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1U Chassis Accepts PCIe or PXIe Cards

Abstract

PCIe and PXIe are both open-standards for expansion and I/O cards, both enabling the end user of the system to configure the desired I/O to suit their needs. The problem is that the two cards are not space-compatible, requiring systems manufacturers to create two separate product to address both markets. This article discloses a means that allows for a flexible architecture that can accept either a PCIe bay or a PXIe bay, thus enabling both types of I/O, PCIe and PXIe, to be supported in a common-design, and in this example, a system that can be mounted in a standard 19" rack that consumes only 1U of rack space.

Description

PXIe™ is a popular platform for test and measurement systems. PXI and PXIe is an open industry standard as defined by the PXI Hardware Specification¹. The first release of this standard was in 1997 and today there are 66 members of the consortium². PXIe is based on the CompactPCI® specifications, or as stated on the cover of the PXI Hardware Specification, “an implementation of Compact PCI”³.

PCIe is the most common I/O interface used in servers, workstations and desktop computers today with 756 members⁴. This open standard is defined by the PCI Express Base Specification, Revision 3.1⁵.

Today test, measurement and instrumentation systems can be obtained that accept either PCIe or PXIe cards. The two systems are radically different due to the mechanical differences between the two types of cards. Besides mechanical, the thermal (cooling) requirements are completely different. The end result, system designers must create two completely different solutions, one for each type of card to be supported. A hardware design that accepts PCIe cards cannot readily accept PXIe cards.

The proposed solution holds from one to four PCIe cards, or when re-configured to accept PXIe cards, from one to four single-width, 3U PXIe cards. This solution also fits an industry-standard 19" rack and occupies one U (1.75") of vertical rack space. Figure 1 shows the rear of the system when configured to accept PCIe cards and Figure 2 shows the rear of the system when configured to accept PXIe cards. For both systems, the cards are rotated 90° and are laying down, as is typical for PCIe cards installed in 1U and 2U rack Servers.

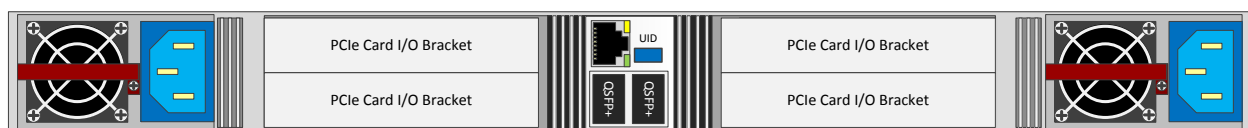


Figure 1. 1U System with Four PCIe Cards



Figure 2. 1U System with Four PXle Cards.

Mechanical Challenges

While a full-height, half-length PCIe card is similar in overall size to a typical 3U PXle card, how they mount within and connect to the system are vastly different. Furthermore, their I/O faceplates are different as well. Figure 3 shows a comparison of a Half-Length, Full-Height PCIe card to a 3U PXle card. Note that with the I/O faceplates aligned, the system connections are in different locations.

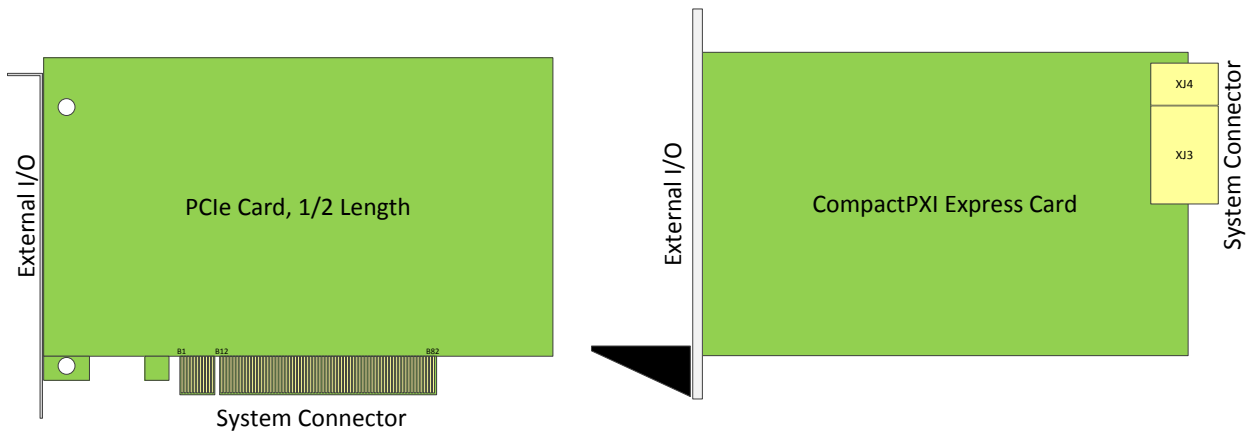


Figure 3. PCIe Card and PXle Card Comparison.

