

Dell Next Generation PowerEdge Servers: Designed for PCIe Gen4 to Deliver Future Ready Bandwidth

Tech Note by

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Summary

PCIe is the primary interface for connecting various peripherals in a server. The Next Generation of Dell PowerEdge servers, and AMD EPYC 7002 processors are designed keeping PCIe Gen4 in mind.

PCIe Gen4 effectively doubles the throughput available per lane compared to PCIe Gen3. The Dell PowerEdge R7525 and R6525 servers have up to 160 available PCIe Gen4 lanes maximizing available bandwidth.

The PCIe Interface

PCIe (Peripheral Component Interconnect Express) is a high-speed bus standard interface for connecting various peripherals to the CPU. This standard is maintained and developed by the PCI-SIG (PCI-Special Interest Group), a group of more than 900 companies. In today's world of servers, PCIe is primary interface for connecting peripherals. It has numerous advantages over the earlier standards, being faster, more robust and very flexible. These advantages have cemented the importance of PCIe.

PCIe Gen 3 was the third major iteration of this standard. Dell PowerEdge 14G systems were designed keeping PCIe Gen 3 in mind. PCIe Gen3 can carry a bit rate of 8 Gigatransfers per second (GT/s). After considering the overhead of the encoding scheme, this works out to an effective delivery of 985 MB/s per lane, in each direction. A PCIe Gen3 slot with 8 lanes (x8) can have a total bandwidth of 7.8 GB/s.

PCIe Gen 4 is the fourth major iteration of the PCIe standard. This generation doubles the throughput per lane to 16 GT/s. This works out to an effective throughput of 1.97 GB/s per lane in each direction, and 15.75GB/s for a x8 PCIe Gen4 slot.

2nd Gen AMD EPYC 7002 and PCIe

Next Generation Dell PowerEdge servers with AMD processors are designed for PCIe Gen4. The 2nd Generation AMD Epyc 7002 series processors support the PCIe Gen4 standard allowing for the maximum utilization of this available bandwidth.

A single socket 2nd Gen AMD EPYC 7002 processor has 128 available PCIe Gen4 lanes for use. This allows for great flexibility in design. 128 lanes also give plenty of bandwidth for many peripherals to take advantage of the high core count CPUs.

The dual socket platform offers an additional level of flexibility to system designers. In the standard configuration, 128 PCIe Gen4 lanes are available for peripherals. The rest of the lanes are used for inter-socket communication. Some of these inter-socket xGMI2 lanes can be repurposed to add an additional 32 lanes. This gives a total of 160 PCIe Gen4 lanes for peripherals (Figure 1). This flexibility allows for a wide variety of configurations and maximum CPU-peripheral bandwidth.

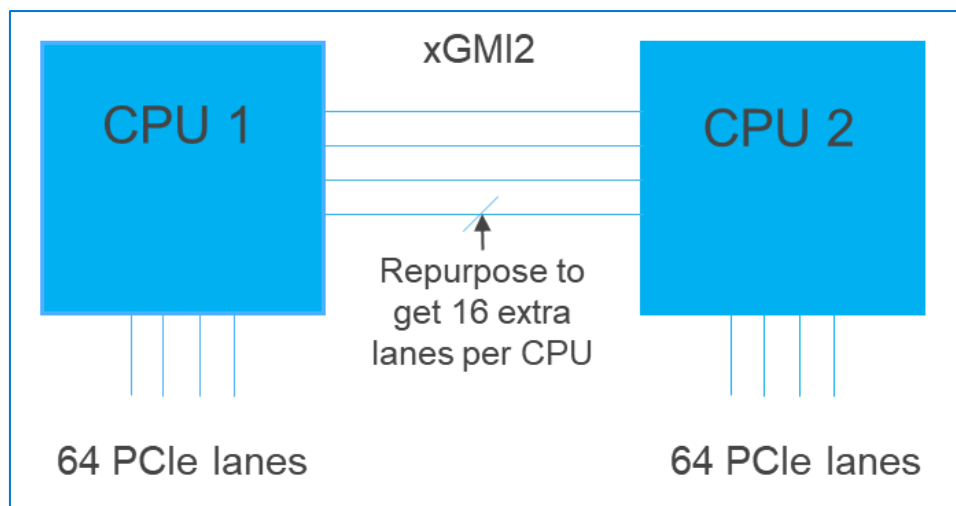


Figure 1 - Diagram showing PCIe lanes in a 2-socket configuration

Designing for PCIe Gen4

The Next Generation of Dell PowerEdge servers were designed with a new PSU Layout. One of the key reasons this was done was to simplify enabling PCIe Gen4.

