PowerEdge Product Group

Direct from Development

PowerEdge MX7000 Direct Orthogonal Connectors

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SUMMARY

The trend of increasingly higher-power processors and DIMMs creates challenges for traditional midplane architectures, particularly with regard to airflow and cooling, high speed signal transmission, and power delivery.

The new PowerEdge MX7000 modular platform eliminates the midplane and instead uses Direct Orthogonal Connectors for internal interconnection of compute, storage and switch modules.

Elimination of the midplane greatly optimizes airflow and enhances cooling. Signal transmission and power delivery are also improved by this new, innovative design.

Modular systems (such as the Dell EMC PowerEdge M1000e blade enclosure) integrating both compute/storage modules and switch (I/O) modules require an intricate method of interconnection within the chassis. A traditional interconnect architecture contains vertical compute/storage modules and horizontal switch modules, and a midplane enabling interconnection between these modules, as shown in Figure 1 below:

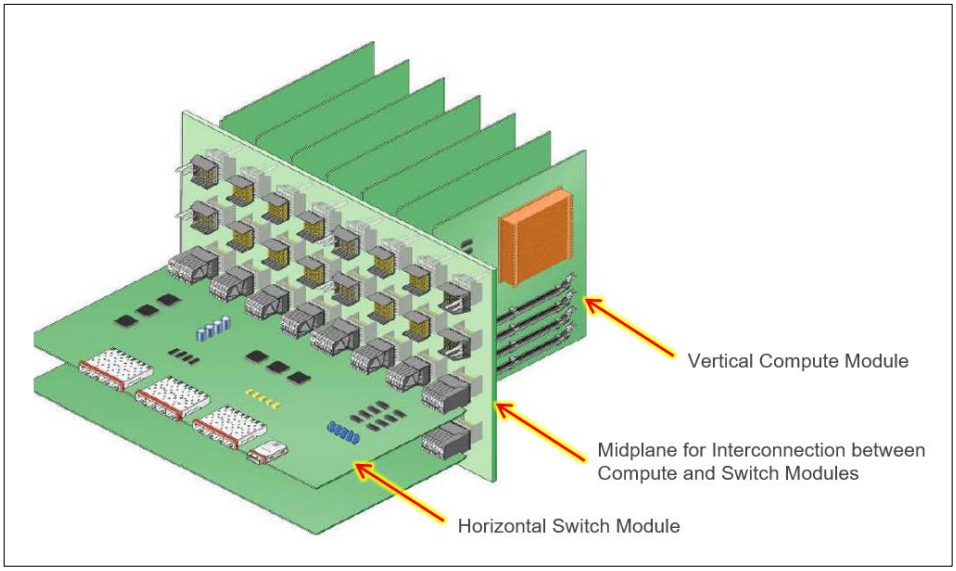

Figure 1: A traditional interconnect architecture using a midplane for interconnection of compute and switch (I/O) modules

A traditional midplane architecture such as the above has been an effective means of interconnect for many generations of servers, but a number of design challenges have been apparent and need to be overcome. Airflow has been a key challenge. Proper airflow is critical in order to ensure cooling of the compute modules, especially with current and future systems with high-power processors and DIMM's. One attempt to resolve this has been to incorporate vent holes into the midplane to allow airflow. However, due to signal and power routing within the midplane, properly sized and effective placement of the vent holes is not always feasible. Moreover, signal integrity (SI) may be impacted when routing high speed signal traces long distances within the midplane. Even the use of Low Loss PCB material (such as Megtron 6) for high speed signal traces has limitations.

Consequently, in the development of the PowerEdge MX7000 Modular Chassis, the elimination of the midplane was a key design goal to improve airflow and signal integrity. To accomplish this, the implementation of Direct Orthogonal Connectors was selected to provide the interconnection between compute

modules and switch modules. Fundamentally, Orthogonal Connectors provide a direct, right angle interconnection between a vertical PWA (Printed Wiring Assembly, also known as a Printed Circuit Board Assembly, PCBA) such as a compute module, and a horizontal PWA, i.e. a switch module, without a midplane. This direct interconnection is shown in Figure 2 below:

