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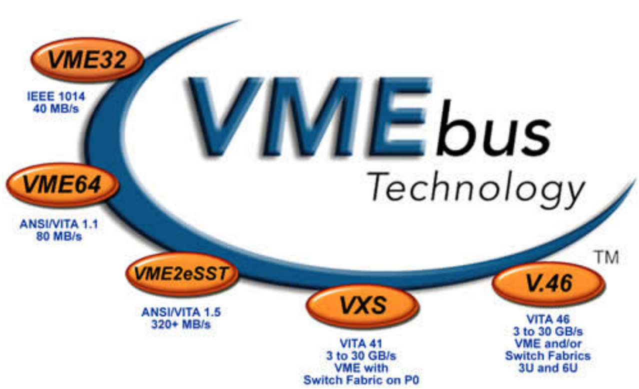
# VMEbus and Beyond: The Next 25 Years

*by Valerie Andrew, Strategic Marketing, ACT/Technico, Warminster, PA, August 2006*

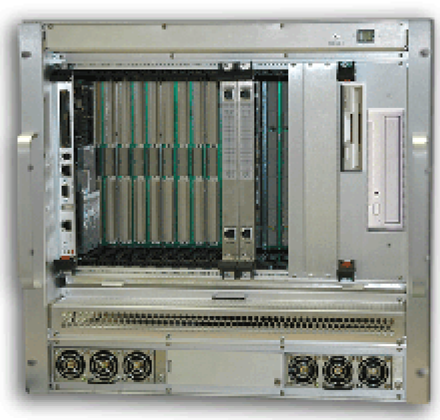
## What Does the Future Hold for VME and VITA?

While one of the many strengths of VME has been the robust nature of its parallel bus architecture, particularly in hard real-time environments, it is bandwidth limited by its design. The extension of the parallel bus via 2eVME then 2eSST (ANSI/VITA 1.5-2003) widens that bandwidth considerably for the vast majority of applications. Other impediments to the architecture had not been solved for the traditional VME environment, such as serial fabric networks, hot swap and system or platform management. Fabrics have introduced some significant advantages in data rate transfers, particularly at 1 Gb and up. PICMG 2.16 broke the first parallel + fabric threshold, enabling the use of both buses. On the PICMG side, ATCA and now MicroTCA have extensively addressed other requirements such as system and platform management. The new VITA standards offer that same future path for VME users via VITA standards 31.1, 41, 46 and beyond. This is where the next generation of standards are forging the future path for VITA and ultimately for VME. (*VITA roadmap*)




## ANSI/VITA 31.1: Ethernet on VME64x

The story begins in 2003 with the adoption of ANSI/VITA 31.1, Ethernet on VME64x. This standard adopted PICMG 2.16, which uses a P3, a 2 mm center connector, for Ethernet fabric switching. VME64x added the same metric connector in between the J1 and J2 DIN connectors and called it the P0. Only GND pins were originally assigned, which left the rest to be defined as required for additional I/O. ANSI/VITA 35 later defined all but 31 of the P0 pins for routing of the PMC P4 connector. This made it relatively easy to implement this improvement to the VME standard, with a backplane change of some sort. The Ethernet fabric is implemented via the P0 connector, becoming the data plane of the system. All slots can now communicate with each other at near wire speed. The parallel VMEbus remains the control plane for out of band operations when required. Both single and dual star topologies are supported; the dual star topology can be used to eliminate any single point of failure. (*Figure 1 shows a VITA 31.1 development chassis*)

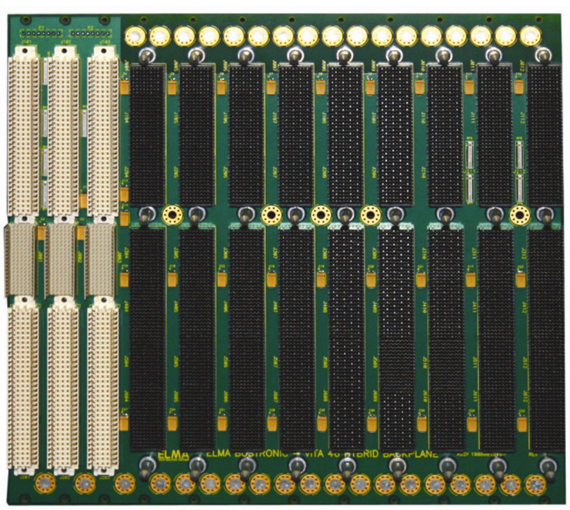


While VITA 31.1 may be an interim migration solution toward serial buses, it offers a quick and low cost upgrade opportunity to programs which otherwise could not afford to change. It has been used in military research labs for image processing on UAVs (Unmanned Aerial Vehicles), and on experimental unmanned ground vehicles for data collection in the DARPA Challenge, a military sponsored race to promote development of new technologies for future combat vehicles, last held in October 2005.

