Status of EPICS at KEK

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Overview of EPICS Activity at KEK

- **J-Parc** → Kamikubota-san’s Talk
- **KEKB**  EPICS based system
- **PF-AR**  EPICS based since 2002
- **PF**  EPICS based since 2005
- **Linac**  Non-EPICS
- **EPICS based small-size systems**
  - **RFGTB**  EPICS based system
    → Araki-san’s talk at EPICS meeting in Tokai, 2004
Linac provides:
for PF: 2.5 GeV e-
for PF-AR: 3 GeV e-
for KEKB: 8 GeV e-
            3.5 GeV e+
Status of Linac Control System

• Non-EPICS control system based on Remote Procedure Call & Distributed Shared Memory

• Linac-to-EPICS Gateway
  1 Portable Channel Access Server (Old)
    ~ 4950 records
  3 SoftIOC on Linux with AsynDriver (New)
    ~ 9672 records

Many of above records are archived in KEKBLog and/or Channel Archiver (~ 400MB/day)
Plan in the coming summer shutdown

• real IOC's will be installed
  ➢ ~10 Windows IOC's on DSO7104 Oscilloscopes for BPM
  ➢ ~7 MVME5500 IOC's for Event/Timing and Low Level RF
Status of KEKB/PF-AR Control System

• KEKB History --- The first application of EPICS in Japan
  – Mar. 1998 part of e- BT line commissioning
  – Jun. 1998 part of e+, e- BT lines commissioning
  – Dec. 1998 KEKB rings commissioning started

• PF-AR History
  – 2001 1 year shutdown of PF-AR for upgrade
    • Control system was completely replaced to EPICS
  – Jan. 2002 operation of PF-AR restarted
Host computers in 2006

• Host computers for EPICS development
  – 2 HP-UX servers
  – 1 Sun server (New)
  – 1 Linux server (New)

• Host computers for Operation & Accelerator Modeling calculation ("SAD cluster")
  – 3 Alpha servers
  – 2 Linux servers
  – 8 Macintosh OSX servers
SAD

• SAD (Strategic Accelerator Design) is a computer program complex for accelerator design developed in KEK since 1986.

• Most of the high level applications for operation are developed by SAD

• Workshop SAD2006
  – Sep. 5-7 2006 at KEK
IOC in 2006

• ~110 VME/VxWorks IOC with EPICS 3.13.1
  CPU: Force PowerCore6750, PowerCore6603e
  Force CPU64, CPU40

• 1 VME/VxWorks IOC with EPICS 3.14.8

• Several PC/Linux IOC with EPICS 3.14
  – For Software records
  – For Ethernet devices (NetDev)
Field bus in 2006

- **Arcnet** for Magnet PS
- **VXI-MXI** for BPM
- **Modbus plus** for interfacing to interlock systems
- **GPIB, RS-232C** for many kinds of instruments
- **CAMAC** for RF control and some devices
  (about 20 years old legacy system)
- We plan to replace CAMAC modules to PLC with Ethernet
- A Mitsubishi **PLC with Ethernet** is used for the special magnet PS (for local orbit feedback)
- Test of a Yokogawa **PLC with Ethernet** is now going in a Klystron Test Station.
Upgrade of the KEK-PF Control System

Photon Factory, KEK

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Jun/2006 EPICS meeting
KEK Site

Linac

PF  2.5GeV e-
PF-AR  6.5GeV e-
KEKB  8.0GeV e-

3.5GeV e+
Brief History

- 1982: Commissioning (420nm.rad)
- 1986: Medium emittance (130nm.rad)
- 1997: Low emittance (36nm.rad)
- 2005: Straight-Sections Upgrade
  - Main purpose of the project
    - enlarge the existing straight sections
    - increase the number of straight sections (7 -> 13)
  - Control : EPICS
Before Upgrade

- based on our in-house software
  - "Device Server" and "Data Channel"

**Device Server**
- many plathome
  - PC, VME, WS
- CAMAC, GPIB, etc

**Data Channel (DCh)**
- not used for equipment control
- Shared memory + Client Lib
- keep latest information
  - always updated
Control Task and OPI

