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How to Properly Manage Network Switch Equipment in Cabinet Spaces

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The heart of your network infrastructure is based on the survival of your core network switches. When employing side-to-side airflow, network switches located in cabinets positioned in a hot aisle/cold aisle layout run the risk of re-consuming hot exhaust air, causing elevated intake temperatures which ultimately results in equipment failure.

Network switches, specifically Cisco 6500 and 9500 series, utilize this side-to-side airflow pattern by drawing cold air in through the right side of the chassis and releasing hot air out of the left side. The hot exhaust air from one switch will repeatedly flow into the air intake of the adjacent switch, creating problems, especially when these switches are installed in a typical cabinet.

Since the installation of network switches inside equipment cabinets is a growing trend, it is critical to manage the side-to-side (right-to-left) airflow pattern that most network switches employ. It is highly desirable to place this equipment in the TIA-942 standard recommended hot aisle/cold aisle layout to control airflow and prevent hot and cold air from mixing. The hot aisle/cold aisle layout works well for server equipment with front-to-rear airflow; however network switches designed with side-to-side airflow require special consideration in order to prevent cascading thermal buildup.

Due to the fact that cabinets are an important part of the data center's airflow management design, they have a major impact on the thermal performance. Selecting a properly engineered network cabinet can overcome these challenges by successfully managing the side-to-side airflow pattern of network switches, eliminating hot exhaust re-circulation inside the cabinet and preventing hot exhaust air from directly entering adjacent equipment. Network cabinets should also be able to manage cabling so that cool air can be effectively delivered to the switch intake and provide adequate cable routing inside the cabinet as well as cable ingress to the cabinet.

In order to deliver the required space for side-to-side airflow and network cables, a wide cabinet footprint is required. It is recommended that a minimum width of 32" (800 mm) be provided in a network cabinet. This way adequate room exists on either side of the switch for airflow, however not just any wide cabinet architecture will deliver an effective solution.

CPI's N-Series TeraFrame™ Network Cabinet is designed to manage equipment with side-to-side airflow and is Cisco® compatible for 6500 and 9500 series switches.

Choosing a cabinet with a recessed frame design delivers both the room required for side-to-side airflow, as well as superior cable access and space for network installations. When a cabinet's doors and side panels are positioned away from the frame by offset brackets, a large volume of area is created which allows air to be directed outside of the frame. The added space inside the cabinet's recessed frame makes it possible to move air to the right side intake, and away from the left side exhaust of network switches. Another significant benefit of a recessed frame design is that cable bundles are directly accessible from the front or rear of the cabinet, and additional interior space around the frame offers more cable management area and makes moving, adding or changing equipment or cables much easier than in a typical cabinet.

Removing the hot exhaust air from the left side of the switch is critical, but it is equally important to manage the flow of cold air entering the intake on the right side. Providing the required volume of cold air is not enough though, it is essential to also control the pathways that the intake air follows as it approaches the right side of the switch. This control can be accomplished by installing filler panels in open rack-mount spaces above and below each switch chassis, which creates a barrier between adjacent switches and prevents cascading thermal buildup. If filler panels are not implemented, uncontrolled airflow patterns above and below the switch will disrupt the uniform flow of air into the air intake, resulting in hot spots within the switch.

It is also critical to completely isolate and re-direct hot exhaust air out the rear of the cabinet and into the hot aisle by adding an exhaust duct to the network cabinet. The use of an exhaust duct helps preserve critical network switches by preventing re-circulation of hot air through equipment and establishing best-practices for a hot aisle/cold aisle layout. Exhaust ducts represent passive cooling technology which does not involve any active components so backup is not needed when changes are preformed, helping to maintain essential uptime.

Figure 1 – Re-directing exhaust air out the rear of the cabinet

The diagram and Computational Fluid Dynamics (CFD) image above shows how CPI's N-Series TeraFrame™ Network Cabinet with a Network Switch Exhaust Duct captures and directs all hot exhaust air out the rear of the cabinet and into the hot aisle. This effectively addresses the exhaust side issues related to placing switches with side-to-side airflow in cabinets and shows a recessed frame design.

Although it is important to the manage the intake and exhaust airflow of side-to-side breathing switches, a cabinet intended to house this equipment must also be able to provide solutions for high-density cabling. And since network switches represent high-density cabling applications, they require very high capacities of cable ingress and cable management space.

Given the placement of the fan module in a network switch chassis, it is common practice to route all of the cables on the front of the switch to the right. This offers the ability to bundle and manage large volumes of cables on the right side of the cabinet, so that additional space is created for air to flow between the cable bundles and the side panels.

Bundling cables helps prevent vertical cables from drifting backward in the cabinet and blocking the intake part of the switch. In addition, brackets or cable spools oriented sideways should be mounted to the side of the frame to create a barrier, but without restricting airflow from the front of the cabinet. Using T-shaped fingers that align with each rack-mount space adds more support and helps divide and organize cables.

T-shaped finger guides divide and organize cables.

When mounting network switches inside cabinets, it is important to make sure they are fully mounted within the cabinet so none of the intake or exhaust screens are obstructed by equipment rails or cabinet structural members. When more than one switch is installed in the cabinet, a cable routing plan must be developed so that the cable installation does not undermine the desired airflow pattern and restrict airflow to the switch. A cable routing guide should be provided by the cabinet manufacturer so that adequate airflow planning can be performed before the cabling is installed.