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## 2U 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 products to address both markets. This article discloses a modular design that can accept either a PCIe or PXI/PCIe card carrier, thus allowing the main chassis and compute solution to be common for both versions. This example is a compact, 2U tall, industrial compute platform.

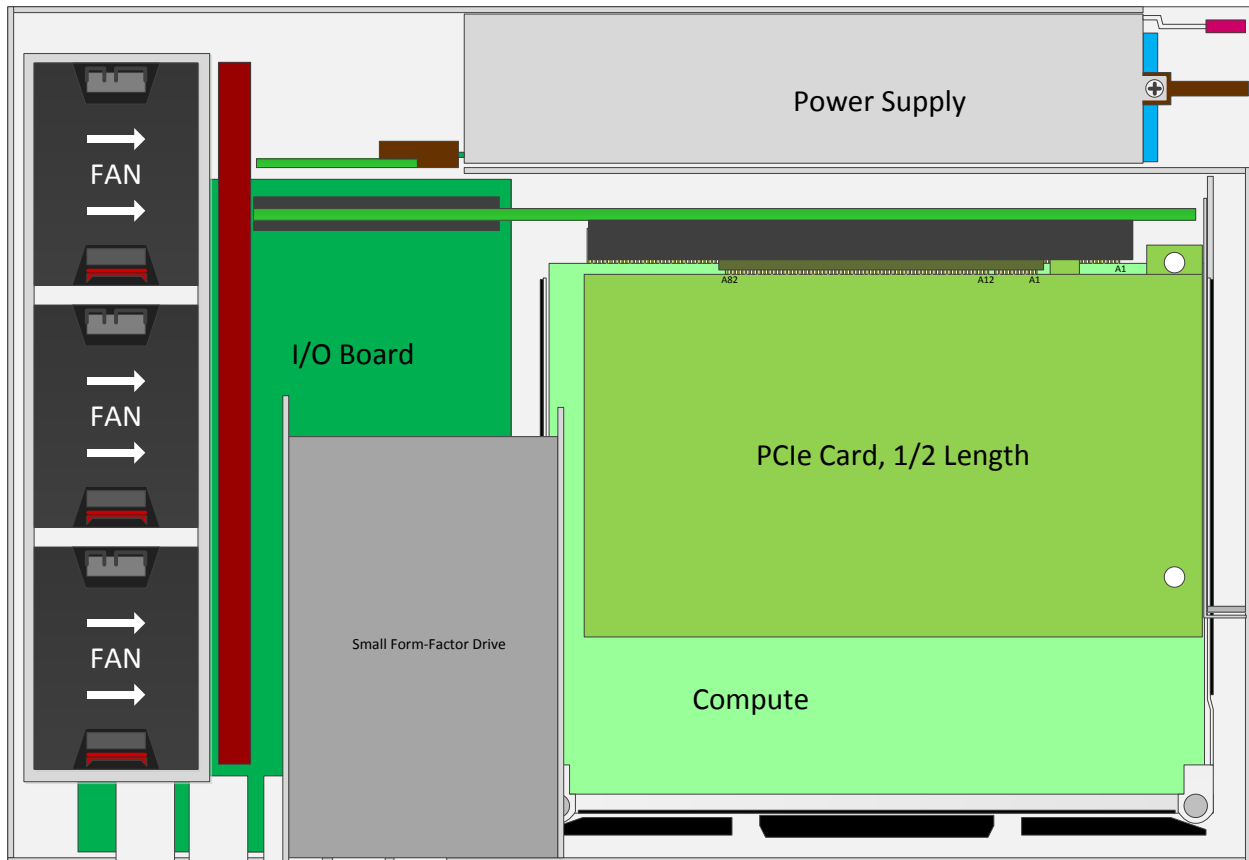
### Description

PXIe™ is a popular platform for test and measurement systems. PXI and PXIe is an open industry standard as defined by the PXI Hardware Specification<sup>1</sup>. The first release of this standard was in 1997 and today there are 66 members of the consortium<sup>2</sup>. PXIe is based on the CompactPCI® specifications, or as stated on the cover of the PXI Hardware Specification, “*an implementation of Compact PCI*”<sup>3</sup>.

