

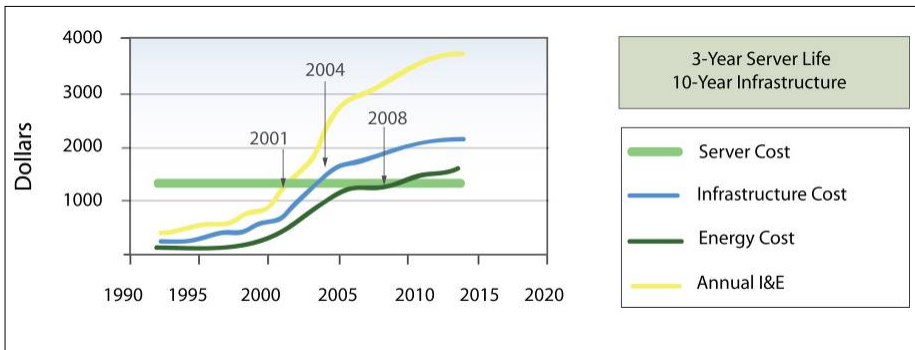
# Rackable Systems Building Efficient Data Centers

*Giovanni Coglitore  
Conor Malone*

November 2008

## In 2008, Lifetime Energy Costs Surpasses Server Capital Costs

Annual Amortized Cost for Purchase and Operation of a 1U Server (United States)



Note: I&E includes both the energy cost and the cooling infrastructure cost

Source: EPA

© 2008 Rackable Systems, Inc. All Rights Reserved.

# Worldwide Data Center Energy Bill Growing at 10% CAGR (2004-2010)



Enabling the ecological data center™

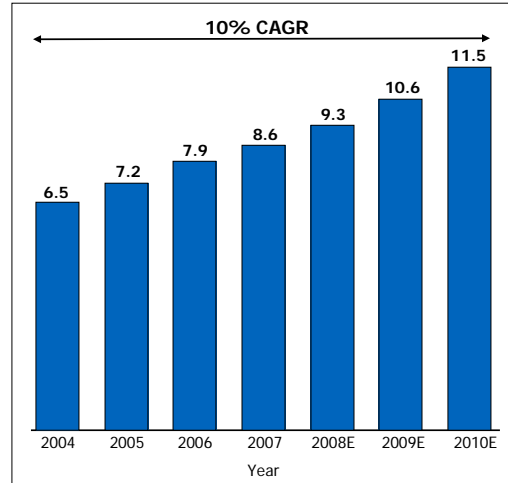
## Drivers of Growth in Energy Consumption

Worldwide server installed base growing at 16% CAGR to 41-43 million servers by 2010

Energy consumption per server growing by 9% because of increased performance

Unit energy prices increased on average of 4%

Total data center energy bill, \$ billions

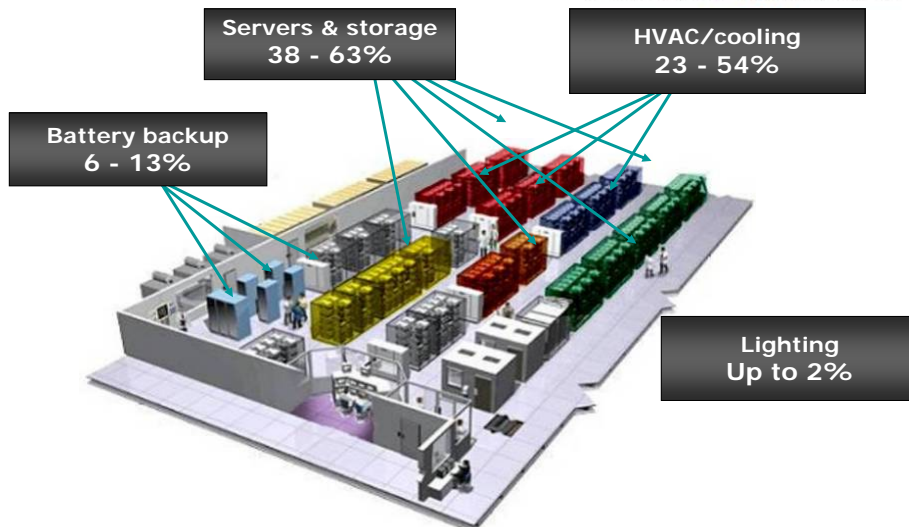


Source: McKinsey Report "Revolutionizing Data Center Efficiency" for the Uptime Institute Symposium

