MICE Controls & Monitoring Overview

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Outline

- Purpose
- Design Philosophy
- EPICS framework
- Hardware
  - DL interfaces
  - Other interfaces
- Step IV IOCs
- Software
- Extensions + Config
- Network
- Higher Level Integration

Purpose

- Interface to MICE hardware for remote controls and monitoring
- Provide user interfaces via graphical user interfaces (GUIs)
- provide equipment protection via hardware interlocks and audible alarms in the MICE local control room (MLCR)
- provide data quality protection via audible alarms in the MLCR
- provide remote monitoring for MICE collaborators not in MLCR
- provide archiving of experimental parameters and tools to view them
- send automated SMS messages to system experts in emergencies

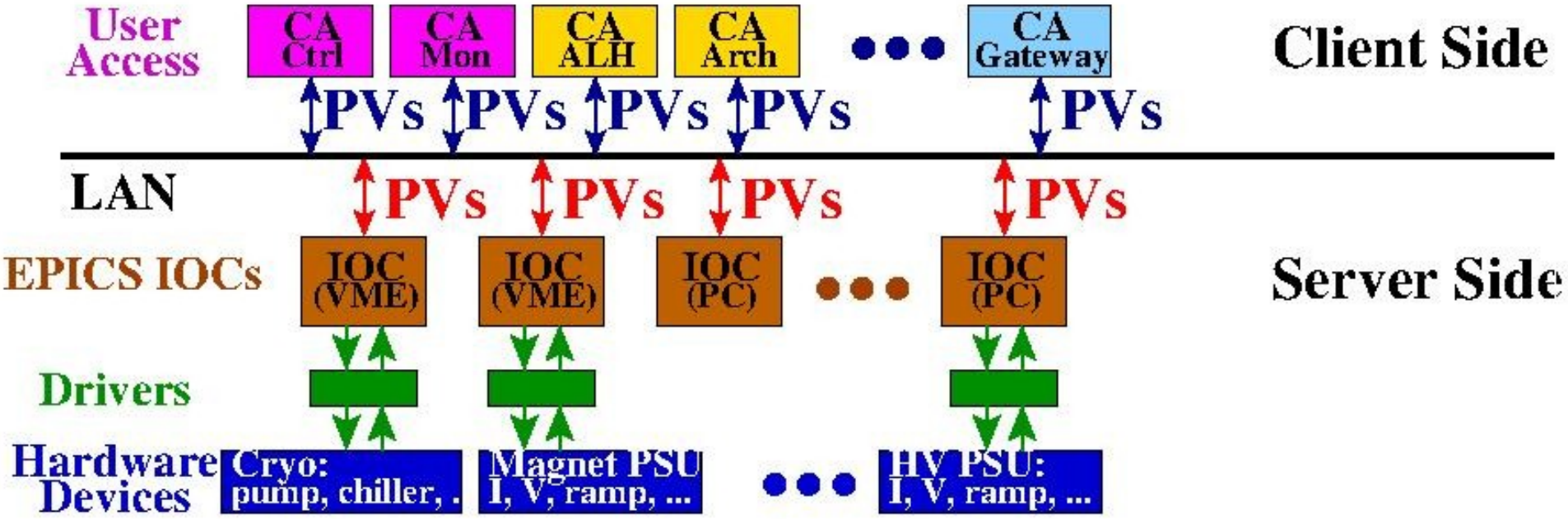
MICE Note 431: http://mice.iit.edu/micenotes/public/pdf/MICE0431/MICE0431.pdf
rewrite in progress to update and prepare for publication

Design Philosophy

Divide and conquer approach – bottom to top:

- Individual components – develop control & monitoring
- Organize components into logical subsystems
  - Beamline
  - Detectors
  - Channel
  - LH_2 absorber
  - other
- Wrapper IOC integrate subsystems and provide uniform controls
- Finite state machines (SM) to monitor subsystems
  - passively monitors
  - states are dynamic (e.g. ramping PSU) or static (e.g. Standby)
  - identifies parameters for each state: sets alarms, archiver, autoSMS via CDB
- Over arching SM – monitors all daughter SMs
- Run Control – integrates C&M + DAQ + OnMon + CDB

EPICS Framework



- IOC – Input/Output Controller:
  - computer + SW
  - physical connection to HW
  - creates process variables (PVs) which represent HW parameters
- clients and other IOCs connect via LAN

Hardware

In what follows, "*hardware*" refers to both the computer used for the IOC and the numerous components to which they connect.