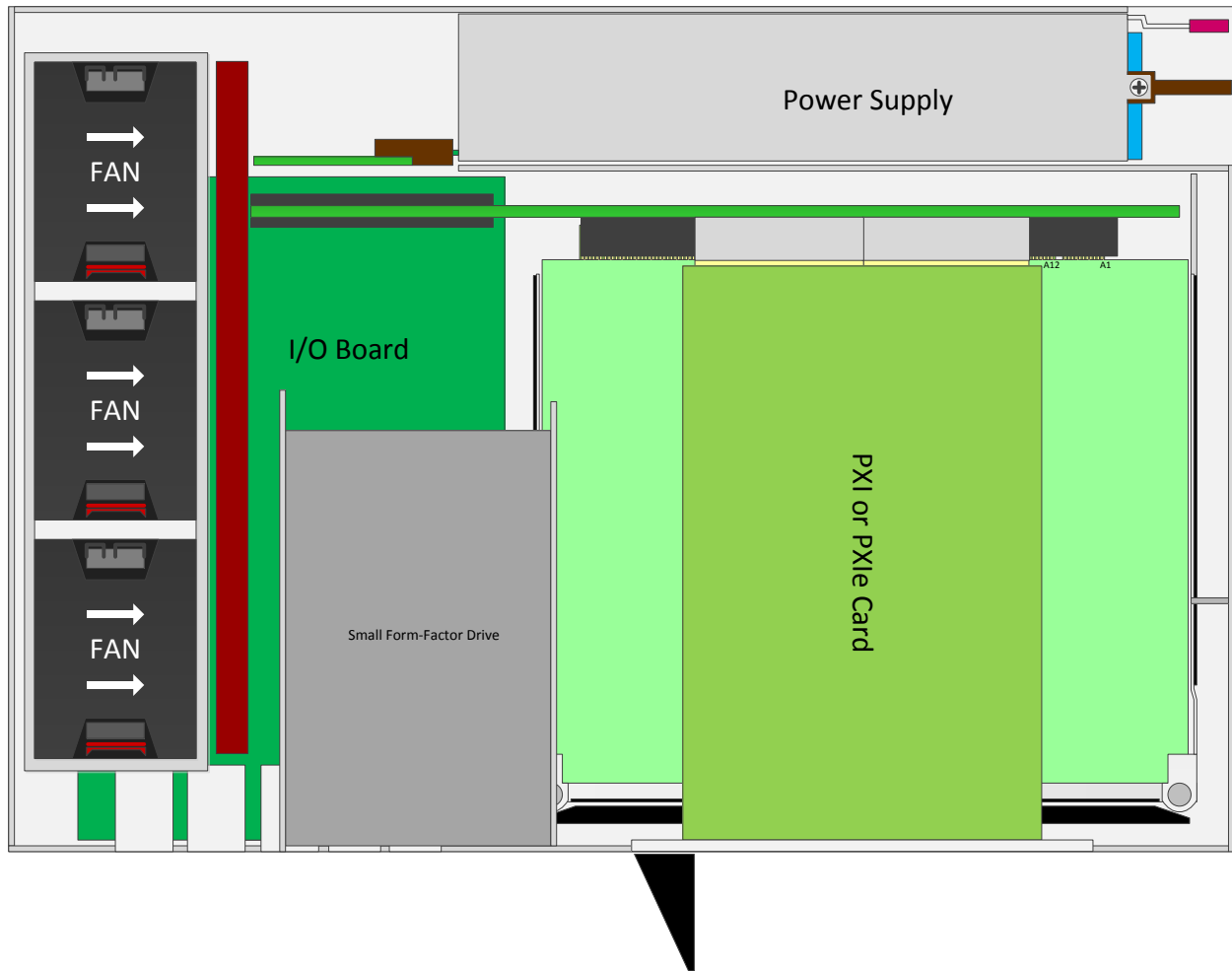
PCIe is the most common I/O interface used in servers, workstations and desktop computers today with 756 members<sup>4</sup>. This open standard is defined by the PCI Express Base Specification, Revision 3.1<sup>5</sup>.

