FC7 setup (CentOS 6 or 7)

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This work is based on Nikie's instructions prepared for 2019 Tracker DAQ school

https://cms-tracker-daq.web.cern.ch/cms-tracker-daq/Downloads/sdgoldenimage.img

Golden image firmware

- Insert your SD card in a USB dongle or PC integrated SD slot
- Download the golden firmware from our downloads section
- Check the name of the SD on your system:

```
> sudo fdisk -l
Disk /dev/mmcblk0: 7744 MB, 7744782336 bytes, 15126528 sectors
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

Output example for an 8GB SD card

- Write the golden image on the SD card

To be able to play with it

```
> sudo chmod 744 /dev/sd_card_name
> sudo dd if=sdgoldenimage.img of=/dev/sd_card_name bs=512
```

! WARNING: If the SD card is partitioned (formatted), pay attention to write on the block device (e.g. /dev/mmcblk0) and not inside the partition (e.g. /dev/mmcblk0p1)

! WARNING: /dev/sd_card_name should be the name of the SD card or you will overwrite the data of whatever else you are referring to

- Slide the FC7 in your nano-crate or uTCA crate and power it: when the SD card has the golden image on it, and it is not corrupted, you should see the blue LED of the FC7 blinking. If the blue LED is not blinking try the next step .. if that also fails then .. yes SD card has not been formatted correctly

PC setup for communication with FC7

- Check the name of your "second" ethernet card on your PC:

  ```
  > ifconfig -a
  ```

- Infer from the output the name of your card

  In the example on the right it is eno1

- Open as sudo the corresponding configuration file:

  ```
  > sudo vim /etc/sysconfig/network-scripts/ifcfg-eno1
  ```

- Add the following line in the file:

  `IPADDR=192.168.1.10`

Use whatever editor you want!

```
eno1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        ether 6c:0b:84:ab:86:ce  txqueuelen 1000  (Ethernet)
        RX packets 10  bytes 3040 (2.9 KiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 0  bytes 0 (0.0 B)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
        device interrupt 20  memory 0xf7d00000-f7d20000

enp3s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 172.16.3.226  netmask 255.255.0.0  broadcast 172.16.255.255
        inet6 fe80::5f2a:8a76:b455:1835  prefixlen 64  scopeid 0x20<link>
        ether 00:06:7b:09:c0:f3  txqueuelen 1000  (Ethernet)
        RX packets 189783  bytes 20298087 (19.3 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 930  bytes 104057 (101.6 KiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
```

- The IPADDR value should be such that your PC belongs to the same local network of your FPGA (usually 192.168.X.X)
- Save file and exit (on vim type ":x" on command mode)
- Restart the network:

  ```
  > sudo service network restart
  ```

- Check again with ifconfig –a that the IP has been properly assigned
- Phisically connect the (nano)crate to this second ethernet card of your PC
- Now you need to figure out the FC7 MAC address, see next slide

```
~ > cat /etc/sysconfig/network-scripts/ifcfg-eno1
TYPE=Ethernet
PROXY_METHOD=none
BROWSER_ONLY=no
BOOTPROTO=none
DEFROUTE=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_FAILURE_FATAL=no
IPV6_ADDR_GEN_MODE=stable-privacy
NAME=eno1
UUID=bc0072cf-7c6f-4d9b-a192-0474978cbd6d
DEVICE=eno1
ONBOOT=no
IPADDR=192.168.1.10
PREFIX=24
```

PC setup for communication with FC7

- Install wireshark, if not already on your PC: you can easily install it using your favourite repository package manager

```
> sudo yum install wireshark
```

- Then listen on network card for the MAC address:

```
> sudo tshark -i ethernet_card_name (eno1 in our example)
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eno1'
  1 0.000000000 NetworkR_00:29:14 -> Broadcast    RARP 60 Who is 08:00:30:00:29:14?  Tell
08:00:30:00:29:14
  2 6.039787918 NetworkR_00:29:14 -> Broadcast    RARP 60 Who is 08:00:30:00:29:14?  Tell
08:00:30:00:29:14
```

Output example

Mac address you are searching for

- Add this address and the name that you want to give your FC7 in the /etc/ethers file using a text editor:

```
> sudo vim /etc/ethers
```

- Add the following line in the file mutatis mutandis:

```
08:00:30:00:29:14   daqschool1
```

Or whatever name you like

- And finally give the card an IP address that belongs to your subnet, adding it to /etc/hosts:

```
> sudo vim /etc/hosts
192.168.1.7   daqschool1
```

PC setup for communication with FC7

- Install the rarpd daemon

```
> sudo yum install rarp_file_name.rpm
```

Taking rarp_file_name.rpm file from
https://archives.fedoraproject.org/pub/archive/epel/6/x86_64/Packages/r/rarpd-ss981107-42.el6.x86_64.rpm

- Start rarpd daemon:

```
> sudo systemctl start rarpd
```

or

```
> sudo rarp -e –A
```

to start rarpd automatically after bootstrap:

```
> sudo systemctl enable rarpd
```

- Try to ping FC7 on the IP address or the name that you gave it in the hosts file

- Then you should be able to upload firmware on the FC7 with the fpgaconfig tool in the Ph2_ACF middleware

Firmware setup

- Clone and install middleware from repository https://gitlab.cern.ch/cms_tk_ph2/Ph2_ACF/-/tree/daqSchool2021
- Configure environment variables with:

```
> source setup.sh
```

- Follow the instruction in the repository readme to properly install the required libraries and compile the code
- Start playing with fpga, have a look to the help:

```
> fpgaconfig –h
```

- Firmware can be downloaded from https://gitlab.cern.ch/cmstkph2-IT/d19c-firmware/-/releases
- As an example, to load **on the SD card** a new firmware you need something like:

```
> fpgaconfig -c hardwareDescriptionFile.xml -f firmware_that_i_want.bin –i name_that_i_want
```

- You can check the name of firmware images on the **SD card** with:

```
> fpgaconfig -c settings/D19CHWDescription.xml –l
```

OR

Same command without –f firmware_that_i_want.bin will load the name_that_i_want firmware on FC7