**AXIe Consortium After Ten Years**

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It's hard to believe that the AXIe Consortium is 10 years old, but the calendar doesn't lie. The AXIe Consortium was announced in late 2009, with the first set of specifications released in June 2010. At that time the AXIe Consortium announced, "Today marks an important milestone in the test and measurement industry. These specifications will enable unprecedented capability and performance for users, all in an industry standard modular form factor open to all vendors. With the release of these specifications, vendors may now develop and deliver AXIe products, knowing that they will be part of a growing ecosystem of compatible chassis, modules and systems."

This is exactly what happened. AXIe became the "big brother" of PXI, delivering software compatibility with PXI but simultaneously offering a larger high-performance modular instrument architecture that enabled higher power, cooling, and rack density than the smaller PXI form factor. This has led to new measurement solutions, many of which are only available in the AXIe modular form factor.

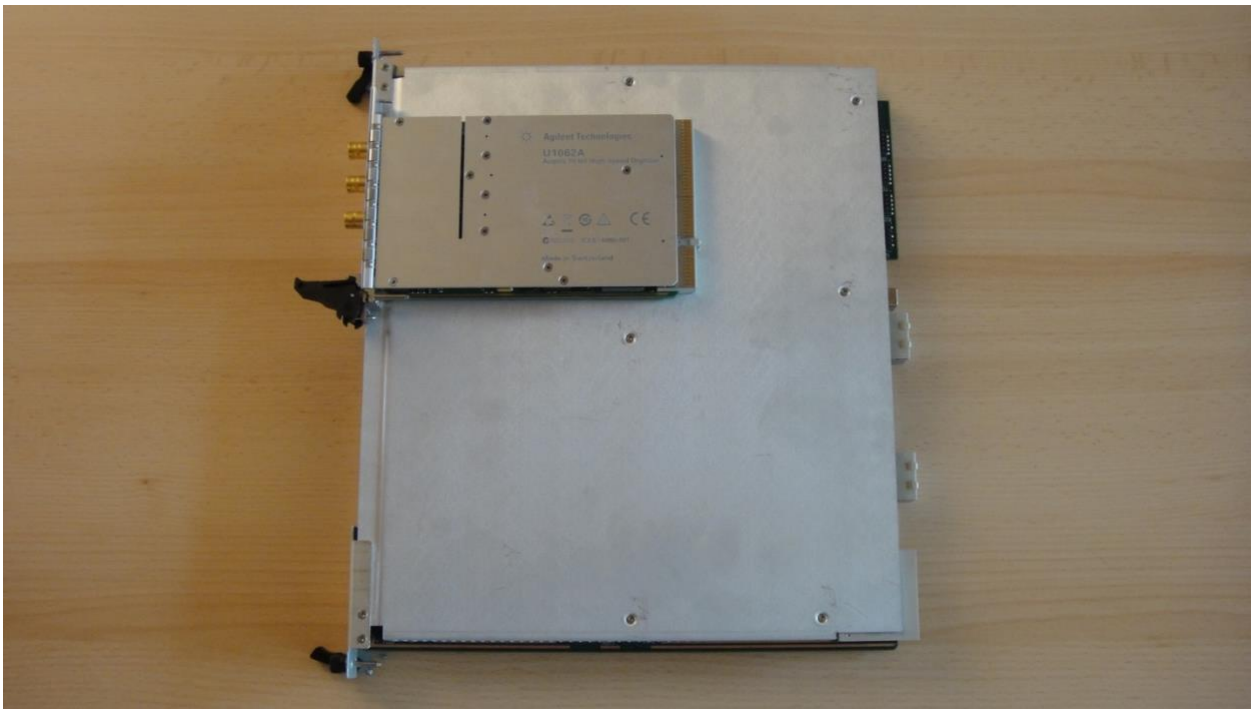

*Figure 1 A PXI module lies on top of an AXIe module, demonstrating the larger footprint and density of AXIe. Because both standards are based on the PCIe bus, AXIe modules appear as PXI modules in a PXI software environment.*

AXIe has succeeded in not only offering a modular platform for high-performance instrumentation, but it has delivered on its mission for scalability and interoperability. The

image below shows several multi-vendor measurement solutions combining chassis and modules from different providers, ranging from 2-slot to 14-slot combinations. A 2-slot chassis offers a solution just half the height of a typical PXI chassis, while the popular 5-slot chassis is the same height as PXI. Though the same height, a 5-slot AXIe chassis will support roughly 2-1/2 times the circuitry volume of an 18-slot PXI chassis. That, combined with the large board format, allows dense co-planar designs for high-speed instrumentation. It's little wonder that companies like Giga-tronics, Guzik, Keysight, and Viavi have adopted AXIe for cutting edge instrumentation solutions.

