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The Impact of Power and Cooling on Data Center Infrastructure

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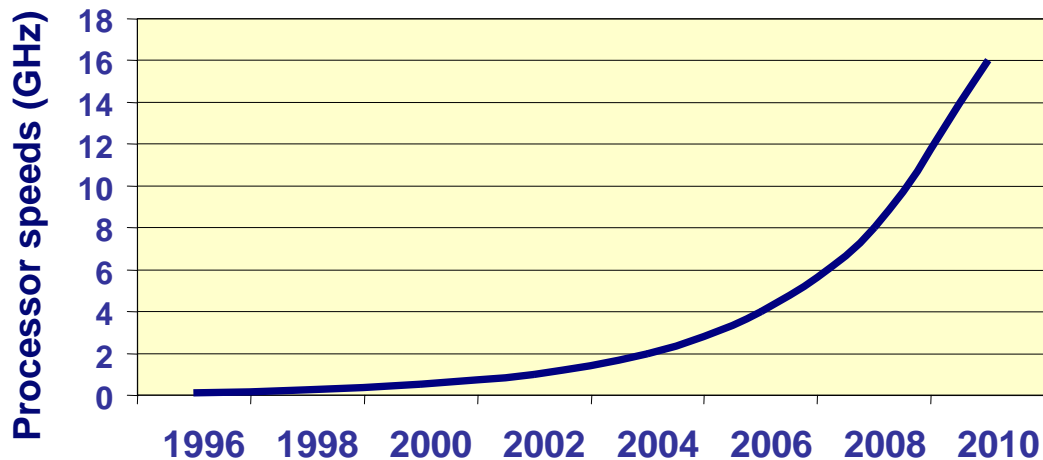


Agenda

- Background: What's going on in the data center
 - Performance trends
 - Power and cooling
 - Density
- No magic bullet: nested solutions
- Conclusions

Server Processor Speeds

Moore's Law



- Continual drive for performance from customers
- Industry has responded with faster
 - Processors
 - Memory
 - Disk drives
- Server power consumption (x86)

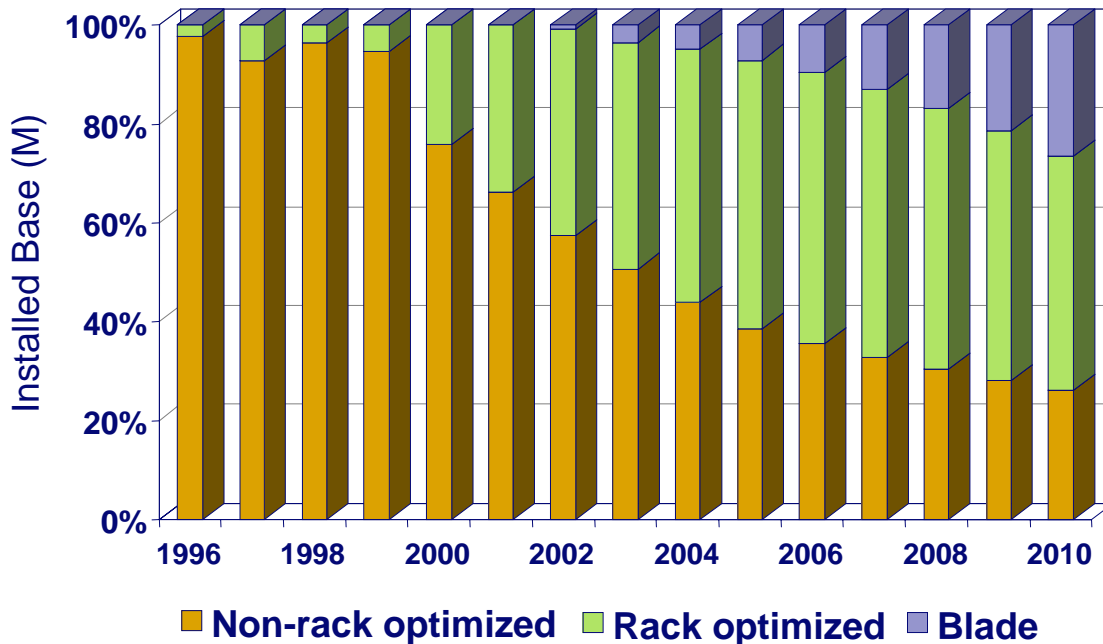
2000: 100–200W

– 2006: 300–400W

- And generating larger heat loads ...

...as systems become more dense.

