



Green IT: reduce energy costs and improve service levels with virtualization

**Bob Good, Manager - Systems Engineers
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MISA Fall Conference**



Current State of the Data Center

Typical x86

“Through 2007, organizations with more than 200 servers will waste between \$500,000 and \$720,000 annually supporting underutilized application/server combinations”

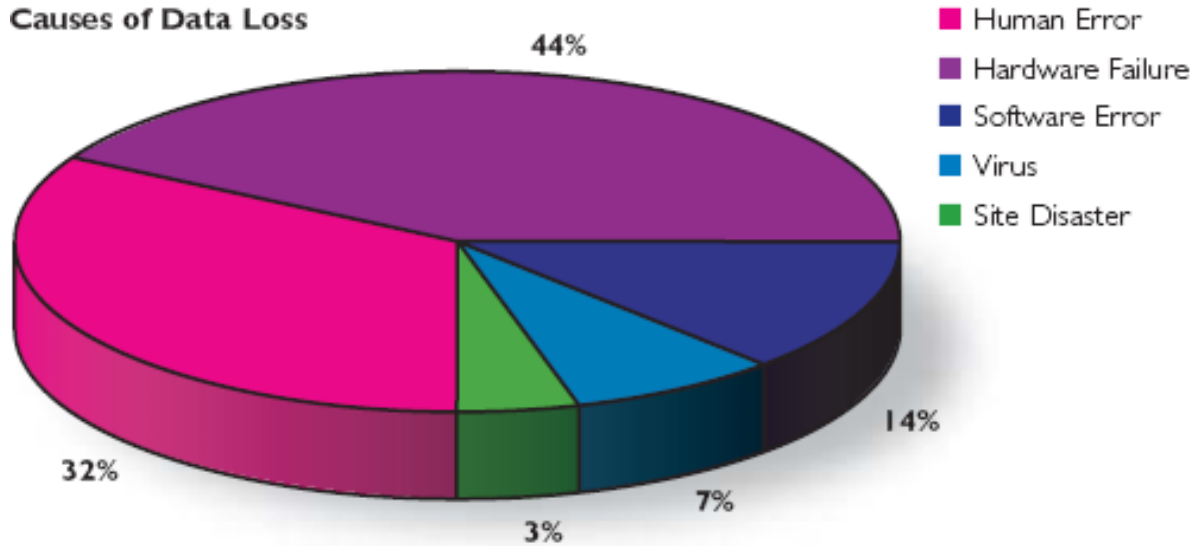
Gartner Research, December 2004

- Average processor utilization is 6% to 7%
- Prime time processor utilization is only 15%
- 40% of equipment is over 3 years old
- Firms have over 20% - 50% more capacity than actually needed

Business Impact Relative to Availability

CHART I

Causes of Data Loss



Source: HP

- Hardware #1
- Human #2
- Totals 76%

TABLE I. - DOWNTIME COSTS

| Vertical Market | Cost of Downtime |
|----------------------------------|--------------------|
| Energy Production & Distribution | \$3.0 Million/Hour |
| Telecommunications | \$2 Mil/Hour |
| Financial/Brokerage Services | \$1.5 Mil/Hour |
| Banking & Commerce | \$1.0 Mil/Hour |
| Pharmaceuticals | \$1.0 Mil/Hour |

Source: Meta Group

Tangible Value of Virtualization

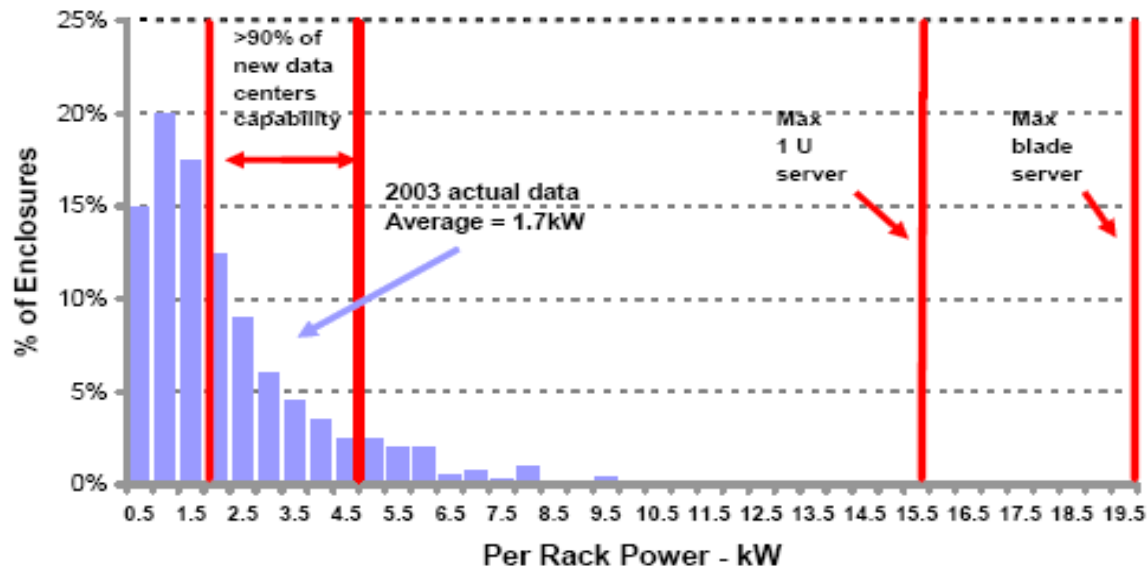
“Companies have to ask themselves, ‘Am I willing to bet the cost of energy is going to go down.’ That’s the cost of doing nothing.”

