Experiment Control System

SCADA and Framework demo

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November 2000
Generic Architecture

To Devices (HW or SW)

Control Units
- T.S.
- LHC
- GAS

Device Units
- Dev1
- Dev2
- Dev3
- DevN

SubSys Units
- SubSys1
- SubSys2
- SubSysN

ECS

Commands

Status & Alarms

DetDcs1
- DetDcm1
- DetDcmN

DAQ
- DetDaq1
- DetDaqN

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HW Architecture

- Storage
- Configuration DB, Archives, Logfiles, etc.
- Other systems (LHC, Safety, ...)
- Controller/PLC
- FieldBus
- Experimental equipment
- WAN
- LAN
- Technologies:
  - Supervision
  - Process Management
  - Field Management
- SCADA
- OPC
- Communication Protocols
- PLC
- Field buses
- Sensors/devices

SCADA = supervisory control and data acquisition
OPC = OLE for process control
PLC = Programmable logic controller
Field buses = CAN, Profinet, WorldFip, ...
The Control Framework

- Will provide guidelines and tools for the implementation of all components in the tree.

- Based on:
  - A Commercial SCADA Tool - PVSSII
  - +Additions (home made or commercial)
    - Finite State Machine Toolkit
    - Specific drivers
    - etc.
Control Framework

Tools for the implementation of Device Units

- PVSSII Tools for:
  - Device Description
  - Several Access Protocols
  - Alarm Generation Configuration
  - User Interface Editor
  - and also Alarm Display, Archiving, Logging, etc.

- Additional FSM tool for:
  - Device Behaviour and Integration in Hierarchy

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PVSSII Overview

- User Interface Layer
  - UIM

- Processing Layer
  - Ctrl
  - API

- Communication and Memory Layer
  - DB
  - DM
  - EV

- Driver Layer
  - D

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Data Point Concept

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Data Point Modelling

- Define type of Data Point

- Create Data Points

- Set Configuration Parameters

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DP Configuration

- default_value
- peripheral address
- message conversion
- command conversion
- smoothing
- PVSS value range
- user value range
- alert class
- alert handling
- DP function
- archiving
- authorization
- delete config
Graphic Objects

$\text{valve}$

$\text{valve}.\text{settings.opening}$

$\text{valve}.\text{readings.end\_position}$

$\text{valve}.\text{readings.malfunction}$

$\text{valve}=V1$

$\text{valve}=V2$

$\text{valve}=V3$

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Example:

- The Control and Monitoring of a Power Supply
  - Define the Structure of a Crate
  - Define the Access Protocol
  - Define Alarm Generation
  - Create a panel to visualize and act on the crate
  - Define the interface to the above hierarchy:
    - States it can have
    - Actions it can receive

- Already done: CAEN SY127 HV Power Supply
Controls Framework

**Will Contain:**

- Predefined (Configurable) Components, like:
  - Power supplies (CAEN, Lecroy, ...)
  - Electronics ECS Interfaces: CC-PC, SPAC, CCU?
  - Any other common items

- User Defined Components:
  (in order of integration facility)
  - Devices Accessible via OPC (Industry Standard)
  - CERN recommended Fieldbus nodes: CAN, Profibus
  - Other Devices

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Tools for Developing the Control Units:

- PVSSII Tools for:
  - Control Unit Description
    - Its Components: Devices and/or other Control Units
  - Alarm Handling
    - Filtering, Summarising, Displaying, Masking, etc
  - User Interface Generation
  - and also Alarm Display, Archiving, Logging, etc.
Tools for Developing the Control Units:

- Additional FSM tool for:
  - CU Behaviour and Integration in Hierarchy
    - Model the dependencies between components
    - Automate Operations & Error Recovery
  - CU Partitioning Rules
Partitioning

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Control Unit Operation Modes

**Normal Operation**
- Hierarchical control only

**Partitioned**
- No Hierarchical control
- Control from a “local” U.I.
Demo Architecture-DCS

DCS

Tracker

Muon

HV

GAS

HV

GAS

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Demo Architecture-Run Control

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Demo Architecture - Safety

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Control Framework

- Other Items that will be integrated:
  - Experiment Infrastructure
    - Rack and Crate Control
    - GAS Systems (GAS WG)
    - Cooling (?)
  - CERN Infrastructure (Data Interchange WG)
    - Technical Services
    - LHC machine
    - LHCb Magnet(?)

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The SCADA Contract has been signed

- It can be downloaded and used by all members of LHC experiments either at CERN or in their own laboratories.

PVSSII courses are available

- Please contact me
Conclusions

- The best way to achieve an homogeneous and maintainable control system (and to save manpower) is:
  - To do the maximum in common
    - The Controls Framework is being developed and will be used by the 4 LHC experiments (Joint Controls Project)
    - New “Devices” should be developed in a re-usable way and included in the Framework
  - To Standardize on HW choices as much as possible
    - So that common SW can be used

- Please contact us for HW choices
  (of potentially common items)
  - like: power supplies, Temperature Sensors, etc

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