Today test, measurement and instrumentation systems can be obtained that accept either PCIe or PXIe cards. Even though a PXI/PXIe card and a half-length PCIe card are similar in size, the two systems are radically different due to the mechanical differences between the two types of cards. The thermal (cooling) requirements are unique to each type of card as well. 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 can be easily configured to accept one or two PCIe cards, or PXI or PXIe cards. This change is made by swapping out the I/O card cage. Furthermore, this compact solution is only 337mm wide by 233mm deep and 87.4mm tall. Figure 1 shows the system when configured to accept PCIe cards and Figure 2 shows the system when configured to accept PXI or PXIe cards.



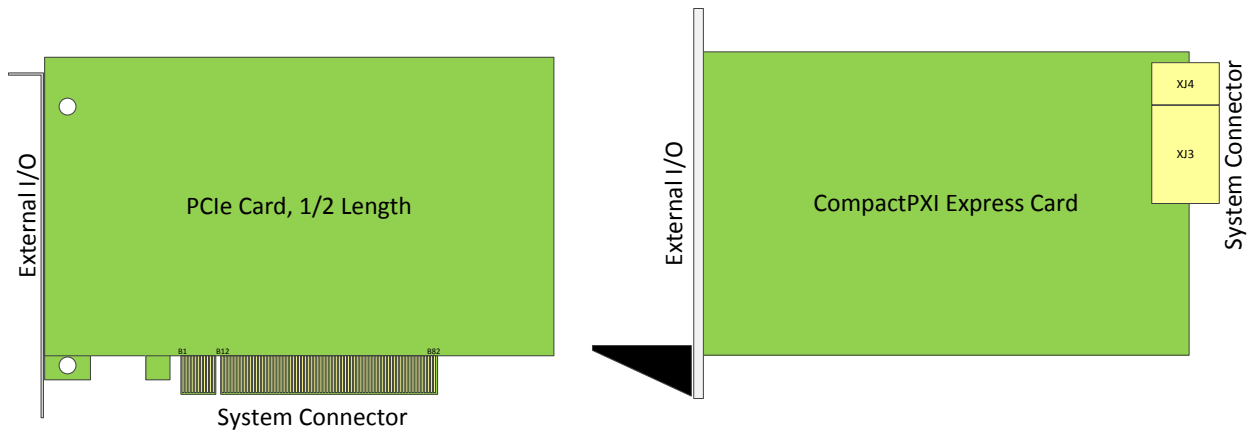
**Figure 1. System Configured to Accept PCIe Cards**



**Figure 2. System Configured to Accept PXI or PXIe Cards.**

### Mechanical Challenges

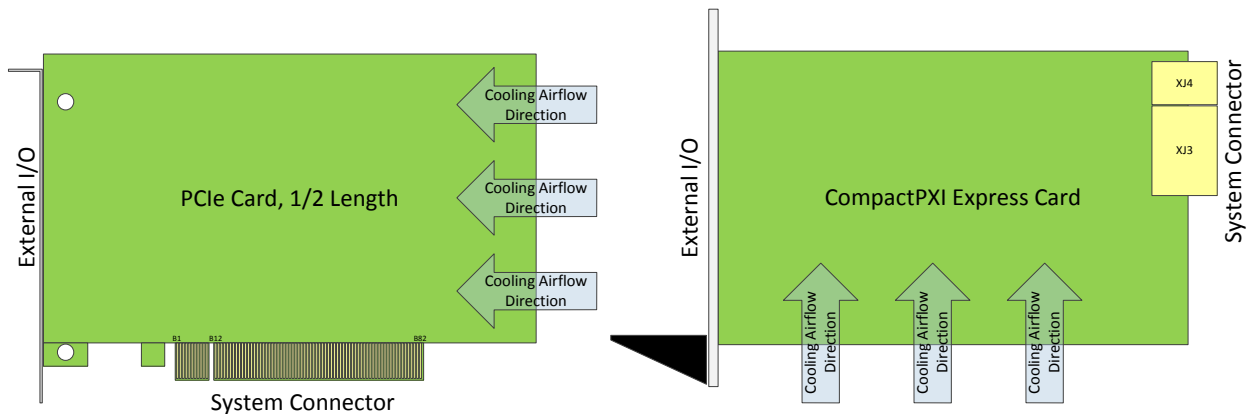
While a full-height, half-length PCIe card is similar in overall size to a typical 3U PXIe card, how they mount within and connect to the system are vastly different. Furthermore, their I/O faceplates are different as well. Figure 3 shows a comparison of a Half-Length, Full-Height PCIe card to a 3U PXIe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