**Andrew Fanara
Environmental Protection Agency
Energy Star Program**

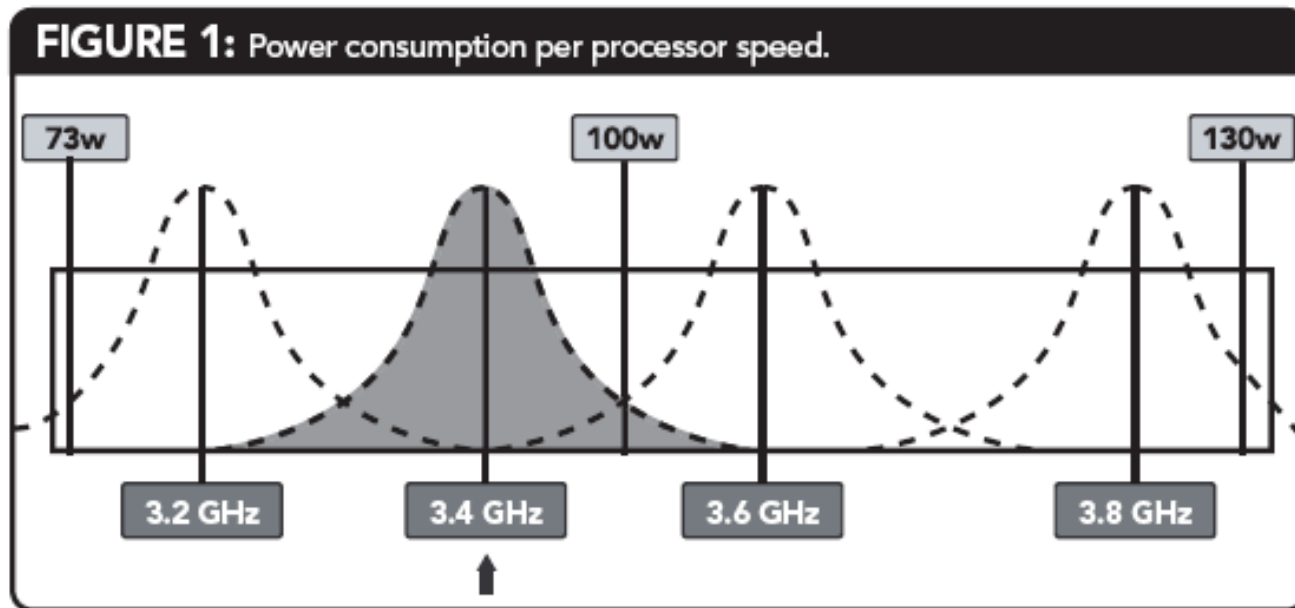
Power Rack Distribution

- In 2003, average data center planned for 1.7 kilowatts per rack, today 12-15 kilowatts common. Blades can exceed 20 kilowatts per rack.
- 30-40% of all data centers in existence today, are presently being redesigned or new data centers being planned to accommodate a massive growth in power and cooling required

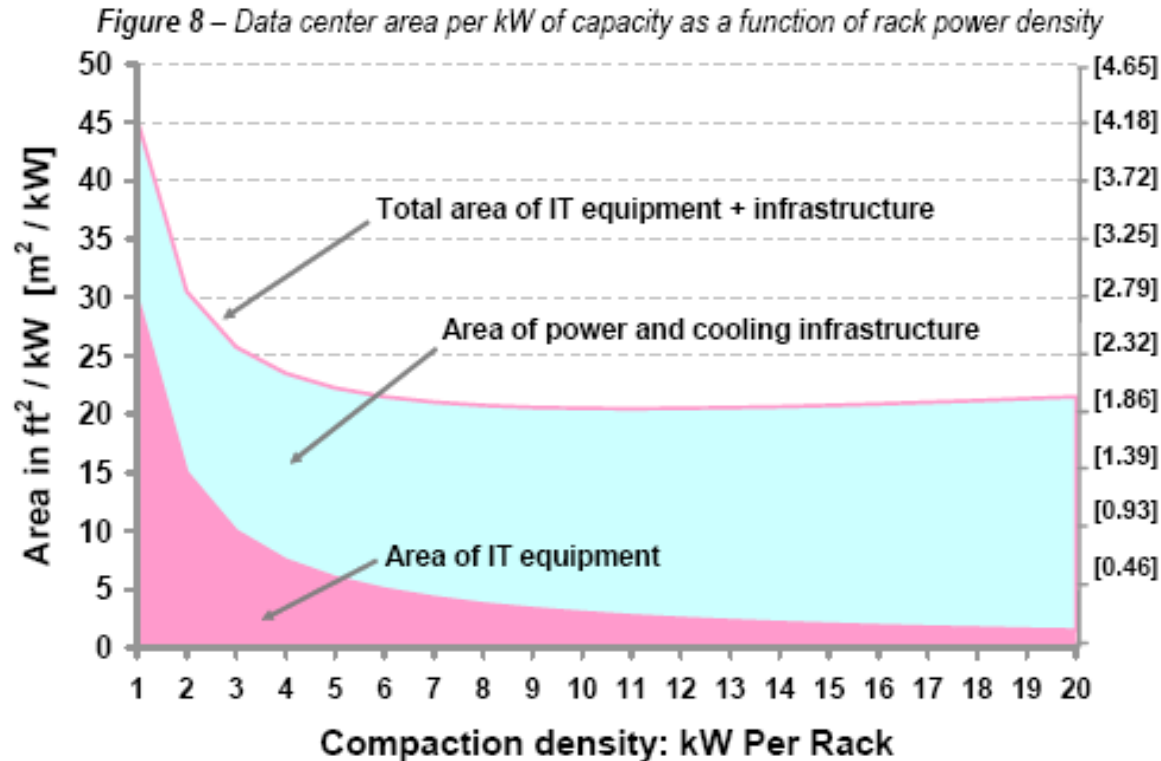
Figure 2 – Frequency distribution of actual rack power consumption, showing relation to maximum possible rack configuration



