



DEVELOPMENT OF EMBEDDED EPICS ON F3RP61-2L

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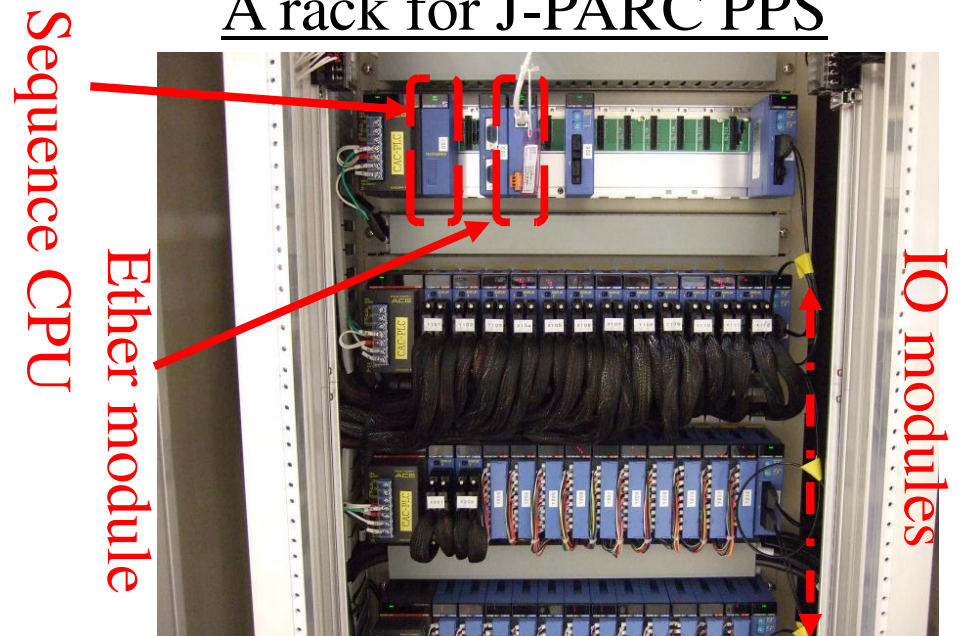
Presented by Norihiko Kamikubota (KEK)

>KEK / J-PARC

Background

- So many Yokogawa FA-M3 PLCs
 - In KEKB – used over 10 years, showed high reliability
 - In J-PARC – also many for Linac/RCS/MR
 - In other institutes
 - RIKEN-RIBF
 - KURRI FFAG by Tanigaki-san
 - Shanghai SSRF
 - and so on ..

A rack for J-PARC PPS



F3RP61-2L (e-RT3 2.0/Linux)



- Available from Yokogawa since **Sept. 2008** as a product name “**e-RT3 2.0/Linux**”
- CPU: MPC8347E (**PowerPC**), 533MHz
- OS: **Linux (kernel 2.6.24.3)**
- DDR2 SDRAM: 128MB + user SRAM 4MB
- I/F
 - **Ethernet: 100BASE-TX** (2ch)
 - RS-232C, IEEE1394a
 - CF ...
- RAS support
- <http://www.yokogawa.co.jp/rtos/rtos-index-ja.htm>
(Japanese)
- Beta release version by Yokogawa in Feb. 2008
 - Discussion between KEK and Yokogawa before Sept.
- “**Embedded EPICS**” with this module - why not ?



EPICS on e-RT3 2.0/Linux

■ Wrapping over BSP is like this

```
static long write_bo(boRecord *pbo)
{
    F3RP61_BO_DPVT *dpvt = (F3RP61_BO_DPVT *) pbo->dpvt;
    M3IO_ACCESS_RELAY_POINT *poutrlyp = &dpvt->outrlyp;
    poutrlyp->data = (unsigned short) pbo->rval;

    if (ioctl(f3rp61_fd, M3IO_WRITE_OUTRELAY_POINT, poutrlyp) < 0) {
        errlogPrintf("devBoF3RP61: ioctl failed [%d]\n", errno);
        return (-1);
    }
    pbo->udf=FALSE;

    return (0);
}
```

- easy for those who have some experience of EPICS

EPICS on e-RT3 2.0/Linux

- What happened ?
 - After “*Make*” process of EPICS Base
 - EPICS IOC-core with Soft Record, EPICS Sequencer run stably over a couple of days
 - After code developing with BSP
 - I/O modules (AD/DA, DI/DO) become accessible

