



Virtualization: The Best Initiative for Alleviating the Power Crisis in the Data Center

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Product Marketing

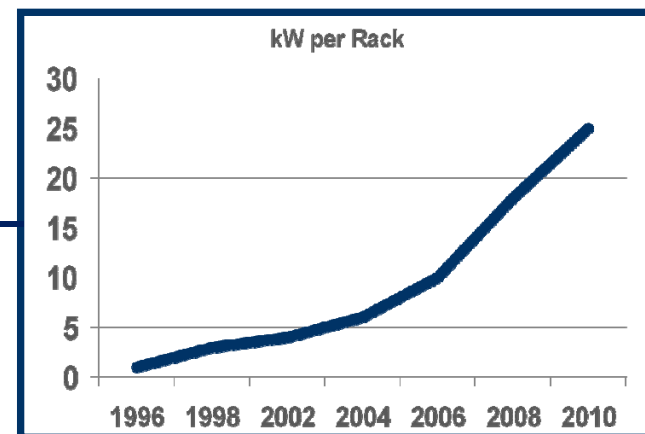
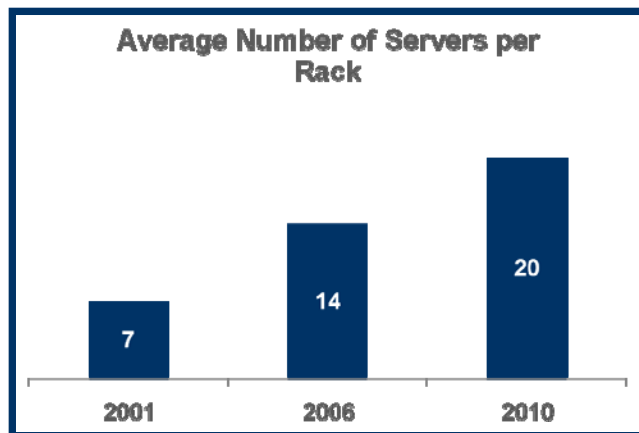
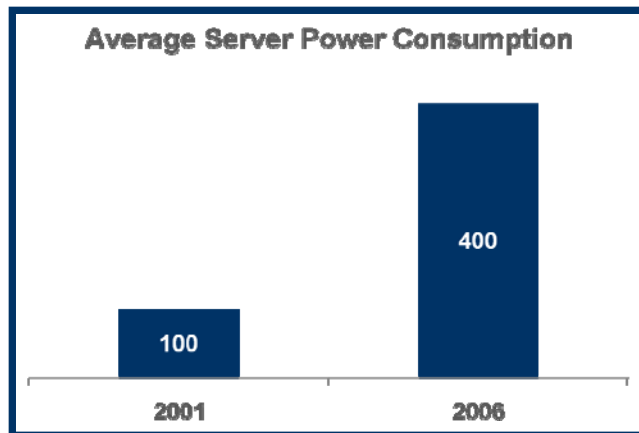
Agenda