**Figure 3. PCIe Card and PXIe Card Comparison.**

Cooling Considerations

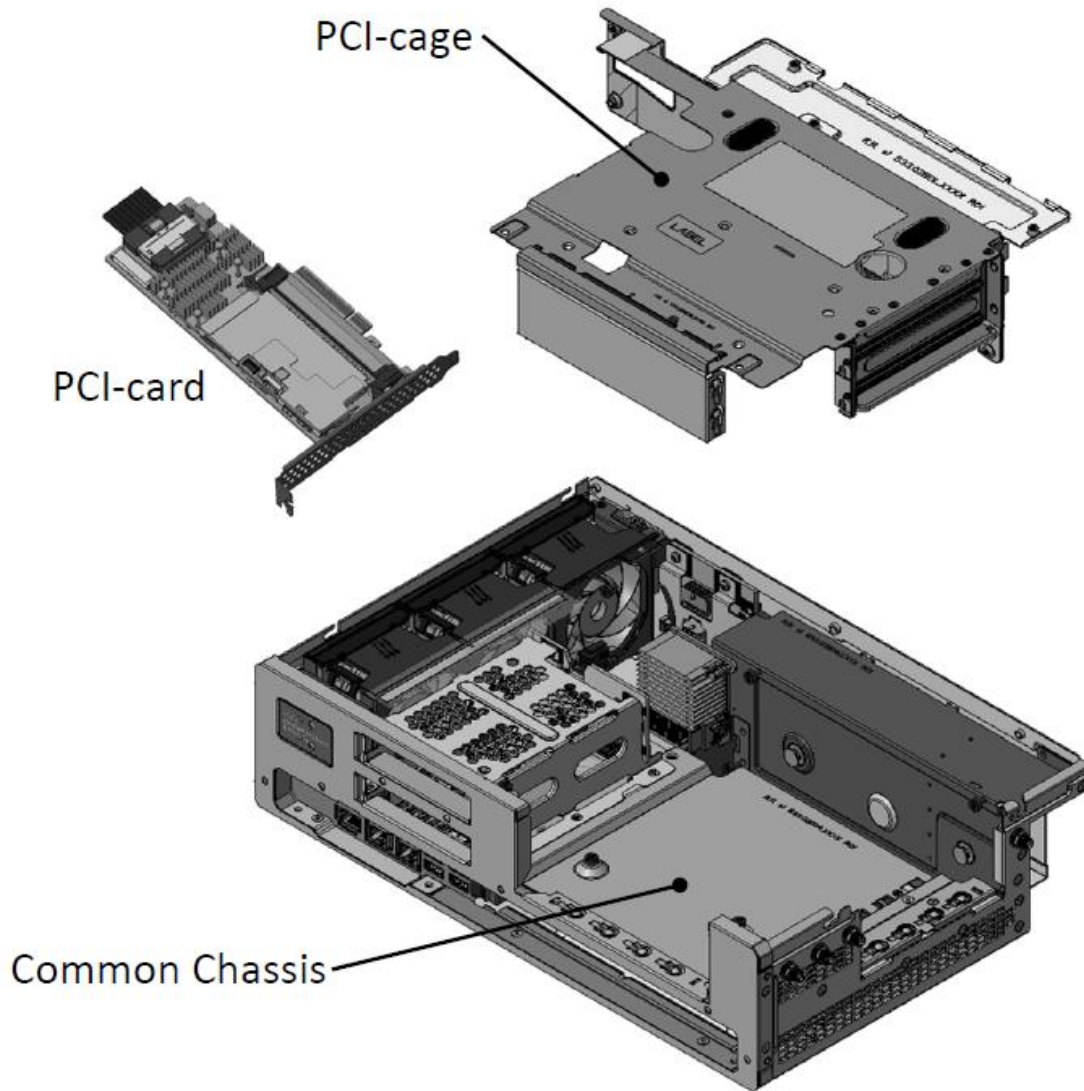
Another concern is cooling. PXIe cards are designed for chassis that provide cooling air from the bottom of the card, with the air flow up across the card, parallel to the faceplate, exiting on the top edge. For PCIe cards, the cooling airflow is expected to flow across the card, parallel to the top 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.**