- Control Task
  - FORTAN or C (running on Workstations)

- Operator Interface
  - Communicate through Input/Output Mediator
  - GUI: developed by VAPS
Upgrade Policy

• DataChannel&Device Server
  – Advantage
    • many OS: Unix(HP/Sun/Linux), OS-9, HP-RT, Windows, etc
    • Simple, light-weight
    • Easy & Fast Development (Device controller or GUI) is possible
  – Disadvantage
    • Control Task & OPI is closely related
    • DCh: no session management
    • DCh: no Event notification

Extend the functionality of DataChannel? or Adopt EPICS?
Hardware: IOC

– RF
  • VME(PPC 750 + VxWorks) for CAMAC
  • PC(Soft IOC on Linux) + PLC with Ethernet : HV Controller
  • PC(Soft IOC on Linux) + LAN/GPIB : GPIB inst.

– Magnet
  • VME(PPC750 + VxWorks) for CAMAC : Large Power Supply
  • VME(Intel PIII + Linux) : Small Power Supply
  • PC(Soft IOC on Linux) + LAN/GPIB : DMM, GPIB inst.

– Timing
  • VME(PowerPC 750 + VxWorks) with Bus Interrupt board

– Insertion Device
  • VME(PowerPC750 + VxWorks) + LAN/GPIB
    we plan to replace with Linux IOC
Hardware (cont.)

– Vacuum
  • PC (Soft IOC on Linux) + PLC with Ethernet
    – Omron PLC

• Device support for Omron PLC is developed by M. Komiyama (RIKEN) and J-I. Odagiri (KEK)
RF Control

- Kinetic VME-Kbus
- IOC(pcore750, VxWorks)
- CAMAC
  - Input register, output reg, Control reg
- PLC
- PC(Linux)
- GPIB
- PC(Linux)
RF Control Panel (Example)
MEDM(DM2K), SAD/Tkinter
Magnet Control

- Two types of power supplies
  - Large Power Supply (LPS) B,Q,S
  - Small Power Supply (SPS) Steering Magnet, BT, etc

- LPS: CAMAC (Input/Output register)
- SPS: Dedicated Controller Board
  - 1 Power Supply Interface (PSI) for 1 Power Supply
  - PSI: ADC, DAC, DIO (for relay, interlock, etc)

- 3 VME CPU (Linux) + Bus Bridge
  - total 7 VME subrack
1 VME CPU/Subrack
7 CAMAC Crate
Number of LPS: about 30

3 VME CPU
8 VME Subrack
Number of SPS: about 200

CC: Crate Controller
IR: Input Register
OR: Output Register

BR: Bus Bridge
PSI: Power Supply Interface (with AD/DA/DIO)
Magnet Control
Archive/Retrieval

• Channel Archiver (2.8.1)
• Number of records / Data Amount
  • Mon: 250record 300MB
  • BT: 50record 14MB
  • ID: 15record 1MB
  • Mag: 750record 40MB
  • OP: 40record 10MB
  • RF: 1200record 60MB
  • Vac: 2100record 130MB

• Total 500-600MB/day
• Retrieval
  – Web (CGI) and ArchiveExport command
Everywhere Python

• We use python as the programming language for OPI applications
• We begin to try using python also for IOC applications. (Linux IOC)
  – Multi-threadable CaPython
  – devPython
  – Python calc record
Multi-threadable CaPython

- Python + CA library + Multithreading
  = “Multi-threadable CaPython”
  - It can describe control logics on IOC
  - Alternative of the SNL/sequencer
  - Provides richer functionality
  - Allow quicker development of applications

- Current Status: under development
devPython

- Device support which invoke python interpreter
- Python program is specified through INST_IO parameter
- Currently ai record is tested
- We expect...
  - Non-EPICS subsystem written in python can be easily integrated into EPICS system.
Python calc record

- Alternative of calc record (or subroutine record)
- More powerful than calc record
- Easier than C programming (subroutine record)
- Current status: Just an idea