SDR Example

https://wiki.cosmos-lab.org/wiki/Workshops/MERIF2023

Chose a node assignment (by animal name)

Basic SDR Usage Tutorial

Please go to the specific instructions for the group you have been assigned to:

- Octopus Choosing Octopus as an example
- Eagle
- Pigeon
- Squirrel
- Tiger
- Zebra
- Panther
- Wolverine
- Goose
- Iguana
- Penguin
- Dolphin
- Jellyfish
- Lemur
- Otter
- Beluga
- Labrador
- Salamander
- Giraffe
- Shark

Chose a node assignment (by animal name)

. Use ssh to connect to the console for the grid domain:

```
ssh your-username@console.grid.orbit-lab.org
```

```
abhiadhikari@Abhis-MacBook-Pro ~ % ssh abhiadhikari@console.grid.orbit-lab.org

                              Welcome to
    ___  ____  ____ ___ _____     _        _    ____
   / _ \|  _ \| __ )_ _|_   _|   | |      / \  | __ )  ___   _ __ __ _
  | | | | |_) |  _ \| |  | |_____| |     / _ \ |  _ \ / _ \| '__/ _` |
  | |_| |  _ <| |_) | |  | |_____| |___ / ___ \| |_) | (_) | | | (_| |
   \___/|_| \_\____/___| |_|     |_____/_/   \_\____(_)___/|_|  \__, |
                                                                |___/

 Hostname : console.grid.orbit-lab.org
 OS       : Ubuntu 16.04.7 LTS 4.15.0-142-generic x86_64
 CPU      : 1 x Intel Xeon Processor (Skylake)
            Total of 6 cores, 6 threads
 Load Avg : 0.00 (1min), 0.00 5(min), 0.00 (15min)
 Memory   : 7.0G (Free) / 15G (Total)
 Uptime   : up 12 weeks, 2 days, 20 hours, 34 minutes
 Users    : 0

Last login: Mon Aug 22 13:18:17 2022 from 217.149.135.167
abhiadhikari@console:~$
```

If you run into SSH issues:

https://wiki.cosmos-lab.org/wiki/Workshops/MERIF2023/SignupInstructions

Load image

In this case, we're loading the "merif2023-tutorial-image.ndz" image, which is a pre-built starting point. The image contains UHD 4.4 and Gnuradio 3.9 and uses Ubuntu 20.04.

```
omf load -i merif2023-tutorial-image.ndz -t node1-1,node1-2
```

```
 INFO exp: Progress(0/0/2): 90/90/90 min(node1-1.grid.orbit-lab.org)/avg/max (18
7) - Timeout: 740 sec.
 INFO exp: Progress(0/0/2): 90/90/90 min(node1-1.grid.orbit-lab.org)/avg/max (18
7) - Timeout: 730 sec.
 INFO exp: Progress(2/0/2): 100/100/100 min()/avg/max (187) - Timeout: 720 sec.
 INFO exp:  ----------------------------
 INFO exp:  Imaging Process Done
 INFO exp:  2 nodes successfully imaged - Topology saved in '/tmp/pxe_slice-2023
-05-20t17.47.51.790+00.00-topo-success.rb'
 INFO exp:  ----------------------------
 INFO EXPERIMENT_DONE: Event triggered. Starting the associated tasks.
 INFO NodeHandler:
 INFO NodeHandler: Shutting down experiment, please wait...
 INFO NodeHandler:
 INFO NodeHandler: Shutdown flag is set - Turning Off the resources
 INFO run: Experiment pxe_slice-2023-05-20t17.47.51.790+00.00 finished after 4:3
```

- It can take a couple of minutes for the image to load, so please be patient
- Once in a while the image will not load on the first attempt, so please try running the command again if this is the case

Power on the nodes and check their status

```
omf tell -a on -t node1-1,node1-2

omf stat -t node1-1,node1-2
```

```
Talking to the CMC service, please wait
-----------------------------------------
 Node: node1-1.grid.orbit-lab.org        Reply: OK
 Node: node1-2.grid.orbit-lab.org        Reply: OK
-----------------------------------------
```

```
Talking to the CMC service, please wait
-----------------------------------------
 Node: node1-1.grid.orbit-lab.org        State: POWERON
 Node: node1-2.grid.orbit-lab.org        State: POWERON
-----------------------------------------
```