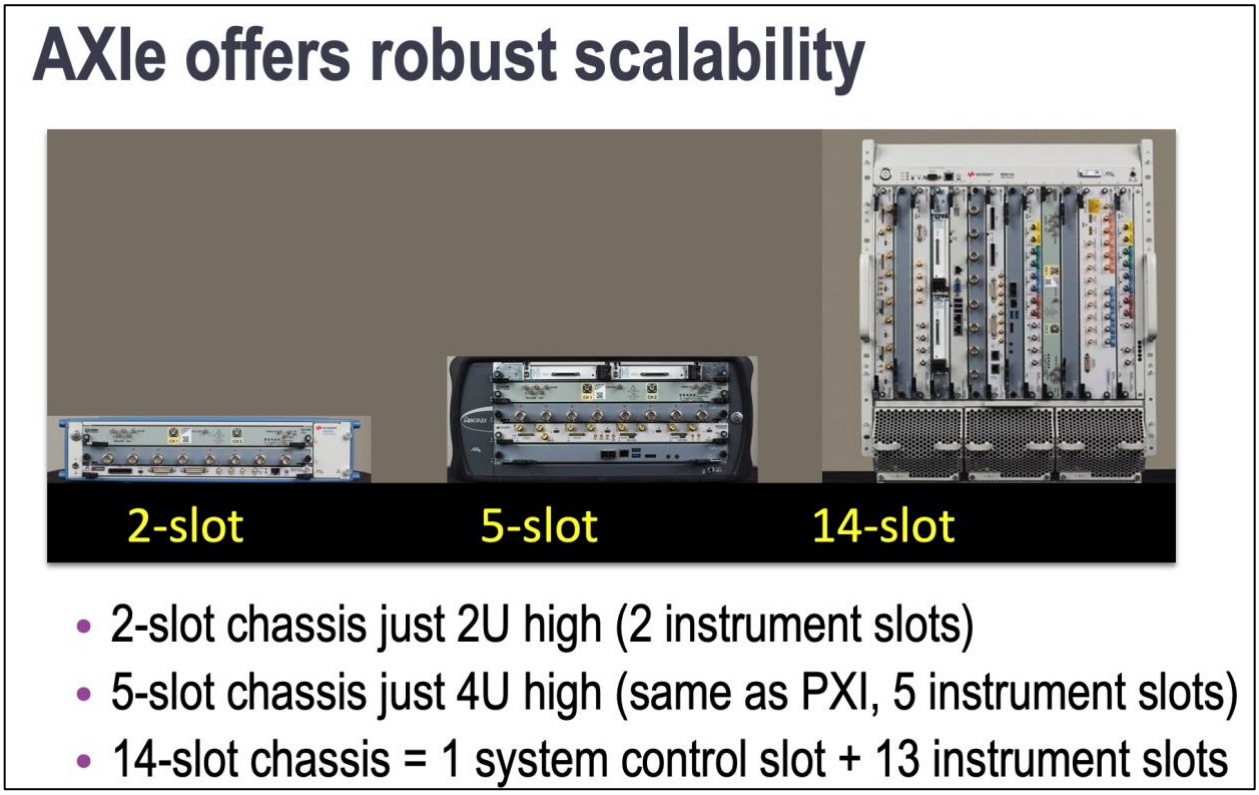


*Figure 2. From a 2-slot chassis that requires just 2U of rack space to a 14-slot vertical chassis, AXIe offers unparalleled scalability and performance. AXIe may be combined with PXI or traditional bench instruments for an entire measurement solution.*

A recent offering from Test Evolution is the single slot EV100. It allows a user to deploy a single AXIe-3.1 semiconductor test module for semiconductor turn-on applications. This further expands the scalability of AXIe.