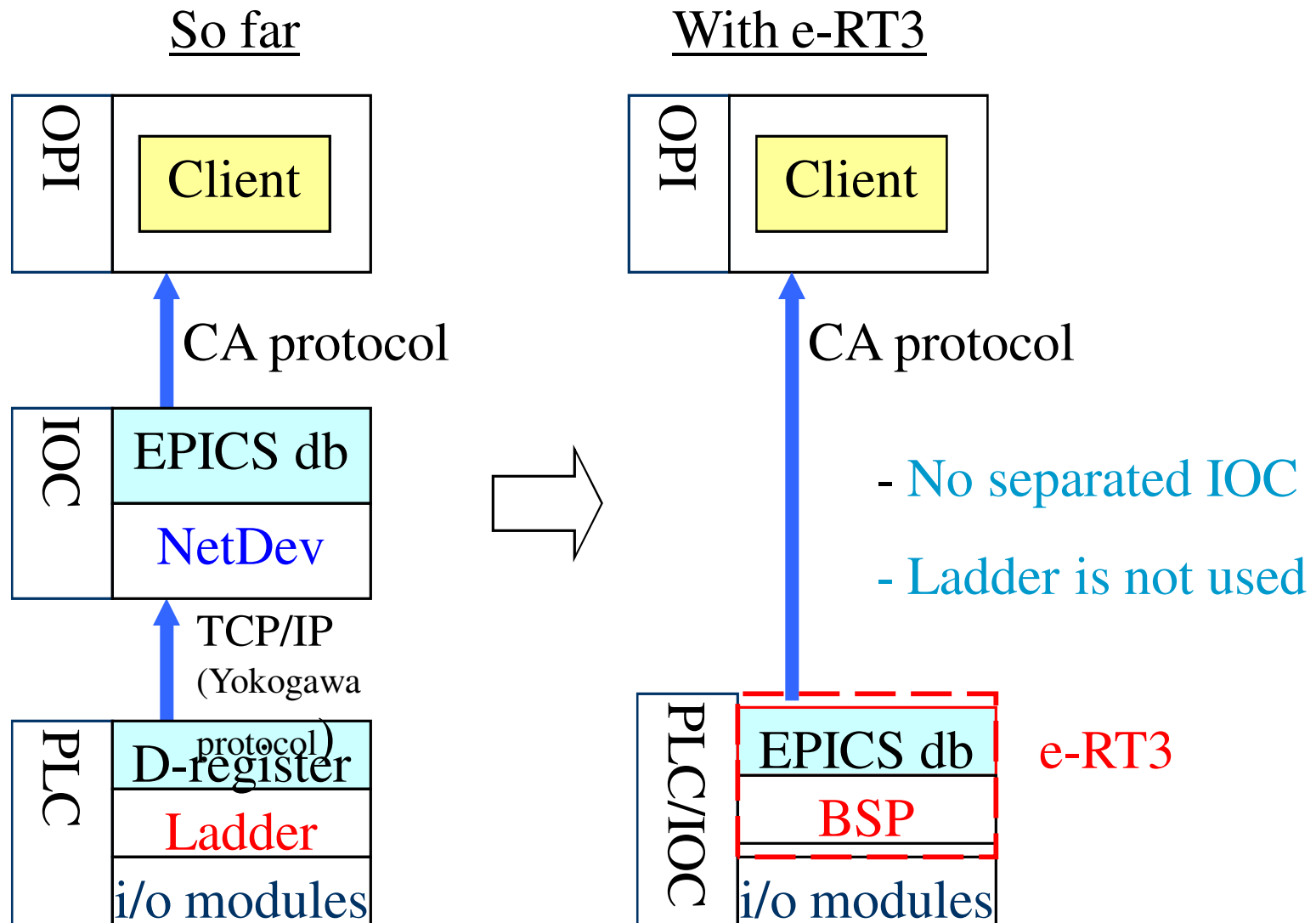
An e-RT3
running
EPICS



I/O
modules

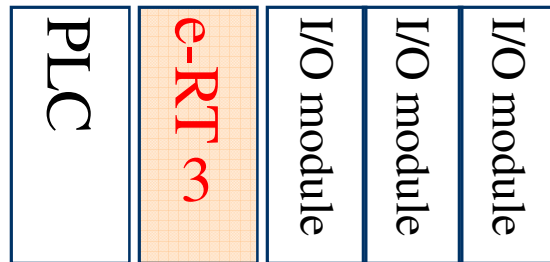
PCaPAC 2008 in Ljubljana

Usages of e-RT3 with EPICS



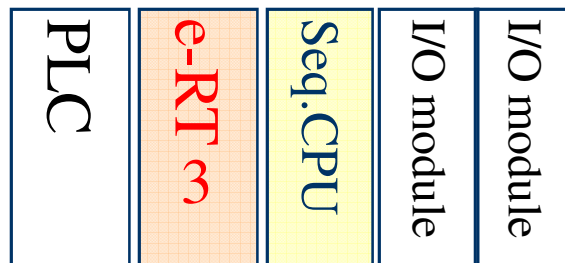
Two Styles with e-RT3

Style (a)



- Similar to the relationship between VME-CPU and VME I/O modules
- No Ladder programming
- Can use highly reliable I/O modules

Style (b)



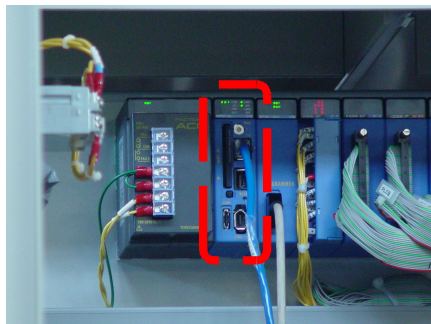
- Keep original style with Sequence CPU
 - Ladder in Sequence CPU
 - e-RT3 works as an EPICS IOC
