Open System Buses Meet Increased Flexibility Requirements In Communication Board Design

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A highly competitive environment and changing market demands in the telecommunications industry is resulting in a need for smaller, more scalable components and systems. To meet these demands and provide lower cost and faster time-to-market solutions, equipment manufacturers are shifting from proprietary technologies to more open platforms.

Open system buses like VME, PMC (PCI Mezzanine Card) and CompactPCI provide a variety of technical design benefits and competitive advantages, including enhanced functionality and application flexibility. Designers can build modular, scaleable systems that can be easily upgraded by replacing the old board with a newer design without changing the basic system architecture. In addition, adding mezzanine capability to communication boards provides an even greater level of flexibility for designers beyond the system bus.

VME- The Industry Leader

Driven by a broad base of products and a rugged, scaleable nature, VME is the most dominant and stable open bus standard available today, providing a good deal of flexibility both in terms of variety of components and choice of suppliers. Hundreds of VME vendors offer thousands of products to choose from, including a variety of supporting products, like operating systems and backplanes. When time-to-market is a critical issue, the ability to buy off-the-shelf VME components and put together systems very quickly is a major advantage.

Competition in the VME marketplace is driving the development of new technologies capable of keeping pace with the increased demand for faster data transfer speeds. When the VMEbus was first introduced in the early 80s, the backplane data transfer limit was 40 MBps. VME64 is now twice that (80 MBps.) and the recently announced 4xVME technology (VME320) could increase the bandwidth to 320 MBps., dramatically increasing VME's capabilities for use in applications requiring higher bandwidth.

From a technical standpoint, VME is also extremely scaleable, housing anywhere from 1 to 21 CPU or I/O boards. VMEís ability to carry up to 21 boards on a single backplane is extremely important in the telecommunications and data communications markets which both require high density and high performance.

The flexibility of VME— including the optional use of mezzanine cards— allows designers to leverage the strengths of the backplane by incorporating additional buses or interfaces in a complementary manner. For example, some designers are using VME as the control bus and ATM on a PMC module as a mechanism to transfer real-time data such as voice or video within a system or to other systems. Others are using VME as the system bus and a PMC T1 or E1 module is acting as the data network.

VME is already being used heavily in several components of the Intelligent Network, including Signal Transfer Points (STP), Service Switching Points (SSP), Mobile Telephone Switching Offices (MTSO), Intelligent Peripherals (IP), Base Station Controllers (BSC) and Broadband Transceiver Stations (BTS). The functionality of PMC, the flexibility of off the shelf modules and the standardization of subsystem buses like TDM (Time Division Multiplexing), will continue to propel VME even further into telecommunications applications where reliability and time to market are essential.

The Emergence Of PMC

The PMC architecture is an open IEEE standard (P1386 and 1386.1) which has been rapidly adopted by many board-level designers, both on open buses like VME as well as on proprietary bus boards. The use of PMC in proprietary environments allows designers to bring elements of openness to a closed system to increase functionality and get to market quicker. PMC is electrically identical to PCI (Peripheral Component Interconnect), the high speed local bus being used in most new PCs today. However, while the PCI specification defines a 10.7cm x

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him for product and vendor recommendations. He personally averages three or four visits a week to the VITA site and his branch utilizes it as an essential tool for the support of their customers. "We can access product information in real time, without having to visit each vendor's site," says Braun. "It really puts all the information in one area where it's easy to find as we compare and identify product availability. Once we find what we want, we can automatically link to a specific company's web site."

Says Rynearson, "VITA deals with information, and the Web is the best way we now have to get that information out into the world. It's a terrific bonus that we can use our own standard, VME, as the heart of our information system."

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29.52cm board to plug into a personal computer motherboard in a perpendicular fashion, PMC modules are 7.4cm x 14.9cm and are mounted parallel to the base board, such as a VME single board computer.

The current trend for board manufacturers is to include more PMC slots on the communication board to enhance the functionality of off-the-shelf board level architectures. In fact, nearly every major VME board manufacturer has introduced a product with at least one PMC slot on it. PMC boards offer greater functionality due to their modularity and ability to take advantage of the wide range of chip-level components available for the PC market.

The open PMC standard also allows equipment buyers to purchase modules with a variety of different communications interfaces, thereby changing the ìfunctionalityî of a base board depending on what type of PMC modules are applied to it. For example, application-specific functionality such as SS-7 links, LAN interfaces and WAN interfaces can be added to standard boards by using PMC modules, at a much lower cost than purchasing a separate VME board.

