The design of the Alba control system

...software and hardware cost effective

D. Fernández-Carreiras.

on behalf of the Alba’s team
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Design choices

- Ethernet As A fieldbus
- cPCI and Industrial PCs (diskless for the accelerators) and with HD for the Beamlines
- Tango as a middleware, Sardana as the SCADA
- Mysql. Central Archiver for the machine handling about 10000 variables
- MRF (Timing),
- PLC based protection systems
- Central repository for the computing and control infrastructure (ccdb)
- Automatic code generation
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Ethernet as a fieldbus

- Homogeneous installation
- Reasonable installation costs
- Easy to maintain

IOCs, PLCs, Diagnostics, Basler GigE ccd cameras, Power supplies, Oscilloscopes, Motor controllers, Electrometers (J. Lidon WEPMS02)...

Application-specific hardware HVSpliters (J. Jamroz, WEPMS024)
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Tango Clients
Graphical interfaces, Command Line Interfaces, Config save/restore

IOCs. Remote booted. Tango Servers. DAQ.
Tango as a middleware
Tango as a middleware
Sardana as the SCADA


Real Time Hw, non deterministic Sw

- Timing System implemented on MRF hardware (O. Matilla WEPMS023, J. Moldes, MOPMU023)
  - cPCI form factor
  - About 100 EVR
  - Upgrade to implement fast interlocks (4 us) using the bidirectional fibers

- Independent PLC installation (Pilz, SIL3,) for the PSS interlocks
  - SafetyBus

- Equipment Protection System Implemented with B&R PLCs (WEPMS023)
  - Ethernet PowerLink

- Other applications like LLRF implemented with specific FPGAs (A. Salom and the diagnostics group)

- IOCs run openSUSE11.1 (few windows XP) standard distribution.
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Ethernet, VLANS and firewalls
Automatic code generation

- Great advantages!! Easier to develop, easier to maintain

- But, a big effort is needed to keep the central repository consistent.

- Although still a lot of coding has been needed!!
  - SVN, sourceforge, RPM (blissinstaller)
Central Repository

ccdb:
- Equipments, connectors and cable types,
- Instances of equipments and cables (naming conventions)
- Documentation files
- Installation logs
- Source for automatic code generation and creation of Tango devices

Next:
- Inventory. Manage serial numbers and integrate maintenance data
ccdb: The computing and cabling DB

- Web (in Plone at the moment) interfaced to a RDBMS mysql
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ccdb: The computing and cabling DB
• Automatic code generation. Tango devices and attribute names
Automatic code generation (PLC)

APJ file
PLC Common INIT file:
- Coms. Libraries (Modbus, EPL)
- Data structures
- Common variables
- Common SW tasks

XLS files
PLC documentation: I/F with devices, I/O channels assignment, etc.
PLC code generation:
PLC variables declaration
PLC Modbus mapping and variables allocation.
PLC standard services: disable and force variables, alarm/warning thresholds checking, permanent memory storage, etc.

ALBA ccdb DB
MySQL

XLS – VBasic script
VBasic

Modbus Device Server
AlbaPLC Device Server

PLC Programming SW
(B&R Automation Studio)

Modbus/TCP

TANGO
Lessons learned and Conclusions

• Ethernet as a fieldbus, provides, homogeneity and longevity.
  • Finding a balance between functionality and security is tough (firewalls)

  • Tango worked well as a middleware. The notification system (about to be replaced) was the biggest source of problems. Nagios helped out to keep it stable.

  • ccdb: A central repository for the installation is crucial and has to be given priority from the beginning.
    • A considerable effort is needed to keep it up-to-date.

  • Automatic code generation reduces errors, make subsystems easier to maintain

  • Using standard distributions (openSUSE, Ubuntu..) and diskless when possible makes the maintenance easy.

  • In most cases, deterministic requirements are successfully implemented by hardware (FPGA, PLCs., dedicated Communication).
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