White Paper

Separating Digital Acquisition and Processing from Local Computing Via PCIe Expansion

The ability to separate one's base computing needs from high performance DAQ and processing systems is increasingly important in several applications. A local Industrial PC typically has key software applications, loaded along with local storage, graphics, etc. To utilize the PC, which may have different user access from the embedded system, is convenient -- as opposed to having it on the DAQ solution. Additionally, it can be advantageous to utilize power hungry and heat-intensive cards in the local PC which has the space and flexibility for such cards versus putting more pressure on the embedded solution. A PCIe Expansion system can help achieve this separation.

PCIe Expansion

Figure 1 shows an illustration of PCIe Gen3 expansion to MicroTCA or AdvancedTCA open architecture embedded systems. Of course, the expansion can be designed to any form factor that has SFF-8644 ports or one PCIe Expansion Module can be on each end of the cable for high-speed PCIe to PCIe system connectivity (see Figure 2). The versatile PCI123 PCIe Gen3 Expansion Module supports an aggregate raw data rate of 128 Gbps, which can be partitioned as a single x16 link, dual x8 (64 Gbps each) or quad x4 (32 Gbps
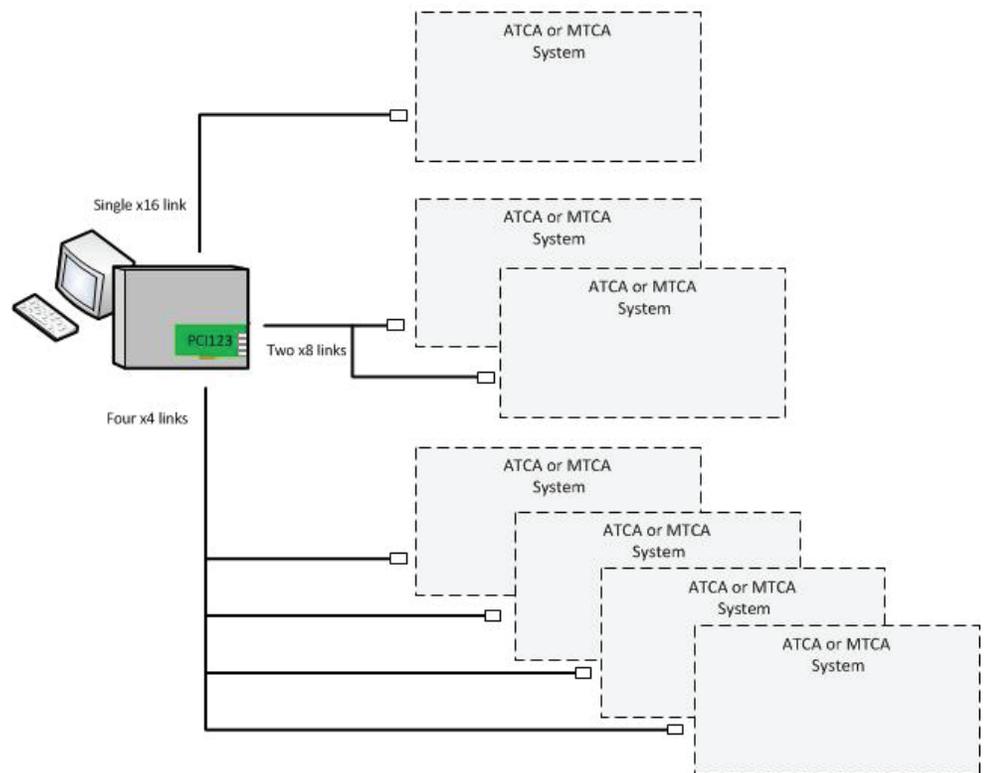

Figure 1: Remote PC links up to 500m using fiber
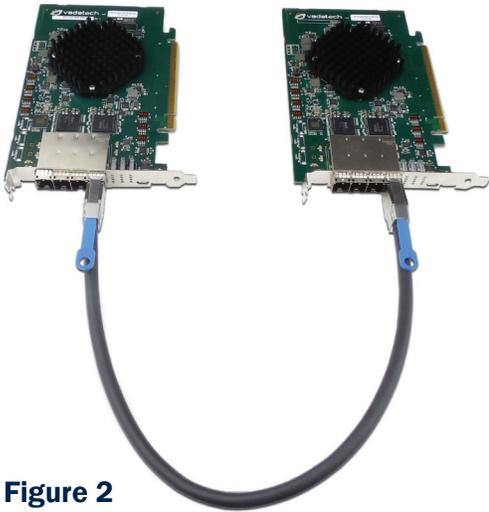
Figure 2

each) as required. This can be achieved using standard copper or fiber (up to 500m) cables.

High Energy Physics Applications

In High Energy Physics (HEP) applications, users often want to separate the data acquisition and heavy FPGA processing from the other analytical general purpose processing (GPP), and instrumentation in the system. Figure 3 shows how a PCI123 can be connected to a MTCA.4 MCH with four of the same ports. The MCH is the intelligent monitoring and control system within a MicroTCA chassis platform. It manages the power modules, cooling units, and up to 12 AMCs in a chassis. It also manages the PCIe Gen3 switch as well as the standard GbE with 10GbE uplink Base Channel switch. Additionally, it implements many other functions such as alarm controls, backplane e-keying, GPS/IEEE 1588/SyncE with time stamping, FRU identification, and has an advanced clocking scheme for precision timing.

PCIe expansion module, such as the PCI123, can be plugged into a MTCA.4 chassis directly (as opposed to the MCH). The chassis just needs the appropriate ports. Alternatively, the PCIe expansion can be incorporated into compact chassis that have an integrated MCH. In Figure 4, the VT817 1U MTCA.4 chassis has quad SFF-8644 ports for up to quad x4 connectivity.

Figure 3

Figure 4

The fiber option of the PCI123 is important in HEP applications as the distances can be far between the industrial PC and the DAQ. The high speed data transfer is equally as important. The expansion module with fiber cables can be used in distances to 500m.

Mil/Aero Applications

In the MIL/Aero market the need to have a local (rugged) PC, which can often be portable, is also desirable. The user can utilize local applications on a secured PC and be able to upload any stored data up to the electronic warfare, signal intelligence, communication control center, RADAR station or other platform. In some MIL/Aero applications, AdvancedTCA (ATCA) is the choice for its

Figure 5

capability of massive throughput. The PCI123 can also be connected to an AdvancedTCA system. Figure 5 shows a expansion module connected to an ATCA PCIe Gen3 carrier. In the MicroTCA format there is also an option to plug to a rugged chassis directly. The VT951 is a 1U rugged chassis designed to meet MIL-STD-810G and 901D for shock and vibration. The chassis has far superior performance density of any open standard, high-end rugged chassis with 6 AMC slots, redundant power, and an integrated MCH with precision timing and time-stamping. It also includes dual SFF-8644 ports for x8 PCIe Gen3 connectivity (see Figure 6).

Figure 6

Versatility

No matter the application, a PCIe Expansion solution can be a very effective tool to separate the DAQ and heavy FPGA processing from other functions/elements of a system. With the versatility of x16, x8 or x4 connectivity options, high-speed PCIe expansion can be easily tailored to your needs. With the PCI123, this can be achieved with standard copper or fiber cables, reducing your costs and making the task much easier and convenient.

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