



## Use Racks for Airflow Management By Carl Cottuli

Collaboration between IT professionals and their facilities management counterparts is advancing the specification of server racks as an integral component of physical data center design. Data centers can now be engineered to manage the airflow pathway as one efficient, contiguous system that saves money and energy.

### **Decision Making and Design**

Historically, overseeing data center white space was the domain of IT management. Interaction between IT and facilities was minimal and conflicts were rare. Data center management and operation was relatively simple and the two groups coexisted independently. Generally, life was good on both sides of the house.

Growth and change in IT introduced smaller server form factors with increased processing power. Heat densities began to rise exceeding the data center's cooling capacity. Although the problem was created by the adoption of new computing applications and hardware, the responsibility to cool the new equipment fell to the facilities department.

Cooling solutions included changes to the core data center design. The new layout for optimized cooling capacity became known as the hot aisle/cold aisle arrangement. Along with this resolution came the understanding that the facility manager now had a vested interest in the exact layout of physical components of the data center.

The new floor plan improved cooling performance, but the solution was temporary because IT continued to bring new, higher density equipment into the data center. Facility managers and teams of design experts countered with improved configuration of equipment in racks and rows. Again, decision rights had to be shared between IT and facility managers. Cooperative decisions included deployment of IT equipment into specified racks and aggregation of racks by IT hardware type. This deployment led to higher levels of energy density, requiring new design features to support specific energy densities, which further increased the need for shared decision making rights. Equipment could no longer be aligned to support a single computing process. Shared decision making was required to ensure optimal data center performance.

### **Server Rack Influences Airflow**

One prevalent strategy in today's high-performance data centers is a focused effort on controlling airflow distribution. Hot and cold aisles characterized the first step, and air containment, in which all hot and cold air streams are isolated from each other, represents the obvious next step in driving up efficiency and reducing energy costs.

At a high level, heat containment strategies connect the return air or supply air directly to the CRAC and consequently deliver improved performance through reduction of hot/cold air mixing and improved CRAC performance. This concept is well-established. Delivery of air streams in an organized manner is typically handled by under-floor or overhead plenums.

A plenum is an air-filled space in a structure, especially one that receives air from a blower for distribution (as in a ventilation system). They have been widely employed in data centers for some time. Strategies for implementing plenums have been the responsibility of the facility manager and the team employed to design the data center. The current state-of-the-art design, which isolates hot and cold air completely, integrates the rack into that plenum. This is the latest and logical next step in cooling design evolution.

For new or legacy data centers, the layout of IT racks and internal specifications can be engineered for efficient and cost effective airflow. As the cold air supply flows into the front of the rack, it is directed to cool the IT equipment and then exhausted through the top rear of the rack directly back to the precision cooling units.

By modeling the air flow patterns based on the equipment being deployed in the white space, data centers can be designed to eliminate stratification, recirculation, and other areas of airflow waste. Viewing the rack as a plenum enables an airflow management strategy that provides dynamic design options in the data center. This effectively returns data center equipment decisions to the IT manager, and allows facilities management to concentrate on the data center as a whole.

By employing the strategy of using the rack as a plenum, the data center manager can now lay out racks in any format required to deliver optimized IT performance and support equipment rollouts as needed. By viewing the rack as a plenum and employing appropriate containment strategies, the data center design can be optimized to meet IT requirements.

Today's enclosures go well beyond simple cabinets that solely house servers; essentially they are mini data centers that reside within the company's physical data center. Viewing the IT rack as an integral and necessary component of the airflow plenum design helps IT and facilities managers regain control of runaway data center energy costs.

While legacy data center design factors are still relevant, the ability to use the rack as a plenum provides data center managers with a new weapon in their arsenal. Each rack can be designed and implemented as an isolated environment. Managers now have the freedom to set the airflow requirements of individual racks as they relate to the larger plenum system.

The evolution and maintenance of airflow management within the white space becomes less daunting now that the rack can be used as a plenum. Tying the rack together with the HVAC system creates a predictable environment that eliminates the need for high-density zones or supplemental cooling while restoring flexibility to IT as the rack becomes part of the engineered airflow system.

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