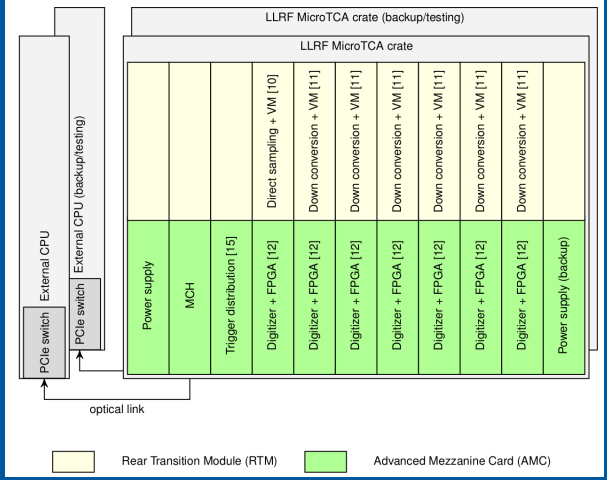

Experience with external CPUs

ARD ST3 Pre-Workshop: MicroTCA for LLRF systems, 07.09.2022

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HZDR

HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

Hardware at HZDR

Main system:

- FUJITSU RX2560 M2 (4HE, 64GB RAM, 2 Intel(R) Xeon(R) CPU E5-2690, 28 Cores, 56 Cores with Hyper-Threading) with NPCIex8-Opt-QSFP-UPLINK card
- Running 7 llrf ChimeraTK applications
- Typically the load is about 25 and $30\,\%$ RAM is used

Backup system:

- FUJITSU RX2540 M4 (2HE, 64GB RAM, 2 Intel(R) Xeon(R) Gold 6132, 28 Cores, 56 Cores with Hyper-Threading) with riser card and NPCIex8-Opt-QSFP-UPLINK card

Overall system performance

- No big issues over the course of 5 years.

Client access

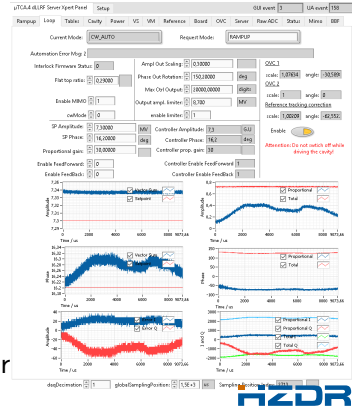
- LLRF applications use the OPC UA control system adapter
- Typically several OPC UA clients are connected from different hosts to the external CPU
- Up to now we use one $1\,\mathrm{Gbit}$ Lan adapter connected to a $10\,\mathrm{Gbit}$ ethernet switch

DAQ data:

- 1 week of data ($\sim 5\,\mathrm{TB}$) is stored in a ring buffer on the external CPU
- 3 month of data are stored on a network drive
- With Ubuntu 20.04 we observed OPC UA client connection losses
- Caused by $100\,\%$ network usage (`rsync` used to copy DAQ data to a network drive)

$\Rightarrow$ Problem solved by limiting the `rsync` bandwidth

- In future we might use an additional $1\,\mathrm{Gbit}$ ethernet adapter exclusively for DAQ data backup



AMC (SIS8300-L2) failure

Issue:

- External CPU system crash and successive reboot
- System error message: CPU internal error
- Happened continuously about every two days

Investigation:

- Replace MCH $\Rightarrow$ problem remained
- Studied syslog

AMC (SIS8300-L2) failure

```
kernel: [732317.494874] PCIEUNI(pcieunis6): Error waiting for DMA to become available: Timeout!
kernel: [732318.514894] PCIEUNI(pcieunis6): Error waiting for DMA to buffer (offset=0x20000, size=0x20000): TIMEOUT!
kernel: [732319.542908] PCIEUNI(pcieunis6): Error waiting for DMA to become available: Timeout!
kernel: [732320.562967] PCIEUNI(pcieunis6): Error waiting for DMA to buffer (offset=0x1000000, size=0x20000): TIMEOUT!
kernel: [732320.565470] mutex_lock_interruptible - locking attempt was interrupted by a signal
kernel: [732320.565497] mutex_lock_interruptible - locking attempt was interrupted by a signal
kernel: [732320.566398] mutex_lock_interruptible - locking attempt was interrupted by a signal
kernel: [732320.567308] mutex_lock_interruptible - locking attempt was interrupted by a signal
kernel: [732321.099087] FILE_REF 2, fops open (filp 0000000042c24443)
kernel: [732321.099091] FREE FILE LIST ENTRY
kernel: [732321.099092] FILE_REF 2, fops open (filp 0000000042c24443)
kernel: [732321.099094] Close Procces is "DM_<Device:Deca" (pid 3374) FILE_REF 1, fops open (filp 0000000042c24443)
kernel: [732321.099095] FILE_REF 2, fops open (filp 000000005715f4d9)
kernel: [732321.099129] Open Procces is "DM_<Device:Deca" (pid 3374) DEV is 3 FILE_REF 2 fops open (filp 0000000031b278ec)
kernel: [732321.099130] FILE_REF 2 fops open (filp 0000000031b278ec)
kernel: [732321.099131] FILE_REF 2 fops open (filp 000000005715f4d9)
kernel: [732321.201929] FILE_REF 2, fops open (filp 000000005715f4d9)
kernel: [732321.201934] FILE_REF 2, fops open (filp 000000005715f4d9)
kernel: [732321.201935] FREE FILE LIST ENTRY
kernel: [732321.201938] Close Procces is "llrfserver" (pid 54350) FILE_REF 1, fops open (filp 000000005715f4d9)
kernel: [732321.201939] FILE_REF 2, fops open (filp 0000000031b278ec)
kernel: [732322.290962] PCIEUNI(pcieunis6): Error waiting for DMA to become available: Timeout!
kernel: [732323.315016] PCIEUNI(pcieunis6): Error waiting for DMA to buffer (offset=0x0, size=0x20000): TIMEOUT!
kernel: [732323.832344] FILE_REF 2, fops open (filp 0000000031b278ec)
kernel: [732323.832348] FREE FILE LIST ENTRY
```

AMC (SIS8300-L2) failure

Issue:

- External CPU system crash and successive reboot
- System error message: CPU internal error
- Happened continuously about every two days

Investigation:

- Replace MCH $\Rightarrow$ issue remained
- Studied syslog $\Rightarrow$ Similar timeouts also happened for the other cards

$\Rightarrow$ pcieuni6 was always the first $\Rightarrow$ Replaced that card, which solved the issue!

MCH firmware update

Firmware upgrade to V2.22.4:

- Upgrade was successful in the first place on the backup system
- Later upgrade on the production system was successful too
- At some point the optical link was not established any more ⇒ Opened ticket with NAT
- Finally it turned out they updated the firmware to work with there new uplink

⇒ When changing the PCIe switch configuration and writing it to the EPROM the uplink does not work any more!

- Intermediate fixed firmware was provided to us and the fix is included in the latest firmware V2.23.2

Important firmware notice

- Do not use MCH firmware V2.22.4 with NPCIex8-Opt-QSFP-UPLINK card
- Use V2.23.2 and set *Sideband communication for Optical Uplink* ⇒ *disabled* in the *Base Configuration*