

# **N** Institute for the Wireless Internet of Things at Northeastern University

## **LXC Containers Assignment**

Andrea Lacava

[andrea.lacava@uniroma1.it](mailto:andrea.lacava@uniroma1.it) | [lacava.a@northeastern.edu](mailto:lacava.a@northeastern.edu)



**N** COLOSSEUM  
at Northeastern University

# Agenda

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## 1. Introduction

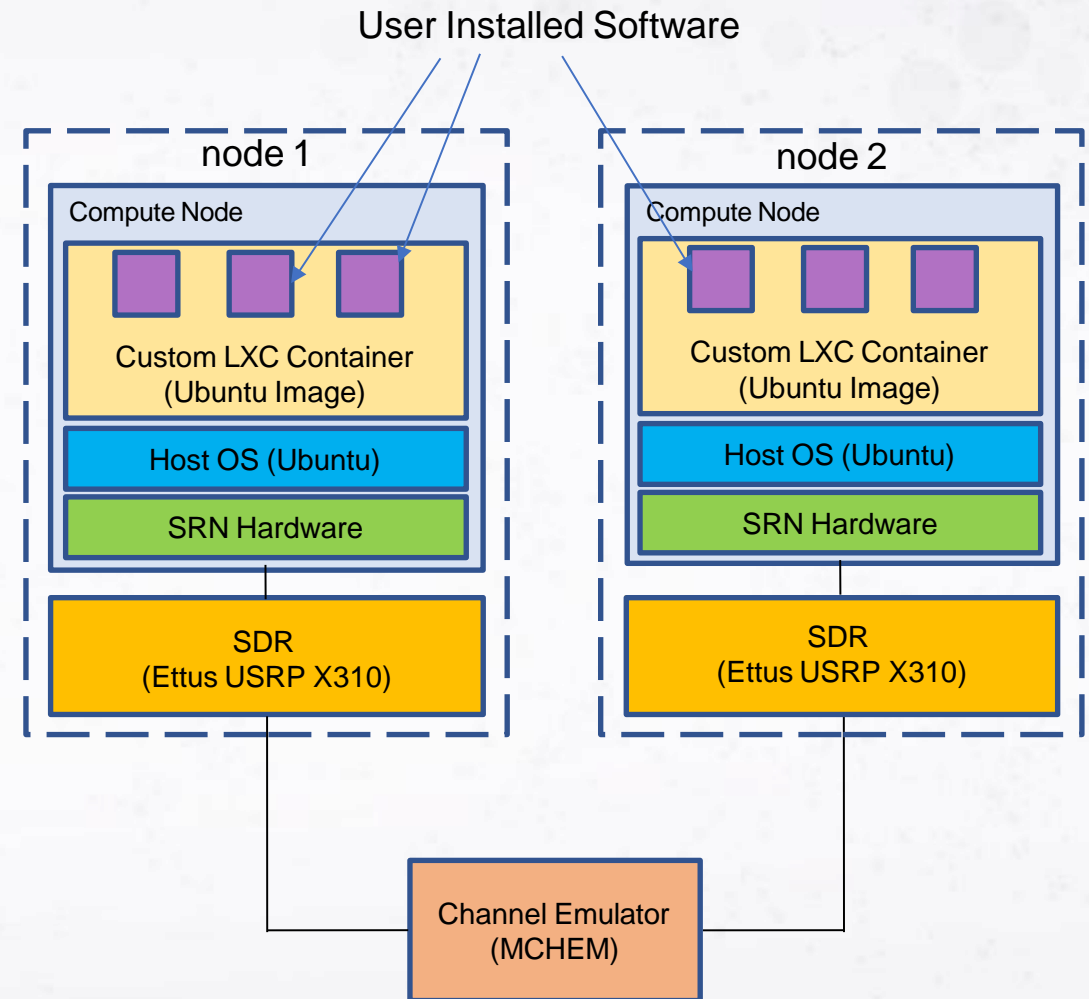
1. LXC Containers
2. File-proxy
3. Data collection on Colosseum