*Figure 3 Test Evolution EV100 supports a single module.*

AXIe can be found deployed in applications ranging from semiconductor test to high-energy physics to advanced radar simulation and test. It is particularly advantageous in applications that require, both, high-speed and multiple channels. This matches the power and density advantages of AXIe. A few application examples are shown below.

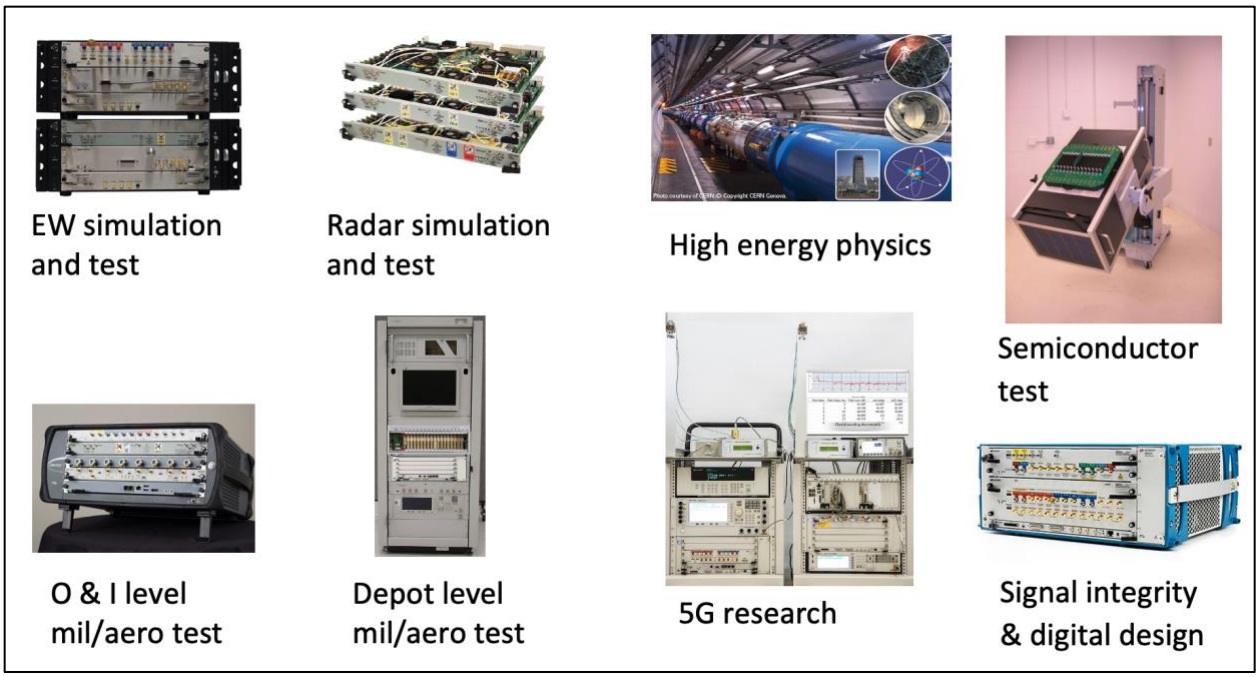


*Figure 4. AXIe is well-suited for applications that require, both, high-speed and multiple channels. This makes is particularly applicable to advanced communication systems such as 5G, or advanced mil/aero applications such as radar or electronic warfare.*

The AXIe Consortium manages the AXIe specifications and associated marketing efforts. In the intervening 10 years, the consortium has:

-Ratified AXIe-3.1, an extension of AXIe for semiconductor test
-Increased the PCIe bandwidth 4x through a wider PCIe bus with 16 lanes each direction
-Explicitly added a software layer (AXIe-2) making it compatible with PXI
-Released an architecture (AXIe-0) for low cost instrumentation and switches
-Developed an optical interface standard (ODI) for unprecedented data streaming bandwidth

Membership to the AXIe Consortium is open to all vendors and organizations. As a member, organizations are allowed to design, market, and deliver any AXIe product they desire, and to attend the ongoing technical meetings. Depending on the level of membership, they may also vote on technical specifications, become a member of the Board of Directors, or be eligible to become an officer of the AXIe Consortium. Another benefit of AXIe Consortium membership is the ability to provide articles that will be published in periodic AXIe Newsletters, like this one.