## VXS (ANSI/VITA 41) VMEbus Switched Serial

Like VITA 31.1, VXS adds a P0 connector between the J1 and J2, but it is a 7-row MultiGig connector. This connector adds high speed differential connectivity to address higher speed serial switching requirements of fabrics such as InfiniBand, Serial Rapid I/O, PCI Express and 10 Gb Ethernet. VME legacy boards without a P0 connector can be inserted in the backplane, thus providing a measure of backward compatibility. The switch slots are vastly different than the current VME slots – they use an entire row of the MultiGig connector. VXS also calls out live insertion and alignment mechanisms for VXS boards, and various system management protocols are being examined in working groups. By combining this access to very high speed network switching options while preserving the legacy VMEbus, VXS provides great choices for embedded computing designs of all kinds, such as radar image capture and processing, military communications networks, and so on.

ANSI/VITA 41.0 has recently been approved and appears to hold the most promise for the future of interoperable VITA standards; several "dot" specs in VSO (VITA Standards Organization) working groups are addressing very high speed requirements such as radar applications, data analysis, and image processing. There is an interesting draft for a 4x redundant, full processor mesh implementation of VXS (VITA 41.7 draft) that would enable relative slot-to-slot bandwidth rates of up to 7.5 Gbytes/sec – faster than the estimated rates of the costlier VPX (VITA 46) standard, which has been calculated around 5 Gbytes/sec. It effectively increases the number of switch slots to five slots, 3 more than is currently available.



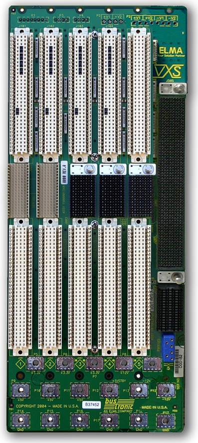
(*Figure 2 – hybrid backplane layout, courtesy Elma-Bustronic*).

Another draft extension, VITA 41.6, would add a Gigabit Ethernet Control Plane on the backplane. This control plane would handle all local control and system setup operations, enabling system management options that won't require additional pins nor interfere with the switch fabric network. Hybrid backplanes are now available that accommodate both legacy VME slots and the new VXS boards.

## VPX (VITA 46)

Where VXS uses the 7-row MultiGig differential connector only in the P0 and switch slots, VPX also uses 6 of these connectors, plus three alignment and keying blocks per slot. The row of MultiGig connectors significantly increases the available pins from 205 on VME64x to 328 in a VPX slot, thus greatly increasing the number of pins that can be user defined. This is very good for customizing applications, yet poses a challenge to maintaining industry interoperability. The backplane also allows for very high power capacities, and excellent ESD and grounding elements have all been incorporated into the draft standard. While the backplane and boards for this new standard are mechanically incompatible with legacy VMEbus, it is electrically compatible, thus allowing for certain applications where a custom backplane could be designed to accommodate legacy and new VPX boards. There is also provision for a 3U version of VPX. VITA 46.1 allows VPX to offer support for parallel VME64x cards by use of a hybrid backplane. Only time will tell how popular this sort of system will be.

Like VXS, there is support for a full mesh fabric in a system. In practice, although VPX supports as many channels as a VSX switch card, all early designs confine the fabric to the P1 connector position. This allows support of only up to 4 channels, with the rest of the differential pairs being devoted to various I/O uses. One note however, is that VPX is not yet an ANSI/VITA approved standard - it is still a working draft document. (*Figure 3 – VITA 46 backplane example*)



The target markets for this new standard are firmly planted in military and aerospace applications, where very high speed data processing and other heavy use of I/O is required in primarily harsh environments, such as mission critical systems on air and ground vehicles. This is by far the costlier solution of the three standards mentioned above, but perhaps far less expensive than the custom designed systems it is intended to replace.

## Other VITA Standards in Progress

Several other standards are in active mode in multiple working groups. To name just a few:

VITA 48 seeks to supply innovative cooling solutions for existing boards in systems with significant cooling requirements, including liquid flow through cooling.

VITA 52 was established as a working group for the military and industry to work together to insure a relatively smooth transition to lead free electronics.

VITA 58, very simply put, is examining a modular chassis standard for housing electronic boards in mobile and harsh environments. Its use could be widespread across several markets and industries: military vehicles, seismic testing equipment, commercial vehicles, and petrochemical control systems. This standard promises to attract much more discussion and debate in the near future.

VITA is in its most active state in years, and exciting new standards are emerging. New standards working groups are actively seeking better performance characteristics for new designs while keeping the legacy infrastructure in mind. While VITA is celebrating 25 years of the VME standard, it is preparing for the next 25 years through innovative and solid new standards. Whoever assumes that VME, or VITA for that matter is dead will be pleasantly surprised.

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## About the Author:

Valerie Andrew manages strategic marketing for ACT/Technico. She has worked in various positions in sales, product management and strategic marketing. Valerie is a 20-year veteran of the embedded computer industry and has worked with ACT/Technico since the early 1990s. Active in the VITA organization, she worked with the trade association to help found the VITA Marketing Group, which works to help promote VME and VME-related standards and technologies. Valerie holds a bachelor's degree with a double concentration on economics and international relations from Knox College.

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