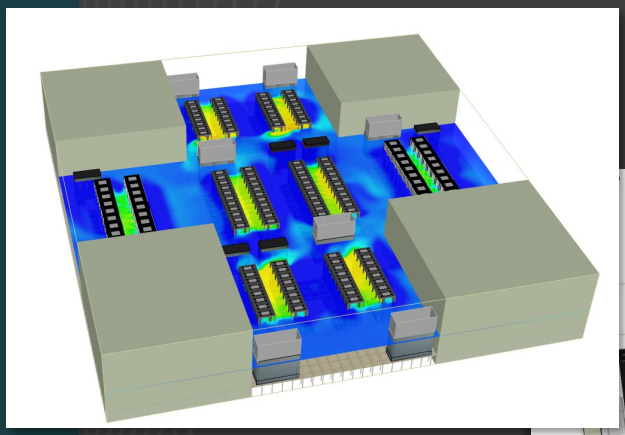
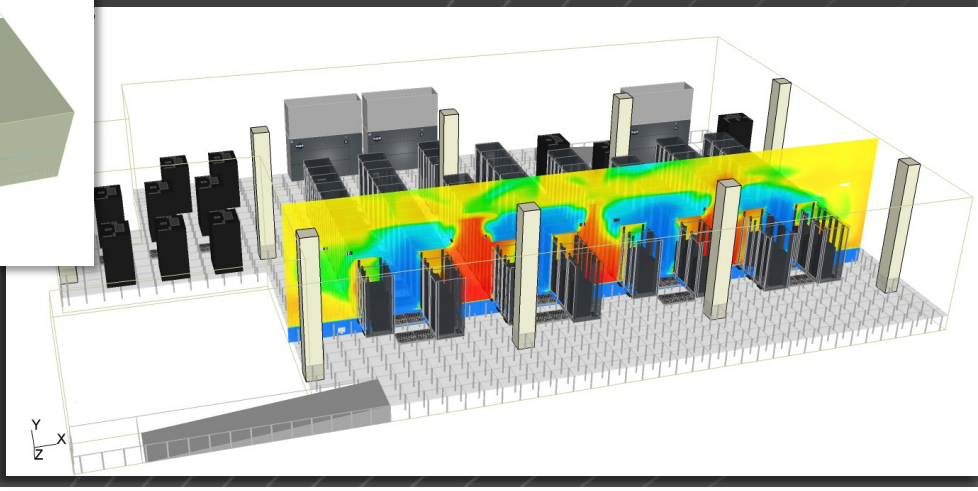
Computational Fluid Dynamics (CFD) Analysis



Understanding and Improving the Effectiveness of Data Center Cooling Systems



The Computational Fluid Dynamics (CFD) Analysis provides Data Center Managers with a clear view of Data Center Cooling System Performance. The CFD Analysis also provides thorough insight of the mechanical systems capability to adequately support a variety of conditions.

TSS uses a premier, internationally renowned Data Center Simulator and CFD engine to create a virtual version of the data center.

A CFD Analysis allows our clients to:

- Maximize existing environment
- Confirm cooling *(and power)* limits well before corrective measures are necessary
- Plan future deployments around existing cooling availability to maximize current capacity
- Confirm where and how containment strategies will improve existing performance
- Estimate the impact of energy efficient improvements such as fan speed control, air temperature reset or aisle containment doors
- Validate the effect of simple performance enhancements such as blanking panels or floor and ceiling grille locations
- Analyze performance at the individual server level including transient analysis to predict "Time-to-Failure" scenarios

The TSS Approach

1. **Data Collection** – Information related to the IT & Facility infrastructure can be provided by the client or TSS can conduct a site survey to collect the required data.
2. **Modeling** – TSS utilizes the collected data to build a model of the existing environment. A CFD simulation is then generated to reflect the existing conditions.
3. **Evaluation & Assessment** – The resulting CFD model is evaluated to identify problem areas. Suggested options for improvement can then be simulated in order to optimize the thermal conditions within the Data Center.
4. **Report** – A report with a summary of findings is generated and presented.

TSS *Bridging the Gap Between IT and Facilities℠*

Computational Fluid Dynamics (CFD) Analysis

Understanding and Improving the Effectiveness of Your Cooling Systems

How It's Done

1. Data Collection

CFD Modeling can be completed for existing or new facilities

Existing Facility

- Inventory of IT Equipment and electrical load data
- Floor Plan of existing area inclusive of IT and mechanical/ electrical support equipment
- In environments utilizing raised floor as a plenum, location of under floor distribution elements
- Specifications of mechanical & electrical support infrastructure in the room

New Facility

- Inventory of IT Equipment and electrical load data
- Drawings and Specifications of IT & Facility Infrastructure

Data Gathering

- Client provided data via as built drawings and other documentation including inventories, maintenance records, etc
- TSS reviews existing documentation and conducts detailed survey

2. Modeling

TSS creates a CFD model of the existing or new environment

Modeling the Existing Facility

- The collected IT and Facility data is used to build a model of existing environment utilizing 6Sigma software.
- A CFD simulation is generated to reflect the existing thermal conditions within the facility.
- The CFD simulation provides a clear understanding of how well the mechanical systems are currently functioning

Modeling the New Facility

- The drawings and documentation provided by the client are used to build a model of the new facility utilizing 6Sigma software.
- A CFD simulation is generated to reflect the thermal conditions within new facility.
- The CFD simulation provides a clear understanding of how well the design of the mechanical systems will function

3. Evaluation & Assessment

Utilizing the simulation model of the existing or proposed new environment, an assessment is made to identify areas of concern including: hot spots, improper distribution, and lack of redundancy.

Evaluate Current Facility Layout and Systems

- Review mechanical capability and capacity versus IT Load.
- Review physical characteristics impacting distribution.
- Evaluate Floor Plan and Equipment Layout

Evaluate Alternative Performance Issues

- Analysis of future IT load growth
- Evaluate different equipment outage scenarios

Optimize the Thermal Environment

- Insure optimization of existing systems to support the current environment
- Develop and optimized model to support future growth and reliability requirements

Recommended alternatives and Budget

- Based upon the optimized model for the current layout, recommend modifications with implementation budget
- Provide recommendations with budget to improve reliability and support future IT requirements.

RESULTS

1. **Simulation modeling provides a clear picture of temperature distribution at any chosen location within the space**
2. **Provides evaluation of an optimal layout of the space to maximize cooling capability and distribution of IT loads**
3. **Conduct of a What-If analysis without any equipment downtime**
4. **Enables intelligent decisions as to where additional capital expenditures will provide the best result**

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END TO END MISSION CRITICAL INFASTRUCTURE SERVICES

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