

# **BANDWIDTH BLUES FOR BOARD VENDORS AND THE SOFTWARE THAT SUPPORTS THEM**

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## The collapse of CompactPCI markets and the threat to VME

As the quest for enhanced bandwidth continues in its inexorable path, the stage is being set for changes in the embedded merchant computer board marketplace that threatens to undermine a multi-billion dollar industry. Segments of the embedded merchant computer board market segment are under assault from different directions – and the need for enhanced bandwidth is the common denominator.

For several years, Embedded Market Forecasters' (EMF) research has alerted embedded vendors to the perils that a CompactPCI (cPCI) merchant board strategy entails. Although cPCI is an enabling technology that permits many PC-based tools and software to be ported to embedded systems applications, the market for cPCI boards remains small compared with PCI and VME merchant boards. Two reasons stand out to account for this fact.

First, there is no off-the shelf cPCI market. cPCI vendors have come forth to support EMF's forecast by reporting that virtually all cPCI board orders now are for custom specifications, and the board's value is very small compared to the overall system application. Second, and most important, cPCI found its greatest potential in the packet-switching applications of the telecom infrastructure. Herein, very clever embedded engineers found new ways to squeeze additional bandwidth out of a slot-limited technology in order to address the "access layer" requirements of the SS7 infrastructure. This market is collapsing as optical and switched fabric technologies better address service provider requirements.

Over the preceding three years EMF has watched wavelength division multiplexing (WDM) developed, tested and successfully deployed with optical routing technology that make unnecessary such behemoth hybrid technologies as SONET (and will shortly make unnecessary node-to-node packet switching). With wideband WDM (WWDM) capable of extremely large bandwidths, it is revolutionizing not only the telecom infrastructure but the Internet as well. The need for packet-based telecom/datacom technology will migrate to the gateways (unless optical technologies emerge for "last mile" applications).

2001 and 2002 has been disasters for cPCI vendors as massive cancellations have resulted from the collapse of "legacy" telecom applications (witness the collapse of Lucent and Nortel, while Ciena, a WDM manufacturer, is rebounding in a down marketplace). Service providers are foregoing the expansion of bandwidth-limited technologies, and the non-marketable services they provided in the Intelligent Network, for the enhanced bandwidth (and revenue-generating core services) that WDM optical technology provides.

cPCI, and the associated packet switching technologies contained therein, addressed the telecommunications "access layer" – a layer that is already saturated. Service providers understand (albeit late) that it's the "services layer" that constitutes the market opportunity – not the access layer.

The services layer runs off bandwidth and CPU cycles. In order to implement revenue-generating core services, service providers need more processing power – not additional

ports or channels. What the multiprocessing architecture requires is a high-bandwidth fabric to concentrate requests for services to the CPU pool.

It is EMF's view that only 10G Ethernet and WDM optical technologies can adequately address this need in the near term and in the foreseeable future.

## **Saving CPU cycles with switched fabrics – a new threat to the merchant computer board industry?**

VME, unlike cPCI, enjoys a growing marketplace thanks to an active VMEbus International Trade Association (VITA) that helps the industry to enjoy a diverse high-end marketplace for realtime, multiprocessing and complex applications. VME also has benefited from significant military COTS procurement. However, the appearance of switched fabrics to enable high-speed data exchange, by off-loading the need for CPU control, has the potential to create havoc for even VME-based systems.

The VME marketplace is characterized by a large group of embedded board vendors serving the needs of a diverse marketplace dominated by telecom, industrial automation, and military vertical markets. As structured, the market for VME products is not dominated by any individual processor, operating system or tool set. This healthy division of the market creates the need for niche products by smaller vendors to meet the needs of the larger board manufacturers whose overhead would be prohibitive to developing such products on their own.

What makes this market segment function is the VITA Standards Organization (VSO) that insures the compatibility and interoperability of merchant boards across a range of processors, mezzanines and interfaces.

Enter the emergence of switched fabrics that enable high-speed data exchange, by off-loading the need for CPU control. According to Ray Alderman, executive director of VITA, there are now at least 62 versions of switched fabrics available for embedded applications! Clearly, this insanity will dissipate and the number of usable switched fabrics will be reduced to a handful. Notwithstanding, it appears that the fabrics that have the greatest chance of survival will create a processor-specific segmentation of the embedded board market. EMF believes that this segmentation, should it occur, would create a fragmentation of the board business.

The fragmentation at the processor local bus level (i.e., Intel Pentium and InfiniBand, PPC and RapidIO, AMD processors and Hypertransport, etc) can lead to a fragmentation at the mezzanine card level. In the fragmentation scenario, a fabric, a processor-specific local bus, a local bus-specific mezzanine card, a particular processor chip, and a specific software model (including drivers and kernels) will eventually be linked inseparably to each other, causing the market to fragment into the specific semiconductor segments, and consequently, specific board segments. Board-to-board interoperability will be lost as this trend progresses.

The common and popular PMC mezzanine card will lose its luster. A fabric that uses PCI as the on-ramp to the fabric will suffer from the antiquated software and associated overheads of PCI, as well as latencies through the bus buffers to get onto the fabric. Moreover, the availability of PCI chips in current use may disappear as foundries look to emerging market potential for chips based on the announced local bus technologies for each processor.

Alderman points out that in order to properly implement the new fabrics, local buses, mezzanines, etc, new packaging mechanicals, cooling techniques, power distribution methodologies and gigabit signal integrity solutions (i.e., connectors) must appear in a well-accepted standard that is recognized worldwide. All fabric implementations done with older technologies and techniques are simply transitional steps. The one exception is military legacy demand where the military is most likely to implement hybrid solutions and keep a great portion of their legacy backplanes, packaging, and software. Telcos have no motivation to retain legacy implementations as new services and higher bandwidths are required.

## Conclusion

Whereas the emergence of unlimited bandwidth will create expansive markets for innovative embedded products (and the associated tools, configurable and re-configurable processors and API's) the technologies that emerge to generate such bandwidth also carry the seeds of destruction for certain established markets.

These possibilities have far reaching consequences across the entire embedded marketplace.

The lessons learned herein include the need for a strong and industry supported professional associations that will establish and enforce standards that assure inter-compatibility and preserve healthy markets. Another lesson learned is that it is essential for embedded vendors to be aware of trends and breakthroughs in other embedded market segments if they are to survive in this expansive and rapidly changing marketplace. That is the role of market research.

*Embedded Market Forecasters is the embedded market research division of American Technology International, Inc. Dr. Krasner is the EMF director.*