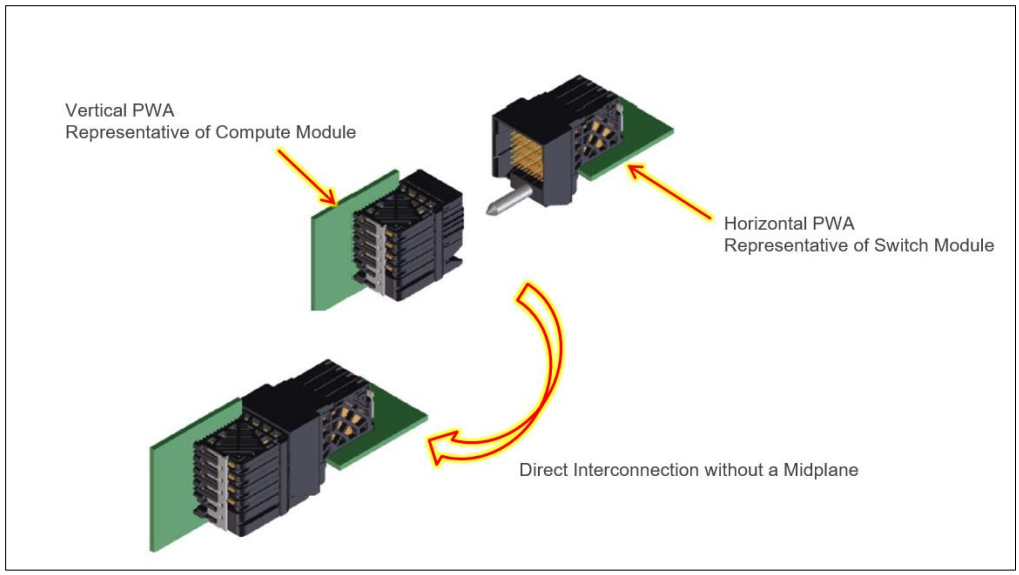

Figure 2: The PowerEdge MX7000 Orthogonal Connectors enable direct interconnection of compute/storage and switch (I/O) modules, liberating the architecture from the encumbrances and cost of a midplane.

The use of direct orthogonal connectors in the MX7000 eliminates airflow impedance caused by a midplane, and enhances overall airflow and cooling. The schematic in Figure 3 below illustrates how eliminating the midplane opens up internal areas of the PowerEdge MX7000 and improves airflow:

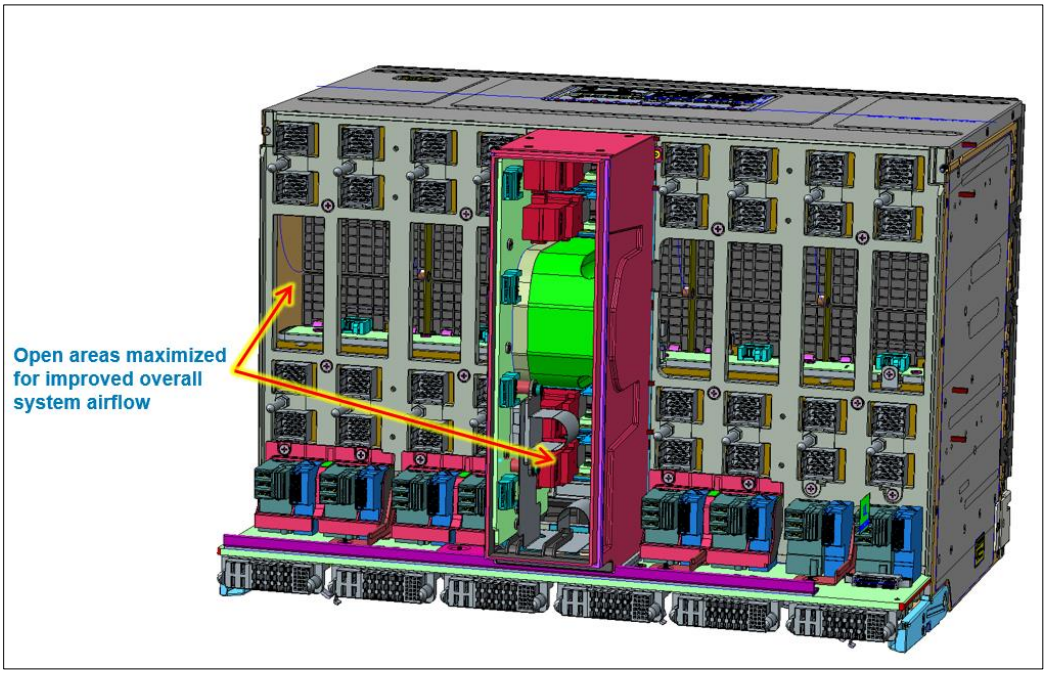

Figure 3: Elimination of the midplane in the PowerEdge MX7000 architecture opens up internal areas to improve airflow.