# Servers, Storage and Cooling Consume the Most Power in a Data Center



Enabling the ecological data center™

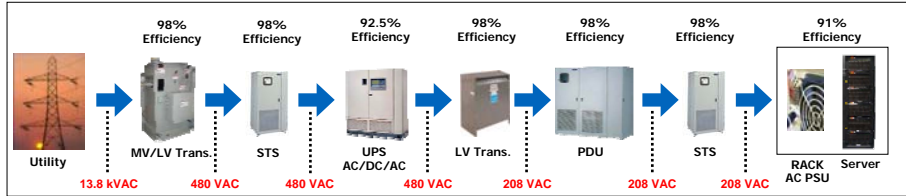


# Direct Current Electrical Path Provides Maximum Efficiency

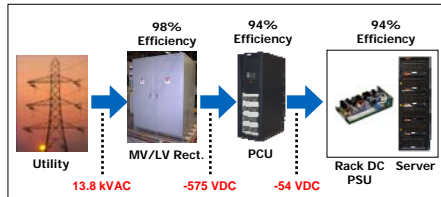


Enabling the ecological data center™

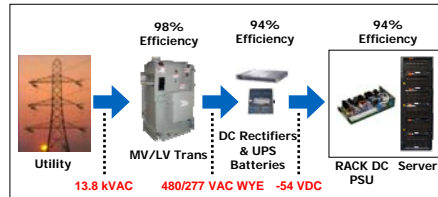
Best Case AC based system efficiency of 76.1% (using RACK best of breed PSU)  
- most other AC PSU efficiencies are in the mid 70s to low 80s



DC based system efficiency of 86.6%



DC based container system efficiency of 86.6%



Source: Validus, Rackable Analysis

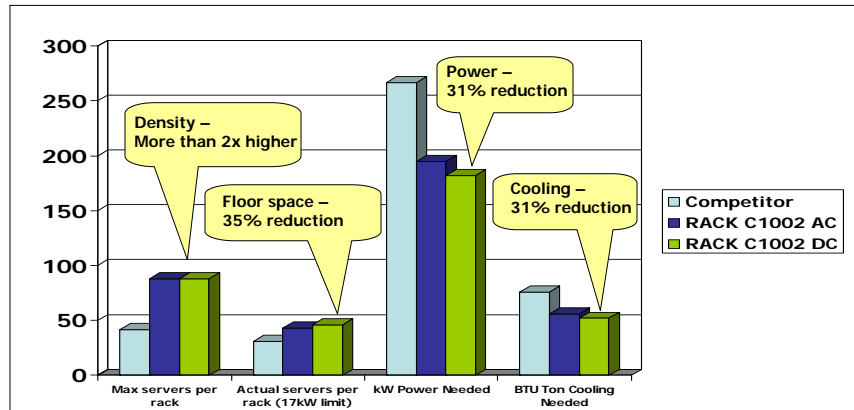
© 2008 Rackable Systems, Inc. All Rights Reserved.

# Leverage Best-In-Class Server Designs and Power Supplies



Enabling the ecological data center™

TCO study for prospective customer who was evaluating Rackable and a Tier 1 Incumbent



➔ Projected \$240k annual power/cooling savings

Source: Rackable Analysis

© 2008 Rackable Systems, Inc. All Rights Reserved.

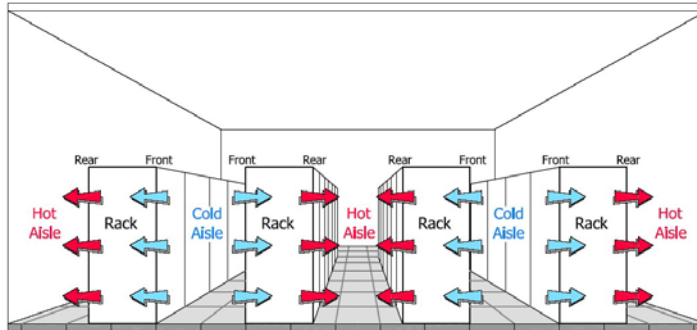
# Leverage Closely Coupled Cooling Solutions



Enabling the ecological data center™

Closely coupled cooling solutions target specific areas where cooling is needed (such as an individual row, rack or server) as opposed to a large open space such as the entire data center

Typical Data Center HVAC Cold Aisle/Hot Aisle Layout (hot air removed overhead - not shown)



Source: EPA, ASHRAE, The Green Grid

© 2008 Rackable Systems, Inc. All Rights Reserved.