Both styles of cards, will require 0.800" of space to accommodate their width. This is right at the limit for two cards, stack side by side, and rotated so that they will fit within the 1.69" of allowable chassis space for a 1U Rack Server.

Cooling Considerations

Another concern is cooling. PXle cards are designed for chassis that provide cooling air from the bottom of the card, with the air flow up across the card, parallel to the faceplate, exiting on the top edge. For PCIe cards, the cooling airflow is expected to flow across the card, parallel to the top edge of the card, then turning and exiting above and below the I/O panel at the rear of the chassis. The cooling solution for this system must accommodate both styles of cards, providing the correct airflow for each type of card. Figure 4 shows the expected cooling airflow for the two styles of cards.

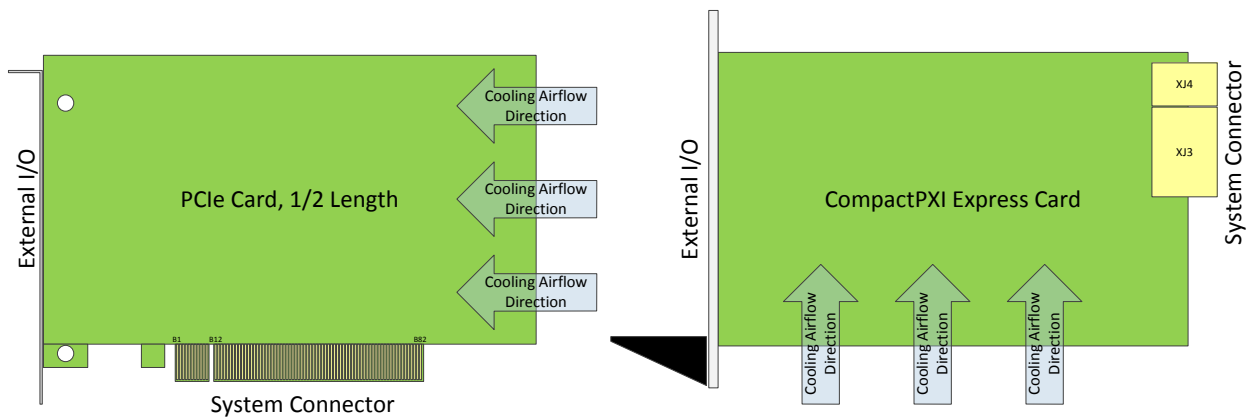


Figure 4. Cooling Airflow for PXIe and PCIe cards.

For this solution, the chassis has two different rear sections, each accommodating the unique requirements of the I/O cards. For PCIe, there are two lift-out assemblies, each carrying up to two PCIe cards. Lift-out carriers were used, as the PCIe cards are serviced by removing them up from the edge connectors, and the placement of the power supplies would preclude removal if the card carriers were fixed in the chassis. Figure 5 shows the carrier assemblies that hold the PCIe cards.

