 306kW room area: 3000 Sq Ft (60' x 50')

24" raised floor 10' from floor to ceiling

CAC New Build



Scenario: 306 kW load installed using Cold Aisle Containment design

Qty(18) 17kW racks, Load = 306kW room area: 896 Sq Ft (32' x 28')

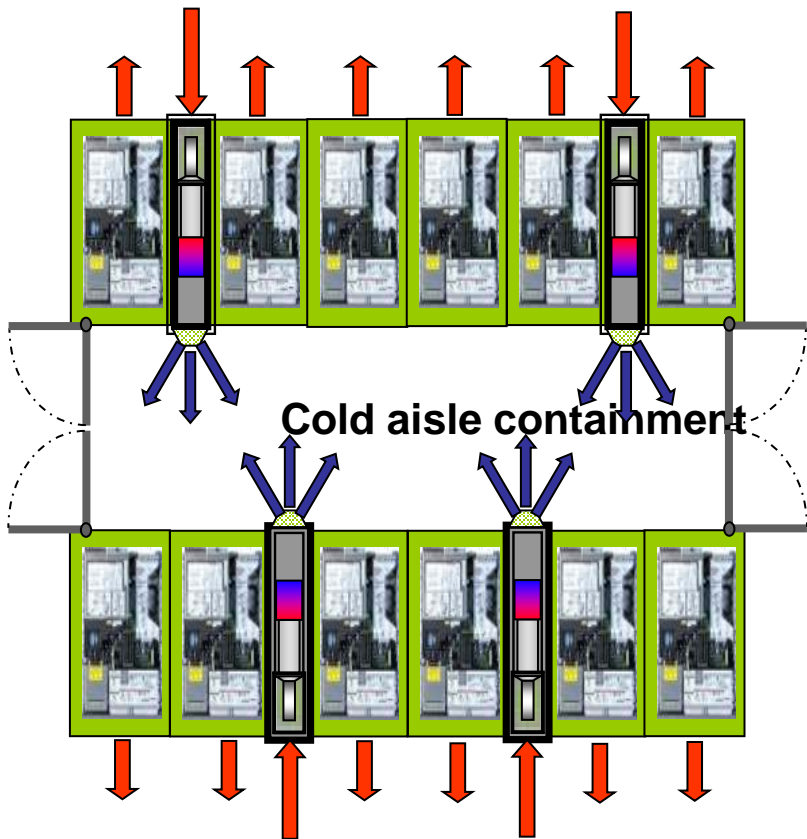
24" raised floor 10' from floor to ceiling

