Hardware Developed at Budker Institute with Tango servers

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for Russian Tango Users Meeting 2017
CAMAC — more than 40 types of modules

VME — 8 types of modules

CAN-BUS — more than 48 types of modules

Systems on board

VME-64 BINP

cPCI - 5 types of modules
CAMAC — more than 40 types of modules

VME — 8 types of modules

CAN-BUS — more than 48 types of modules

Systems on board

End of Service?
CAN-BUS
CAN-BUS

CANADC40 — 40-channel ADC with I/O registers
CANDAC16 — 16-channel DAC with I/O registers
CDAC20/CEDAC20 — precision DAC and 5-channel ADC with I/O registers
CEAC51 — precision DAC and 5-channel ADC with I/O registers
CEAC124 — precision 4-channel DAC and 12-channel ADC with I/O registers
CEAC121 — precision 1-channel DAC and 12-channel ADC
CAC208/CEAC208 — precision 8-channel DAC and 20-channel ADC
CAC168 — 8-channel DAC and 16-channel ADC with I/O registers
CEAD20 — 20(40)-channel precision ADC with I/O registers
CGVI8 — 8-channel programmable delay line with I/O registers
CPKS8 — 8-channel PWM module
SLIO24 — interface CANbus — 24-bit parallel bus
VSDC2/3 — precision digital integrator with CAN and VME versions
CAN-BUS

CAN over Ethernet
2 isolated CAN ports
Ethemet, RS232
PowerPC
32 Mbytes RAM, 
Embedded Linux
PC libraries
(can4linux driver)

VME-CAN
2 isolated CAN ports
(can4linux driver)
Tango support for CAN devices

Pulsed power supply
Device class

CEAC-124
Device class

*handler()

CGVI-8
Device class

*handler()

send()

can-wrapper (static library)

send()

can4linux

socketcan?
Systems on board

Beam position monitor
Processor (VEPP-4)

NICA RF Controller
Tango for Systems on Board

Device Class

System on board

Ethernet

?
Tango for Systems on Board

As most of the embedded TCP/IP stacks are specific, middle industrial PC with «full-scale» OS is required
Tango for Systems on Board

«Full scale» OS could be run on separate core of the multi-core processor
VME-64 BINP

VME-64 CERN
VME-64 BINP

21 Slots
VME-64x compatible
64 RIO lines
Inter-module synchronisation:
System clock 125 MHz
Precise individual starts
UserClk
Daisy-chain lines
400 Watt power supply
Health monitor with individual CAN-line
VME-64 BINP Modules

BIVME-2 controller
Motorolla MC68EN360
32 Mhz
16 Mbytes RAM
128 kbytes BootROM
8 Mb flash
1 Ethernet 10base-T
2 RS232
VME-64 BINP Modules

**System timer**
- 9 optical outputs
- Delay measurement
- Master clock and event transfer
- 4 ns clock precision

**Local timer**
- 1 optical input
- Delay measurement
- Clock syntonisation
- Event decoding
- Output clock 125 MHz
- Output user clock
- 8 trigger lines
- In/Out cross-commutation
**Delay line**
16 + 8 channels
4 ns precision
17 s range
125 MHz synchronisation

**RIO module**
16 isolated outputs
$I_{out} = 200$ mA
0.5 us width
5 ns front
Short-circuit protection
VME-64 BINP Modules

Platform
- 4 ADC with 450 MHz bandwidth
- 12 bit precision
- 3 Mwords memory
- Internal 250 MHz clock
- Jitter 0.7ps
- VME-Binp synchronisation

ADC4x250 – 4ch
- 4 synchronous channels
- Ranges: ±0.5, ±1.0, ±2.0, 4.0 V
- Bandwidth 80 MHz
- ENOB – 10.1 bit @ 11 MHz
- Memory 0.75 MWords/Channel
- On-board calibration

ADC4x250 – 1ch
- 1 channel
- Ranges ±0.5, ±1.0, ±2.0, 4.0 V
- Bandwidth 300 MHz
- ENOB – 7.3 bit @ 110 MHz
- Memory 3 Mwords/Channel
- On-board calibration

ADC4x250 – 4ch-optic
- 4 channels (current), 2 ranges, bandwidth 100 MHz, photodiode current compensation
VME-64 BINP Modules

**VME ADCx32**
- 32 channels (4 multiplexed ADC`s)
- Max speed 1 MSPS
- Ranges: ±0.5, ±1.0, ±2.0, ±4.0 V
- 12 bit ADC
- Differential inputs
- Programmable channel sequencer
- 80 kWords/channel
- VME-BINP synchronisation
- Post-Trigger mode
- Built-in calibration
- RIO-module available
VME-64 BINP Modules

VSDC-3 Precision digital integrator
2 channels
Ranges: ±0.2, ±2.0 V
Absolute error @ 50 ms 5e-5
Absolute error @ 10 ms 1e-5
24-bit ADC
ENOB @ 100 kHz 18 bit
ADC non-linearity ±2e-5
Sampling speed 312 kSPS
Synchronisation precision ± 1 ns
Tango for VME64-BINP

Device Server

- ADCx32 Device class
  - vme_read()
  - vme_write()
  - *handler()

- DL250-VME Device class
  - vme_read()
  - vme_write()
  - *handler()

- vme-wrapper (static library)
- vme-interrupts (static library)

- TSI-148 driver
- vmei interrupt driver
Tango for VME64-BINP

Device Server

vme-wrapper (static library)

semaphored read/write

Shared fd`s

TSI-148 driver

vme-wrapper (static library)

request for fd

fdsd (file descriptor sharing daemon)