Status of the Control System for the European XFEL

Kay Rehlich
On behalf of the FLASH /XFEL Controls Group
Hardware status:
- μTCA: First results @ FLASH

Software developments
- μTCA integration
- Middle layer services

Conclusions
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The European XFEL Project

Hamburg City Centre (7 km)
DOOCS Control System Architecture
One accelerator module with 8 cavities was controlled by $\mu$TCA™
- September 2011 (just before shut-down)

System includes:
- 3 slots with 16 bit ADCs, 81 MHz sampling (tot. 30 ADC channels)
- Down converter 1.3 GHz $\rightarrow$ 54 MHz as RTM (Rear Transition Module)
- Controller with FPGA, Giga links on backplane and front
- Vector Modulator for 1.3 GHz as RTM
- Timing AMC with trigger distribution on backplane

Implements new MTCA.4 standard
XFEL will be based on the new MicroTCA.4 standard
- Double size AMC modules with PCIe link to CPU
- Rear Transition Modules for signal conditioning
AMC and RTM:
~ 457 cm²

VME:
~ 345 cm²
FLASH jddd panel:

<table>
<thead>
<tr>
<th>ACC1 Operation (MicroTCA Version)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage: 150.00                MV</td>
</tr>
<tr>
<td>VSRreadback: 0.24 MV</td>
</tr>
<tr>
<td>Phase: 46.04dg</td>
</tr>
<tr>
<td>Error Msg: FSM.ERRORSlave:alive:...</td>
</tr>
<tr>
<td>FM on RF on FM is off</td>
</tr>
<tr>
<td>Feedforward</td>
</tr>
<tr>
<td>Feedback</td>
</tr>
<tr>
<td>LoopGain: 15.00 W</td>
</tr>
</tbody>
</table>

On-crest energy stability:

Energy stability \( \frac{dE}{E} = 5 \times 10^{-5} \)

SR-camera resolution limit

Energy stability \( \frac{dE}{E} = 5 \times 10^{-5} \)
2 radial clocks per AMC, Low jitter, configurable direction

8 bussed M-LVDS lines, For triggers, clocks and interlocks

To Timing Distribution

MTCA.4
New timing system
- Fiber optic links 1.3GHz
- with drift compensation
- AMC prototype is receiver and transmitter
- ps stability (< 5ps RMS)
- Clock, trigger and event distribution
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MicroTCA Remote Management

![Image of MicroTCA crate diagram]

October 11, 2010                     ICALEPCS 2011             Kay Rehlich, DESY
Online status of modules:
- Is-inserted, fault, …
- Temperatures, voltages
- Reset, power on/off
- Act. Power consumption
Runs on CPU:
- DOOCS device server
- Linux driver
- Hot-swap support: remove a module in a running system

Management Data is available in all applications

DOOCS xTCA IPMI Server

IPMI
The XFEL can produce 27 000 bunches per second
The DOOCS Data Acquisition Concept

Console Applications: access to all components

- ADC
- ∆φ
- Clock
- Trigger
- Event Number + Trigger
- Orbit Server
- Energy Server
- Other Server
- Feedback Server
- Buffer Manager Shared Memory
- Fast Collector
- Buffer
- DISK
- Tape
- DAQ

FLASH / XFEL
Dynamically placed elements

jddd workshop
Talk:
THBHAUST04
E. Sombrowski
Conclusions

- XFEL fast diagnostics and controls will be based on \( \mu \text{TCA} \)
- Successful system test of key MicroTCA modules (incl. 16 bit ADC) based on MTCA.4 standard
- MicroTCA integration in DOOCS demonstrated:
  - Hardware management
  - Hot-swap, Linux driver with DMA, device server
- Middle Layer Software:
  - DAQ system to collect distributed data
  - Slow orbit feedback attached to DAQ
- Applications created with jddd editor
- Test of XFEL Hardware and Software in FLASH
Thank You for Your Attention!

More Info:
http://doocs.desy.de