Back to the future

Thirty years after its launch, the VME system remains the backplane of choice in many applications. By **Graham Pitcher**.

The KC46 tanker, set to replace the long serving KC135, will use five VME chassis in the refuelling boom guidance system
Pic: Boeing

It is highly unlikely that electronic components introduced in the early 1980s are still being specified by designers. Yet 30 years after its introduction, the Versa Module Europe format – VME – continues to generate annual sales of around $500million for suppliers.

Ray Alderman joined the VMEbus International Trade Association, or VITA, in 1990 as its technical director and is now executive director. He said that, in the early 1980s, VME was essentially a 16bit technology. "But it was designed to use 3U or 6U Eurocards and 3U was a great foundation for 16bit."

However, VME systems in the early days were not particularly sophisticated. "They were messy," Alderman recalled. "For a while, I/O was being taken in through the front panels, although that changed to using user defined pins at the rear."

But VME has, in Alderman's words, 'hung around'. "The reason? Because it was designed properly," he believes. "Those who developed it had a vision; they knew clock speeds would increase, they knew I/O density would increase and the standard accommodated all these changes. VME got a good foundation from good thinkers. It was then, and is now, the only hard real time deterministic architecture."

Time to reach a tipping point

Nevertheless, it took some time for VME to reach what could be termed a 'tipping point'. One of the first successes for the technology was as a replacement for Digital Equipment's PDP11 minicomputer in industrial control applications.

VME board brings 600% performance boost

The 6U VME64 SVME/DMV-194, based on a Freescale Power Architecture QorIQ P2020 processor with dual 1.2GHz cores, delivers six times the compute performance that was available from earlier VME designs, at nearly the same cost. This air or conduction cooled single board computer is suitable for upgrading weight, power and cost constrained systems based on older PowerPC or Power Architecture processors.

The board also allows system integrators to undertake cost effective technology insertion upgrades of legacy VME systems. Designed especially for demanding military systems that require maximum processing in extreme temperature conditions, the board typically consumes 25W.

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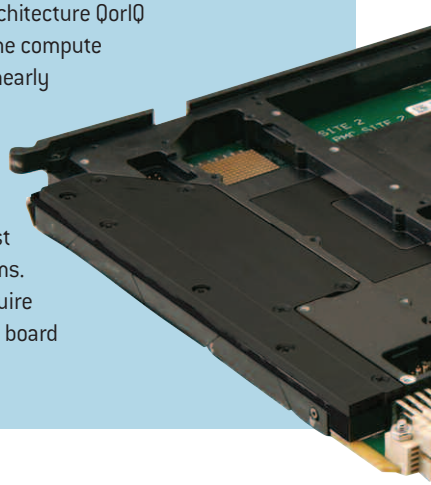


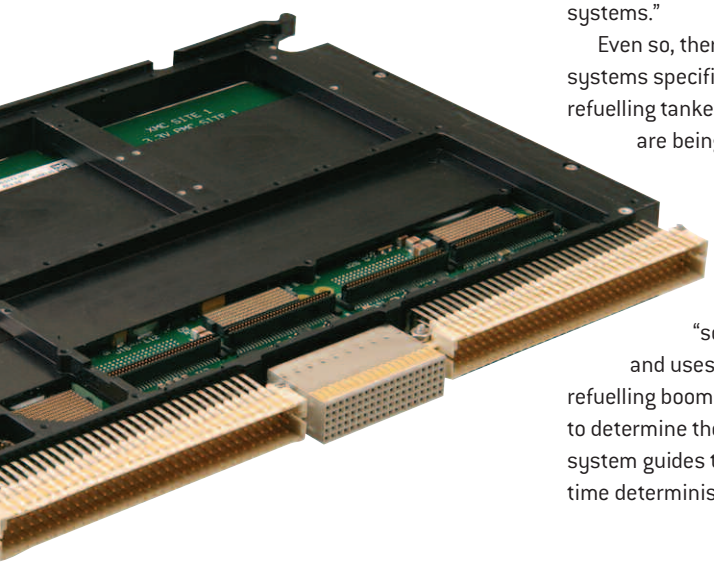
"PDP11s were expensive and created all kinds of problems," Alderman recalled. "In order to develop solutions, you had to be a DEC partner. VME, by contrast, was open – there were no constraints. That allowed people to think and to solve problems."