# Back-to-Back Servers



Enabling the ecological data center™

### Flexibility

Choice of 22U, 36U, 40U, 44U racks & full range of AMD/Intel configs

### Density

Half-depth server design mounted back-to-back for 2x density

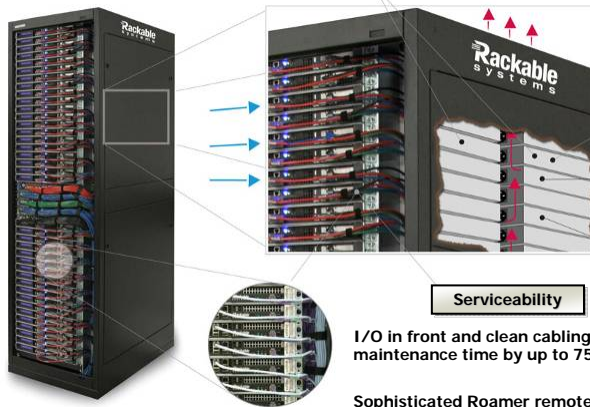
### Thermal Management & Power Distribution

- Unobstructed central air plenum for superior ventilation
- DC Power option provides power savings of up to 30%
- Passive cooling design for highest reliability

### Serviceability

I/O in front and clean cabling reduces maintenance time by up to 75%

Sophisticated Roamer remote management



© 2008 Rackable Systems, Inc. All Rights Reserved.

# Change the Unit of Growth



Enabling the ecological data center™

- Server at a time:
  - 1 system
  - Racking and networking
- Cabinet at a time:
  - ~90 systems
  - Rack, stack and cable
  - Considerably more efficient and now the unit of growth in efficient centers
- Container at a time:
  - 2,800 systems
  - No packaging to remove
  - No installation required
  - Plug and play
- Weatherproof, secure and transportable
- Reduce Data Center construction from 12+ months to weeks while reducing required regulations



# Product - The CloudRack™ Cabinets



Enabling the ecological data center™

Significant Reduction of Metallic Piece Parts >> Ecological Design and Lower TCO

Serviceability: Super-Easy Top & Front Access to All Key Components & Cabling in Seconds

Ultra Efficient 26"Wx 40"D Design >> Best in Class Compute & Storage Density

Common Cooling Infrastructure >>> Higher Reliability

208VAC Ultra- High Efficiency Power Infrastructure

Customer Choice of 22U & 44U Cabinets

**CloudRack™ Innovations Bring Together Ecological™ with Economical**

## Product - The CloudRack™ Trays



**Enabling the ecological data center™**

Serviceability – Super Easy Top/Front Access to All Key Components & Cabling

Ultra Efficient (up to 92.5%\* Efficient) 250W Power Supply\*

Customer Choice – Broad Selection of Intel and AMD Base Boards

Two Mini-SS1 (7x13) or Single EATX Base Boards/Tray

Ecological Fan-Less, Cover-Less Tray Design

Ultra Dense 1.75"H (1U)x19"Wx31"D Design

Investment Protection-Support for Next Gen. Intel Tylersburg (Q1'09) & AMD Fiorano Platforms (Q2'09)

Best in Class Storage Density - 8 "Quick Release" 3.5" Drives

Significant Reduction of Metallic Piece Parts >> Ecological Design and Lower TCO

**CloudRack™ Innovative Design Raises the Bar in Density, Serviceability & Configurability**

\*Peak efficiency based on power supply specifications  
\*\* Initially available based on AC power

© 2008 Rackable Systems, Inc. All Rights Reserved. 11

## Containerized and Modular Data Center (ICE CUBE) for x86 Compute and Storage



**Enabling the ecological data center™**

Introducing **ICE Cube™**  
Rackable  
The world's most efficient modular data center

**Key Enablers**

- Closely coupled cooling system
- Distributed UPS closely matches load
- Modular design allows infrastructure to match IT load
- Best-in-class server designs and power supplies
- DC based power infrastructure
- Self-contained and rugged

- A modern design point:
  - New construction
  - Augment existing locations
  - Mobility
  - Rapid world-wide deployment
- Extreme efficiency by reducing
  - Data center power up to 50%
  - Cooling costs up to 80%
  - Facility costs up to 50%
  - Redundant equipment and infrastructure

Source: Rackable

© 2008 Rackable Systems, Inc. All Rights Reserved. 12

ecological