**Instructions after succeeding in booting Linux on COPPER CPU**

Apr. 11, 2015 S. Yamada

**1, How to install COPPER driver on COPPER CPU**

**1-1, Get driver’s source code**

~~svn co~~ [~~https://belle2.cc.kek.jp/svn/trunk/software/daq~~](https://belle2.cc.kek.jp/svn/trunk/software/daq)~~/copper/driver/cprdist-0.1.0~~

~~svn co~~ [~~https://belle2.cc.kek.jp/svn/trunk/software/daq/copper/driver/cprdist-0.1.5~~](https://belle2.cc.kek.jp/svn/trunk/software/daq/copper/driver/cprdist-0.1.5)

~~svn co https://belle2.cc.kek.jp/svn/trunk/software/daq/copper/driver/cprdist-0.1.6~~

~~or~~

Download the latest version from

https://belle2.cc.kek.jp/~twiki/bin/view/Detector/DAQ/COPPER

**1-2, How to compile and install COPPER drivers**

Log in COPPER CPU first. (You can compile on a boot server but in that case you need to be careful of specifying proper **gcc and kernel version in Makefile**. )

% make clean

% make

% cd cprfin\_fngeneric/

% make

% cd ..

% /bin/su

You can obtain the following installation scripts from svn repository : daq/copper/driver/copper

(<https://belle2.cc.kek.jp/browse/viewvc.cgi/svn/trunk/software/daq/copper/driver/copper/>)

# ./initd\_copper start

# ./initd\_cprfin\_fngeneric start

check if drivers are successfully installed.

% /sbin/lsmod

Module Size Used by

cprfin\_fngeneric 9808 0

copper 30208 0

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To avoid an error message below during installation of modules, please check notices,

"insmod: error inserting 'cprdist-\*\*\*/drv/copper.ko': -1 Invalid module format"

NOTICE : the version of compiler(/usr/bin/gcc) should be

same as the one used for kernel compilation or PXE server's gcc version.

You can check the version by % /usr/bin/gcc --dumpversion

NOTICE : If you try to compile drivers on a PXE server and COPPER\_CPU's linux kernel is different from

the one used on PXE server, please modify KERNEL\_VERSION in drv/Makefile and cprfin\_fngeneric/Makefile.

The “invalid module format” occurs when the vermagic of copper.ko is different from that of the running kernel on cpr\*\*\*. You can check the vermagic of copper.ko as follows;

[user @cpr\*\*\*: daq/copper/driver/cprdist-\*.\*.\*/drv]$ modinfo copper.ko

*filename: copper.ko*

*license: GPL*

*srcversion: C4ED63ABE5BABCCCFF7C688*

*depends:*

*vermagic: 2.6.18 SMP mod\_unload 686 REGPARM 4KSTACKS gcc-4.1*

**1-3, How to install COPPER drivers modules automatically**

1) correct path of module and script

e.g.)

insmod ./drv/copper.ko -> Need to modify

action $"Making nodes: " ./src/mkdevs.sh -> Need to modify

2) copy initd\_copper and initd\_cprfin\_fngeneri files

[ on COPPER CPU] # cp initd\_copper /etc/init.d/copper

[ on COPPER CPU] # cp initd\_cprfin\_fngeneric /etc/init.d/cprfin\_fngeneric

If you boot many COPPER CPUs w/ one boot server, note that those files may be common to all COPPER boards,

unless you specify them in /tftpboot/copper/snapshot/files.

3) use chkconfig to register

[ on COPPER CPU] # chkconfig --add copper

[ on COPPER CPU] # chkconfig --add cprfin\_fngeneric

4)

Maybe it will work.

It is better to place drivers under /lib/modules.

**2, Configure CPLD before using an unused HSLB**

**2-1, download a CPLD configuration directory**

% svn co <https://belle2.cc.kek.jp/svn/trunk/software/daq/copper/HSLB> HSLB

The CPLD configuration file is HSLB/**130621\_HSLB\_cpld\_readback.jed** .

**2-2, Configure CPLD**

1) Attach a HSLB on a COPPER, set the COPPER in a KEK-VME crate, and turn on the power of the crate.

2) Download the CPLD configuration file to the CPLD on the HSLB

A) Prepare a USB-JTAG adapter cable

B) Connect between your PC and the HSLB by the cable

C) Use iMPACT software to download the CPLD configuration file to the CPLD

**3, How to download FPGA firmware and check data from HSLB**

**3-1, Download a utility folder**

svn co <https://belle2.cc.kek.jp/svn/trunk/software/daq>/copper/test\_program

**3-2, Download a HSLB firmware**

(The following is just a copy of Nakao-san’s e-mail :

[b2link\_ml:0082] Re: new HSLB firmware on bdaq SVN )

Get a firmware from the svn repository on bdaq.