Other reasons for the popularity of PMC is speed; the 32-bit synchronous interface has a theoretical bandwidth of 132 MBps and an upgrade path to 64-bit data transfers that will allow speeds to approach 264 MBps. In comparison to VME, itís easy to see why a designer would place their highest speed interface on a PMC board instead of a VME board. The PMC bus can also be employed in proprietary systems, allowing the proprietary architecture to be used for communication between boards within the system, and the PMC boards to add application-specific functionality. PMC boards also donít use any of the VME bus bandwidth or consume a VME bus slot. As a result, bandwidth can be reserved to synchronize processes between intelligent VME boards rather than as a means to move large blocks of real-time data to and from the processor board. This high-speed bandwidth is also needed to handle high speed interfaces like 155 Mbps ATM.

Enter CompactPCI

While VME is clearly the dominant open bus architecture for real-time systems in the Intelligent Network, CompactPCI is certainly a technology to watch. In one way, most VME CPU vendors have already acknowledged the importance of the PCI bus. From an appearance perspective, the VME and CPCI buses use the same Euro-card-style packaging. Both come in 3U and 6U versions. However a CPCI board uses a dense 2mm connector that can be front-loaded into a rack-mount system, providing greater rear panel I/O. The CPCI data bus is 32 or 64 bits wide with a theoretical top speed of 133 MBps for 32-bit transfers and 266 MBps for 64-bit transfers

One advantage CPCI has for the board and system supplier is that the same electrical PCI bus used in personal computers is used both as an on-card bus and as a system bus for CPCI cards. This means that CPCI manufacturers can take advantage of all the chip sets available for the PC market, allowing users to take advantage of new technologies quickly. It also lets designers simplify their system integration headaches through the use of system-oriented concepts like plug and play.

One application where CPCI is likely to grow is in Computer Telephony Integration (CTI) applications. These include such functions as voice mail and interactive automated phone attendants. Since CTI applications are largely PC-based today, they can easily be migrated to a PC in the CPCI form factor and bus architecture providing the scalability required for high-end CTI systems.

System Design For Real Time

A major issue in telephony and Intelligent Network applications is the ability to transfer voice and video data in a real-time, deterministic fashion. While VME and PCI are ideal control buses in telecommunications applications, they are less than ideal for delivery of voice data. As a result, thereís a trend toward the integration of subsystem buses like TDM buses or subsystem networks like ATM (Asynchronous Transfer Mode) which are designed specifically to handle real-time voice and signal data.

One local internal TDM bus architecture, the SC bus or SCSA, can handle up to 4,096 timeslots and offers a defined standard technology for putting signals across a P2 backplane in a VME environment. Conceptually, itís structured like a T1 or E1 where multiple voice circuits are multiplexed onto a single transfer medium. The primary attraction of a TDM bus over a technology like ATM is the ease with which data can be routed from a T1 or an E1 line onto the time-slots of a TDM bus.

Higher speed cell structure networks like ATM can be configured to operate in a variety of modes, allowing applications to make the most efficient use of available bandwidth. Advantages of ATM networks include: effective method of real-time data transfer; easy to make redundant; available in a variety of media, including copper and fiber; and superior scalability. Users can implement ATM 25 Mbit/sec, and then increase bandwidth as needed with very few changes to the application software. ATM at speeds of 155 Mbits/sec is currently available on a PMC module, and ultra-high bandwidth rates of 620 Mbits/sec (or OC12) will be available in the future.

By implementing a VME bus system for system control communications and either a TDM bus or cell-based ATM network for signaling, designers can get the best of both worlds ó the cost and flexibility benefits of a standard bus combined with the performance and determinism benefits of today's most advanced communications networks.

As open architectures continue to be employed in telecommunication applications as development platforms, system developers can take advantage of the modularity and the wide range of functionality available to test applications and get prototypes up and running. For example, if an application running on SS7 over a 56 KBps link needs to be bumped up to an ATM solution running on a 1.5 MBps over a T1, or even up to 155 MBps over an OC3 fiber, the the PMC modules can simply be swapped, without having to touch the base board architecture. Once the wrinkles are ironed out and the system is ready for high-volume production, modified standard product can be used to reduce overall system cost and get to market more quickly.

Open systems like VME, PMC and CPCI are well-suited to the communications market and will continue to grow as companies that once designed all proprietary systems realize the benefits an open system approach offers in meeting their customersí needs. Time to market, scalability and upgradeability have become big issues for the communications market, and open systems will continue to provide those advantages while allowing designers to tailor systems to their application needs.

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