NEW DEVELOPMENTS ON EPICS DRIVERS, CLIENTS AND TOOLS AT SESAME

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Abstract

SESAME is a 2.5 GeV synchrotron light source under construction in Allan, Jordan. The control system of SESAME is based on EPICS and CSS.

Various developments in EPICS drivers, clients, software tools and hardware have been done. This paper will present some of the main achievements: new linux-x86 EPICS drivers and soft IOCS developed for the Micro-Research Finland event timing system replacing the VME/VxWorks-based drivers; new EPICS drivers and clients developed for the Basler GigE cameras; an IOC deployment and management driver developed to monitor the numerous virtual machines running the soft IOCs, and to ease deployment of updates to these IOCs; an automated EPICS checking tool developed to aid in the review, validation and application of the in-house rules for all record databases; a new EPICS record type (mbbi2) developed to provide alarm features missing from the multibit binary records found in the base distribution of EPICS; a test of feasibility for replacing serial terminal servers with low-cost computers.

TIMING SYSTEM DRIVER

Figure 1: VME-EVG230

Figure 2: VME-EVR230

➢ New Linux-x86 EPICS drivers were developed for the VME-EVG230 and VME-EVR230 timing modules from Micro-Research Finland.

➢ Building an EPICS over Ethernet instead of the VME bus has the following benefits:

- Drops the dead weight: The VME CPU card, the RTOS that runs on the CPU card along with any required licenses.
- Lowers the cost of implementation.
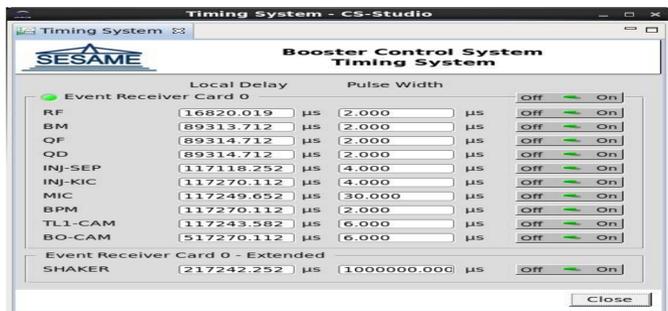- Confines the required development skills to Linux/x86 platforms

Figure 3: CSS Timing OPI

BASLER GIGE CAMERA DRIVER & CLIENT

Basler GIGE Camera Driver

- Purpose: Speed up scientific analysis, system integration, needed image, gain, exposure, ROI, and trigger control
- Record types: bi, bo, longin, longout, waveform
- Device support: Asynchronous processing (I/O thread)
- Driver support: One thread per device, message passing
- Device driver: Shared C++ libraries from Basler

Figure 4: Ace acA1300-30gm GigE camera

Figure 5: Basler GigE camera client

Basler GIGE Camera Client

- Uses EPICS client framework
- Built using C, OpenGL, SDL , AntTweakBar and EPICS channel access libraries
- Provides an interface to control basler camera parameters such as: image size, offset, gain, ROI, exposure and trigger source
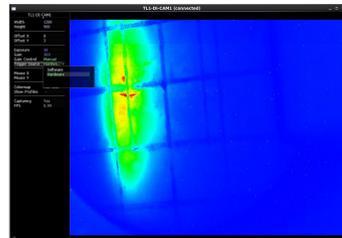- Provides different color maps

Figure 6: Camera client colours mapping

TERMINAL SERVER

➢ Terminal server is an experiment to provide simple serial to Ethernet converters using low cost computers.

➢ The software is running under minimal x86 or x64 Linux systems using libevent2 for asynchronous non-blocking communication.

➢ The software reads a configuration file and connects to a serial device and starts listening for clients on a TCP port.

Figure 7: Terminal Server

IOC MANAGER

➢ The control infrastructure at SESAME uses 12 virtual machines to run the different IOC's and 8 physical machines to run the clients and for development purposes.

➢ The IOC manager is a Linux/x86 EPICS driver developed for the purpose of managing all the machines that are part of the control infrastructure at SESAME.