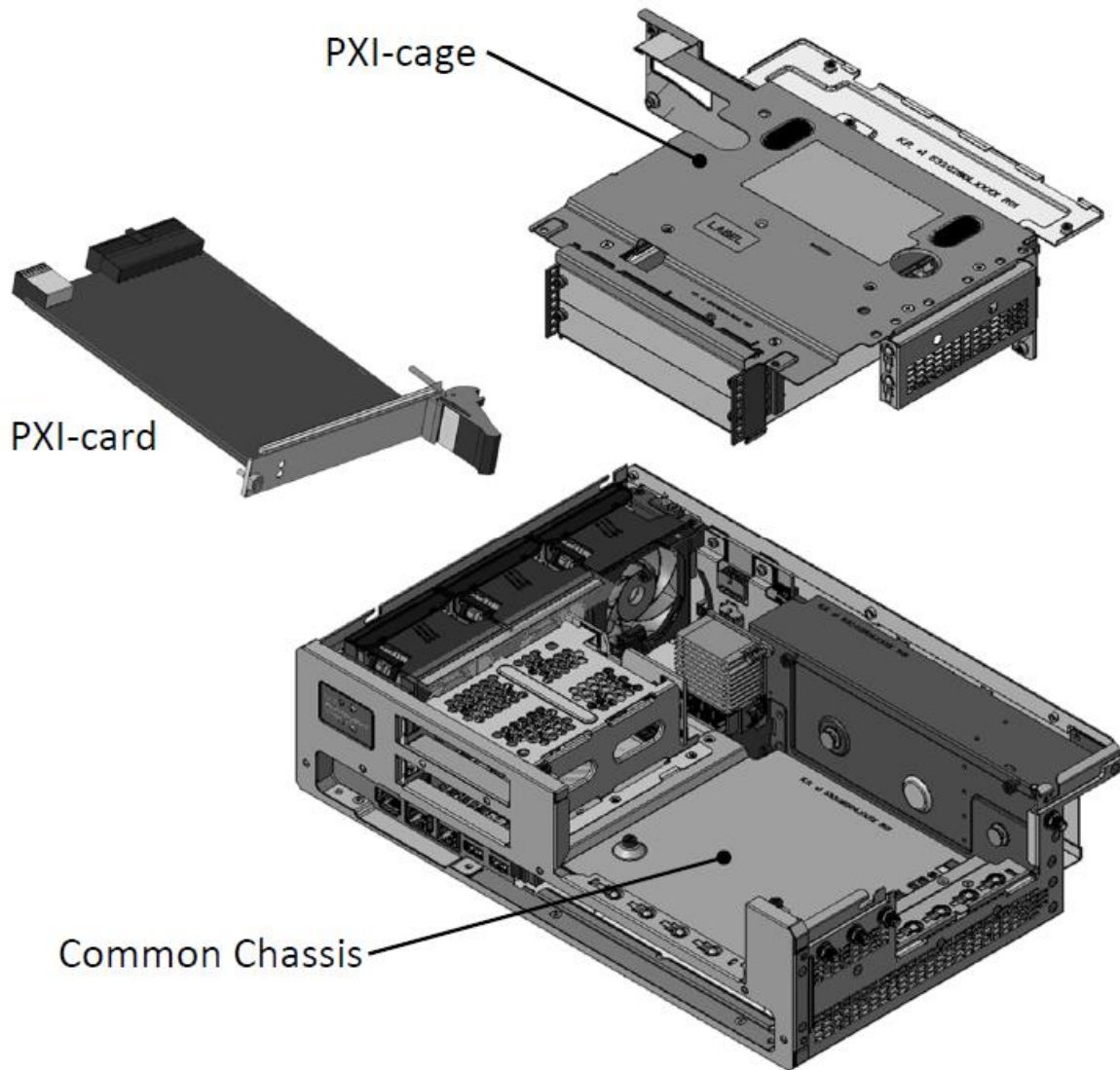
For this solution, the chassis is identical for both versions, the type of I/O card supported, PCIe or PXI/PXIe is determined by the I/O cage assembly that is installed in the chassis. The two styles of I/O cages are each designed so that the unique requirements of the I/O cards are met. For PCIe card support, the cage rotates the cards so that their system card-edge connector is oriented towards the back of the chassis and that the I/O faceplate is on the side of the chassis.