Rising Costs of Power and Cooling in the Data Center

How Virtualization Can Help

VMware Customer Case Studies

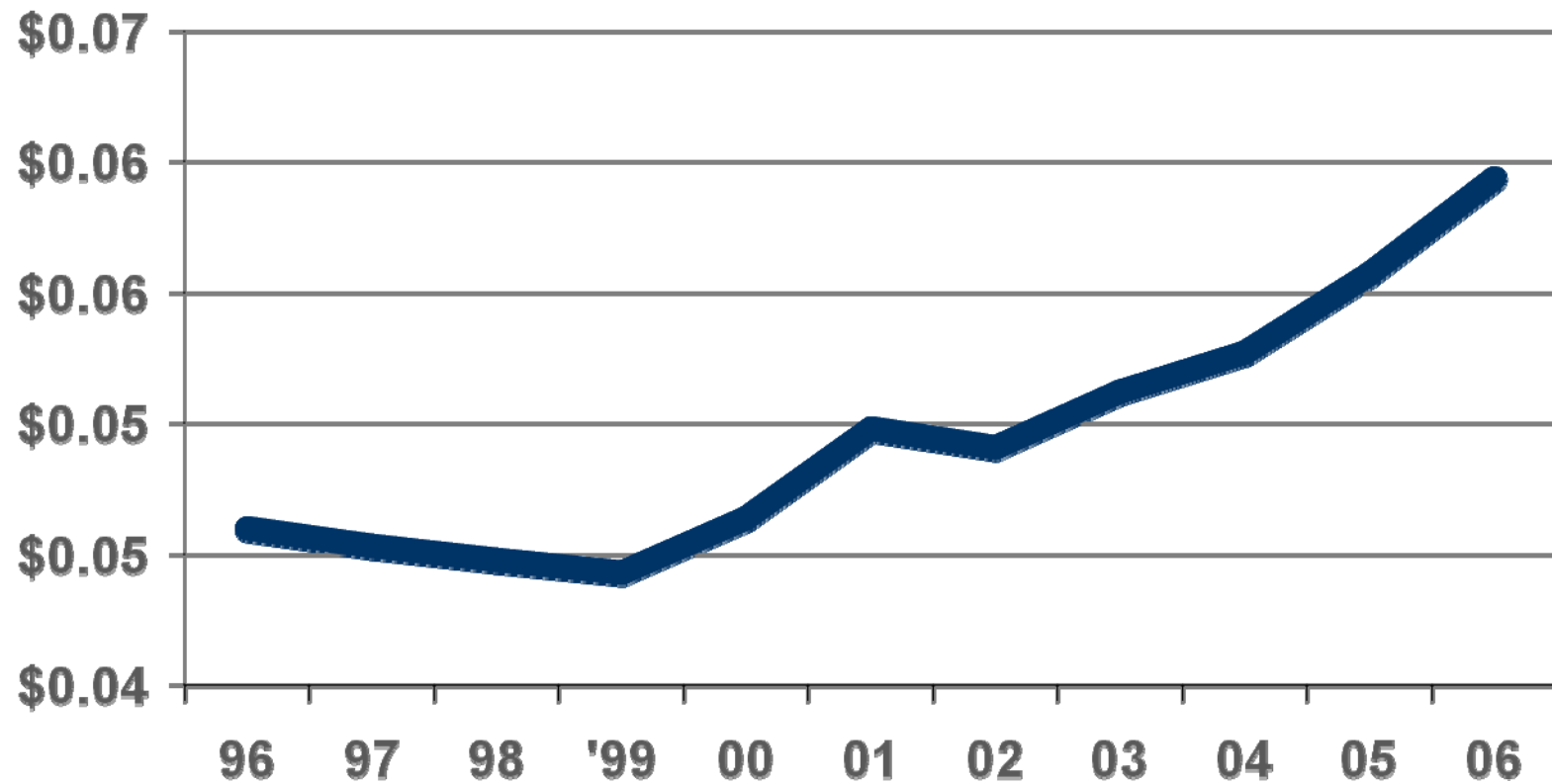
Power Density is Increasing...



