Demonstration of Embedded EPICS on F3RP61 PLC

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1) Impact of F3RP61

- J-PARC MR/KEK introduced F3RP61 since 2008
  - Many (40?) F3RP61/Linux-IOC systems are in operation successfully

- When we need simple I/O channels
  - Left: before 2008, our standard style is:
  - Right: after 2008, new style with F3RP61:

<table>
<thead>
<tr>
<th>IOC/VME</th>
<th>F3RP61-IOC</th>
</tr>
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<tbody>
<tr>
<td>Linux/VxW</td>
<td>Linux</td>
</tr>
<tr>
<td>netDev/Epics</td>
<td>Epics</td>
</tr>
<tr>
<td>LAN</td>
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  - No separated IOC
  - No ladder, but snl
  - Fit “CA everywhere” idea

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Impact of F3RP61 (continued)

- Consider VME-IOC and F3RP61/PLC-IOC
  - Left: our traditional style was vme:
  - Right: with F3RP61:

<table>
<thead>
<tr>
<th>VME-IOC</th>
<th>VMEIO</th>
<th>VMEIO</th>
<th>F3RP61-IOC</th>
<th>PLCIO</th>
<th>PLCIO</th>
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<tbody>
<tr>
<td>VxWorks</td>
<td>VMEIO</td>
<td>Epics</td>
<td>Linux</td>
<td>Epics</td>
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</tbody>
</table>

- F3RP61-IOC can be an alternative to VME-IOC
- KEK introduced Yokogawa’s FAM3 PLC since 1995
  - We believe high reliability of PLC IO modules
  - Good partnership with Yokogawa over 15 years
- FAM3 PLC modules are small and easy to use

Reasons why we like F3RP61 style

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2) Support for test users of F3RP61

- Many requests to develop new subsystems
  - from non-control groups (mag, beam-diag., rf, ..)
  - F3RP61-IOC style fits well for many cases
  - But our standard setup for F3RP61 requires J-PARC control network, not available in office rooms

  to support such test users

- (a) F3RP61 setup for J-PARC laboratory LAN
- (b) module workshop in J-PARC CCR (to be started very soon)
(a) F3RP61 setup for laboratory LAN

- We developed a new CF
  - Start Linux with DHCP
  - Start Epics ioc assuming default module-layout
    - Default is => Slot2:AO, Slot3:AI, Slot4:DO, Slot5:DI
  - Automatic generation of Epics PVnames
    - Ex) `<hostname>`:AO_1:SET, `<hostname>`:AI_2:VAL

    `<hostname>`="plc159" for plc159.intra.j-parc.jp

    
    [root@plc159 ~]# caput plc159:AO_1:SET 0.123
    Old : plc159:AO_1:SET 0
    New : plc159:AO_1:SET 0.123

    [root@plc159 ~]# caget plc159:AI_1:VAL
    plc159:AI_1:VAL 0.123

    [root@plc159 ~]#   caput plc159:BO_1:SET 1
    Old : plc159:BO_1:SET ZERO
    New : plc159:BO_1:SET ONE

    [root@plc159 ~]# caget plc159:BI_1:VAL
    plc159:BI_1:VAL ONE

    [root@plc159 ~]#
How to start F3RP61-IOC?

- How to start a F3RP61-IOC in your office room?
  1. Ask Computer Center to register F3RP61’s mac-address to DHCP server
  2. If you have non-default module-layout, modify st.cmd and execute “make”
  3. Reboot the F3RP61-IOC

## default config in st.cmd
```
dbLoadRecords "db/ao1.db", "name=${HNM},S=2,ch=1"
dbLoadRecords "db/ao1.db", "name=${HNM},S=2,ch=2"
dbLoadRecords "db/ai1.db", "name=${HNM},S=3,ch=1"
dbLoadRecords "db/ai1.db", "name=${HNM},S=3,ch=2"
dbLoadRecords "db/bo1.db", "name=${HNM},S=4,ch=1"
dbLoadRecords "db/bo1.db", "name=${HNM},S=4,ch=2"
dbLoadRecords "db/bi1.db", "name=${HNM},S=5,ch=1"
dbLoadRecords "db/bi1.db", "name=${HNM},S=5,ch=2"
```
(b) module workshop in J-PARC CCR

• Basic ideas
  – Prepare stock boxes in CCR, which contain standard PLC modules
    • Boxes are categorized as: CPU(F3RP61), CPU(Ladder), D-in, D-out, Analog, Special, ..
  – One can pick-up necessary modules from boxes
  – Periodic (every 1-2 month) supply of modules by control group

=> One can get modules to make your own F3RP61-IOC setup

no need to order, no need to wait

no need to pay ? <= pay request will be forwarded later
PLC module workshop

1) Behind a wall, there are hidden boxes...

2) D-out modules are listed: relay, DC(8ch,24V), DC(64ch,24V), TTL, ..

3) You can find a necessary module in the box

4) Kindly asked, white down modules you pick up to the notebook

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((^ ^)) review the procedure again ..

- 9am - you get an inspiration
- 9:30 - visit the **module workshop** to pick up PLC modules needed for your F3RP61 setup
- 10am - ask to C.C. to register your F3RP61
- 11am – assemble PLC modules, edit st.cmd if necessary, make cable connections ..
- 3:30pm – registration to DHCP at C.C. finished
- 4pm – connect your F3RP61 setup to Laboratory network, reboot it .. Get started ?

**Inspiration => start your F3RP61-IOC within a day**

**=> 1 month later, you will receive money accounts**
Summary

• Impact of F3RP61-IOC in J-PARC is discussed
  – Since 2008, many pieces have been introduced
  – Simple architecture than before
  – An alternative to VME-IOC

• Support for test users of F3RP61 is reported
  – Test at Laboratory network
  – Easy start with default module-layout
  – Module workshop will be started soon

2 pages more for demonstration
3) Demonstration of F3RP61 startup

• Today I don’t use DHCP server, thus I modify network configurations:
  – fixed IP (10.105.56.159) and hostname “plc159”

• Demonstration kit has default module-layout
  – Default is => Slot2:AO, Slot3:AI, Slot4:DO, Slot5:DI
  – Generated PVnames are:
    • Ex) plc159:DO_1:SET, plc159:BI_2:VAL, ..
Demonstration will be
- during next break
- at the entrance hall