Wattage Kills: as Chips Exceed 100 Watt Threshold



As Server Area Decreases, NCPI Increases



- Avg rack is 7-8 sq ft, 35% of data center floor space dedicated to racks, remaining 65% for aisles & support systems. Misperception about blades, NCPI may cause sq footage to increase.

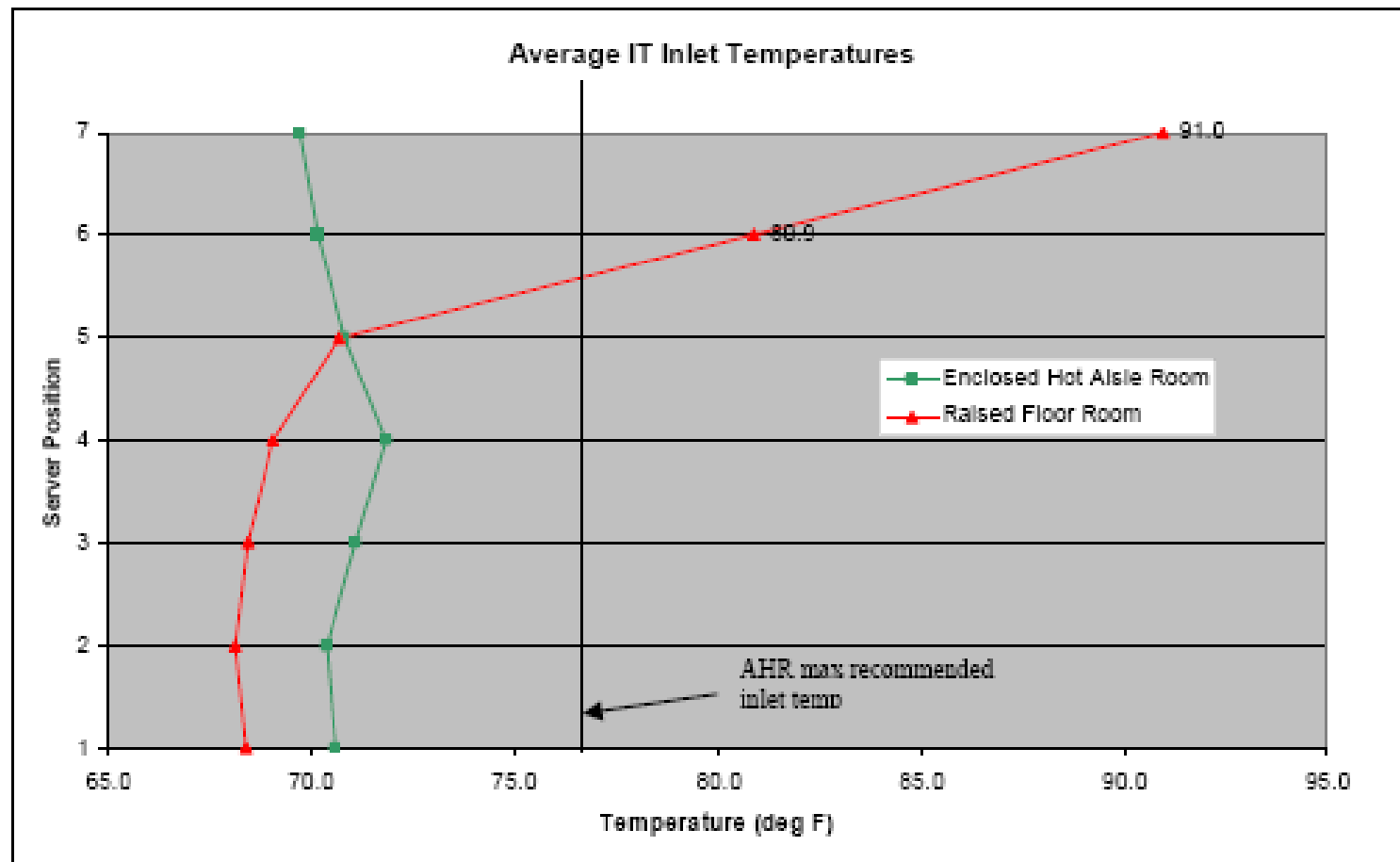
Density & Cooling directly connected to failure rates

“The failure rate in the top third of server racks is three times the bottom two-thirds. Overheated servers can slow throughput and affect system reliability.”