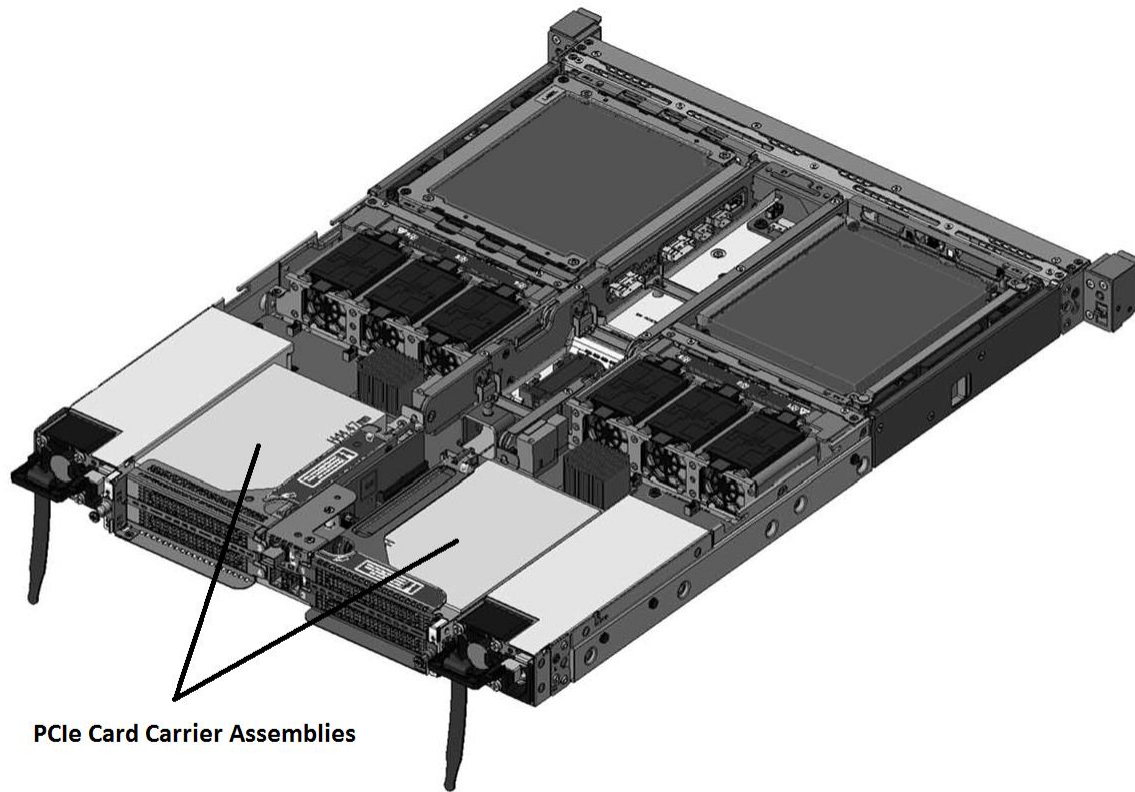
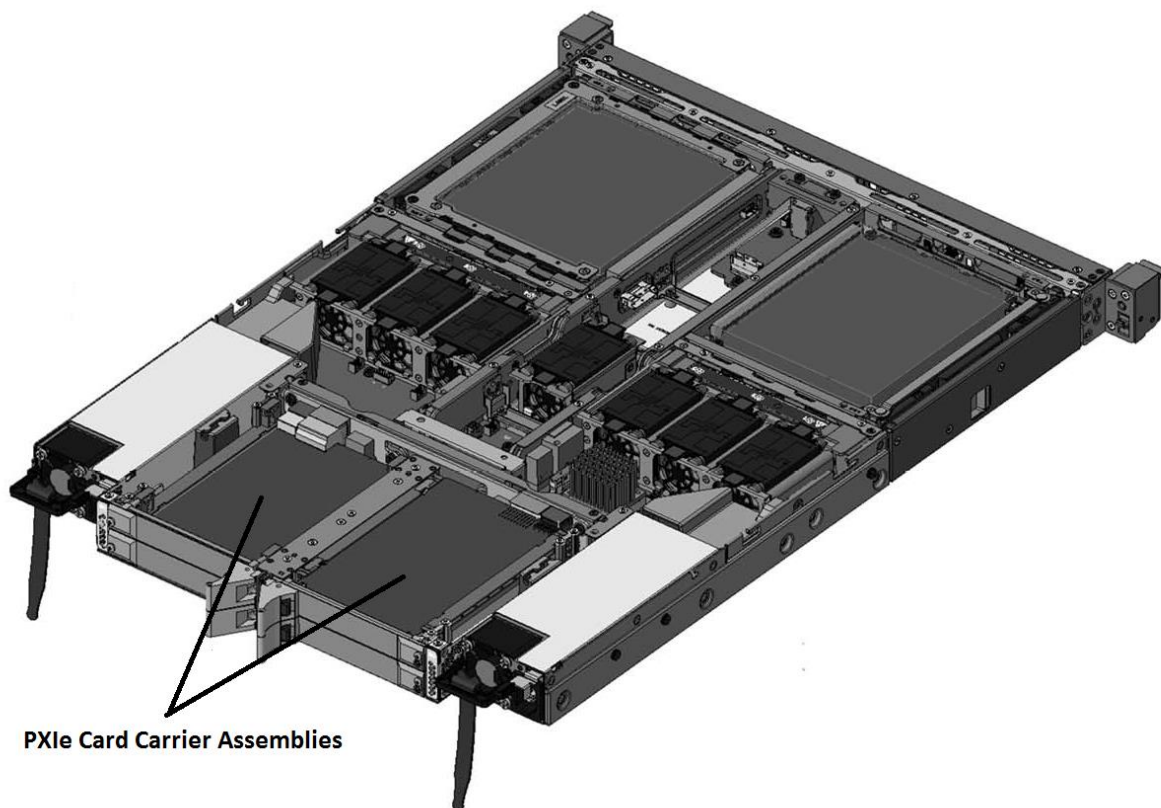


Figure 5. PCIe Card Mounting

PXle cards are accommodated with different carriers, these hold the PXle cards with their faceplates facing to the rear of the chassis, but, since PCIe cards are serviced by inserting and removal from the faceplate opening, this solution also accommodates insertion and removal directly from the chassis. Figure 6 shows the carrier assemblies that accept PXle cards.

