Push your VME data acquisition and control systems beyond their boundaries

PEV 7912 Connection Kit

Overview

Multi-core processing platforms are the response to the need for more performance in today's applications, but because of their power consumption they are not well suited to be used as direct replacement of Single Board Computer in VME systems. However, PCI Express (PCIe) has become a de facto standard in computer industry, and the outcome of PCIe external cabling specification establishes a standard method of using PCIe technology over copper and optical cables, allowing a physical separation between the computing element and I/O resources. IOxOS Technologies has taken all these factors into account to develop a solution, the PEV 7912, that leverages these technologies to improve both the performance and long term availability of your VME systems while keeping your investment in terms of hardware and software.

The PEV 7912 has been designed in order to enhance existing VME64x data acquisition and control systems, relocating the computing node from the VME64x crate, while preserving most of your valuable I/O modules. This innovative approach allows to port specific real-time environments to work with widely available high-end multi-core servers running standard operating systems such as Windows or Linux.

This solution minimizes the obsolescence risks inherent to expensive embedded processors driven by proprietary operating systems. With the PEV 7912 and its PCIe connection by cable, the I/O resources are physically separated from the computing module, but still belong to its addressing domain. For this purpose, the PEV 7912 implements SR-IOV and MR-IOV capabilities (following PCI-SIG latest specification), in order to support Single or Multi Root I/O Virtualization through its built-in PCIe external cabling connections.

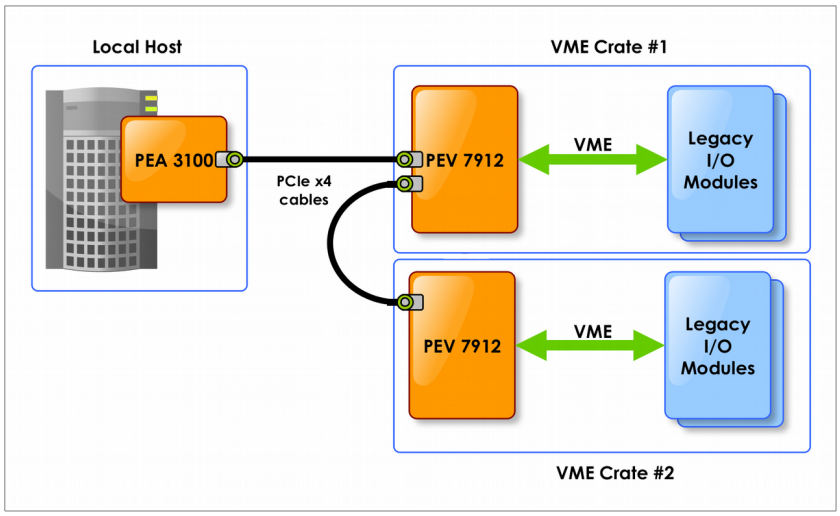
The PEV 7912 can become a key element of VME64x data acquisition and control systems where high performance and computing power is a major challenge: High energy physics equipment and particle accelerator control, Aerospace integration test benches and flight simulators, as well as Medical imaging systems.

How it works

Basically the PEV 7912 allows an external local host equipped with a PC Host Card (PEA 3100) to access in a transparent way the I/O resources hosted in a VME crate by extending its PCIe Bus infrastructure over medium and long distances (up to 7 meters with copper cable and 100 meters with optical cable). The connection between the host and the PEV 7912 interface is built on the latest PCI-SIG "PCI Express External Cabling Specification" defined to support PCIe from x1 up to x16 lanes. The connectors and the cables are fully specified and widely available on the market.

As a result of this connection, all VME resources (I/O modules) are seen on the PCIe link by the external local host as any other of its pure PCI resources.

A second connection port in the PEV_7912 allows chaining several crates. This port can be configured in non transparent mode to connect another host acting as "system supervisor" in order to perform non-intrusive monitoring tasks.



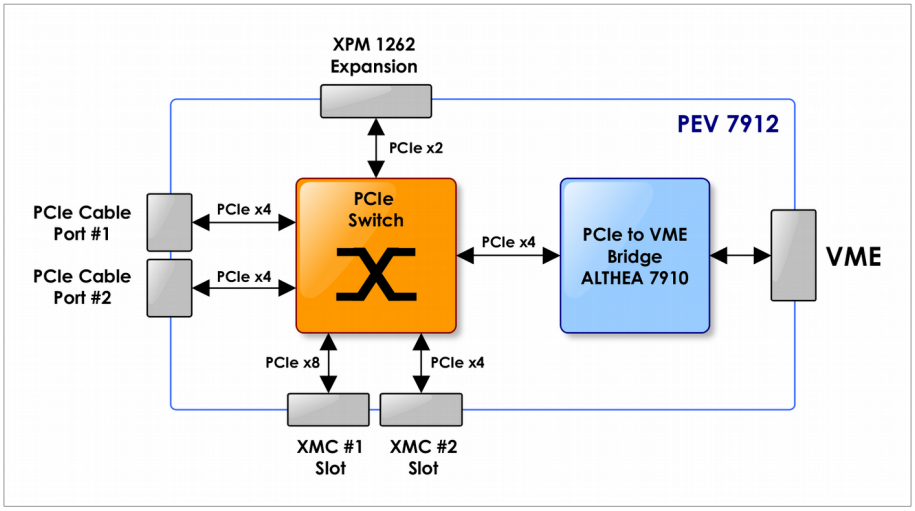
Unprecedented flexibility and scalability