## 2. Assignment

1. GNU Radio
2. Local container creation and upload
3. Scenario and experiment run

# Colosseum Experiments at glance

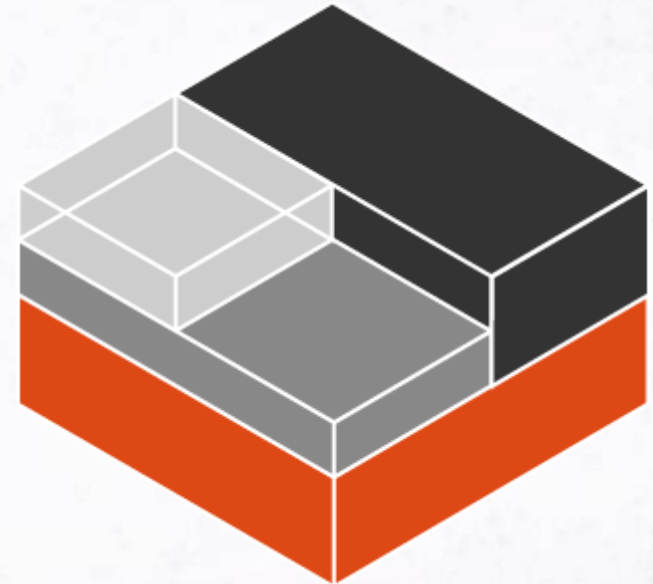
- Reserve the resources;
- Access the nodes;
- Run the experiments to the node;
- Save the output somewhere;



# LXC containers

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- Image-based software for the creation of OS Linux instances:
  - Isolated environments
  - Hardware access (e.g., SDRs)
- In Colosseum:
  - LXC images are immutable
  - Every experiment will be consistent and repeatable
  - Limited storage space to save for container images
    - (e.g., don't save your data in the containers)



# File Proxy Server

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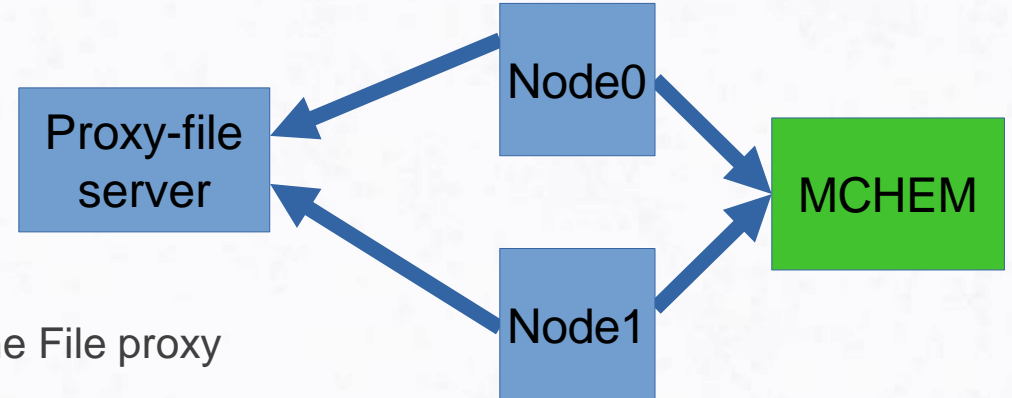
- Server on Colosseum:
  - Location of all LXC images;
    - Common images: /share/nas/common
    - Group images: /share/nas/<your\_group>/images
  - Connected with your reservations:
    - Store configurations
    - Save data location

```
ssh alacava@file-proxy # ssh <your_username>@file-proxy
```

# Save results of an experiment

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- Reservations and File Proxy are connected between each other:
  - `/share/` on every node is a symlink to a folder on File Proxy
  - `/share/<your_team>/reservation/<reservation_id>`
- Data must be written as unprivileged user
  - `su srn-user #` within the container
- Examples commands to save data:
  - `cp results.txt /share/ #` copy the file results.txt from the node to the File proxy
  - `cp /share/config.conf , #` copy the file results.txt from the File proxy to the node



# Hands-on: Creating custom containers

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1. Download base image from the File Proxy;
2. Customize it locally (install GNU Radio);
3. Upload the image;
4. Run a basic experiment;