In addition to improving airflow and enhancing cooling, use of Direct Orthogonal Connectors in the PowerEdge MX7000 enables the formation of a comprehensive interconnection for high speed signal transmission between compute/storage modules and switch (I/O) modules, as well as for effective power delivery to these modules. Figure 4 below illustrates direct orthogonal interconnections between a vertical Compute Module and horizontal Switch Module, as well as power delivery using both Vertical and Horizontal Power Distribution PWA's to those modules:

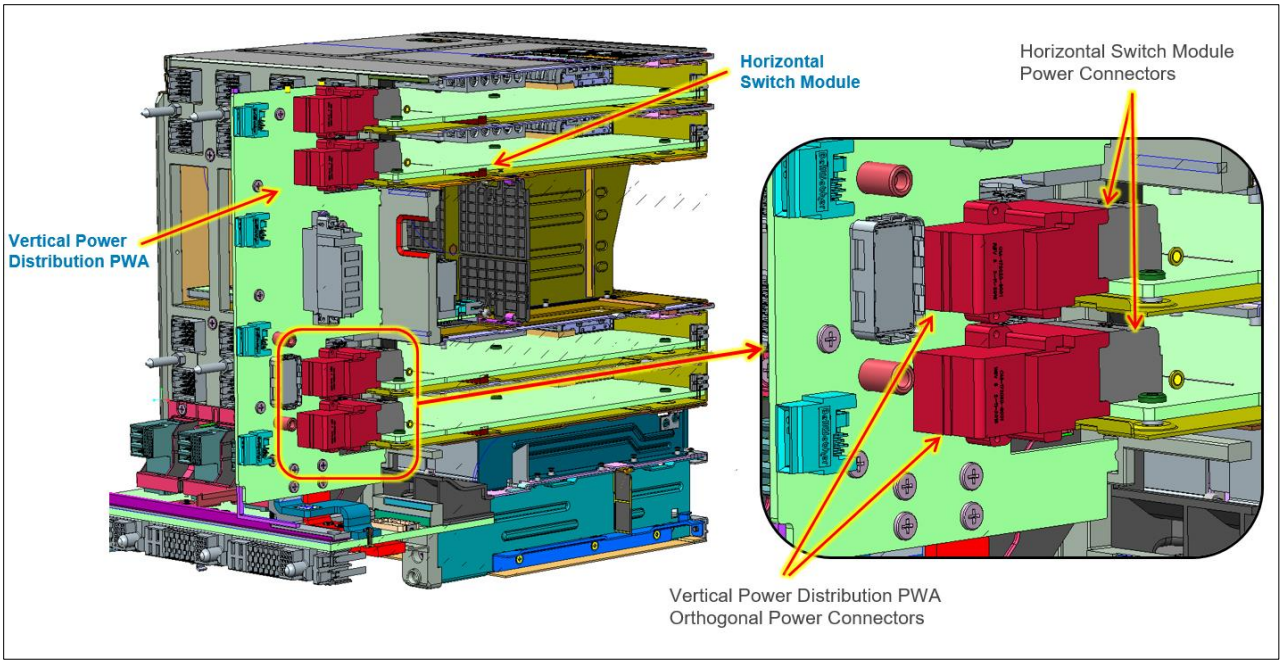

Figure 4: Schematic showing orthogonal power connectors for horizontal switch modules and vertical compute/storage modules.

Conclusion

While earlier servers and modular systems relied on a traditional midplane architecture, implementation of innovative Direct Orthogonal Connectors in the new PowerEdge MX7000 eliminates the midplane and greatly optimizes airflow through the compute and switch modules. This enhances cooling and ensures that current and future high-power processors and DIMM's can be cooled more effectively, even at high ambient temperatures. Additionally, signal integrity will be optimal without being compromised by long Printed Circuit Board (PCB) traces, allowing for high speed signals (including PCIe Gen 4).

- For more information about airflow and cooling in the new PowerEdge MX7000, including its Multiple Airflow Zone design, see the *Direct from Development* tech note, *PowerEdge MX7000 Chassis Thermal Airflow Architecture*.