SSH into the nodes

```
abhiadhikari@console:~$ ssh root@node1-1
root@node1-1:~#
```

```
abhiadhikari@console:~$ ssh root@node1-2
The authenticity of host 'node1-2 (10.10.1.2)' can't be establishe
ECDSA key fingerprint is SHA256:m5uDnyPnB4hQKzSzLO9a1/csR8JsvMn8Fz
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'node1-2,10.10.1.2' (ECDSA) to the list
s.
root@node1-2:~#
```

- You can use tmux to split the terminal or simply open a new terminal window and log into the grid

Configure and detect SDR

. On the nodes, run the following command to configure the network interface to the SDR:

```
ip addr add 192.168.10.1/24 dev DATA2
```

. Use `uhd_find_devices` to make sure that the onboard n210 SDR is detected as in the following image:

```
--------------------------------------------------
-- UHD Device 14
--------------------------------------------------
Device Address:
    serial: F3C45F
    addr: 192.168.10.2
    name:
    type: usrp2


root@node1-1:~#
```

```
--------------------------------------------------
-- UHD Device 14
--------------------------------------------------
Device Address:
    serial: E0R16T0UP
    addr: 192.168.10.2
    name:
    type: usrp2


root@node1-2:~#
```

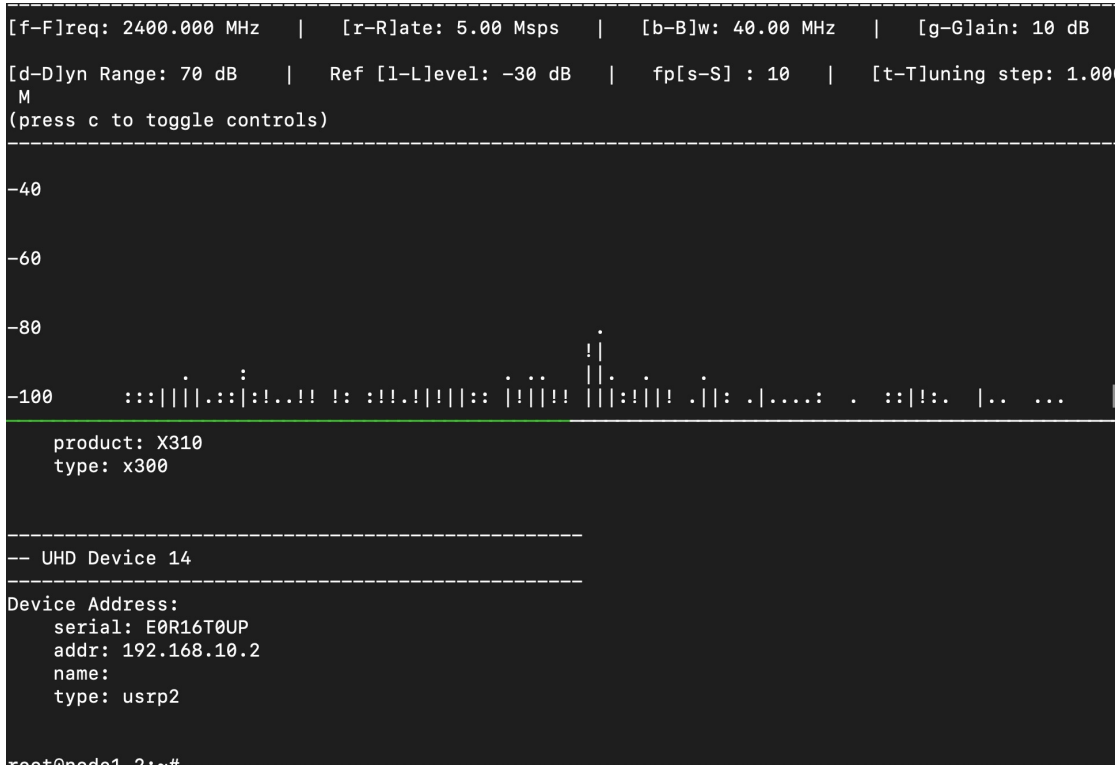
. Use the `uhd_usrp_probe` command to get more details on the n210 a
radio is probed, instead of the radios on the network.

```
  ------------------------------------------------------
 /
|       TX Frontend: 0
|   Name: SBXv3 TX
|   Antennas: TX/RX, CAL
|   Sensors: lo_locked
|   Freq range: 400.000 to 4400.000 MHz
|   Gain range PGA0: 0.0 to 31.5 step 0.5 dB
|   Bandwidth range: 40000000.0 to 40000000.0 step 0.0 Hz
|   Connection Type: QI
|   Uses LO offset: No
  ------------------------------------------------------
 /
|       TX Codec: A
|   Name: ad9777
|   Gain Elements: None
```