This facilitates electrical connection to the PCIe card and also achieves the correct airflow across the PCIe card. Figure 5 shows the carrier assemblies that hold the PCIe cards.



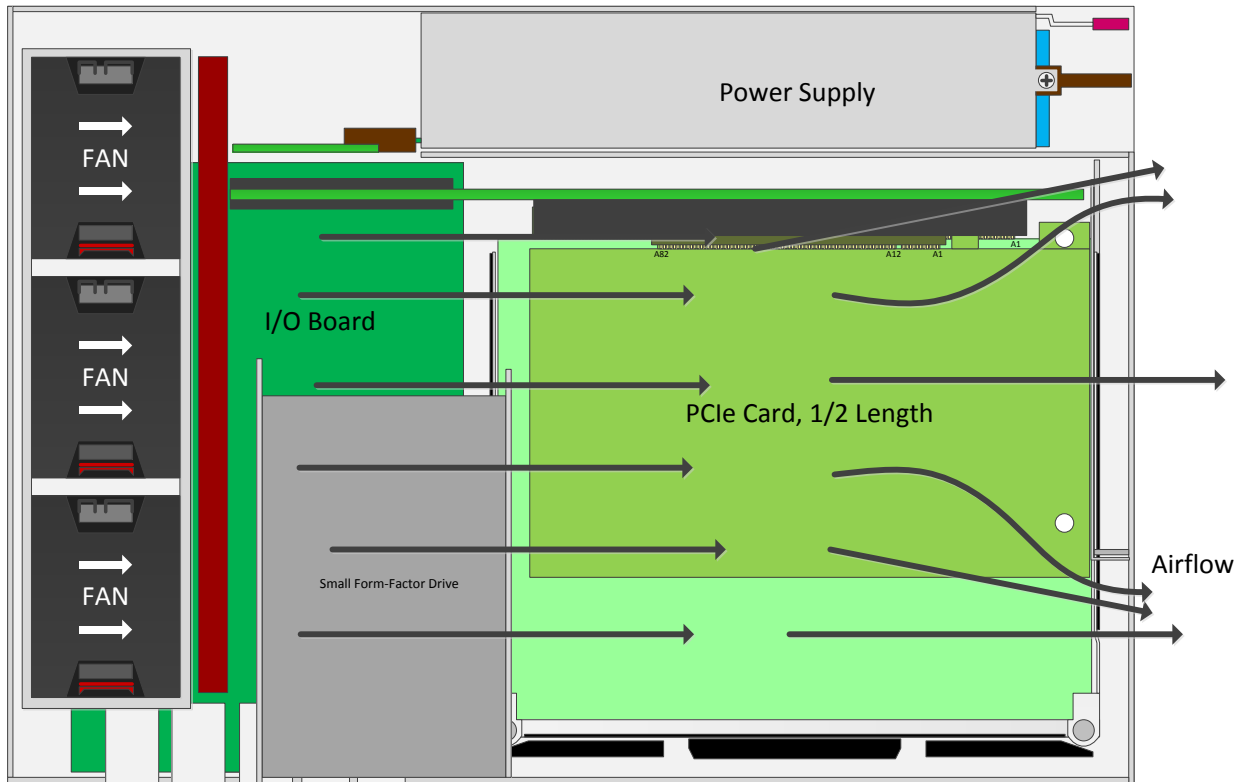
**Figure 5. PCIe Card Mounting**

PXIe cards are accommodated with a different I/O cage assembly. This cage holds the PXI or PXIe card with the system electrical connections towards the back of the chassis to allow for easy connection to the system and this also achieves the correct airflow across the PXI or PXIe card. Figure 6 shows the carrier assemblies that accept PXIe cards.



