Application Note AN2004-1
March 2004

The Emergence of Processor PMCS

Abstract

Defined as a modular building block to support plug-and-play processing and I/O expansion, PMCs and PMC carriers have wandered way beyond their traditional space by invading the likes of the high-end embedded market, a market increasingly characterized by high-speed processors and I/O elements, fabric-switched interconnect technologies, and new levels of modularity and interoperability requirements typified by the emergence of the Processor PMC (PrPMC). This document describes the evolution of Processor PMCs.

Evolution of the PMC

Not many years ago, single board designs dominated embedded computing. These products integrated all of an application's components on a single, immutable board. Any change in I/O protocols, storage capacities, memory models, or processing power meant a respin and, more often than not, an interminable cycle of software porting and testing to support the new board. To add some modularity to the mix, along came the proprietary daughtercard, enabling designers to preserve some parts of the puzzle while others parts evolved. While a step in the right direction, the proprietary daughtercard limited choices to a single organization's product line.

But about the time that the daughtercard concept was catching on, the demand intensified for a common local bus architecture suitable for a wide range of applications and capable of supporting plug-and-play integration. From this demand came the PCI local bus standard from PCI-SIG, which was widely adopted. This enormous stride toward standardizing local communications complemented another headline event, the publishing of the IEEE Common Mezzanine Card (CMC) standard, a mechanical standard for daughtercards (re-dubbed, of course, mezzanine cards). At that point, the road was clear to to unite interoperability's trendiest couple, CMC and PCI, into the IEEE PMC standard.

Moving the Processor to the PMC: The PrPMC

PMCs came out of the gate fast. With confidence that the PCI local bus would be a major player in carrying local data traffic, semiconductor vendors proliferated off-the-shelf bridges between PCI and other protocols, providing instant glue logic for waning legacy protocols such as ISA, for specific I/O protocols such as SCSI, FibreChannel, and Ethernet, and for entrenched embedded backplane protocols such as the VMEbus. In essence, functional modularity spread from single-board computers communicating over the backplane to mezzanine cards communicating over the local bus, and protocol heterogeneity, often multiple levels if it, could be traversed by an application's data before it ever reached a backplane.

The inherent modularity of PMCs led to their appearance on nearly every rung of the application ladder, from commodity bus-based systems to exotic fabric-based multi-computers. Of late, the progress of interoperability and modularity has escalated, particularly in the embedded space. Parallel buses are giving way to serial, switched fabrics capable of gigabit bandwidths per lane, and the PCI local bus is being bridged to oblige. Once more, PMCs are prominent in this progression, and in numerous ways. In some cases, PMCs link processing elements and fabrics implemented on the carrier to external I/O interfaces implemented on the PMC. In other cases, the system's processing power resides on the PMC module, allowing carriers to concentrate solely on switch fabrics, bus interfaces, and external I/O demands.

In the latter cases, moving the processor to the mezzanine isolates what is often a system's most costly asset, its system software, from the anticipated explosion of interconnect schemes. Recent developments enabling this evolution include the appearance of the ANSI/VITA-32 standard, which enhances PMC mechanicals and signaling to support critical CPU features. Because of VITA-32's enhancements, a system's main processor can move to the mezzanine and the processor's local bus can be bridged to whatever interconnect protocols fit the target applications.

VITA-32 accommodates the requirements of a system using the PMC module as its main processor. Known as Processor PMCs (PrPMCs), these modules “isolate the complexities of a high-speed CPU, cache and memory signals from application-specific hardware on the carrier” says Greg Novak of the Motorola Computer Group, manufacturer of the PrPMC610. Andy Reddig of Tekmicrosystems, manufacturer of the PowerRACE-3 fabric-based PMC carrier, agrees. “PrPMCs simplify the integration of processors, I/O, and switch fabrics, leaving integrators free to focus on application requirements”.

Tekmicro’s Leadership in PrPMC Support

As a case in point, the PowerRACE-3’s two PMC slots can accept either PrPMCs or I/O modules, allowing a single flexible, high-performance topology to fit any number of processing and I/O solutions. Conversely, complete product lines of carriers, each offering unique configuration possibilities based on differing I/O and connectivity features, can leverage a common processing function in the form of a plug-in PrPMC module. Without a doubt, PrPMCs and carriers supporting PrPMCs will play a prominent role in emerging embedded applications by adding performance, reliability, and flexibility while extending the reach of PMCs into these important markets.