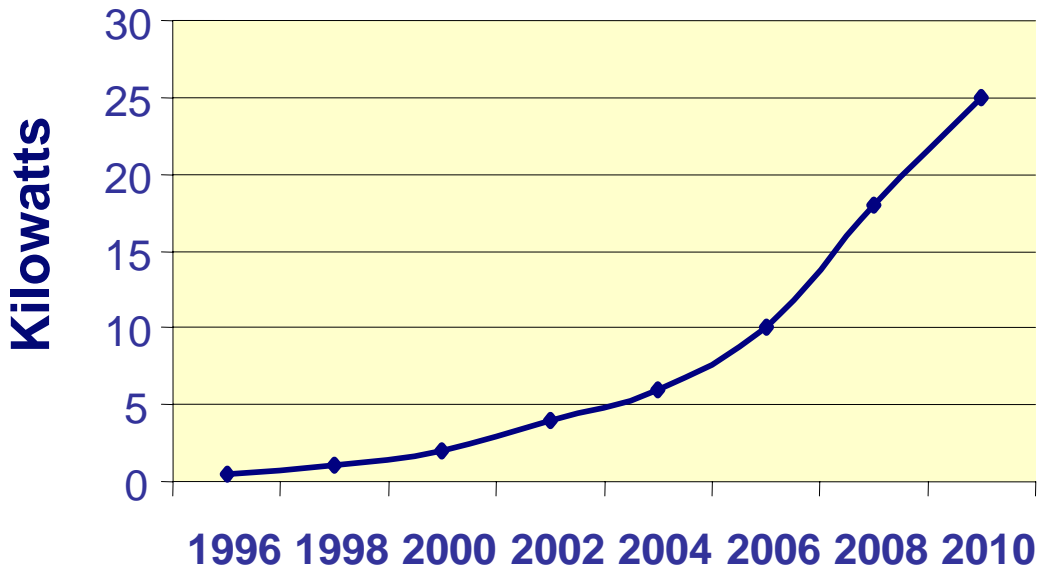
Data center power density is increasing by approximately 15% annually.



- Rack optimized and blades change the density landscape:
 - Average: 7 servers per rack in 1996
 - Average: 10 servers per rack in 2002
 - Average: 14 servers per rack 2005
 - Average: 20 servers per rack by 2010!!!

