Energy Efficiency Case Study: Cisco Systems Data Center

"When it comes to data center efficiency, there are few larger gains than improving the heat removal architecture. The Virtual Facility is the best tool I've seen to tie together cooling, availability and efficiency in one analytic model. A very valuable tool for many data center operations."

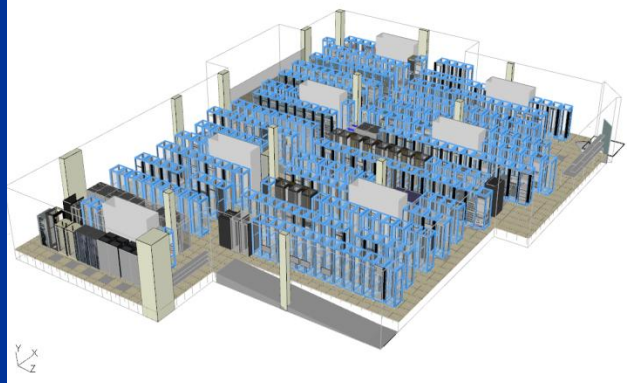
Rob Aldrich

Cisco Principal, Energy Efficiency

The Virtual Facility

The Virtual Facility (VF) is a fully detailed, 3D representation of a actual facility and is the basis for a holistic methodology to address design, and load growth management of the facility.

The VF is unique in its ability to predict the impact of operational changes at any time within the facility. Throughout the life cycle, from initial design, construction, commissioning, to day-to-day operations, the VF can replace inadequate rules-of-thumb with scientific precision to manage resilience and efficiency of the mission critical facility.



- Can cooling energy costs for this facility be reduced by 30% without putting the IT equipment at risk?

- 7,000 square feet
- 1 MW of total power available
- 820 kW of cooling capacity
- 3202 units of IT equipment drawing 770 kW
- Total energy bill: $1.4M per year
- $660k per year in cooling energy costs
- $707k per year in IT equipment energy costs

How Much can be Saved?

The typical data center cooling system consumes up to 50% of the total facility power. Up to 50% of the cooling system power is wasted due to design flaws and overly conservative safety margins for the IT equipment. These common conditions make the cooling system one of the best opportunities to increase overall data center efficiency. After full accounting, up to 25% of total power can be recovered by improving cooling system design and operation for the typical data center.

The Energy Efficiency Challenge

Chris Noland, Cisco Systems Engineering Manager, has a goal to improve cooling system efficiency for a data center on Cisco's San Jose campus. There were many challenges to overcome as the facility has been in operation since 1999 with limited considerations for efficient operations. Seven different product groups manage the IT configurations and Chris' group manages the room. Historically, none of these groups have had any responsibility for efficiency. These circumstances have led to suspected areas of inefficiency such as cooling oversupply and mixing of supply and return air. Cisco estimated a cost savings of $200,000 annually but was unsure if this was achievable due to a lack of data related to the cooling architecture. In reality, any cost savings would be viewed as a win.

future facilities

Cisco Systems Case Study cont'd

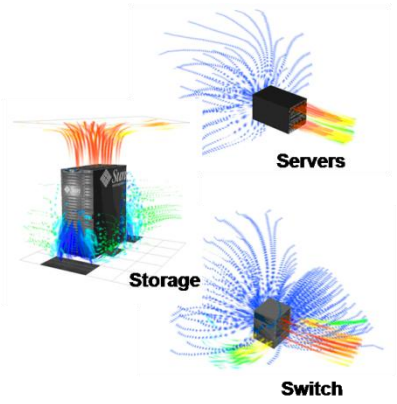
Cisco Advanced Services

Cisco Advanced Services provides facilities assessment capabilities that help users determine the capacity, density and efficiency requirements of improvements to the data center architecture. For mechanical systems assessment and specifications, Future Facilities Virtual Facility approach provides valuable insight and allows Cisco's Data Center Advanced Services teams to provide improved efficiency and availability modeling options to data center operators. Modeling options are available as part of Cisco's Facilities and Efficiency Assessment Services.

Future Facilities

Future Facilities is a global, full-service organization for thermal design, optimization, troubleshooting and management of Mission Critical Facilities.

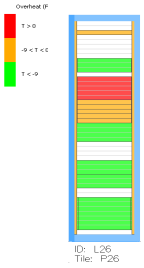
Future Facilities supplies the popular 6SigmaDC suite of data center software tools for 3D space, power and cooling design, optimization and management.



The Solution Options

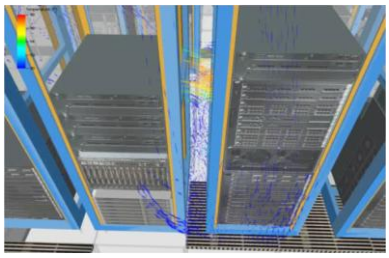
Cisco employed two techniques, used in parallel, to improve energy efficiency. This first was the familiar set of best practices that include blanking panels and plastic curtains to prevent mixing of supply and return air. Note was taken by Chris' team of two major limitations of best practices. Firstly, best practices offer no foresight of outcome and Chris wanted an ROI estimate in advance to justify the required expenditure. Secondly, best practices are designed to address room-level efficiency issues. In most data centers, efficiency problems are as likely to be caused by thermal incompatibilities between IT equipment and cabinets as they are by flawed room designs. As it turned out, cabinet-level problems were widespread in Lab7D. Chris found that blanking and containment curtains actually ***increased*** inlet temperatures for many units of equipment in the lab.

The second technique used was a simulation-based approach called the Virtual Facility (VF). The VF is a detailed, 3D model that can simulate the space, power and cooling behavior of the actual facility, including the thermal interactions between the room infrastructure, cooling system, cabinets and individual units of IT equipment.



High inlet temperature was common in lab 7D

Before



After

Inlet temperatures were reduced by 9 ºF by relocating floor grilles

The VF analysis showed clearly that exhaust recirculation within cabinets was the pressing problem. This led to high IT equipment inlet temperatures (as shown above) and the need to over cool the supply air. The VF model was used to guide the tactical placement of floor grilles and blanking panels to eliminate a handful of the cabinet and room-level hot spots (as shown above). The result was lower IT equipment inlet temperatures and the opportunity to raise the chilled water set point by 8 ºF. Cisco Systems has estimated that $200k per year in energy costs will be saved by the set point increase.

Services Available

- Software and methodology training
- Technical Support
- Software Maintenance
- Design consulting services
- Management consulting services

The Results

- 30% reduction in power required for cooling and $200,000 per year in energy cost savings by an 8 ºF increase in chilled water set point
- No decrease in equipment resilience as determined by inlet air temperature
- Cisco Systems has adopted the Virtual Facility approach to maximize resilience and efficiency over time

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