Since the computing element is kept outside the VME crate, you are free to choose the best adapted solution among the widely available multi-core engines running standard operating systems.

In addition to the ability to chain several VME crates, each PEV 7912 features two PMC IEEE 1386.1 slots with support of legacy 32-bit PCI (33/66 MHz) and two XMC VITA 42.3 slots supporting PCIe x4 GEN2. These slots allow to add new I/O boards and protocol-specific functions to the system and to have them tightly coupled with the local host.

The expansion capabilities are enhanced by attaching the XPM_1262 expansion module that provides two additional PMC/XMC slots directly connected to the PEV 7912 PCIe infrastructure by means of a high-speed coaxial flat cable.

An onboard 24-port PCIe GEN2 switch is at the core of the PCIe infrastructure, allowing an optimal interconnection of all onboard resources.



Unparalleled performance

The PEV 7912 integrates a large on-board memory (256 MBytes of DDR3) directly mapped in the PCI and VME address spaces in order to provide transparent access from the local host, the onboard PMC/XMC modules and other VME boards on the system.

To overcome the PCIe overhead and latency, the shared memory is a central element of the PEV 7912 architecture by allowing to gather data in a common area before performing block transfers to the target destination. In order to support efficient data sharing and synchronization the shared memory hardware logic includes a set of Doorbells and Semaphores linked to the PEV 7912 interrupt mechanism.

The DDR3 Memory Controller, implemented in the onboard Artix-7 FPGA, integrates a 4-channel DMA engine optimized for long burst transactions, in order to exchange data at a speed of several hundreds of MBytes per second. Each DMA channel has chaining capability (up to 16 MBytes per chain-descriptor) and is associated to an "End of Transfer" interrupt, coupled to a status and time-stamp information. This embedded DMA can move data among the onboard shared memory, the VME bus and the PCI tree with transfer data rates up to 185 MBytes/s (read) and 270 MBytes/s (write) when operating in VME 2eSST mode.

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Protect your investment against obsolescence

The PEV 7912 not only minimizes the obsolescence risk of the entire system by replacing the most vulnerable of its components -the VME processor board-, it also features the IOxOS Technologies proprietary ALTHEA 7910 solution, a PCI Express to VME64x Bridge implemented in a Xilinx Artix-7 FPGA that overcomes the obsolescence threaten posed by the EOL announcement of the Tsi148 back in 2014.

In 2015, IOxOS Technologies decided to market this FPGA-based bridge, opening the technology to other VME manufacturers. The specialized media promptly echoed this initiative, and its remarkable market uptake, where the ALTHEA 7910 solution has been adopted by key VME suppliers worldwide to retrofit their existing legacy systems and to develop new programs.

This field proven solution natively supports all Master/Slave VME64x modes of operation with Slot_1 System Controller function, including VME64x data transport 2eVME and 2eSST modes with maximal burst length capability, while guaranteeing very long term availability of the board as a result of not depending on already obsolete third party VME interfaces.

A true *VME Renaissance*.

Key Features

- 6U VME64x PCI Express to VME transparent bridge with enhanced expansion capabilities
- ALTHEA 7910 FPGA based PCI Express to VME64x transparent bridge:
  - ✔ Implemented in Xilinx Artix-7 device
  - ✔ VME64x Master/Slave interface with Slot-1 functions
  - ✔ True PCI Express End Point x4 GEN1/GEN2
  - ✔ Supports VME Data D08, D16, D32, BLT32, MBLT64, 2eVME, 2eSST and 2eSST Broadcast
  - ✔ High-performance DMA
- 256 MBytes DDR3 Shared Memory
- VITA 35 compliance (PMC/XMC Jn14/Jn24 mapping to VME P2): P4V0-64, P4V2-64ac
- VME P0 extension, VITA 35 compliant
- Enhanced I/O expansion capabilities
  - ✔ Two front panel PCI Express x4 cable connections supporting copper and fiber
  - ✔ Optional XPM_1262 module to control two additional XMC/PMC slots (PCIe GEN2 link)
- PCIe GEN2 24-port switch
  - ✔ Eight NTB ports
  - ✔ Embedded DMA Controller
- Thermal and Power supplies monitoring
- Device drivers for Linux and Windows 7 (32-bit and 64-bit)