

DEBUGGING EPICS APPLICATIONS

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Outline

References

Booting a VME Crate - vxWorks and EPICS

Debugging Hardware Failures

Debugging Database Problems

Debugging Client Connections to the Database

Developing and Debugging new code under vxWorks

DEBUGGING REFERENCES

EPICS Documentation on WWW at APS

<http://epics.aps.anl.gov/asd/controls>

Applications Developer's Guide

Particularly -- Chapter 2. -- IOC Test Facilities

Record Reference Manual

VxWorks Programmer's Manual

Particularly

Chapter 2 -- Getting Started

Chapter 12 -- Debugging

Chapter 11 -- The Shell

Boot Parameters

mv167> bootChange

'.' = clear field; '-' = go to previous field; ^D = quit

boot device : ei
processor number : 0
host name : leia
file name : ~wright/vx/v51.epics/config/mv167/vxWorks
inet on ethernet (e) : 189.165.32.83:ffffff00
inet on backplane (b):
host inet (h) : 189.165.32.26
gateway inet (g) :
user (u) : vx
ftp password (pw) (blank = use rsh): xxxxxxx
flags (f) : 0x29
target name (tn) : vxmv156733a
startup script (s) : ~wright/camac_demo/camac/startup.mv167
other (o) :

Booting vxWorks

Boot Parameters Used for Booting vxWorks

boot device : ei
host name : leia
file name : ~wright/vx/v51.epics/config/mv167/vxWorks
host inet (h) : 189.165.32.26
user (u) : vx
ftp password (pw) (blank = use rsh): xxxxxxx

Successful Boot of vxWorks - from Serial Port

Attaching network interface ei0... done.
Attaching network interface lo0... done.
Loading... 362104 + 102960 + 26566
Start at 0x1000
Attaching network interface ei0... done.
Attaching network interface lo0... done.
Loading symbol table from leia:~wright/vx/v51.epics/config/mv167/vxWorks
...done

Booting vxWorks

Unsuccessful Boot of vxWorks - from Serial Port

```
Attaching network interface ei0... done.           :ei0 is correct
  ethernet driver
Attaching network interface lo0... done.
Loading...
Error loading file: errno = 0xd.
Can't load boot file!!
```

Possible Reasons

- Verify boot parameters are OK
- Network is down, a bad cable connection or has an improper termination
- vxWorks does not exist at the specified filename in the boot parameters
- vx account or password not setup on the specified host
- file protections on the specified filename are not correct

Booting EPICS

After Successful Boot of vxWorks - from Serial Port

- runs this: startup script (s) :
~wright/camac_demo/camac/startup.mv167

Successful Boot

done

Executing startup script ~wright/camac_demo/camac/startup.mv167

(will execute each command in the startup script)

Booting EPICS

Verify Successful Boot by telnet'ing to IOC and typing: i

NAME	ENTRY	TID	PRI	STATUS	PC	SP	ERRNO	DELAY
------	-------	-----	-----	--------	----	----	-------	-------

*timeStamp	_gts_select	2b9570	32	PEND	a2a0	2b9414	0	0
*callback	_callbackTas	2bd2cc	40	PEND	a2a0	2bd284	0	0
*scanEvent	30da20	299184	41	PEND	a2a0	29913c	0	0
*gpibLink	2c99b2	2bb5e4	47	PEND	a2a0	2bb590	0	0
*scanPeriod	30d676	29ba44	53	DELAY	46772	29b9f8	0	4
*CA client	_camsgtask	2ad814	180	PEND	a2a0	2ad71c	0	0
*CA repeater	_ca_repeater	38439c	181	PEND	a2a0	384250	0	0
*CA TCP	_req_server	2b5a28	181	PEND	a2a0	2b598c	0	0
*CA event	_event_task	27f7c0	181	PEND	a2a0	27f778	0	0
*CA event	_event_task	33ce64	181	PEND	a2a0	33ce1c	0	0
*CA UDP	_cast_server	2b44b0	182	PEND	a2a0	2b4384	0	0
*CA online	_rsrv_online	2b2f24	183	DELAY	46772	2b2e88	0	283
*taskwd	31a368	2c4500	200	DELAY	46772	2c444c	0	241

value = 0 = 0x0

* - EPICS tasks

Booting EPICS

Unsuccessful Boot of EPICS

telnet to IOC successfully verifies that vxWorks booted
observe the execution of the startup script

rename the startup file

reboot the IOC

telnet into the IOC

invoke the startup script manually using the '<' redirection
character

for example:

```
< ~wright/camac_demo/camac/startup.mv167
```

Common Errors

missing record or device support

recSup.ascii or devSup.ascii lists support that is not in the object
file being loaded

undefined symbol

you added code that references external symbols that were not
loaded first

Hardware Interfaces in the IOC

Detecting Errors

dbior - command that calls the report function of every driver

*Note: most drivers have reports - some do not!

dbpr "database record name" - report all of the fields of a database record if the SEVR field is Invalid and the STAT field is either READ/WRITE then there is a failure returning from the device/driver support

Common Source of Errors

address jumpers on the card not correct - check manual and module_types.c
for interrupt devices:

the backplane jumpers need to be correct from CPU to this module

the interrupt vector needs to be unique - use the veclist diagnostic to list all vectors

verify that the device and driver support were loaded (see booting EPICS)

Database Logic in the IOC

Detecting Errors

dbpr "database record name" - report all of the fields of a database record if the SEVR field is Invalid and the STAT field is UDF the record was never processed

Use the database debugger to step through the database execution see chapter 2 of the Application Developer's Guide

Set the TPRO field of a database record - this will cause all records processed as part of this chain to print their name to stdout

Use the dbt command to determine the execution time of a particular database chain

Common Source of Errors

address fields are incorrect

forward links do not pass data

scan mechanisms are wrong

passive records are processed too frequently (improper use of Process Passive)

Connections to the Database

Detecting Errors

Standard channel access clients give an indication when they are not able to connect

Applications must do the same: sequences, tcl/TK

Use cau or probe to check out the channel access connection

Common Source of Errors

The process variable name is incorrect - use dbgrep to verify the name is in the IOC

Broadcast address on the IOC and workstation must match

bootChange to see the boot parameters where the IOC sets the net mask
ifconfig -a to see the netmask on the Unix workstation

The IOC is using 100% of the CPU - telnet to the IOC and use the spy command

Verify client connection - telnet to the IOC and use the client_stat command

Plots, Sliders, Bars Not Working

Common Source of Errors

HOPR and LOPR are not set in the database or the display list

The value is outside the specified display range - either
HOPR/LOPR or in display

Value is outside the control range in the database - see DRVH
and DRVL fields

Debugging New Code in the IOC

New Subroutines / tasks in vxWorks

Verify it loads successfully - linking is done at load time

vxWorks treats all global symbols as commands available from the shell:

- telnet to the ioc

- set a breakpoint on your new routine

- spawn the routine using the sp command

- step through the routine and verify that it works before integrating it

- use global symbols to peek/poke or turn on/off debug statements

New drivers in vxWorks

Use the m command to peek/poke memory locations to verify new hardware

Put in good diagnostic routines that dump all available registers (this is for dbior later)

Put in test codes to exercise, calibrate or reinitial the hardware