Source: IDC, The Impact of Power and Cooling on Data Center Infrastructure

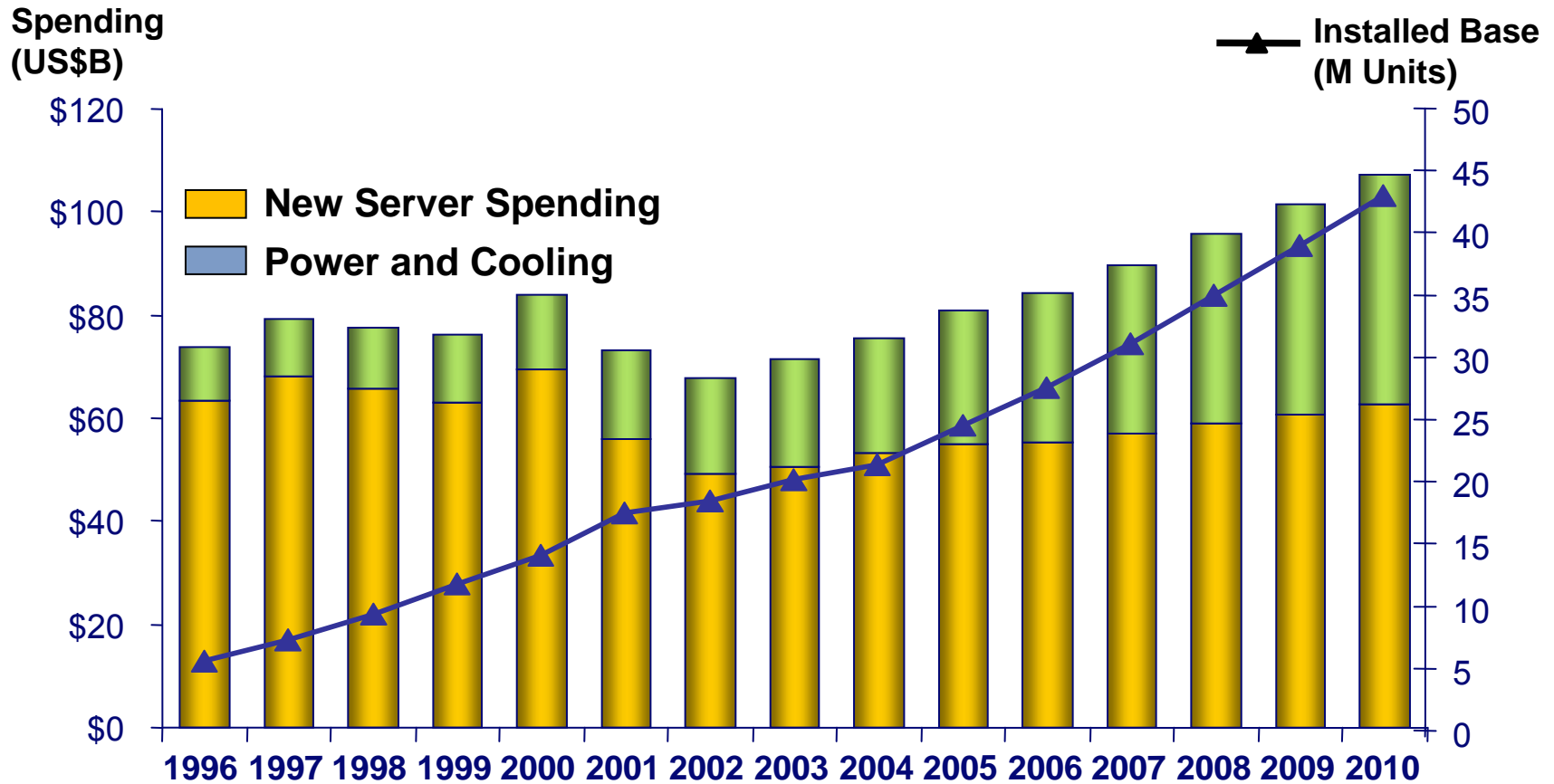
Electricity Costs Are Rising

US Industrial Electricity, cents per kW



Source: <http://www.eia.doe.gov/cneaf/electricity/epa/epat7p4.html>

As a Result, Power Costs Rival New Server Spending



Source: IDC, The Impact of Power and Cooling on Data Center Infrastructure

How Customers Are Impacted

- > IT budgets are increasingly consumed by data center power & cooling costs
- > Power supplies are constrained in some geographies
- > Heat causes servers to fail and results in service interruption

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Rising Costs of Power and Cooling in the Data Center

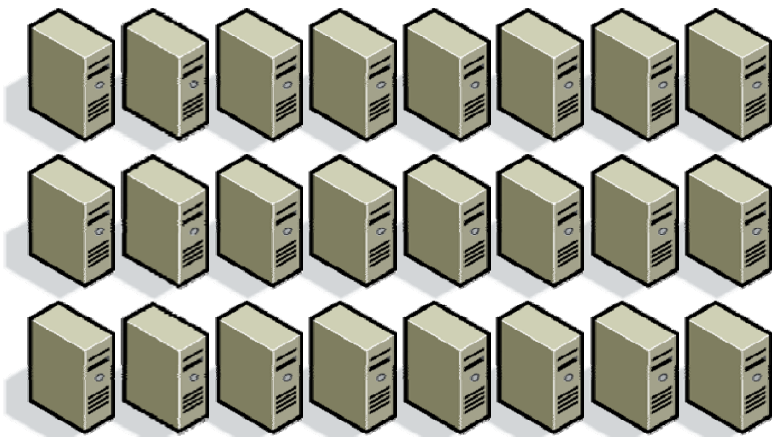
How Virtualization Can Help

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Less Servers Means Less Power And Cooling

