Solving vendor lock-in in VME Single Board Computers through open-sourcing of the PCIe-VME64x bridge
Outline

• What is the VME standard?
• What happened in 2015?
• Open-source VME bridge
• Conclusions
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What is a VME standard

- Modular electronics from 1980s
- Master – Slave architecture
- Shared parallel bus
- Maximum rate 80MB/s
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- Modular electronics from 1980s
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- Still widely used in research and military
- 900 VME crates in CERN accelerators
- 200 new crates to be deployed in 2019-2020

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VME Single Board Computer

PC running an operating system (e.g. Linux)
- x86 / PowerPC processor
- DDR memory
- USB, Ethernet interfaces
VME Single Board Computer

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Expanded with
- VME connector
- PCI/PCIe-to-VME bridge

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Why is VME still alive?
Why is VME still alive?

- Already existing investment
- Long lifetime of electronics
- Custom designs for critical systems
- Sufficient performance
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IDT TSI148 story

- TSI148 is a PCI to VME bridge
- was the de-facto standard found in many SBCs
- including MEN A20 deployed widely at CERN
- until IDT decided to discontinue it mid-2015

- SBCs used at CERN could not be produced anymore
- and we continue getting requests from CERN users
CERN’s call for tender

Possible options:
1. Secure enough stock of TSI 148 chips
2. Use Tundra Universe II
3. Implement an open-source FPGA bridge

The cheapest offer:
CERN’s call for tender

Possible options:

1. Secure enough stock of TSI 148 chips
2. Use Tundra Universe II
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The cheapest offer: MEN A25
MEN A25 Single Board Computer

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Bridge characteristics

- 30% of Intel Cyclone IV FPGA resources

**Supports:**
- VME single cycles
- VME block transfers (DMA)
- Geographical addressing
- CR/CSR configuration space

**Does not support:**
- VME extensions for fast transfers (2eVME, 2eSST)

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FPGA-based implementation

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FPGA-based implementation
Bridge sources

VHDL published under GPL3-or-later license:
• Full VHDL sources of the design
• Set of VHDL testbenches

Software package published under GPL2-or-later license:
• Linux kernel drivers
• FPGA loader tool
Conclusions

• VME is still alive
• Open-source VME bridge for new CERN deployments
• Solves VME bridging problem for everyone
• ... and forever
• Anyone can produce a compatible SBC
• Anyone can add new features

• Let’s build a community around it!
   https://www.ohwr.org/projects/pcie-vme-bridge