Start the receiver

. ssh to node1-1 and start the rx_ascii_art_dft demo with the following command:

```
/usr/lib/uhd/examples/rx_ascii_art_dft --args "addr=192.168.10.2" --freq 2400e6 --rate 5e6 --frame-rate 10 --gain 10 --ref-lvl -30 --dyn-rng 70
```



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Start the transmitter

ssh to node1-2 and start the tx_waveforms demo with the following command:

```
/usr/lib/uhd/examples/tx_waveforms --args="addr=192.168.10.2" --wave-freq 1e6 --wave-type SINE --freq 2400e6 --rate 5e6 --gain 10 --ampl 0.2
```

Transmit a square wave

We can generate a different type of signal by changing the `wave-type` argument. For instance, if we transmit a square wave:

```
/usr/lib/uhd/examples/tx_waveforms --args="addr=192.168.10.2" --wave-freq 1e6 --wave-type SQUARE --freq 2400e6 --rate 5e6 --gain 10 --ampl 0.2
```

Turn the nodes off

```
abhiadhikari@console:~$ omf tell -a offh -t node1-1,node1-2
```

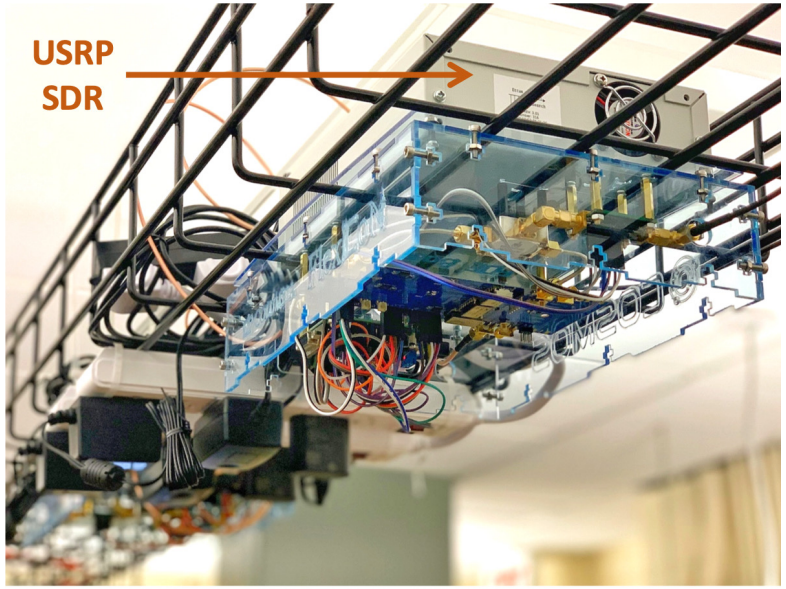
```
 INFO property.command: command = "offh" (String)

Talking to the CMC service, please wait
---------------------------------------------
 Node: node1-1.grid.orbit-lab.org        Reply: OK
 Node: node1-2.grid.orbit-lab.org        Reply: OK
---------------------------------------------
```

```
abhiadhikari@console:~$ omf stat -t node1-1,node1-2
```

```
---------------------------------------------
 Node: node1-1.grid.orbit-lab.org        State: POWEROFF
 Node: node1-2.grid.orbit-lab.org        State: POWEROFF
---------------------------------------------
```

Full-duplex and mmWave using COSMOS



Full-duplex and mmWave capabilities in COSMOS SB2