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Processor PMC (PPMC), Taking Mezzanines to New Heights

This article discusses the benefits of PPMC that stands for Processor PMC. By moving the processing component to the mezzanine level, users have a complete processor/memory subsystem that is flexible and easy to upgrade. Base boards do not have to be swapped each time a processor enhancement is made. The cost and resource savings are obvious.

For several years, board-level manufacturers have designed and produced proprietary mezzanine cards with built-in processors. The inspiration for this hardware sprung from the fact that most elements on a carrier card - like I/O and serial ports - are static. The CPU, however, is always in flux due to ever-increasing clock speeds and functionality. By moving the processing component to the mezzanine level, users have a subsystem that is flexible and easy to upgrade. Base boards do not have to be swapped each time a processor enhancement is made.

As bus speeds and semiconductor integration accelerated and companies continued to launch advanced processor and memory technologies, the focus shifted to building a processor mezzanine card based on a standard form factor. This has resulted in a new draft standard known as the Processor PMC (PPMC). Designated VITA32-199x, the PPMC draft standard is an extension to the popular PCI Mezzanine Card (PMC) draft standard, IEEE P1386.1, and delivers processing functionality in a smaller, standardized form factor.

Conceived in early 1999, this new proposal maintains electrical, mechanical and environmental compatibility with existing PMCs. Although its predecessor is typically seen as an expansion or I/O card solution, the PPMC is a subsystem that includes a present signal and can handle interrupts, 66 MHz PCI operation and PCI bus enumeration. The draft standard also allows the addition of an optional second PCI agent.

The features of the PPMC specification are implemented by redefining previously reserved or obsolete PMC pins. Additionally, the specification deviates from the PMC standard by relaxing side-two height restrictions. The boundaries are extended to accommodate large devices like heat-sink and fan-sink cooled processors, SODIMM-socketed memory modules, connectors, and power supplies.

WHAT DOES PPMC OFFER?

Specs and details aside, a PPMC module delivers the same benefits as its proprietary counterpart. Users have the ability to quickly upgrade systems to new processor and memory architectures while retaining the carrier board. But unlike vendor-exclusive processor mezzanines, the PPMC is an open, modular solution. That means companies can access the PPMC solution without committing new manpower and manufacturing resources to build an application-specific mezzanine. Nor do designers need to buy more expensive custom designs. And because PPMCs can be purchased off-the-shelf, users are able to speed time to market considerably.

The benefits are best explained, however, through an application example. A communications equipment manufacturer is building a system with a proprietary form factor. Due to its size, the slot will not fit either a VME or CompactPCI (cPCI) board. In lieu of developing a CPU/memory subsystem and dealing with the time-consuming debugging process, the user purchases an off-the-shelf PPMC. As a result, the custom base board that is fabricated for the machine only has to provide PPMC connectivity. Data and protocol processing are handled by the PPMC and the system is ready for sale months ahead of schedule.

MONARCH VS. NON-MONARCH

In addition to greater flexibility, the PPMC draft standard has also introduced two new terms - Monarch and Non-monarch - which classify the operational mode of a module. While the modes share similarities with PCI host functionality, it is important to note that PPMCs do not provide PCI clock, reset or arbitration functions. Thus the need for an alternate lexicon.

A Monarch module is defined as a PPMC that acts as the main processing element. In this mode, the PPMC performs PCI bus enumeration at power-up and handles interrupts from devices requesting service. This is the role the PPMC plays in the previous application example.

Non-monarchs, as the name implies, have a contrary function. A Non-monarch PPMC is a secondary CPU, does not enumerate the PCI bus and is an interrupter. And while there is just one Monarch per system, the number of Non-monarchs is only limited to the electrical interface capacity on the carrier card. This allows a variety of subsystems to handle the processing requirements and report back to the principal CPU (Figures 1 & 2).

For instance, a telecom company that runs an SS7 application may use PPMCs in tandem with T1/E1 interfaces. In this scenario, the I/O processors would run the data-link layer (MPT1 and MPT2) of the SS7 stack and a PPMC would oversee the I/O modules, handling the higher levels (MPT3 and up). A second

