

Energy Implications of Data Centers

Topics covered

- What is a data center
- Characteristics of data centers
- Energy consumption of data centers
- Conservation opportunities

What is a Data Center?

- Data center or server farm is a generic label for facilities that house:
 - Hardware
 - Servers (computers)
 - Storage Devices
 - Power backup Devices (PDC, and UPS)
 - Communication devices (Routers, Switches, etc)

And of course the Software to control

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Types of Data Centers

- Hidden Data centers
 - Server closets, rooms
 - Enterprise data centers
 - Co-Located Server Hosting facilities
- Custom Data centers
 - Yahoo
 - Google

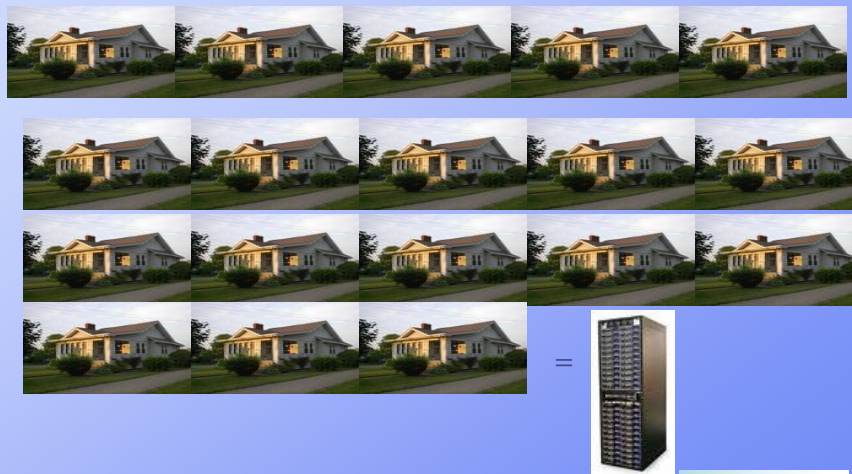
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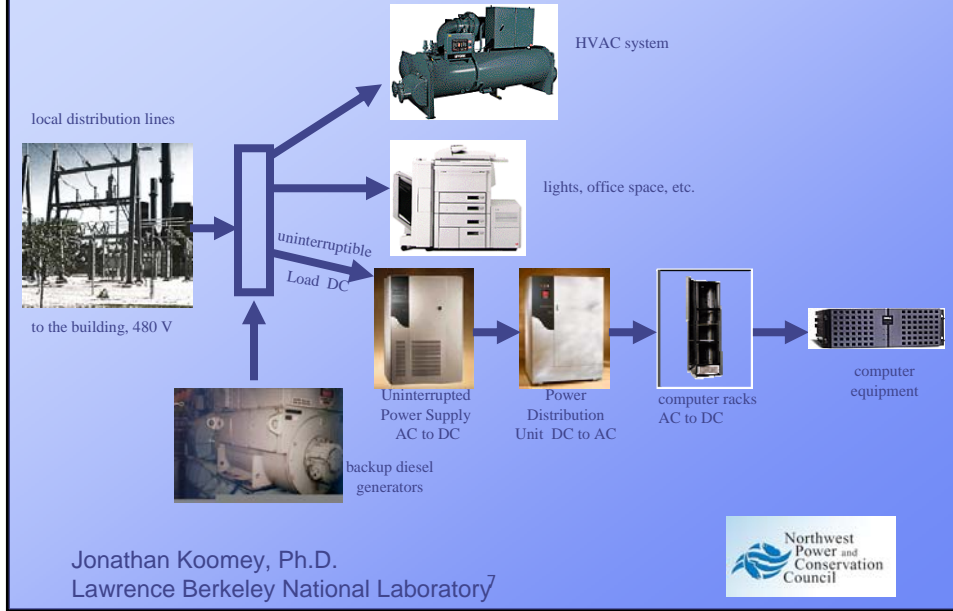
Typically Data centers are not design for humans



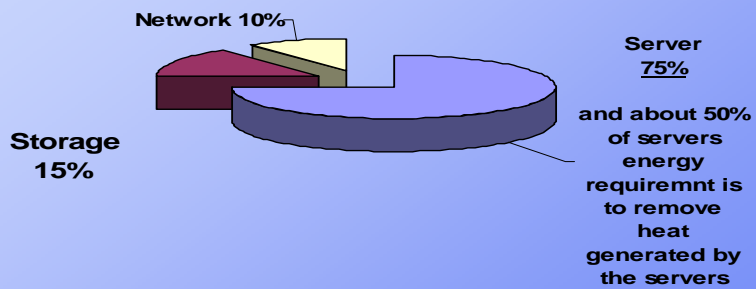
But they have large energy footprint



Electricity Flows in Data Centers



Breakdown of Electricity consumption In a typical Data Center



Estimates of Data Center Load in the Northwest

- Hidden Data Centers ~300 MW
- About 1.5% of regional Load
 - Concentrated in information tech firms
 - Law and accounting firms
 - Northwest share slightly higher than national average.

In addition Northwest has attracted

- Custom Data Centers ~ 300 MW
- Connected load
 - Will be phased in over the next few years.
 - Data center have flat hourly load profiles.

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Future Load Growth at Data Centers

- In 2006, Data center loads were projected to double by 2011, however limiting factors and efficiency improvements is expected to keep slowdown pace of growth:
 - Local power supply constraints
 - water/water treatment constraints
 - Low power prices availability
 - Space constraints
 - Demographics of high-tech information firms
 - Improved efficiency of existing and new installations
- Data center loads can increase by 50% by 2011.

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Large Efficiency Opportunities

Server use optimization.

A recent survey found

- 32% of servers were practically dead (utilization rates below 3%)
- 63% of servers have peak and average utilization below 10%

Better Cooling and power load management

Better storage management

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Energy Efficiency Tactics

- Optimize power deliver system
- Use higher temperature settings in the cold and hot aisles.
- Reducing cooling load
 - Right sizing the equipment
 - Integrate cooling delivery with demand
 - Use Water cooling
 - Separating hot and cold aisles
 - Using outside air more often (economizers)
- Use Virtualization to reduce number of servers

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Possible Range of Efficiency Opportunities

Low Hanging Fruit: Data Center Thermal Assessments

– 5-15% Savings Available

Server Consolidation Projects

– Large Opportunity: 20-80%
Depending on Hardware and Workloads

Source: Data Centers and Servers Track ©
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Past , Present and Future



1970s



Current



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Treatment of Data centers in the forecast

- Exogenous for the Custom data centers?
- Endogenous for the hidden data centers?