Kenneth Brill
Executive Director
Uptime Institute

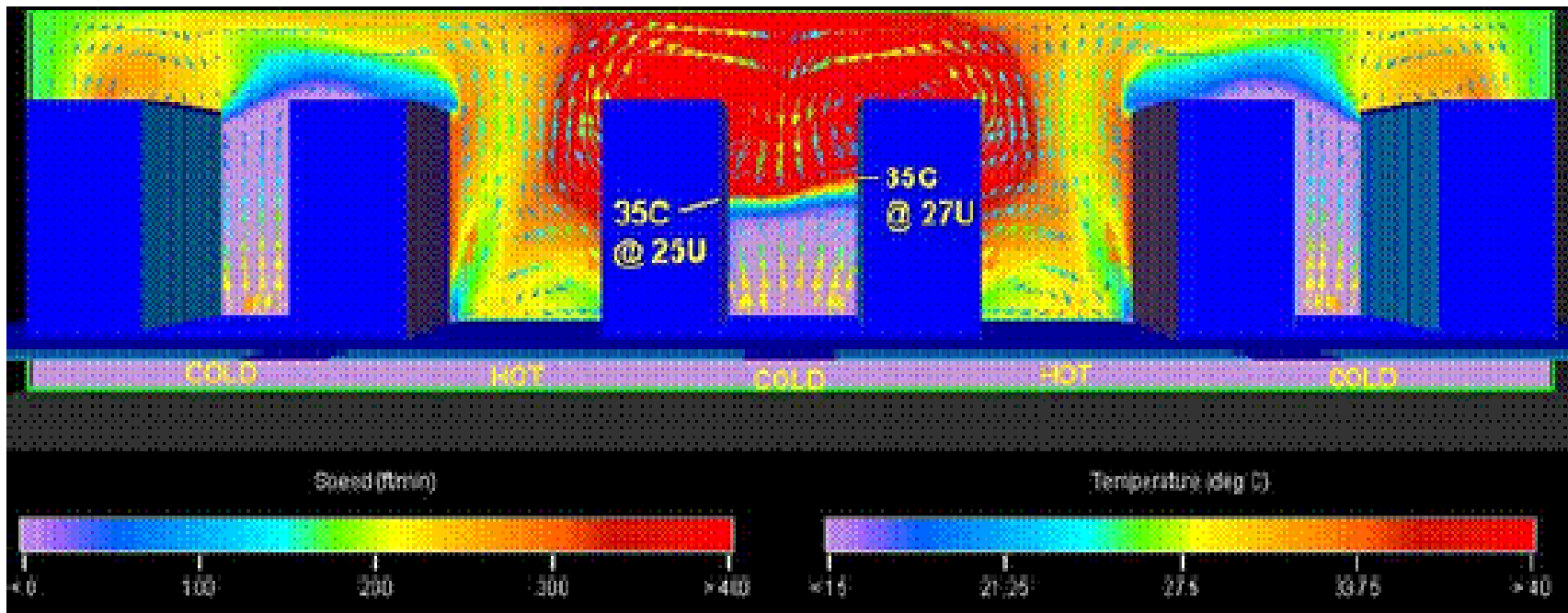
Top One Third of Racks Take in Hot Air

Figure 6 – IT equipment inlet temperature as a function of mounting position in rack.



Failure Rates Increased, Rack Densities Decreased

- Airflow inefficiencies and fan failure, #1 reason for X86 hardware downtime
- Disk drive failures #2, also related to #1
- Hot air recirculation as a result of front to back cooling failures, leads to systemic thermal shut down. Customer work around is to not fully populate racks like below, can only fill racks to ~ 50% full to keep systems up





What is the power industry doing?

Public Law 109-431: EPA Report to Congress

“Electricity use associated with the nation’s servers and data centers grew significantly from 2000 to 2006. As of 2006, the electricity use attributable to the nation’s servers and data centers is estimated at about 61 billion kilowatt-hours (kWh), or 1.5 percent of total U.S. electricity consumption (US DOE 2007a). This electricity use has more than doubled since 2000 and amounts to about \$4.5 billion in electricity costs. It is equivalent to the electricity consumed by 5.8 million average U.S. households (which represent 5% of the U.S. housing stock) and is similar to the amount of electricity used by the entire U.S transportation manufacturing industry (which includes the manufacture of automobiles, aircraft, trucks, and ships) (US Census Bureau 2006, US DOE 2005).

It is estimated that federal servers and data centers accounted for roughly 6.1 billion kWh (10%) of this electricity use in 2006 at a total cost of \$450 million.”