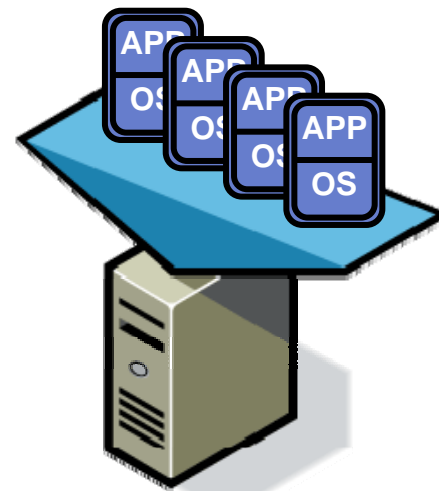
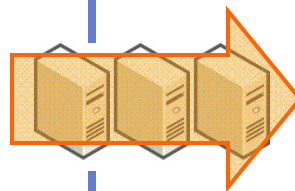
BEFORE

- > 1000 servers
- > 200 racks



AFTER

- > 50 servers
- > 10 racks



Calculating Power Consumption

Input	Description	Default Value
S	Sum of the nameplate power ratings.	Before/After 1 CPU: 475W / 550W 2 CPU: 550W / 675W 4 CPU: 950W / 1150W 8 CPU: 1600W / 1900W 16 CPU: 4400W / 5200W 32 CPU: 9200W / 11000W
λ	Steady-state constant	0.67
$E_{\$}$	Price per hour of 1 kW of electricity.	\$.0813 (Average commercial value for in 2005)

Power Savings Example

BEFORE

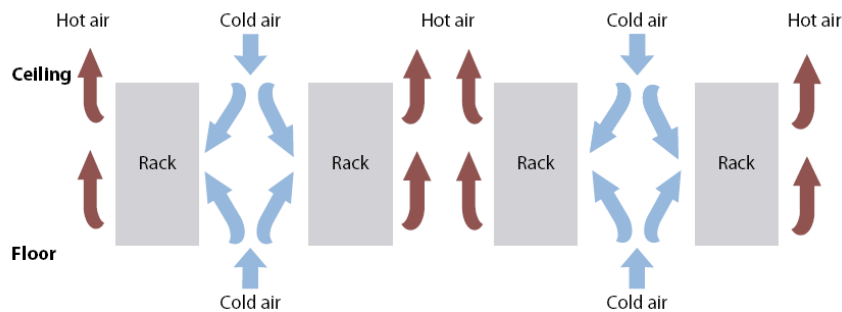
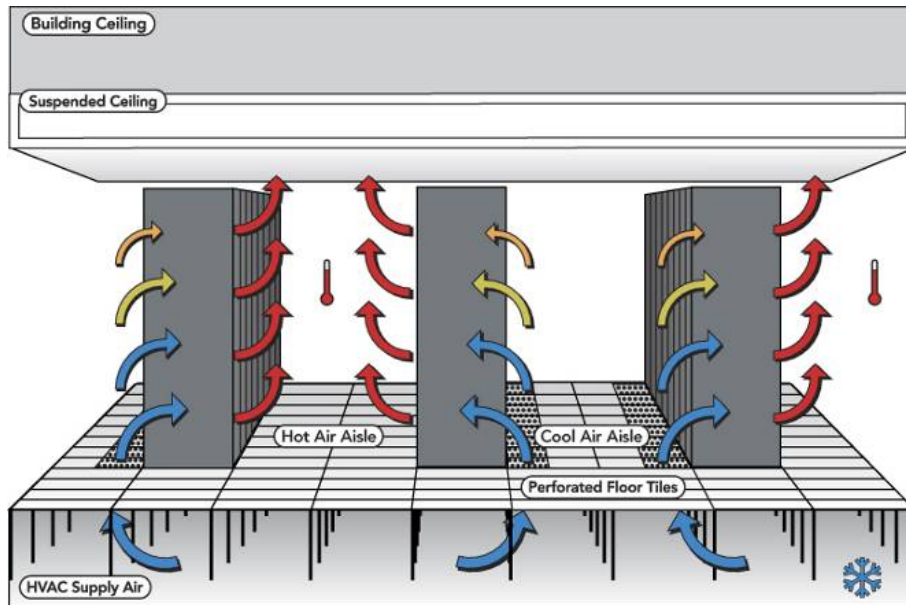
Type	Qty	Power Rating
1 CPU	300	475 W
2 CPU	500	550 W
4 CPU	200	950 W
8 CPU	--	1600 W
\$289,878 / year		