- suitable when high reliability is needed

Application at Accelerators

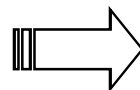
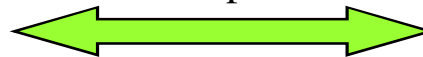
■ J-PARC MR

- Still under construction toward 1st beam acceleration (3GeV to 30 GeV) on Dec. 2008
- Will use 8 e-RT3 modules with style (a), mostly for power supplies
 - Cost / Time effective solution for us

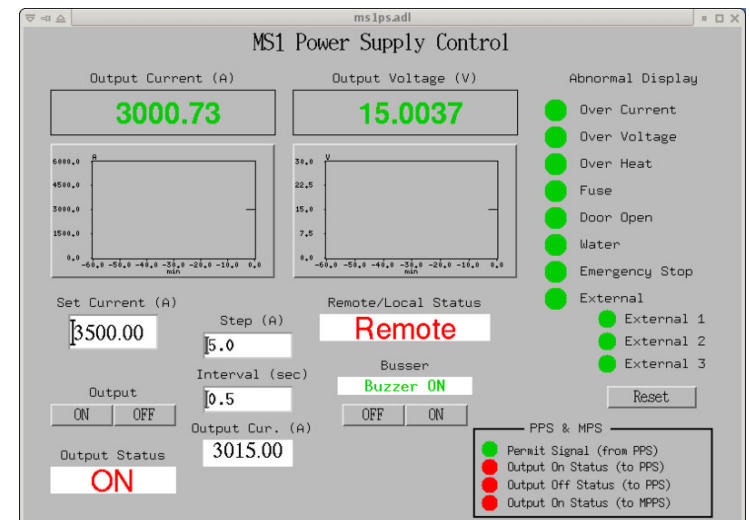
Septum magnet control with e-RT3 (in test)



EPICS CA protocol



Power supply



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”The Japan Corporation”