**Figure 6. PXle Card Mounting**

Airflow is routed differently in the two solutions. For the PCIe cards, the airflow enters the front of the PCIe card area, flows across the cards and then is turned and exits the chassis at the top and bottom edge of the PCIe card bracket. This is the same airflow that the card would be subjected to if it was installed in a traditional desktop or workstation chassis. Figure 7 shows the airflow when the chassis is configured for PCIe cards.

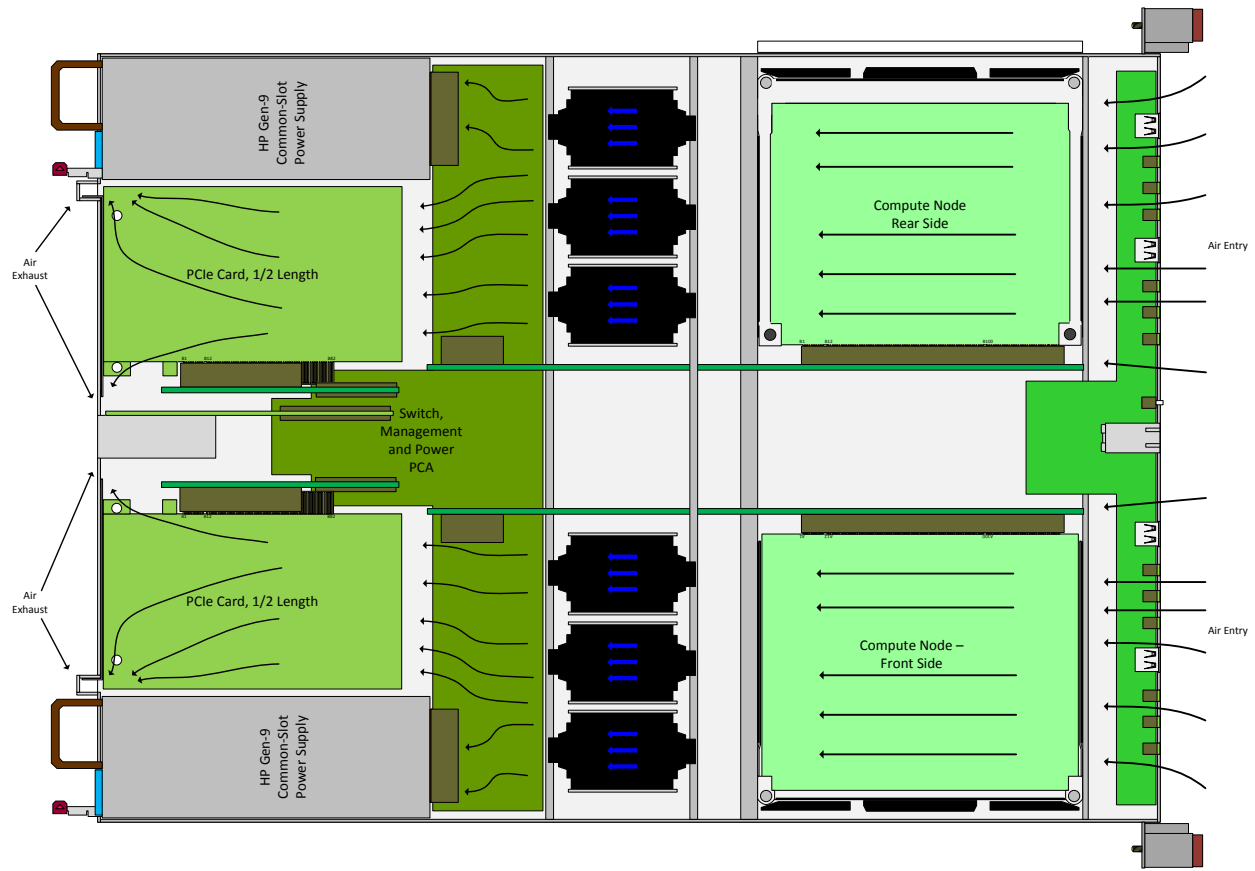


Figure 7. Airflow through PCIe Configuration

For the PXIe system, the cards are installed with their bottom edge towards the center of the chassis. This results in the stack on the left side (as viewed from the rear of the chassis) being installed with the component side of the PCB up, while the PXIe cards installed on the right side of the chassis are installed with the component side of the PCB down. Once the air exits the PXIe cards, it enters a plenum area where it is directed out the rear of the chassis. See Figure 8 for an illustration of the airflow and major component placement within the chassis when configured to accept PXIe cards.