**Figure 6. PXIe Card Mounting**

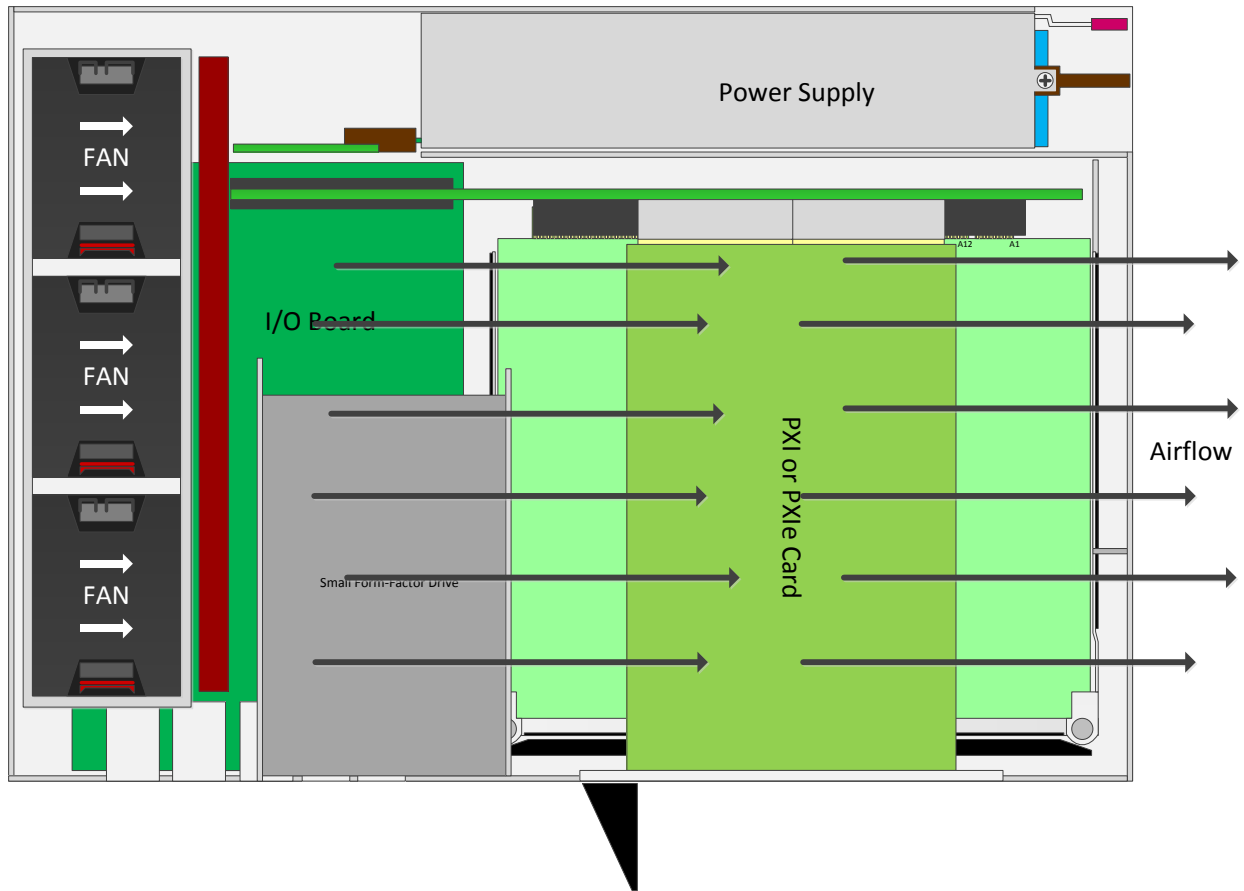
Airflow is routed the same for both solutions. The cards are mounted so that the resulting airflow across the cards is correct for the type of card. For PCIe cards, the air enters the card area at the end opposite the I/O connector faceplate and this is the same airflow direction that the card would be presented with if it were 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 (ejector handle end) towards the center of the chassis. This results in the PXI or PXIe card being installed with the component side of the PCB up. The system cooling air enters the PXI or PXIe card area and flows across the cards in the same direction as if the cards were installed in a traditional PXI or PXIe platform. Figure 8 shows the airflow when the chassis is configured to accept PXI or 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 that is compact and ruggedized. This solution is only 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](http://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](http://www.PXISA.org/Members/Roster.aspx)
3. PICMG® PCI Industrial Computers, 401 Edgewater Place, STE 600, Wakefield, MA 01880, [www.PICMG.org](http://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](http://www.pcisig.com/membership/member-companies)
5. PCI-SIG Administration, 3855 SW153rd Drive, Beaverton, OR 97003, [www.pcisig.com](http://www.pcisig.com)

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