➢ The IOC manager provides the following services:

- Hostname and user of the IOC
- Date, time, and uptime of the IOC
- Drive, memory, and CPU utilization
- Control over which IOC's to run
- Enabling/disabling of the IOC's
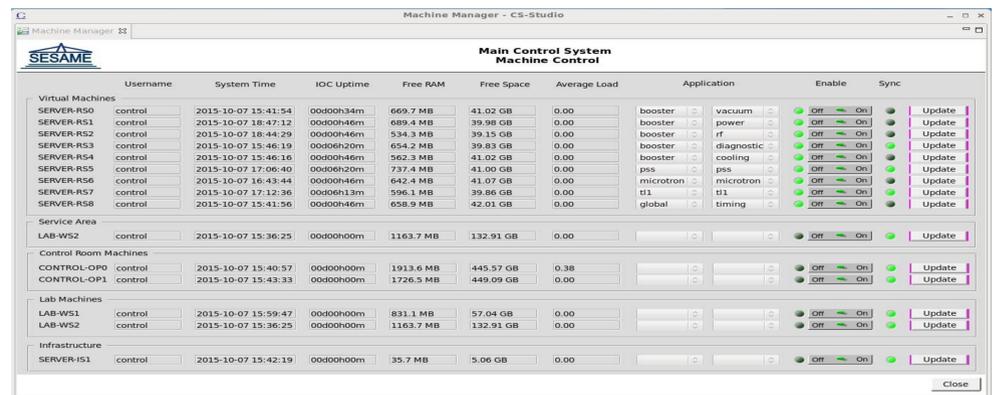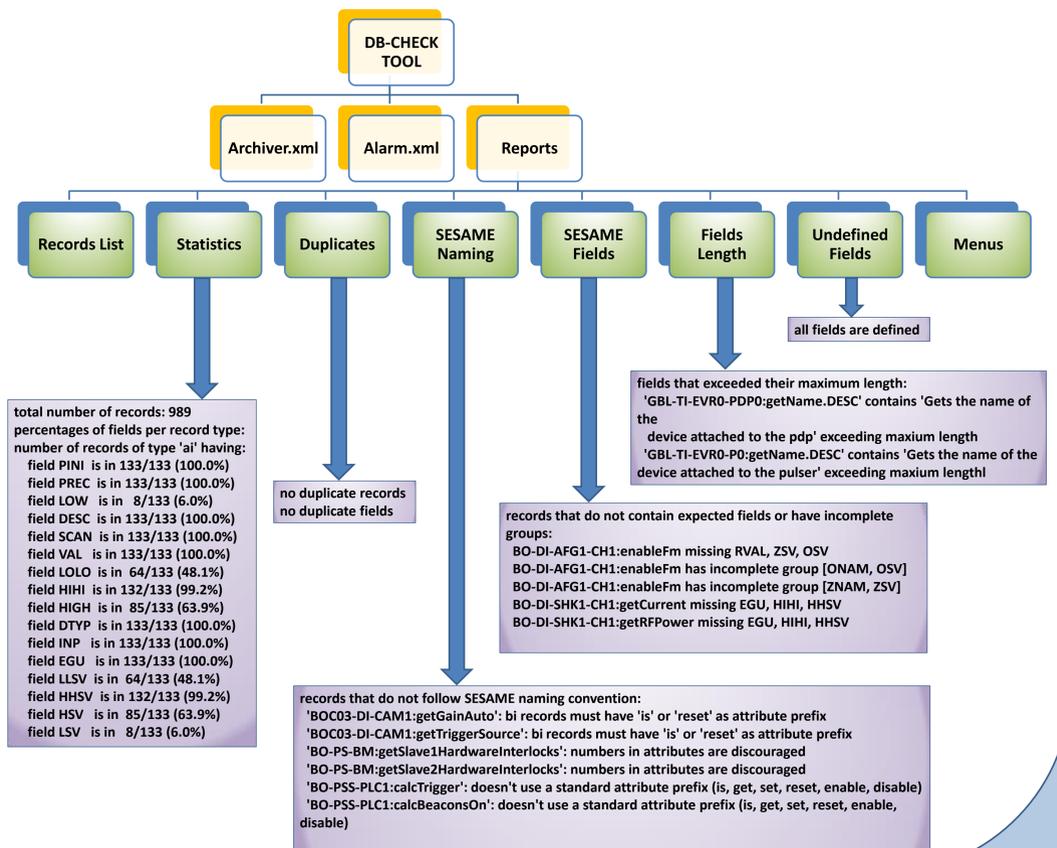- Build system which synchronizes the IOC with the main Git repository

Figure 8: CSS IOC Manager OPI

EPICS DATABASE CHECK TOOL (DB-CHECK)

➢ A command line tool built to help in reviewing, unifying and maintaining the numerous EPICS databases at SESAME.