For more information about AXIe Consortium membership, contact Chris Miller, Chairman of the AXIe Consortium at chris_miller@keysight.com or Aaron Hall, Executive Director of the AXIe Consortium at execdir@axiestandard.org.

Optical Data Interface

The most recent technical activities have been focused at ODI (Optical Data Interface), a new high-speed interface standard for advanced instrumentation and embedded systems. ODI breaks speed and distance barriers by relying on optical communication between devices, over a simple pluggable optical cable. With speeds up to 80 GBytes/s, ODI is designed to address challenging applications in 5G communications, mil/aero systems, high-speed data acquisition, and communication research. Though managed by the AXIe Consortium, ODI is not specific to AXIe, and works equally well with any product format, whether AXIe, PXI, LXI, VPX, or a traditional bench instrument design. Standard ODI ports enable communication between instruments, processors, storage, and embedded devices.

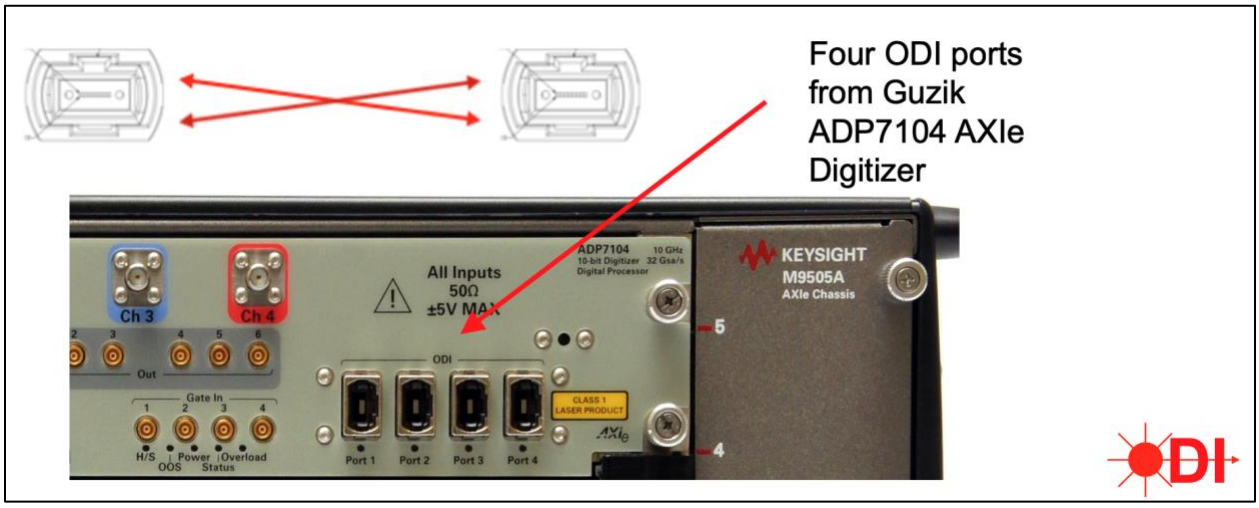


*Figure 5 shows four ODI ports on the faceplate of the Guzik ADP7104 AXIe Digitizer. Together they offer up to 640Gb/s (80 GBytes/s) of gapless streaming.*

Because ODI is a pluggable interface standard, it is not specific to AXIe. Correspondingly, AXIe Consortium membership is not required to market or deliver ODI-enabled products. A description of ODI and the specifications themselves may be found on the AXIe website at http://axiestandard.org/odispecifications.html.

Nevertheless, AXIe membership is recommended for developing ODI products. Membership allows a member to participate in the AXIe-sponsored ODI technical discussions and related interoperability activities. A good example of this is Conduant Corporation's membership in AXIe. Conduant has developed a PXI-based data recorder with ODI interfaces. Their membership enables their participation on the related technical committees as well as the ability to place articles, like this one, into the AXIe Newsletter. Give it a read, as they show some interesting applications that combine AXIe and PXI, interconnected with ODI.

The ODI specification is not specific to test and measurement applications and is equally applicable to mil/aero embedded systems. It relies on the VITA 49 packet standard for transporting digitized signal data from one device to another in real time. Through clever

architectural decisions, these packets can now be transported at FPGA-to-FPGA speeds across an optical fabric. These systems can combine signal digitizers, signal processors, signal generators, and storage. A good example is a system shown at the Association of Old Crows last year, a conference dedicated to advanced electronic warfare systems and signal intelligence.