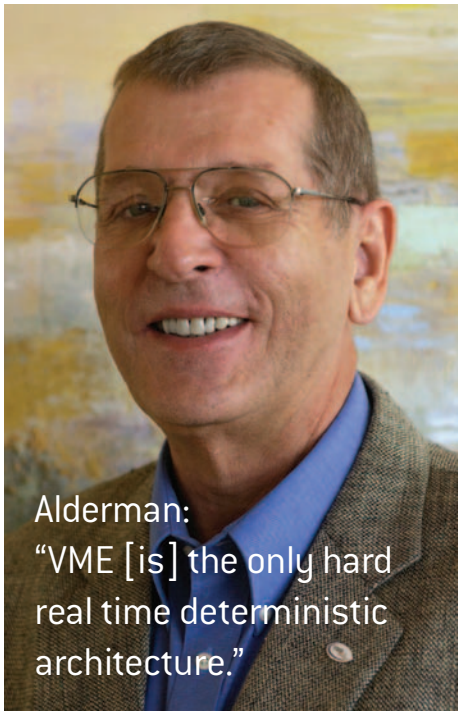
One of VME's initial successes came in the telecomms market, where it was a basic technology in use with Ericsson. "But it also became the architecture of choice for military applications," said Alderman, "because VME supports hard real time operation."

In the early days of VME, boards were predominantly based on the Motorola 68000 processor. "By the mid 1980s, that had got to the point where it could move to 32bit," said Alderman. "The higher clock rate is what put VME on the map." And by 1987, things were taking off. "The availability of the VxWorks and pSOS real time operating systems helped and the ecosystem came together, with hundreds of companies seeing opportunities." That pushed VME sales beyond the $1billion barrier for a number of years.

VME was also processor agnostic, said Alderman. "You could use pretty much whatever processor you wanted and each different processor addressed another market segment." This expanding footprint saw VME taking a horizontal, rather than a vertical, approach. "It's a classic example of what open systems can do," Alderman reflected. "The future of VME was not dictated by one company."

It is testimony to the technology's longevity that, even today, more than 400 military programmes remain based on VME. Alderman continued: "When you're tracking a target using





Alderman: "VME [is] the only hard real time deterministic architecture."

radar, it's a closed loop real time process; you have to get it right or you will miss. These applications haven't changed very much."

And, despite the fact the basic approach is 30 years old, VME looks set to continue serving military applications for some time yet. Alderman believes that, apart from VME being the best solution, the military – primarily in the US – doesn't have the money to do what he termed 'fork lift' upgrades, or install completely new systems. "Fabric based architectures won't work in military applications," he claimed, "so we'll see a huge number of upgrades to existing systems."

Even so, there are likely to be new VME systems specified. "Take the KC46 aerial refuelling tanker," said Alderman. "Six of these are being built in the next three years and each will have five VME chassis."

The KC46 is a replacement for the venerable KC135 tanker. "In the KC135," Alderman said, "someone lies in the aircraft's tail and uses two joysticks to steer the refuelling boom into place. The KC46 uses lasers to determine the plane's position and the VME system guides the boom into place. It's a real time deterministic application."

The VITA Standards Organisation (VSO) is VITA's standards development arm, providing a platform for companies to develop and promote new open standards. One of these is VPX, which provides VMEbus based systems with support for switched fabrics. "Where VME is event driven," Alderman explained, "VPX is data and algorithm driven, so VPX is replacing VME in such applications as radar and signals intelligence. But many of these VPX systems are supercomputers in a box – and with a similar price tag."

Steve Edwards, chief technology officer for Curtiss-Wright Controls Defense Solutions, said that, while VPX is newer, faster and more rugged, VME is still a force to be reckoned with in the embedded COTS defence and aerospace market.

"With a huge installed base and military programme lifecycles that frequently range from 10 to 20 years, demand for VME boards will continue for a long time to come," he noted. "As military budgets favour the upgrading of existing systems, the enormous quantity of deployed VME backplanes offers a great opportunity for technology refresh, replacing old technology with new cards that add faster, larger multicore processors without greatly burdening the existing thermal envelope."

Even after market consolidation over the years, there are still around 150 companies supplying VME technology. "The domain isn't shrinking," Alderman pointed out, "but it's mainly about addressing US based military applications."

So why haven't technologies like Compact PCI (CPCI) taken over? "CPCI has limitations," Alderman claimed. "For example, it uses a synchronous bus and it has bandwidth limitations. With VME, you can bring streaming data in on the P0 connector at up to 5Gbit/s. CPCI is limited to 1Gbit/s on the 2mm hard metric connector."

The growth of VPX based systems is being accommodated with hybrid backplanes. "If you do want to use VPX in some form, then you can have a backplane which accommodates both," he said.

"VME is what it is," Alderman conceded. "It's unlikely there will be many more enhancements. We might change the P0 connector for a higher data rate, but what you see is what you get."

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