➢ The way the db-check works is by parsing the DB and DBD files using a PEG grammar. The tool is built in D programming language and using pegged library for the parser.

total number of records: 989
percentages of fields per record type:
number of records of type 'ai' having:
  field PINI is in 133/133 (100.0%)
  field PREC is in 133/133 (100.0%)
  field LOW is in 8/133 (6.0%)
  field DESC is in 133/133 (100.0%)
  field SCAN is in 133/133 (100.0%)
  field VAL is in 133/133 (100.0%)
  field LOLO is in 64/133 (48.1%)
  field HIHI is in 132/133 (99.2%)
  field HIGH is in 85/133 (63.9%)
  field DTYP is in 133/133 (100.0%)
  field INP is in 133/133 (100.0%)
  field EGU is in 133/133 (100.0%)
  field LLSV is in 64/133 (48.1%)
  field HHSV is in 132/133 (99.2%)
  field HSV is in 85/133 (63.9%)
  field LSV is in 8/133 (6.0%)

no duplicate records
no duplicate fields

fields that exceeded their maximum length:
  'GBL-TI-EVR0-PDP0:getName.DESC' contains 'Gets the name of the
    device attached to the pdp' exceeding maxium length
  'GBL-TI-EVR0-P0:getName.DESC' contains 'Gets the name of the
  device attached to the pulser' exceeding maxium lengthl

records that do not contain expected fields or have incomplete groups:
  BO-DI-AFG1-CH1:enableFm missing RVAL, ZSV, OSV
  BO-DI-AFG1-CH1:enableFm has incomplete group [ONAM, OSV]
  BO-DI-AFG1-CH1:enableFm has incomplete group [ZNAM, ZSV]
  BO-DI-SHK1-CH1:getCurrent missing EGU, HIHI, HHSV
  BO-DI-SHK1-CH1:getRFPower missing EGU, HIHI, HHSV

records that do not follow SESAME naming convention:
  'BOC03-DI-CAM1:getGainAuto': bi records must have 'is' or 'reset' as attribute prefix
  'BOC03-DI-CAM1:getTriggerSource': bi records must have 'is' or 'reset' as attribute prefix
  'BO-PS-BM:getSlave1HardwareInterlocks': numbers in attributes are discouraged
  'BO-PS-BM:getSlave2HardwareInterlocks': numbers in attributes are discouraged
  'BO-PSS-PLC1:calcTrigger': doesn't use a standard attribute prefix (is, get, set, reset, enable, disable)
  'BO-PSS-PLC1:calcBeaconsOn': doesn't use a standard attribute prefix (is, get, set, reset, enable, disable)

all fields are defined

MBBI2 RECORD

➢ mbbi2 record is the same as an mbbiDirect record except for its ability to specify alarm states for individual bits.

➢ mbbi2 is used for devices which provide read access to status registers where different bits hold on/off status, others hold warnings and others hold interlock status.

```
record(mbbi2, "BO-PS-${DEVICE}:getMasterHardwareInterlocks")
{
    field(DESC, "Reads master hardware interlocks")
    field(SCAN, "5 second")
    field(DTYP, "stream")
    field(INP, "@bruker.proto getRelayInterlocks $(DEVICE)")
    field(VAL, " 0")
    field(PINI, " YES ")
    field(B0ST, "Fan")          field(B0ZSV, "NO_ALARM")  field(B0OSV, "MAJOR")
    field(B1ST, "Door open")    field(B1ZSV, "NO_ALARM")  field(B1OSV, "MAJOR")
    field(B2ST, "Phase")        field(B2ZSV, "NO_ALARM")  field(B2OSV, "MAJOR")
    field(B3ST, "DC On")        field(B3ZSV, "NO_ALARM")  field(B3OSV, "MAJOR")
    field(B4ST, "Temperature")  field(B4ZSV, "NO_ALARM")  field(B4OSV, "MAJOR")
}
```