*[on bdaq]*

*svn co file:///bdaq/svn/firmware/hslb/trunk hslb*

*[on elsewhere in KEK]*

***svn co svn+ssh://xxx@bdaq.local.kek.jp/bdaq/svn/firmware/hslb/trunk hslb***

*(please replace xxx with your bdaq account name)*

*[from outside of KEK]*

*add two lines in ~/.subversion/config*

*[tunnels]*

*ssh\_bpost = ssh -A xxx@bpost.kek.jp ssh*

*(again, replace xxx with your bpost account name)*

*Then*

*svn co svn+ssh\_bpost://xxx@bdaq/bdaq/svn/firmware/hslb/trunk hslb*

*(again, replace xxx with your bdaq account name.*

*bpost knows bdaq is bdaq.local.kek.jp.)*

*If you are using Windows, similar instruction can be found by googling*

*with "subversion windows ssh tunnels".*

*Setting an SVN repository on bdaq instead of using belle2 SVN may sound*

*like duplicating efforts, but I have a few reasons.*

*- It will be a bit more convenient for online environment in experiment*

*hall while it is a bit less convenient for people outside world.*

*Construction will continue for next a few years, but experiment*

*should continue much longer than that.*

*- Based on agreement with IHEP, I don't think it's a good idea to*

*unnecessarily widen the accessibility to the firmware code. Belle2*

*repository can be accessed by any Belle II members, while bdaq*

*repository can be accessed by those who has a bdaq account.*

**3-3, Download firmware to FPGA on HSLB**

% gunzip ./hslb/ise12/HSLB.bit.gz (the file from the b2daq repository)

Then use an executable file in the utility folder to download the bit file.

% ./test\_program/hslb/boothslb -abcd ./HSLB.bit

"-abcd" specifies slots for the HSLB cards

If you fail to download firmware, please try following

* Check if CPLD on HSLB is already programmed.
* Check if copper and cprfin\_fngeneric have already been installed

% /sbin/lsmod

* Install drivers again

# driver/cprdist-0.1.0/initd\_copper stop

# driver/cprdist-0.1.0/initd\_copper start

# driver/cprdist-0.1.0/initd\_cprfin\_fngeneric stop ( do not use “restart”)

# driver/cprdist-0.1.0/initd\_ cprfin\_fngeneric start

* Download firmware to CPLD on HSLB again. ( basically not necessary ).

**3-4, Read data in COPPER FIFO**

% ./copper/record-nakao -abcd

"-abcd" specify slots for HSLB cards

**3-5, Use HSLB as a dummy data producer for test**

1, Get a test firmware which make a HSLB produces dummy data with size of about 256byte and 1Hz rate

COPPER II : https://belle2.cc.kek.jp/~twiki/pub/Detector/DAQ/PocketDAQ/HSLB\_1Hz256B\_COPPER2.bit

COPPER III : https://belle2.cc.kek.jp/~twiki/pub/Detector/DAQ/PocketDAQ/HSLB\_1Hz256B\_COPPER3.bit

2, Download the firmware to FPGA

% ...daq/copper/test\_program/hslb/boothslb -abcd ./HSLB\_1Hz256B\_COPPER?.bit

"-abcd" specify slots for HSLB cards

3, Read data

% ...daq/copper/test\_program/copper/record-nakao -abcd

**4, How to get and download a TTRX firmware**

**4-0, download and install TTRX driver software**

Download the latest ttprogs tar ball at

<https://belle2.cc.kek.jp/~twiki/bin/view/Detector/DAQ/COPPER>

Please follow the README file in driver/ directory.

You can also see Nakao-san’s e-mail, “[b2link\_ml:0169] ttrxprogs”.