- Collaboration between academic institutes and companies has worked very well

KEK - RIKEN - Yokogawa - SHI - MESS

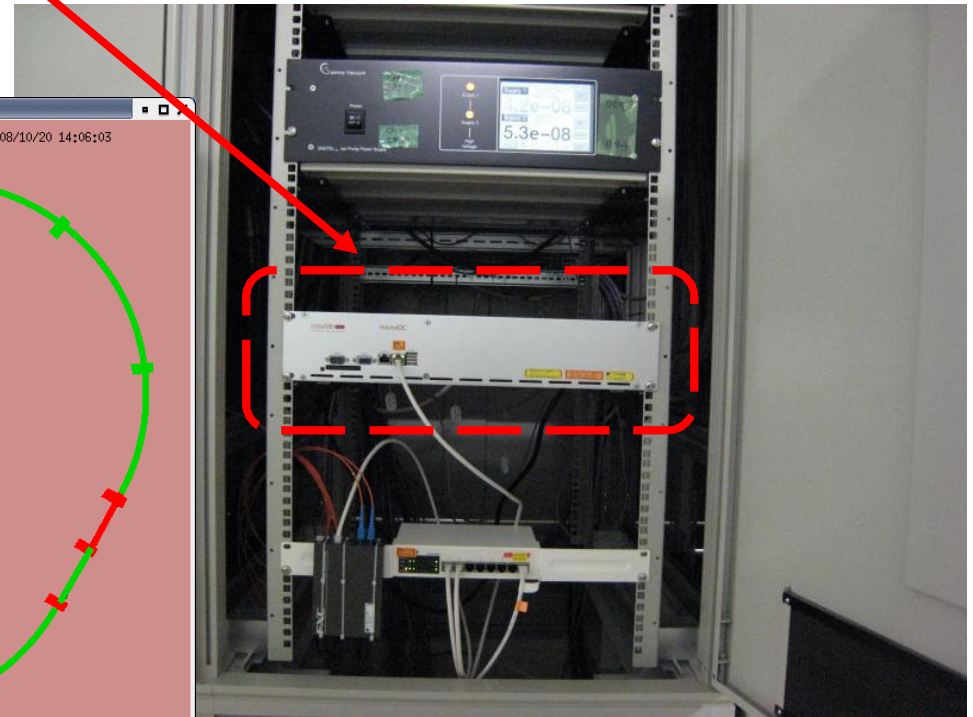
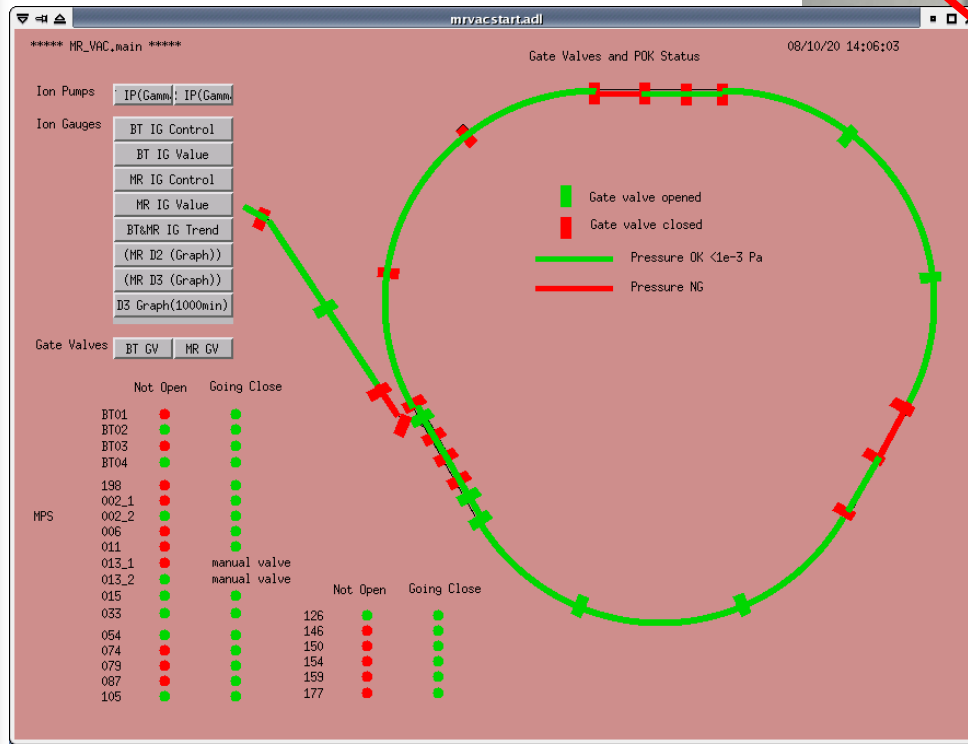


Demonstration
at a meeting in
Japan

(Aug. 2008)

Yet another collaboration with ..

- Three microIOCs/RS485 have been used
 - For Vacuum system of J-PARC MR





Summary

- “Embedded EPICS” on F3RP61-2L (e-RT3 2.0/Linux) is very successful
 - With e-RT3, we can use PLC I/O modules in “VME-like“ style without Ladder and a separated IOC.
 - e-RT3 modules will be used in controls of power supplies in J-PARC MR
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- microIOCs by COSYLAB have contributed J-PARC MR commissioning