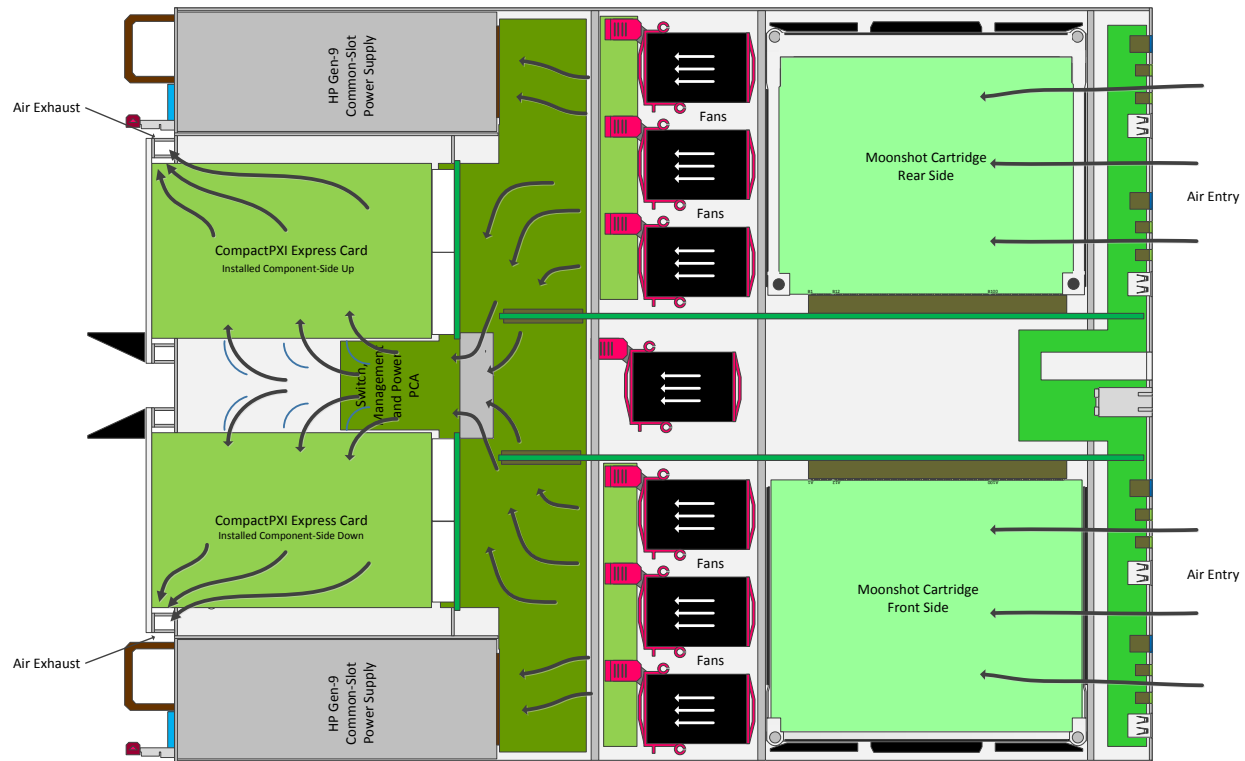


Figure 8. Airflow through PXIe Configuration

Summary

It is possible to create a high-performance server-grade compute solution that can be configured to accept either PCIe or PXIe cards and also have up to four server-grade compute cartridges that also fits in 1U of vertical rack space. Furthermore, this solution is only 24" deep, thus maximizing test and measurement capabilities while minimizing total rack space utilized.

References

1. PXI Systems Alliance, PO Box 1016, Niwot, CO 80544-1016, www.pxisa.org
 - a. PXI, PXIe are registered trademarks of PXI Systems Alliance
2. Number of members as listed on the PXISA.org website, members roster, www.PXISA.org/Members/Roster.aspx
3. PICMG® PCI Industrial Computers, 401 Edgewater Place, STE 600, Wakefield, MA 01880, www.PICMG.org
 - a. CompactPCI and the PICMG logo are registered trademarks of PCI Industrial Computers Consortium.
4. Number of members as listed on the PCISIG.com website, members roster, www.pcisig.com/membership/member-companies

5. PCI-SIG Administration, 3855 SW153rd Drive, Beaverton, OR 97003, www.pcisig.com

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