Rack Drawing More Power

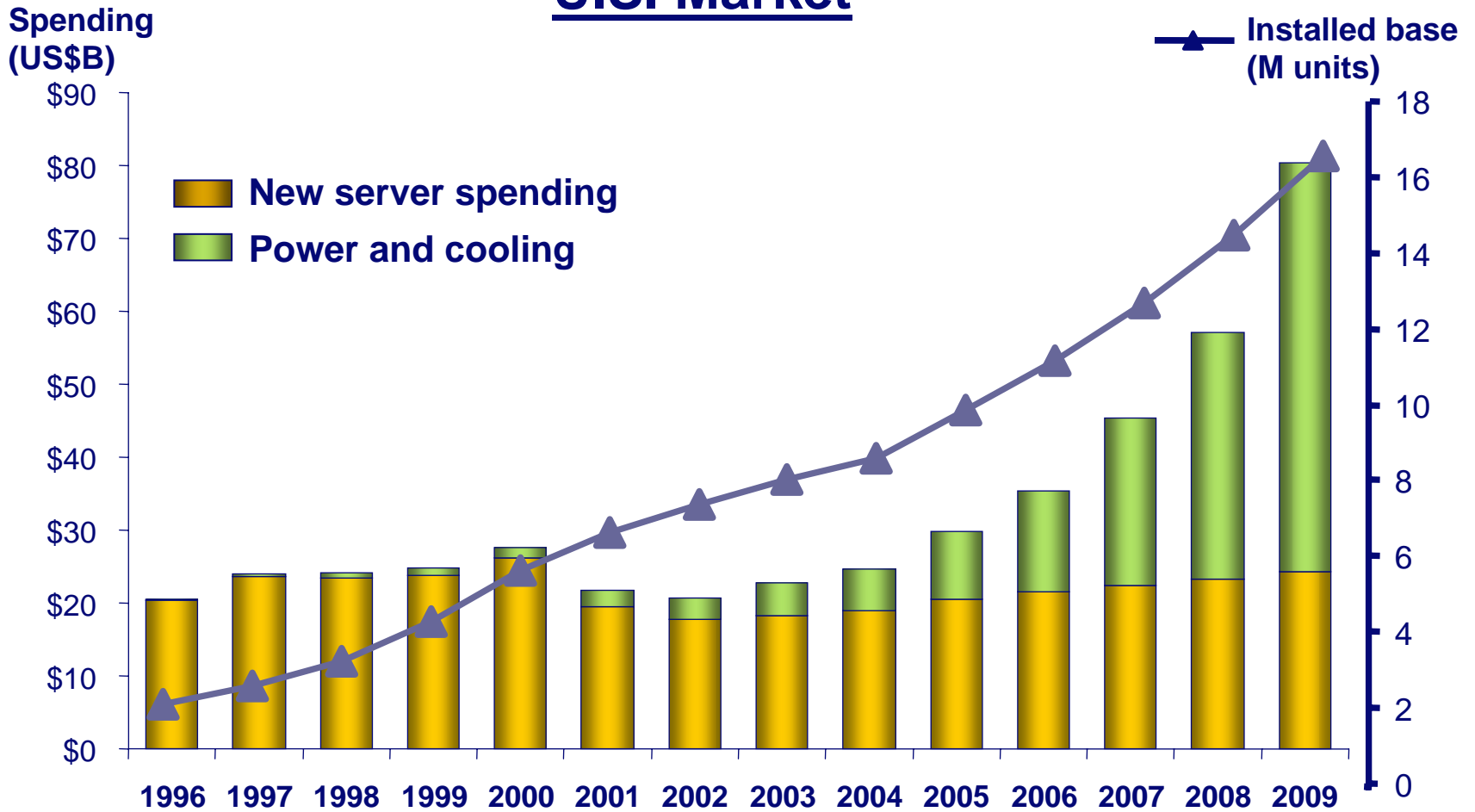
Kilowatts per rack



- Resulting power draws per rack have grown eightfold since 1996
- Average kW per rack
 - 2000: 1kW
 - 2006: 6–8kW
 - 2010: 20kW+
- Over 40% of data center customers report power demand outstripping supply
- Power density is increasing with new server form factors
- Power and cooling budgets have become difficult to predict ...
- And the pace of technology continues unabated ...

Installed base is growing...

U.S. Market



Survey Results

Qu: What is the average breakdown of your data center operational expenditure?

50 enterprise data centers

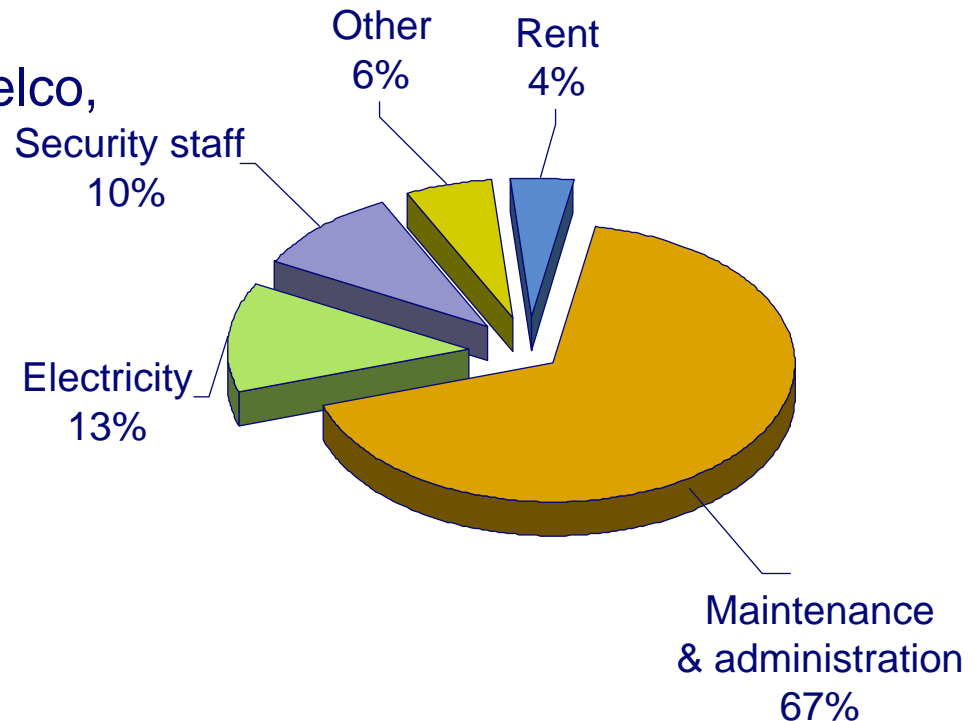
Covering public sector, finance, telco, manufacturing, transport

Age from 1 to 15 years, plus:

- 23% 5 to 6 years old
- 21% 9 to 10 years old

Floor space:

