ODI Interoperability and Specification Update

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One of the standards developed and supported by the AXIe Consortium is the Optical Data Interface standard, or ODI for short. Based on optical links between instruments, instead of electrical links, ODI can stream data up to 20 GBytes/s from a single optical port, with speeds up to 80 GBytes/s through port aggregation. ODI is designed to address challenging applications in 5G communications, mil/aero systems, high-speed data acquisition, embedded systems, and communication research. A good overview of the physical characteristics of this optical interface standard, and the markets it addresses, can be found here.

ODI links, being a separate pluggable interface, can be placed on any product regardless of form factor. Below is a diagram of a hypothetical recording and playback system that combines any combination of bench instrumentation, AXIe modular instrumentation, and PXI modular instrumentation.

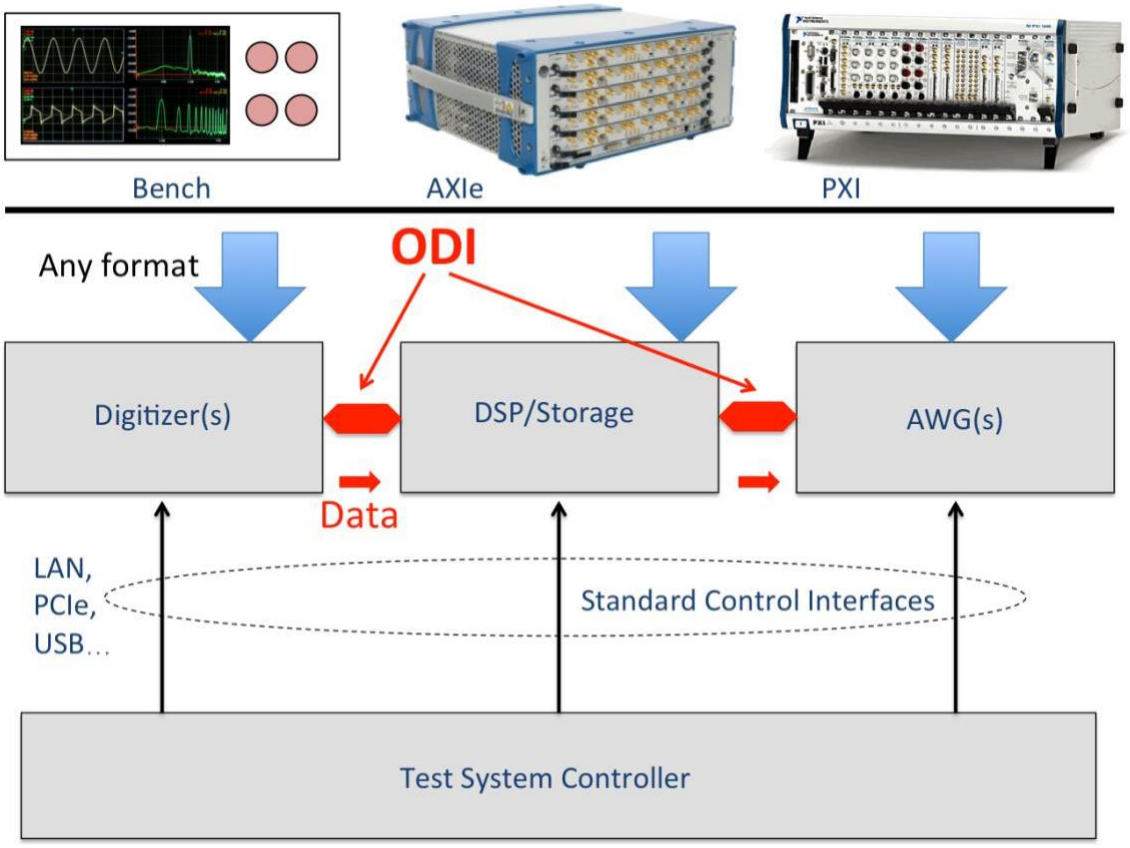

Figure 1 shows a hypothetical storage and playback system using ODI, the Optical Data Interface standard.

Besides breaking speed and distance barriers, ODI also supports the VRT packet structure. This enables a high degree of interoperability between devices and allows ODI to address embedded

applications, such as those found in mil/aero systems. More details about the VRT packet structure may be found here.