Source: EDS



Containment: Next Steps

Cold Aisle Containment with InRow Cooling



Cold Aisle Containment with Overhead Cooling



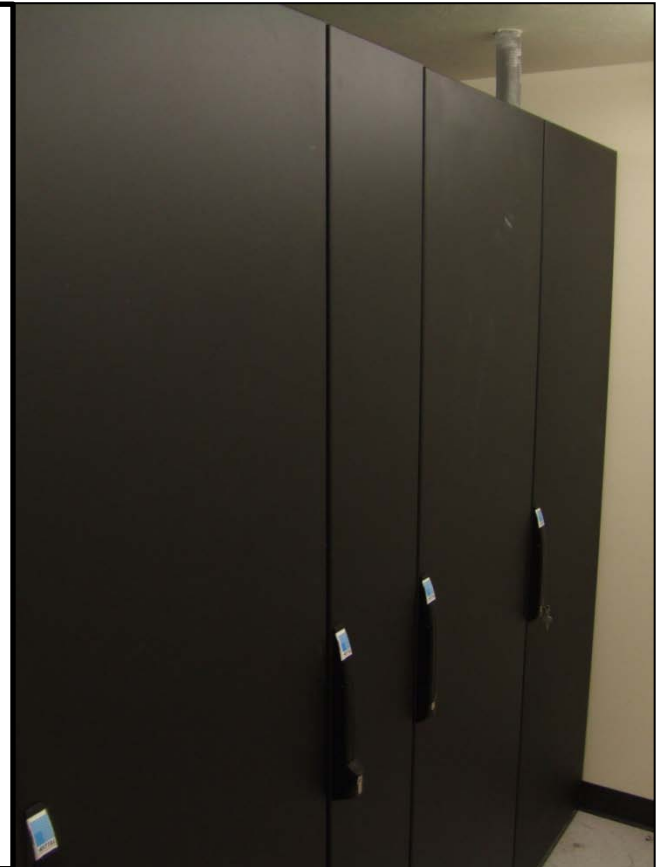
Containment: Next Steps



Front of cabinets and cooling unit

Close Coupled Cooling

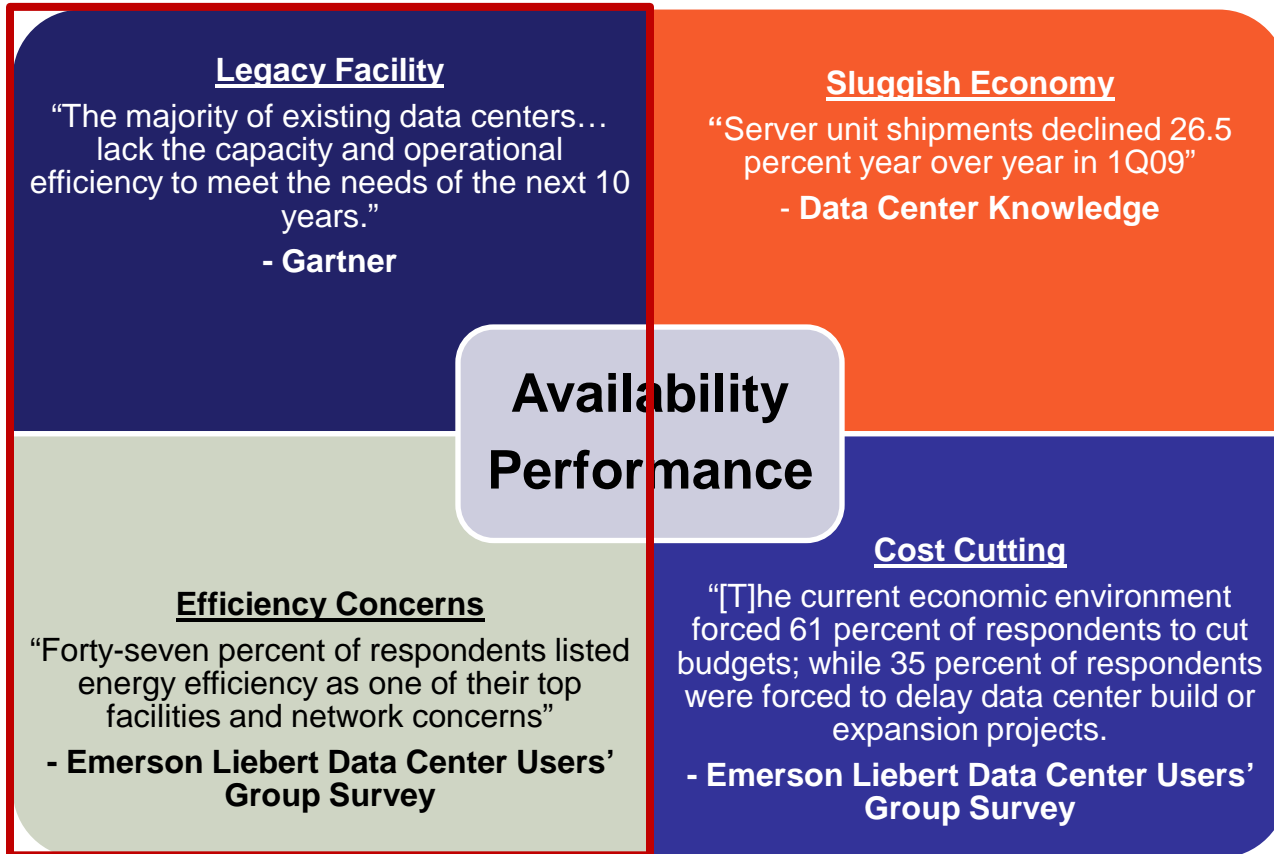
- Dual containment within the same rack footprint-
 - Chilled water or refrigerant based cooling
 - High density, high efficiency
- Hot air has no choice but to pass through HEX