- Most 51–300sqm
- 8% below 50sqm
- 6% over 1,000sqm

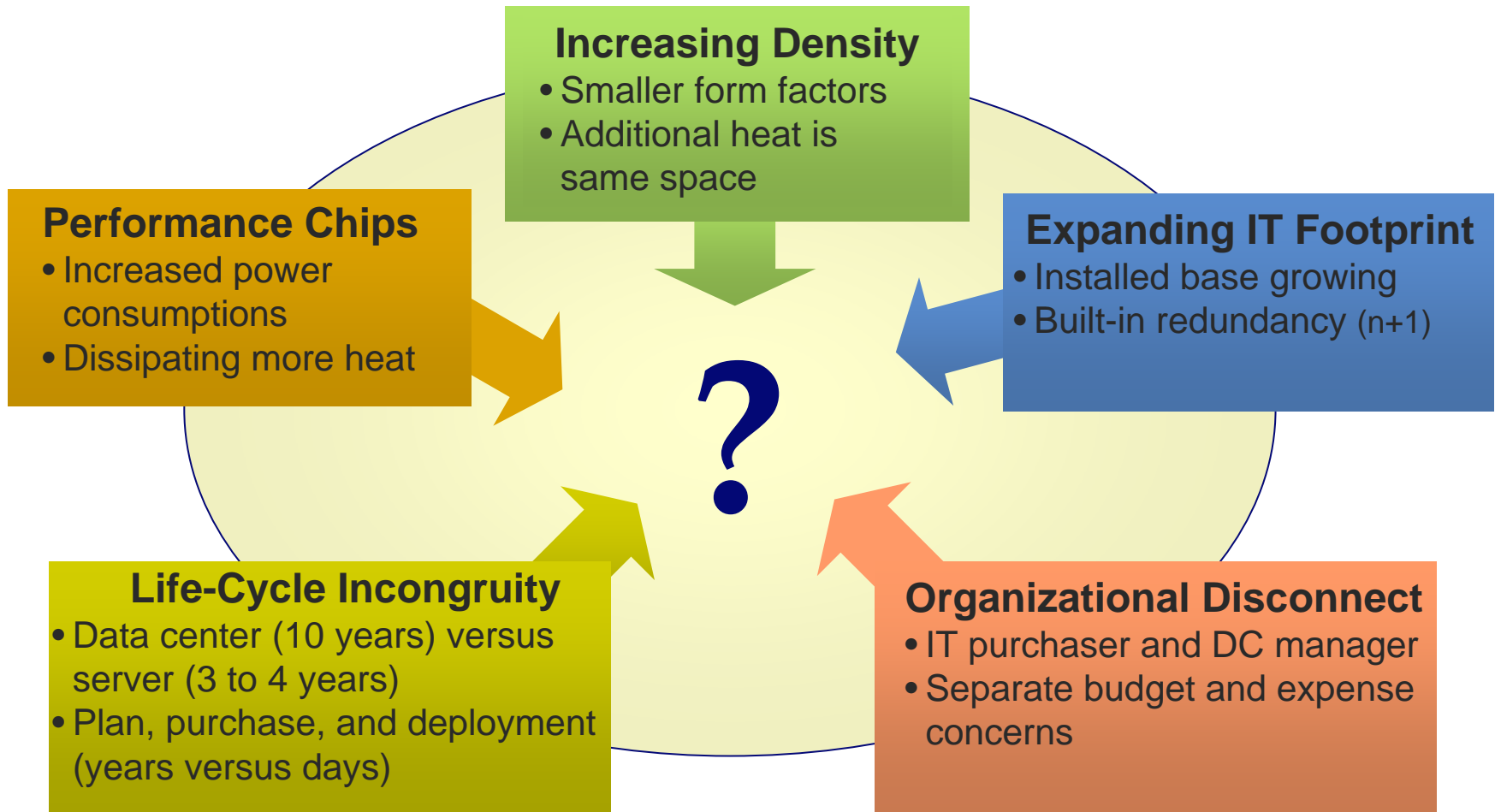


Cooling the Data Center



- While power expenses can be quite costly, cooling is often the limiting factor in most data centers.
- For a price, power can usually be added on to existing infrastructure.
- Existing building, room size, floor/ceiling, and HVAC system can make cooling a most difficult challenge.
- Forward-leaning customers are looking to new technologies and new paradigms to expand power and cooling capabilities:
 - New chips
 - Power throttling
 - DC power
 - Modular power and cooling

Visualizing the Problem



And Finally

- ❑ **Historically, power and cooling issues have been the realm of the facilities manager**
 - Rising power costs are forcing enterprises to examine the problem
 - They represent a large portion of ongoing management expenses
- ❑ **Technology needs keep pace with business demands**
 - Reliability, availability, redundancy
 - Large data sets, complex applications
- ❑ **IT departments moving toward service-oriented structure**
 - Increase focus to control overhead costs
 - Agility and modularity are the new mantras for technology
- ❑ **Data center infrastructure is challenged to keep pace**