**4-1, download a bit file from the svn repository on bdaq**

~~svn co~~ [~~https://belle2.cc.kek.jp/svn/trunk/software/daq/copper/driver/ttrx/ttrxprogs-20060413-for-SL5~~](https://belle2.cc.kek.jp/svn/trunk/software/daq/copper/driver/ttrx/ttrxprogs-20060413-for-SL5)

( See Nakao-san’s e-mail :

[daq2ml:0162] FTSW firmware / tools update (ft2u) on bdaq SVN )

*[on bdaq]*

*svn co file:///bdaq/svn/firmware/ft2u/trunk ft2u*

*[on elsewhere in KEK]*

*svn co svn+ssh://xxx@bdaq.local.kek.jp/bdaq/svn/firmware/ft2u/trunk ft2u*

*(please replace xxx with your bdaq account name)*

*[from outside of KEK]*

*add two lines in ~/.subversion/config*

*[tunnels]*

*ssh\_bpost = ssh -A xxx@bpost.kek.jp ssh*

*(again, replace xxx with your bpost account name)*

*Then*

*svn co svn+ssh\_bpost://xxx@bdaq/bdaq/svn/firmware/ft2u/trunk ft2u*

*(again, replace xxx with your bdaq account name.*

*bpost knows bdaq is bdaq.local.kek.jp.)*

*If you are using Windows, similar instruction can be found by googling*

*with "subversion windows ssh tunnels".*

There are bit files for TTRX in the svn repository:

ft2u/bit-files/tt4r\*\*\*.bit (For ver.4 TTRX used for COPPER-II)

ft2u/bit-files/tt5r\*\*\*.bit (For ver.5 TTRX used for COPPER-III)

**4-2, Download the TTRX firmware**

bootrx should be used.

You can obtain it from the latest ttprogs tar ball at

<https://belle2.cc.kek.jp/~twiki/bin/view/Detector/DAQ/COPPER>

$ ./bootrx tt\*r\*\*.bit

**5, How to get and download a FTSW firmware**

Bit files are available in Nakao-san’s svn repository on bdaq (*bdaq.local.kek.jp/bdaq/svn/firmware/ft2u/trunk/bit-files )*

5-1, login to VMIC PC in the same crate where FTSW is installed.

5-2, download fitmware by bootft

The location of bootft should be asked to Nakao-san.

For FTSW#48(It should have a label of FTSW # on its front panel),

VMICPC $ ~nakao/bin/bootft -48 ~nakao/daq/ftsw/ft2u\*\*\*.bit

**APPENDIX A. setup for handling COPPER and TTRX drivers**

Sep. 2, 2014 S. Yamada

The following is a procedure to set up COPPER and TTRX drivers in ecl02

1, copy \*.ko and script files from ecl01

2, make a direcotry for module files

[b2daq@ecl02:yamadas]$ sudo mkdir /tftpboot/copper/root/lib/modules/2.6.18/misc

3, copy module files in the misc directory

[b2daq@ecl02:yamadas]$ ls \*.ko

copper.0.1.5.ko copper.131010.ko cprfin\_fngeneric.131008.ko vme\_universe.ko

copper.0.1.6.chksumcheck.ko copper.ko cprfin\_fngeneric.ko

copper.0.1.6.ko cprfin\_fngeneric.0.1.5.ko ttrx\_fifo.ko

copper.0.1.6.timeout1s.ko cprfin\_fngeneric.0.1.6.ko ttrx.ko

[b2daq@ecl02:yamadas]$ sudo cp \*.ko /tftpboot/copper/root/lib/modules/2.6.18/misc

4, copy scripts

[b2daq@ecl02:yamadas]$ sudo cp copper /tftpboot/copper/root/etc/rc.d/init.d/

[b2daq@ecl02:yamadas]$ sudo cp ttrx /tftpboot/copper/root/etc/rc.d/init.d/

5, Add copper and ttrx in the startup list in COPPER

[root@cpr5014:b2daq]# sudo /sbin/chkconfig --add copper

[root@cpr5014:b2daq]# sudo /sbin/chkconfig --add ttrx

6, reboot COPPERs or install the drivers by hand

[root@cpr5014:b2daq]# /sbin/service copper start

Loading COPPER driver: [ OK ]

Loading FINESSE driver: [ OK ]

[root@cpr5014:b2daq]# /sbin/service ttrx start

Loading TT-RX device driver: [ OK ]

Loading TT-RX FIFO driver:

Update history :

Nov. 5, 2014 : Change the location of initd\_copper and initd\_cprfin\_fngeneric

Nov.10, 2014: The locations of tt\*r\*\*\*.bit, ft2u\*\*\*.bit, bootrx and bootft are updated.

Feb. 5, 2015 : Add dummy-data firmware for HSLB on COPPER III

Apr. 11, 2015 : TTRX related softwares should be downloaded from

<https://belle2.cc.kek.jp/~twiki/bin/view/Detector/DAQ/COPPER>, not from svn repository.