AFTER

Type	Qty	Power Rating
1 CPU	--	550 W
2 CPU	38	675 W
4 CPU	38	1150 W
8 CPU	4	1900 W
\$36,718 / year		

✓ Rule of thumb: \$250 and 3,000 kWh saved per year per workload virtualized

Data Center Cooling

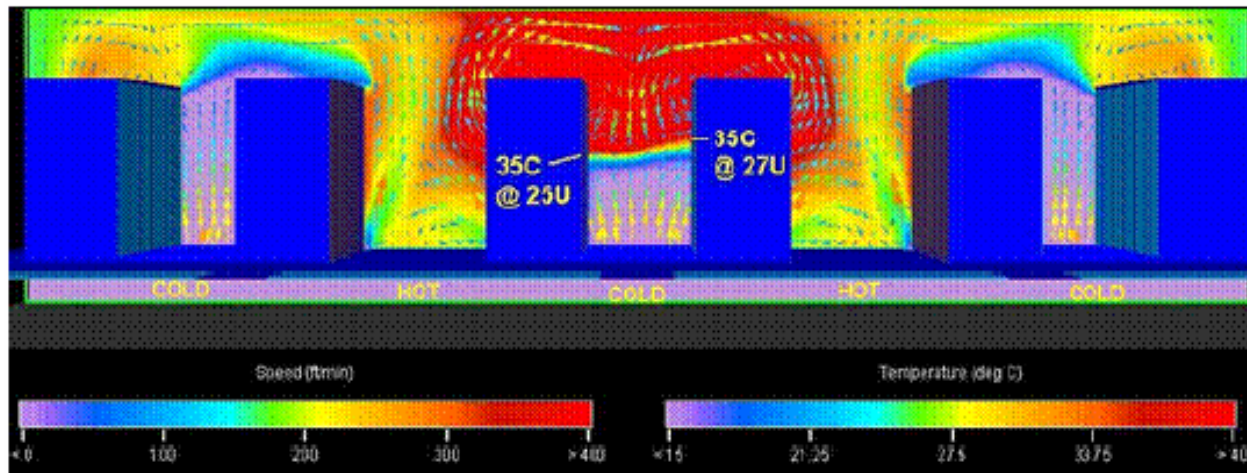


Source: Forrester Research, Inc.

- > Power consumed by the data center must be evacuated in the form of heat
- > Heat dissipation is more expensive than power
- > Data center design is important

Density and Thermal Management

- Airflow redundancy for proper cooling
- Additional redundancy for humidity



Calculating Cooling Costs

Input	Description	Default Value
S	Sum of the nameplate power ratings	Before/After 1 CPU: 475W / 550W 2 CPU: 550W / 675W 4 CPU: 950W / 1150W 8 CPU: 1600W / 1900W
λ	Steady-state constant	0.67
L	Cooling Load Factor	0.8
ρ	Airflow Redundancy Constant	125%
δ	Inefficiency (Humidification) Constant	125%
$E_{\$}$	Price per hour of 1 kW of electricity.	\$.0813 (Average commercial value for in 2005)

Cooling Savings Example

BEFORE

Type	Qty	Power Rating
1 CPU	300	475 W
2 CPU	500	550 W
4 CPU	200	950 W
8 CPU	--	1600 W
\$362,348 / year		

AFTER

Type	Qty	Power Rating
1 CPU	--	550 W
2 CPU	38	675 W
4 CPU	38	1150 W
8 CPU	4	1900 W
\$45,897 / year		

✓ Rule of thumb: \$310 and 3800 kWh saved per year per workload virtualized

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Annual Savings			
	Before	After	Savings
Cooling	\$28,332	\$2,004	\$26,328
Power	\$15,036	\$936	\$14,100
Totals	\$43,368	\$2,940	\$40,428

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