Server consolidation saves energy for Utilities and Customers

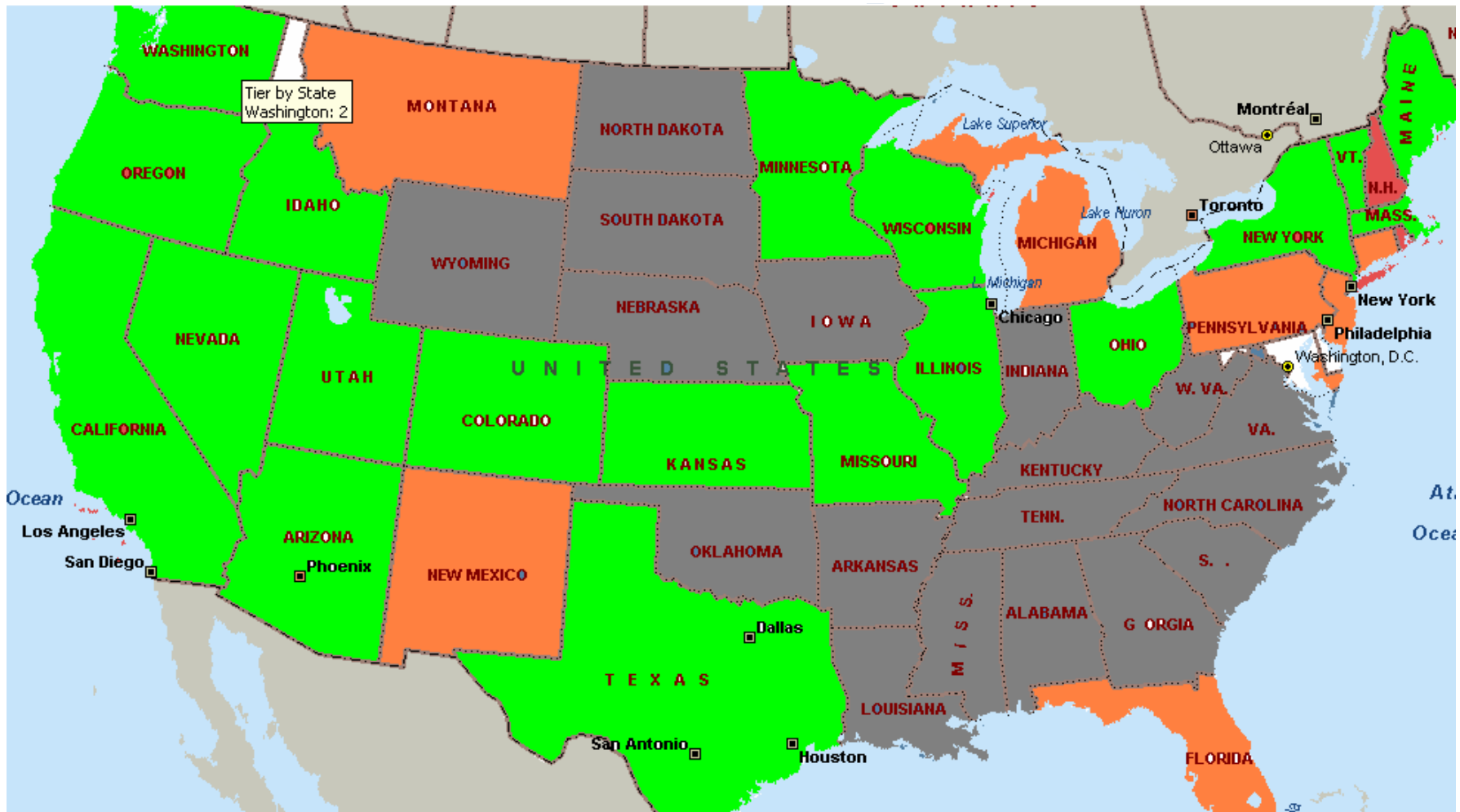
- Utilities across the country have energy efficiency incentives for customers
 - HVAC and Lighting rebates are common
 - Now many are adding incentives for **Virtualization** paying anywhere between **\$166 – \$250** per server removed and **\$35 - \$50** for desktops



utility

- AEP, PG&E, SDG&E, SVP, Pacific Power, Austin Energy, SCE, ...
- 40 utilities in the US and CAN

Coverage Map: States with EE



- Tier by State**
- 1 HAS VIRTUALIZATION INCENTIVES
 - 2 LIKELY TO HAVE VIRTUALIZATION INCENTIVES
 - 3 NO INCENTIVES



*What does the work load
look like in the Data
Center?*

The 70's. What a great time (Before EPA mandated MPG)



=



The 80's. Still great times (After EPA mandated MPG)



=



Still the same Problem



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The real fix is?



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Gartner Research, December 2004

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Capacity Planner

Partner Portal | Setup | Help | Logout

Dashboards

Inventory

Performance

Optimization

Analysis

Enterprise Dashboard (Week: 9, Year: 2005)

Quick Search

Server Name

Filters:

Company:

AOGDemoV2

Domain:

All Domains

Department:

All Departments

Environment:

All Environments

Application:

All Applications

Location:

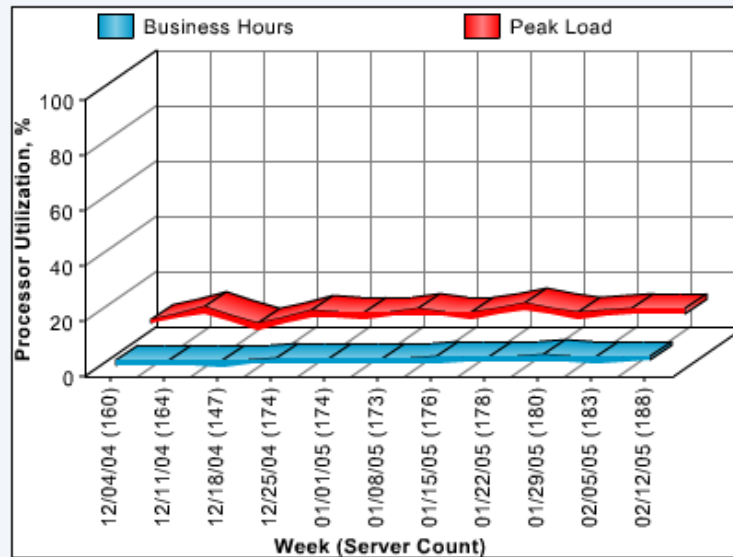
All Locations

Host Name:

