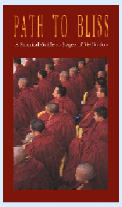

Generic VME Interface for Linux 2.6 Kernels

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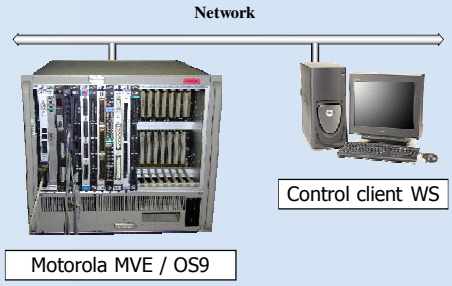
BLISS

ESRF Control System Evolution: from OS/9 to Linux

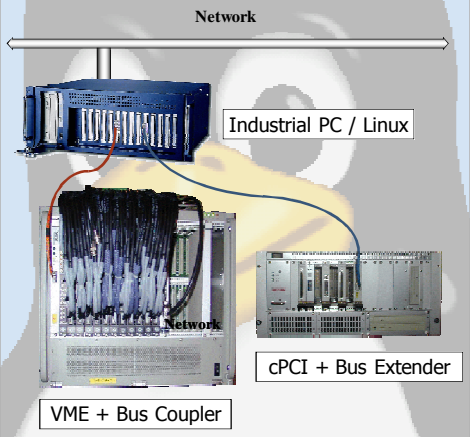
Original: Machine and Beamlines

- VME-based instrumentation
- Motorola 68000 CPU, 33 MHz, OS/9, 10 Mbps running TACO device servers
- HP/Sun workstations with TACO clients.



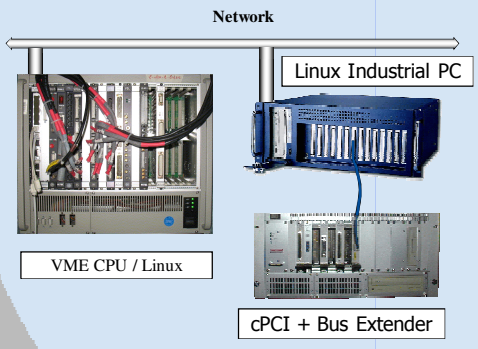
Evolution on the Beamlines

- Connect VME crates with PCI/VME bus coupler (SBS Bit 3) to industrial PCs with Intel Pentium III 1GHz running Linux (SuSE 7.2, RedHat EL 4)
- Using PCI and cPCI hardware via PCI/cPCI bus extenders.

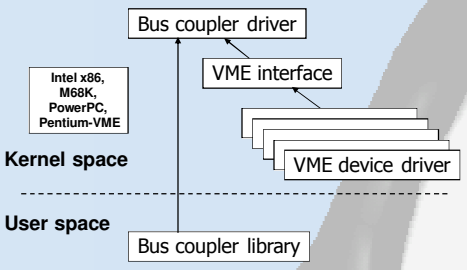


Evolution on the Machine

- Replace Motorola CPUs with Concurrent Technologies' VP101s running Linux (Debian 3.0, RedHat EL 4) and using Tundra Universe PCI/VME bus coupler.
- Also use Linux on Intel Pentium III industrial PCs
- cPCI crates and PCI/cPCI bus extenders



VME software layout for Linux 2.4



Limitations:

- Platform specific code implemented in C macros:
  - Cryptic code
  - VME device driver binary code highly dependent of bus coupler implementation
- Existing VME devices defined in driver *insmod* command line ⇨ must stop the driver (and applications) to add new boards.

New VME implementation in Linux 2.6:

Bus/device Abstraction

- New bus type = VME (like PCI,USB,…)
- Multi-bus (for SBS Bit3): /dev/vme0, /dev/vme1, …

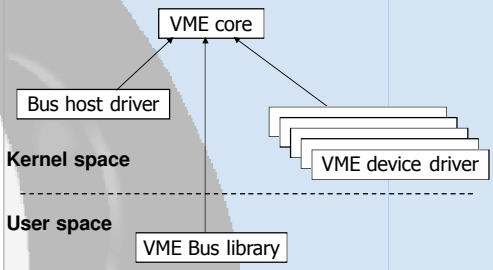
Full sysfs (/sys) integration

- Bus / host resources: mem. maps, IRQ
- VME device: config and IRQ statistics
- Class device + udev: /dev/vpap_01, …

Hot-plug (SBS Bit3)

- Automatic device detection through *probe*
- Detect bus coupler disconnection (IRQ)
- Automatic reconnection by status poll kernel thread

VME software layout for Linux 2.6



Independent host and device drivers

- New host available: probe registered driver devices
- New driver registered: probe on existing hosts

VME bus generic library

- Allows user-space drivers

Interface version checking

- Verify binary compatibility (independent packaging)
- Core interfaces: bus host, device driver, library

Additional features

Multi-CPU (SMP)

- Efficient and hot plug safe
- Event wait (IRQ): a waiting process is woken up and notified if the device disappears (disconnect)
- Multi-thread lock (semaphore): also support a thread blocked because another thread is waiting for an event

Concurrent VME host access

- Can be used by the host user space library
- At the same time, is accessed through the VME subsystem
- Locking mechanisms are provided to the host driver to avoid conflicts

Installation status

On the Beamlines:

- Linux 2.4 (80 %):
  - 63 VME crates, controlled by
  - 49 industrial PCs
- Linux 2.6 (20 %):
  - 15 VME crates, controlled by
  - 11 industrial PCs

On the Machine:

- Linux 2.4:
  - 49 VME crates (90 %)
  - 5 industrial PCs (PCI/cPCI)
- Linux 2.6:
  - 5 VME crates (10 %)
  - 59 industrial PCs (PCI/cPCI)
- More and more Tango device servers

Remains to be done

- Write the documentation
- Put the project code on Sourceforge
- Implement generic DMA access
- Integration into fast acqisition architecture (Hook)
- Port to recent kernels (currently runs on 2.6.9)

Acknowledgements

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