Overview of DCS Technologies

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SCADA

- **Purpose**
  - Display, Archiving, Alarm handling, Access control.
  - User triggered actions.
  - Automatic actions.

- **PVSS pure vanilla versus Framework**
  - Additional functionality for
    - Operators (e.g. FSM)
    - Developers (e.g. panels).
Middleware

- ETM’s COTS
  - A few proprietary protocols
  - OLE for Process Control (OPC DA)
- Custom
  - DIM
  - Others
- In preparation (by ETM for CERN)
  - UNICOS protocol
  - Modbus TCP/IP
OPC Overview

Set of DCOM interfaces
- Data Access
- Alarms & Events
- Historical Data Access
OPC is client/server

OPC Client

OPC Server
  Process Data

OPC Server
  Process Data

OPC Client
OPC data model
OPC Data Access mechanisms

- Three kind of access
  - Read/Write
    - Synchronous/Asynchronous
    - Device/Cache
  - Subscription
    - Update rate
    - Dead band
  - Refresh

- Flags
  - Time stamp and quality
OPC in DCS 1/2

- COTS OPC DA servers
  - PLCs (Siemens, Schneider, Wago)
  - Fieldbuses (Profibus)
  - Devices (CAEN SY1527)
- Custom OPC DA servers
  - Standard ELMB
  - Old CAEN crates, ISEG, Wiener
OPC in DCS 2/2

- New COTS OPC servers
  - CAEN
  - ISEG
  - Wiener (PS and Fan tray)
  - PVSS (2.12)
- New custom OPC servers
  - Standard ELMB
OPC Trends

- New Specifications
  - DA 3.0, DX, Batch...XML

- Market
  - A lot of DA servers
    Fieldbuses, PLC, devices and SCADA
  - DA clients
    - SCADA
    - Other (office, expert systems,...)
  - Some A&E servers
DIM 1/2

- TCP/IP based middleware
- Publish/Subscribe mechanism
- Available for a large set of platforms and OS
  - VMS (VAX and APHA)
  - UNIX flavours (HP-UX, Sun-OS, Sun-Solaris, IBM-AIX, DEC-OSF, Linux)
  - Windows
  - Real-time OSs (OS9, LynxOS, VxWorks)
DIM 2/2

- Temporary JCOP solution
- Integrated in PVSS
- A FW component
- In production in many experiments
Modbus TCP/IP

- Based on the old TCP/IP
- A very simple protocol to read/write bits and registers.
- Specifications and sources available on Modicon web site.
Programmable Logic Controllers

- Diskless computers
  - Modules: I/O, Communication, others
  - Remote I/O
- Specific Software
  - OS, Firmware
  - IDE and Programming languages
- Domains: industrial control
  - Closed loop, regulation, safety
PLC in DCS

- **Recommended PLCs**
  - Schneider, Siemens

- **Others**
  - E.g.: Wago

- **Purpose**
  - Gas, Magnet, DSS, Cooling, ...

- **Integration**
  - OPC or specific PVSS drivers
PLC Trends

- HW evolution
  - CPUs, memory
- IT
  - OPC, Web, SNMP, Email
  - Open IDE.
  - Security
UNICOS

- An application framework
  - For both SCADA and PLC levels
- HW/SW
  - Schneider PLCs and PCVue32
  - Is being ported towards PVSS
- In DCS
  - For the Gas Control System
  - Others?
Framework content

**SCADA**

- Display types
  - Synoptics
- Trends (Predefined/Configurable)
  - Lists (Alarm, Event, Object)
  - Diagnostics, info
- Basic background design
- Display navigation facility
- Object presentation
  - Display element (color codes)
  - Faceplate
  - Online / History trend
  - Diagnostic screen
- Object selection mechanism

**PLC**

- Mode management
  - Manual, Auto, Forced, Local
- Activity state
  - On/Open. Off/ close, position
- Interlock, Warning status
  - Full stop, Temp stop, Start interlock, acknowledged
  - IO-error, auto/manual
- Output setting
Custom Front-End

- HW solutions
  - PC (Std, Industrial, Credit card)
  - VME
  - Other

- SW solutions
  - Integration of drivers
  - Device access strategy
  - Integration in PVSS
    - Communication (OPC, DIM, ...)
    - Configuration
Recommended Fieldbus

- **Recommended at CERN**
  - CAN: PS and ELMB
  - Profibus: Industrial control
  - WorldFIP: custom RT

- **Ethernet**
  - Complex devices
  - Distributed bus couplers
Fieldbus integration

- CAN: cards, OPC or PLC
- Profibus: cards, COTS OPC or PLC
- WorldFIP: an Ethernet gateway.

Ethernet:
- Proprietary protocol: OPC
- Modbus: OPC and PVSS Driver
Conclusion

- A large set of components
  the list is not exhaustive...
- A potential heterogeneity
- Frameworks are a solution