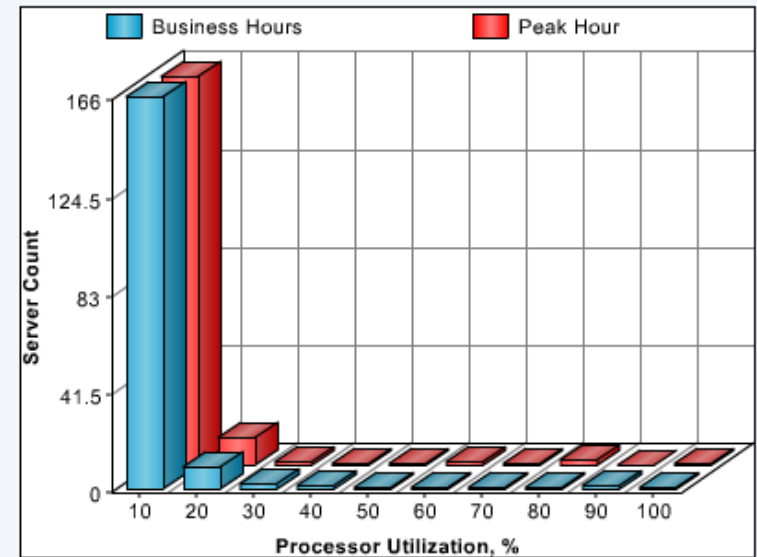
Interval

Hourly Weekly

Processor Utilization Most Recent 12 weeks



Server Distribution by Processor Utilization Most Recent 12 weeks



Server Count

| CPU(s) | Servers |
|--------|---------|
| No Inv | 46 |
| 1 | 50 |
| 2 | 65 |

Processor Summary

| | |
|----------------------|---------|
| CPU Mhz | 499,606 |
| Ave CPU Utilization | 5.89 |
| Peak CPU Utilization | 14.20 |
| CPUs | 316 |

Optimization Opportunities

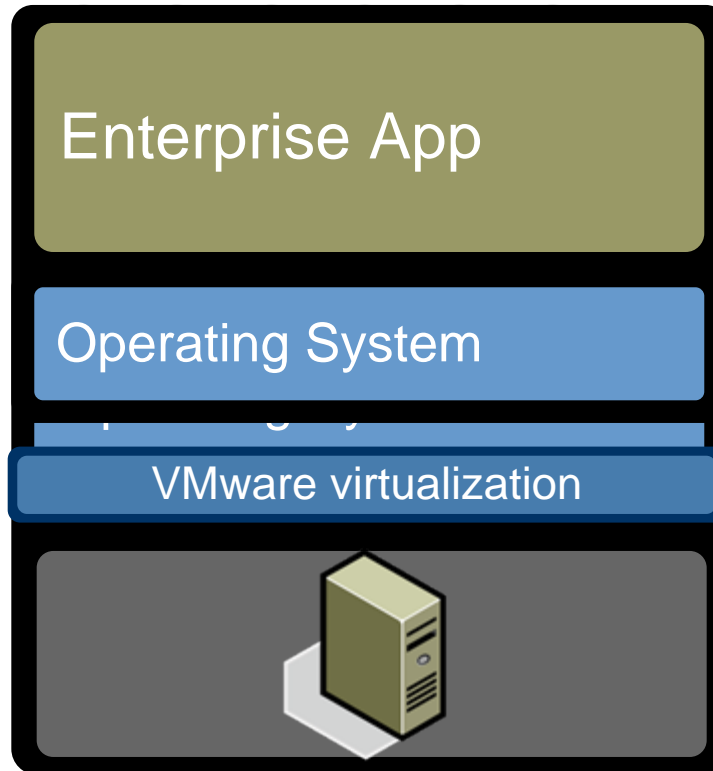
| | |
|-------------------|----|
| Consolidation: | 14 |
| Anomalies: | 0 |
| Alerts: | 0 |
| Trend Deviations: | 0 |