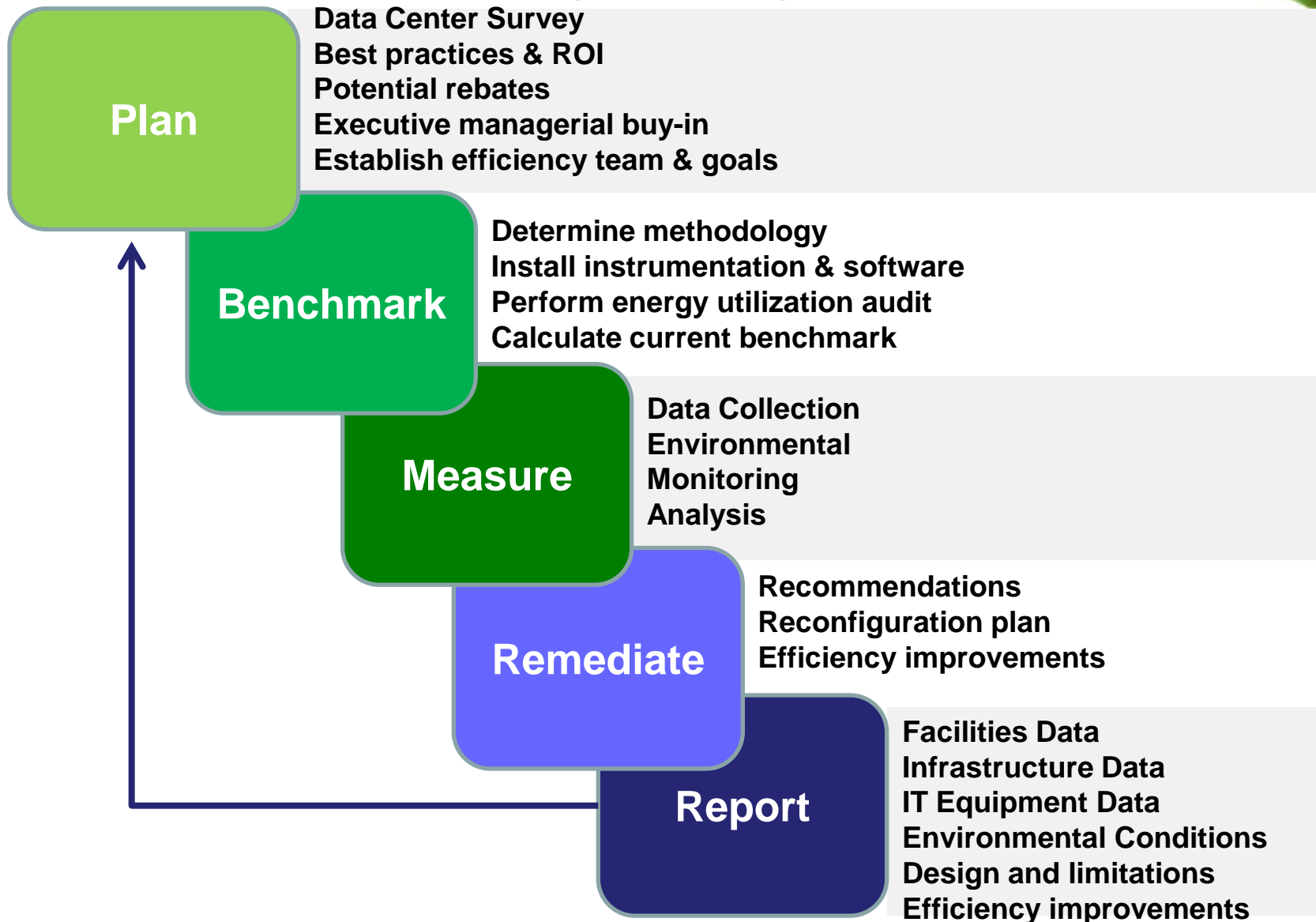
Rear of cabinets and cooling unit



Data Center Dilemma



An Efficiency Study Process



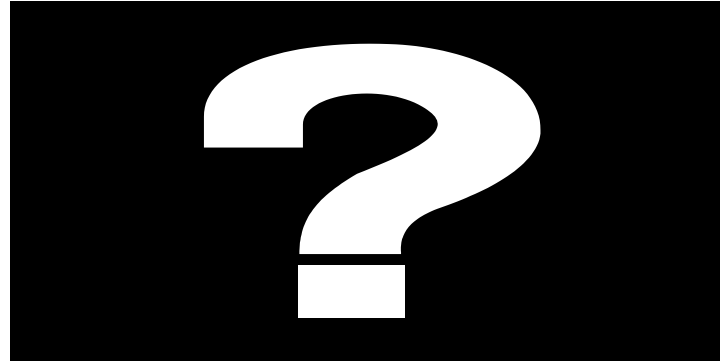
The Reality

What can I do today?



- Steel containment is more aesthetic but better suited for new builds.
- Hot Aisle Containment can require extensive rework to deploy in existing cabinet rows.
- Curtain solutions, though not beautiful, offer flexibility

Q&A



For a copy of today's presentation please email
rebecca.mccue@42U.com

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Thank You!