ODI Interoperability Testing

That's all fine and good, but how do we know we get those speeds in the real word between vendors? That's the goal of AXIe Consortium sponsored interoperability testing. Here, a pair of devices from different vendors are connected together, and a known pattern is sent from one device to the other at speed. The pattern received is then compared to the original pattern. In a series of separate tests, compatibility was confirmed between ODI devices from Guzik Technical Enterprises, Conduant Corporation, and Keysight Technologies, all at the top speed of 20GB/s per port.

The testing between Guzik and Conduant was particularly promising, as the two product vendors chose different FPGA vendors to execute the ODI standard. This was the first verification of ODI interoperability between an Intel-based FPGA device (Guzik) and a Xilinx-based device (Conduant), as shown in the figure below.

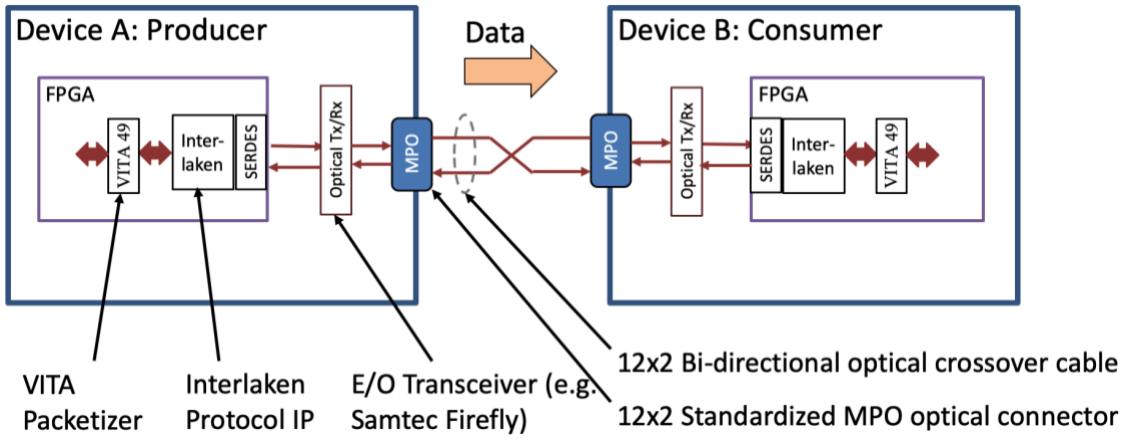

Figure 2 shows the communication link between two ODI-enabled devices. FPGAs are essential at these speeds. The ODI specification is designed to be FPGA vendor independent.

In Figure 2 above, the Guzik digitizer is the producer and the Conduant storage system is the consumer. Successful interoperability testing not only demonstrates that ODI can work between FPGA vendors, but that developers using either FPGA vendor interpret the specifications the same. This latter point is critical in successful specification development. A good specification should be unambiguous to the product designers and interpreted the same to achieve interoperability. The completion of physical layer testing of ODI indicates that it is. Also interesting to note is that the Guzik digitizer was based on AXIe, while the Conduant storage system is based on PXIe, further demonstrating ODI interoperability between form factors.

ODI Specification Updates

With this phase of interoperability testing complete, the AXIe Consortium updated the ODI Specifications. Only minor changes were needed.

For ODI-1, the physical layer standard, a standardized test pattern was added. This pattern allows developers or users to quickly verify an operational link. This standardized test pattern has been verified in interoperability testing between Guzik, Conduant, and Keysight.

For ODI-2, a correction was made regarding the Packet Count function when multiple stream identifiers or packet types are used. This is a fairly esoteric correction as the majority of ODI devices use a single stream identifier and packet type. It affected no existing products.

ODI-2.1 was unchanged and ODI-A, the Application Programming Interface was updated to include the new standardized test pattern.

The new specifications can all be found on the ODI Specifications page.

Each AXIe Technical Committee starts by soliciting problems found in the ODI Specifications by any of the developers, whether interoperability issues or ambiguity in the specifications. This is a best practice of any standards organization. Like a Maytag repairman, it's a lonely job, as the issues are few and far between. This is good news! This shows the robustness of the ODI specifications.

With the ODI specifications in good shape, we are now looking at the next stage of specifications, most likely focused on doubling the speed of ODI ports. Stay tuned!