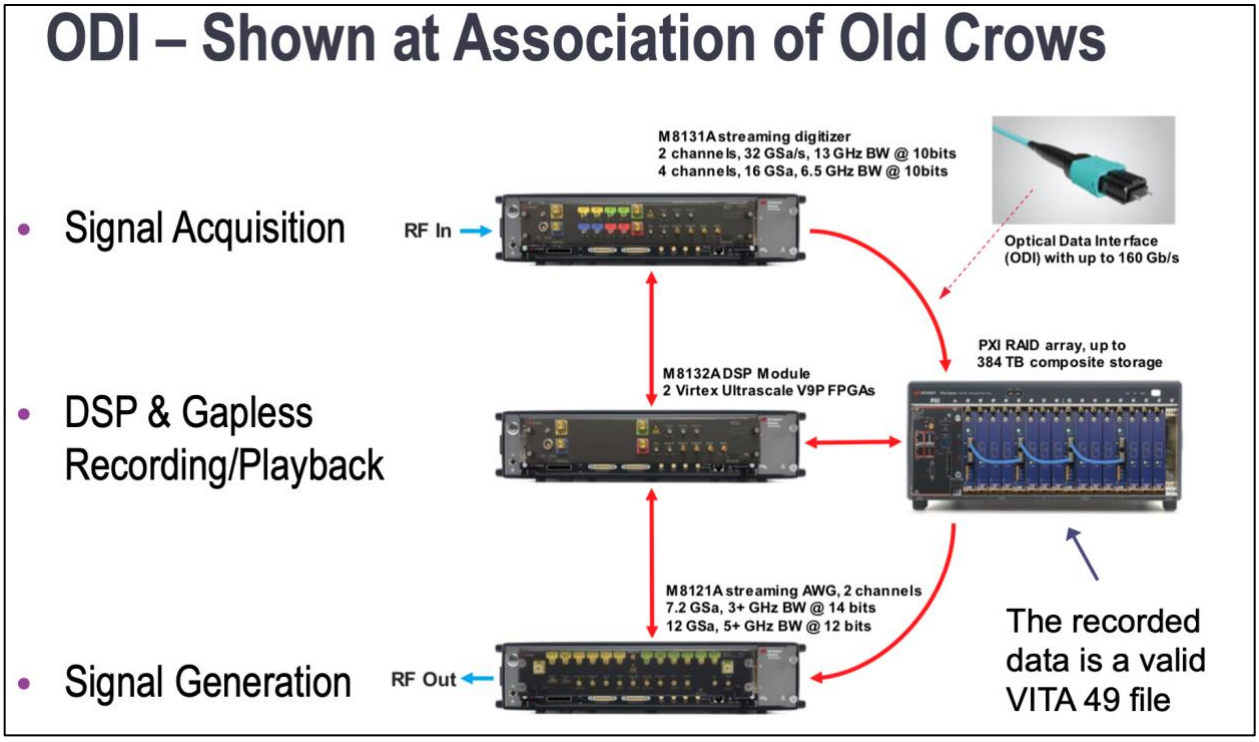


*Figure 6 shows how ODI can connect between signal generators, digitizers, processors, and storage to emulate or stimulate an electronic warfare system.*

Figure 5 shows instrumentation emulating an EW (electronic warfare) system. The red lines show the ODI interconnect between devices. This system can enable faster development of operational equipment by allowing an operational device under development to replace any number of the instruments. The remaining instruments can emulate the rest of the system. By relying on a single standard, ODI, instrumentation and embedded devices can be mixed and matched at will during the development process.

Summary

AXIe has had an exciting 10 years. It has earned its reputation as the industry's highest performance modular instrument standard while remaining software compatible with PXI. AXIe is continuing to innovate as exemplified by the roll-out of the ODI standard, the fastest data bus in the industry. The AXIe Consortium is open to all vendors and organizations and offers its members technical and marketing benefits to realize their development and marketing goals. Check us out at http://axiestandard.org.

*Larry Desjardin is President of Modular Methods, a consulting company in the test and measurement industry. He is also chairman of the AXIe Technical Committee, and chairs the technical discussions related to ODI. Larry may be contacted at larry@modularmethods.com.*