*How does VMware fix
this?*

First Things First: Virtualization

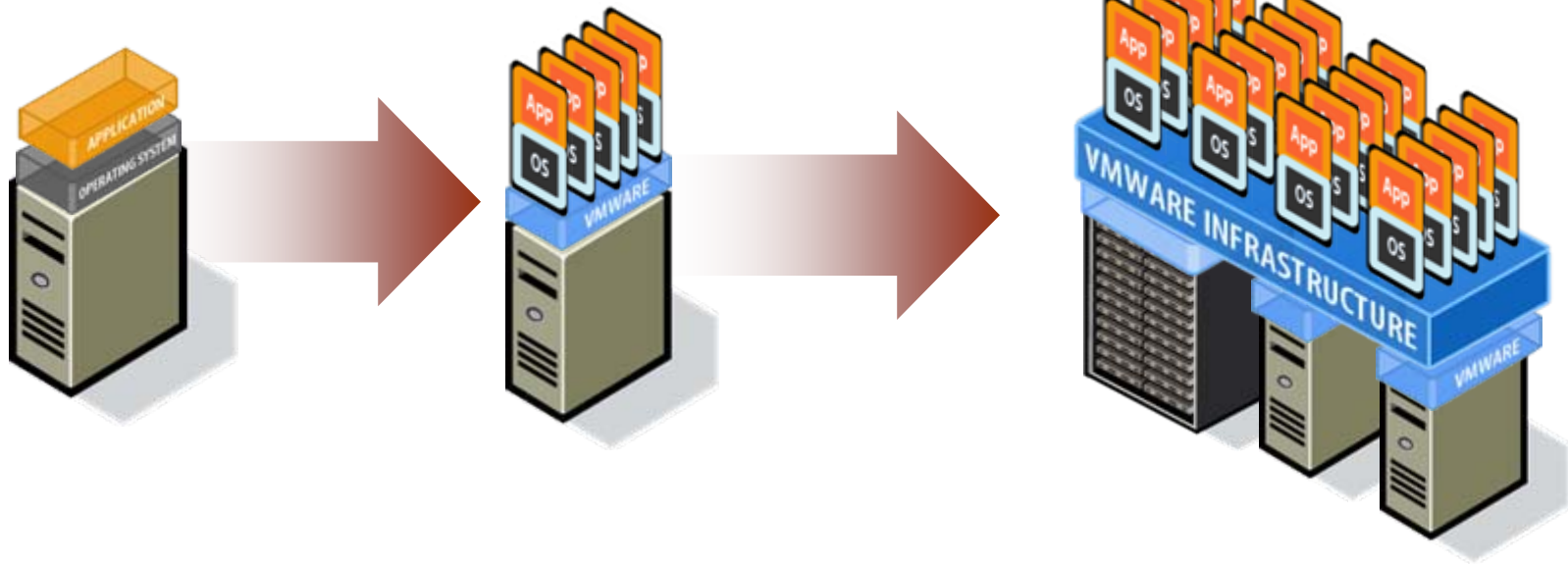
VMware decouples software from hardware.



Virtualization: Fundamentally Better

Run several operating systems on a single machine.

Create shared pools of resources to optimize your infrastructure.



The Always On, On Demand Data Center

Automated Resource Assurance

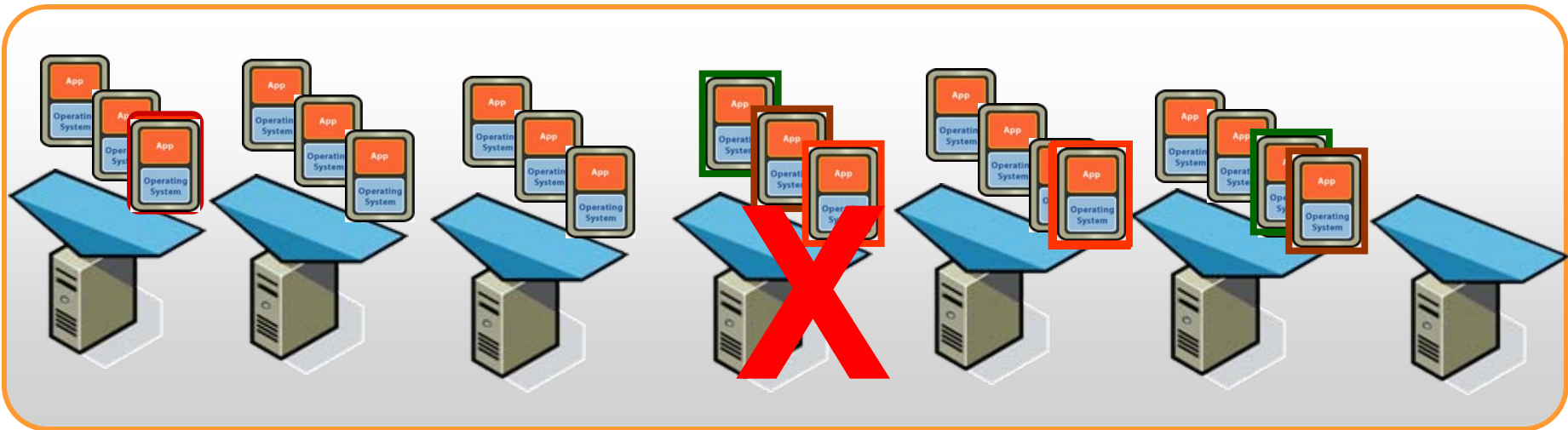
- Dynamic Balancing
- Continuous Optimization