Two thrusts: Daresbury Lab team and local effort

- DL team:
  - IOCs are VME based – PLC controls for LH_2 not discussed here
  - RS232/RS485 (serial) + TCP/IP
  - target, decay solenoid, conventional magnets, trackers, vacuum, channel magnets
  - electrical work
- Local effort:
  - IOCs are Linux based
  - RS232/RS422/RS485 + TCP/IP + modbus + SNMP
  - beam stop, proton absorber, diffuser, Caen HV + LV PSUs, Weiner PSUs, LM, environment and services sensors, A/C, UPSs, vacuum pumps/gauges, ISIS mon, target wrapper, tracker wrapper

DL – Step IV IOCs

- CS1: Decay Solenoid
- CS2: Target
- CS4: Conventional Magnets
- CS7A: Channel Magnets (SSU/FC/SSD)
  - serial and analogue devices
  - LHe level, GHe pressure, temperatures
- CS7B:
  - CanBus
  - Interlocks
- CS7C:
  - SSU/SSD PSU controllers
  - FC load cells
- CS8A: LH_2 testing

DL – Step IV IOCs

- CS9A: Vacuum analogue and Cryo-cooler compressors
  - serial
  - pressure gauges, turbo pumps, compressors
- CS9B: Vacuum interlocks
  - interlocks
  - backing pumps
  - valves

Local – Step IV IOCs

- Historically, “local” IOCs were developed for individual components:
  - Environmental sensors – air flow, pressure,
  - A/C units
  - HV – SY127(now abandoned), SY527 (now only KL), SY4527 (2 crates: ToF + EMR)
  -

Local – Step IV IOCs

- Many of these were merged into subsystem (wrapper) IOCs
  - BeamLine
    - Target
    - Conventional Magnets
    - Decay Solenoid
    - Proton Absorber
    - Beam Stop
    - Diffuser
  - Detectors
    - Luminosity Monitor
    - HV for ToF0/ToF1/ToF2/KL/EMR
    - EMR LV and crate control (still to be merged)
    - Trackers

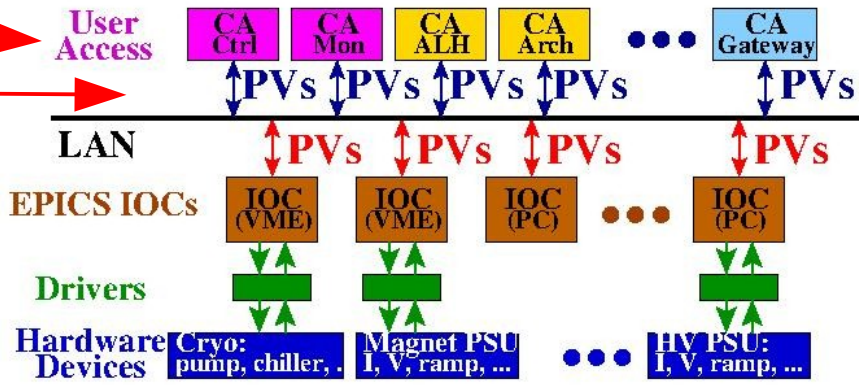
Local – Step IV IOCs

- Many of these were merged into subsystem (wrapper) IOCs
  - Channel
    - hall probes (Nikhef and conventional)
    - PRY movement monitor
    - E5AC monitor (heater control)
    - Tracker volume GHe
    - QPS monitoring (SSU/SSD/FC)
    - PSU wrapper
    - leads blowers and heaters
    - north side turbo pump control
  - Environment and Services
    - A/C units (hall, RR2), RR1 incomplete
    - UPSs (RR1, RR2, LH_2 room)
    - water leaks
    - water temperatures
    - air pressure and flow
    - temperatures (hall, RR1, RR2)

Software Organization

- DL code built on micecss1
  - micecss1 is also server for all DL IOCs
  - version control built into directory structure

- Local software /home/epics/epicsXXX (where XXX is DEV or PRO)
  - epicsDEV for development and testing
  - epicsPRO for production version
- I followed DL organization:
  - ./epicsXXX/Config/*
  - ./epicsXXX/extensions/*
  - ./epicsXXX/iocTops/*
  - ./epicsXXX/Support/*
- code versioning in bzr
- extensions/Config/Support NFS mounted
- micecss1 SW also in our bzr



Extensions + Config

- extensions: client applications used in MICE
  - Graphical User Interfaces (GUIs) – a.k.a. edm panels
  - Alarm Handler (ALH)
  - Data Archiver
  - Strip Tool
  - Gateway
  - Probe
- Config: configuration files – mostly for extensions
  - ALH
  - Archive configurations
  - Archive viewer configurations
  - StripTool viewer configurations
  - application launchers and scripts

Network

- private LAN
- firewall
- ssh lockout