A key element in PCIe performance is the length of PCIe traces. With the new system layout, a main goal was to shorten the overall PCIe trace lengths in the topology, including traces in the motherboard. By positioning PSU's at both edges, the I/O traces to connectors can be shortened for both processors. This is the optimal physical layout for PCIe Gen 4 and will enable even faster speeds for future platforms. The shorter PCIe traces translate into better system costs and improved Signal Integrity for more reliable performance across a broad variety of customer applications.

Another advantage of the split PSU is the balanced airflow that results. The split PSU layout helps to balance the system airflow, reduce PSU operating temperatures, and allows for PCIe Gen4 card support and thus an overall more optimal system design layout.

Figure 2 below illustrates how this will look, comparing the 14G series with the next generation of PowerEdge servers.

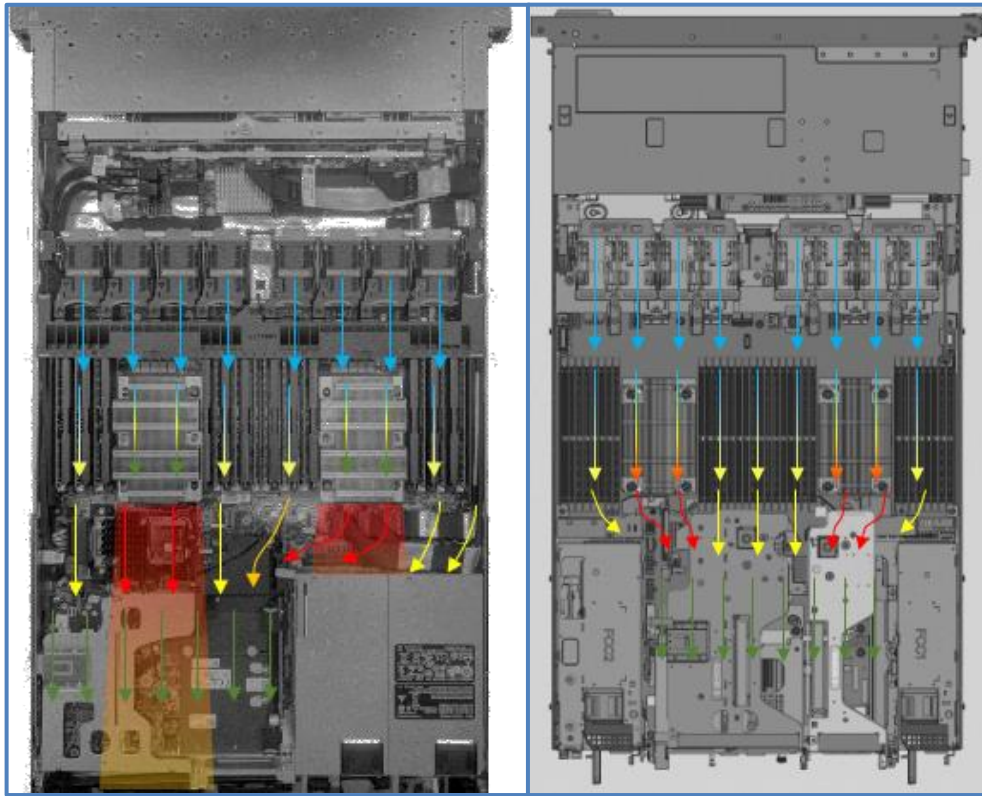


Figure 2 - Figures showing the 14G server layout to the left and the balanced airflow of the next gen AMD platforms to the right.

In Conclusion

PowerEdge servers continue to deliver best-in-class features. The new PowerEdge servers have support for the higher speed PCIe Gen4, with innovative designs to improve signal integrity and chassis airflow.



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