Increased Availability

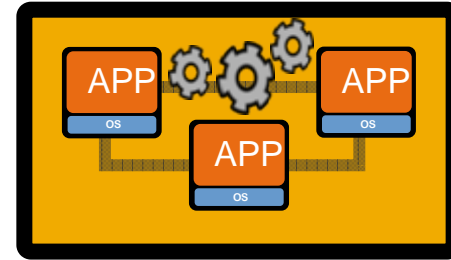
- Automated
- Across Applications

On Demand Capacity

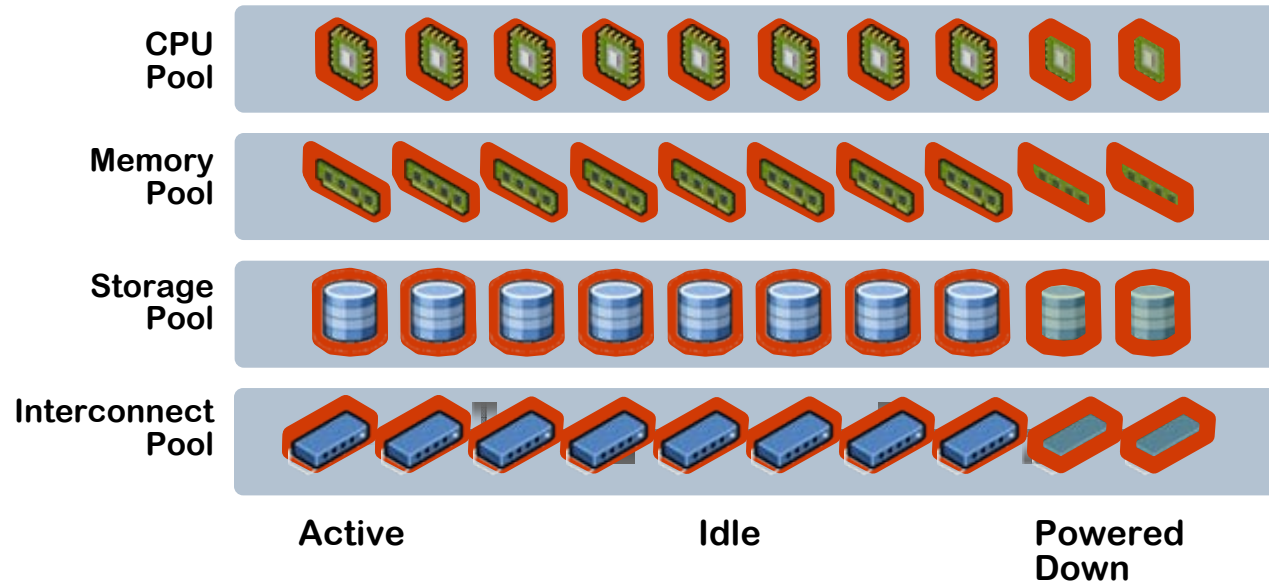
- Non-Disruptive
- Flexible



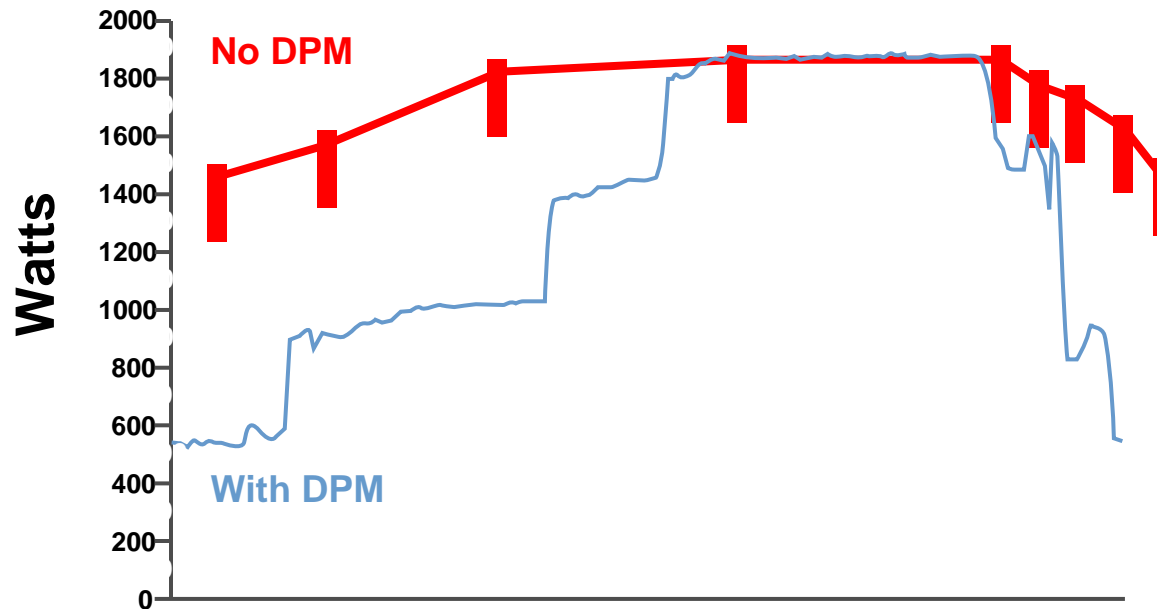
Power Management



Virtual Infrastructure



Example of Intelligent Pooling: Make the Software Mainframe Thrifty (DPM)



50% Savings During VMmark™



Virtualization in the Test & Dev Lab



Actual Lab
“Before”

Virtual Lab Infrastructure



Actual Lab
“After”

- Drastically reduces the software development lifecycle
- Fewer machines and dramatically reduced hardware replacement cost
- Supports concurrent lab users in multiple worldwide locations
- Improves IT response time from days to minutes

Questions and Answers

Appendix: DATA Spreadsheet
IVR Cherry Pick
Repeatable Process