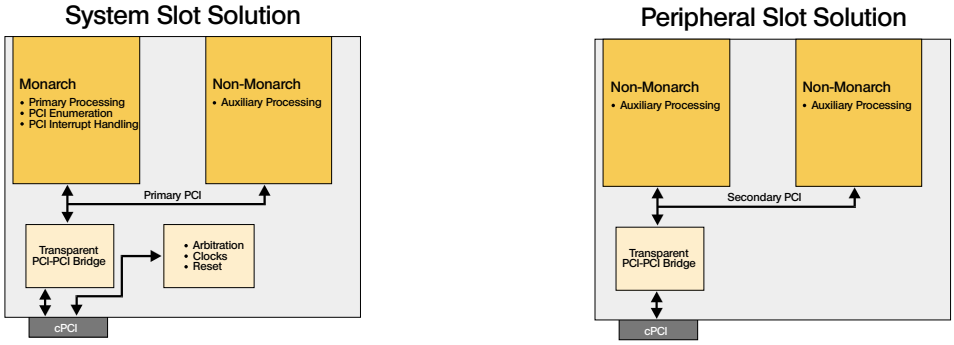

Figure 1 and 2. The use of Monarch and Non-Monarch PPMCs in typical CompactPCI applications.

PPMC would take care of the operations, administration and maintenance (OA&M) functions. All of the distributed processors would report back to the principal CPU.

The main reason to design a system with multiple processors is to avoid running all software on one CPU, an architecture that yields finite performance levels and leaves no latitude or longitude for improvement. Moving satellite tasks (e.g. OA&M) to autonomous subsystems, in contrast, increases the system's overall processing capacity. Simply put, a hierarchical structure using Monarch and Non-monarch PPMCs assures that operational goals are met and time to market is reduced.

The MONARCH signal designates each PPMC in a system as Monarch or Non-monarch. An optional EREADY signal is also possible. This cue, generated by Non-monarch PPMCs, indicates that the module has completed its on-board initialization and can respond to the monarch's PCI bus enumeration via configuration cycles.

PPMC IN THE REAL WORLD

Artesyn Communication Products has emerged as one of several pioneers in the PPMC market that includes real-time applications such as gateways, switching, call processing, and wireless communications. Released in early 2000, the Artesyn PM/PPC-750 (Figure 3) is a working example of the PPMC standard. The PM/PPC-750 combines the speed and computing power of the PowerPC™750 microprocessor with a variety of connectivity and expansion options that create a highly functional and flexible solution. The module retains the original IEEE P1386 PMC envelope in both form factor and power dissipation, and, as a result, can be used in cPCI, VME or proprietary environments.

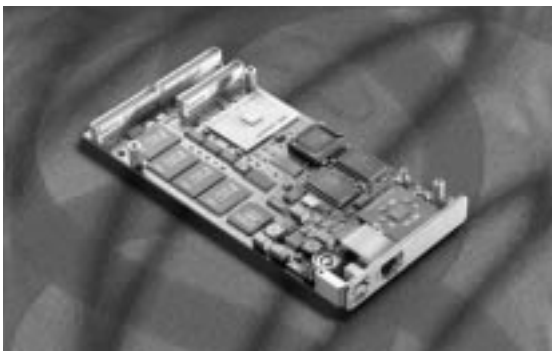

Figure 3. The PM/PPC-750 from Artesyn Communication Products is based on the PPMC draft standard.

A major teledatacom customer employs the PM/PPC-750 module as an embedded VxWorks development environment. Engineers place the PM/PPC-750 on a PMC carrier for PCI, install it into a Windows NT workstation, connect the console serial cable to the PC's COM port and drop in a separate Ethernet connection for the PM/PPC-750. The company sidesteps the cost of a chassis and a full-blown cPCI or VME board.

Another customer has a dual-rail Gigabit Ethernet backplane as part of a high-availability system. The company wanted to upgrade this platform for use in another application. To do so, engineers had to build a new node on the Ethernet backplane. Rather than start the design from scratch, designers focused on the overall application. They included a PPMC site on the carrier card and the PM/PPC-750 was inserted as the main processor. With the processor and memory supplied in an off-the-shelf module, the company saved time and money.

In other applications, the PM/PPC-750 is used to run upper-layer protocol stacks or process data coming from a port on the PMC carrier. The wide range of application examples of the PM/PPC-750 testifies to the flexibility of PPMCs.

THE FUTURE OF PPMC

Products like the PM/PPC-750 are just the beginning of the PPMC invasion. Soon, the PPMC will gain industry acceptance on par with its predecessor, the PMC. As the draft standard evolves and more PPMC modules hit the market, users will realize the widespread benefits of processor mezzanines - an awareness sure to fuel a trend toward more distributed systems ■

Jeff Durst has been with Artesyn Communication Products for more than 13 years. He was originally hired as a hardware engineer and later promoted to project manager. In the engineer position, Jeff designed single-board computers used in military, scientific and communications applications. And as project manager, he supervised multiple projects for several of today's major telecom companies. Jeff recently made the transition to product management and is currently focusing his efforts on product definition.