Follow the link: <https://tinyurl.com/container2022>

# GNU Radio

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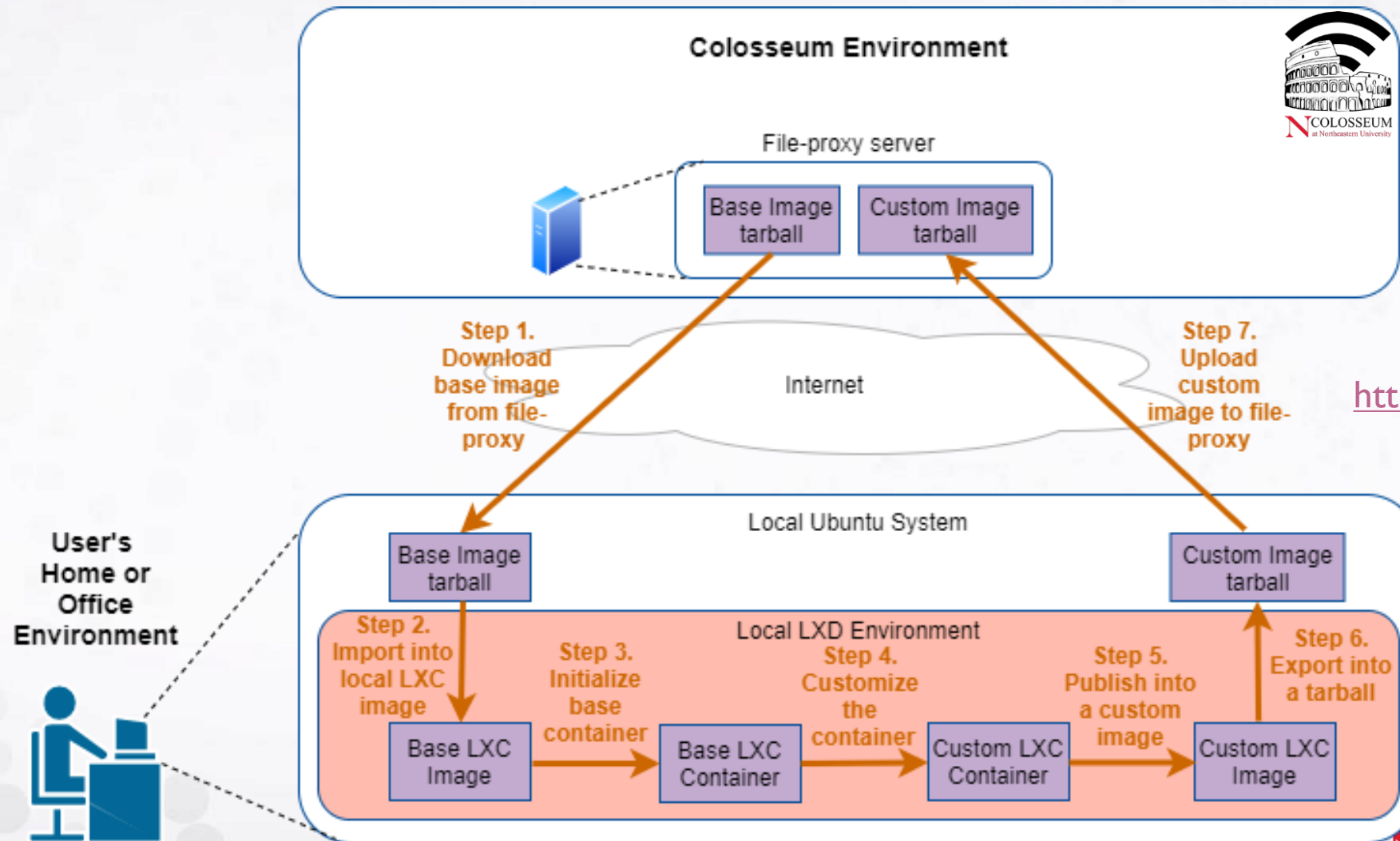
- Software development toolkit
- Compose signal processing blocks
- Usable with USRP x310 radios (Colosseum main RF hardware)





# Hands-on recap

PWD: I23lecci32I



<https://tinyurl.com/container2022>

# Reservation setup

- Upload the image prepared with GNURadio
- Make and start a reservation for two nodes, using the image
- Check the SRNs identifiers

The screenshot shows the 'Request New Reservation' page on the experiments.colosseum.net website. The page has a navigation bar with 'Home', 'Reservations', and 'Batch Jobs'. The 'Reservations' section is active.

The reservation form includes the following fields:

- Name:** A dropdown menu is open, showing a list of images. 'my-colosseum-image' is highlighted. Other options include cellos-bernardo, cellos-leo, frank-wifi-basic, michele-wifi-basic, shweta-oal-harqbr, shweta-oal-new, shweta-oaldevbr-w26-ulfix, shweta-srsite, srsite-basic-20-04, webinar-1604, common, base-1604-cuda, base-1604-nocuda, incumbent-active-v1-4, incumbent-active-v1-5, and incumbent-dsrc-v2-2.
- Start date:** A text input field.
- Start time:** A text input field.
- Duration:** A text input field with a note: 'Note: 5 minutes'.
- Number of SRNs:** A text input field.
- Node 1:** A dropdown menu with 'shweta-srsite' selected.

Below the form, there is a table titled 'Request New Reservation' showing resource availability for three quads (Quad 1, Quad 2, Quad 3) on Tuesday, July 14. The table has columns for time slots (11:00 pm, 11:10 pm, 11:20 pm, 11:30 pm, 11:40 pm) and rows for 32 time slots. The bottom of the table shows the current cost and remaining tokens.

	Current	Cost	Remaining
Tokens	2514	12	2502

# Login and start RF

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- Login
  - use two different terminals
- Start the MCHEM
  - scenario 1009 (CF 1GHz, 0dB of path loss)
  - This command should be executed just in one of the terminals

```
$> ssh -Y <srn-hostname1>  
$> ssh -Y <srn-hostname2>
```

```
#> colosseumcli rf start 1009 -c
```

# Start software

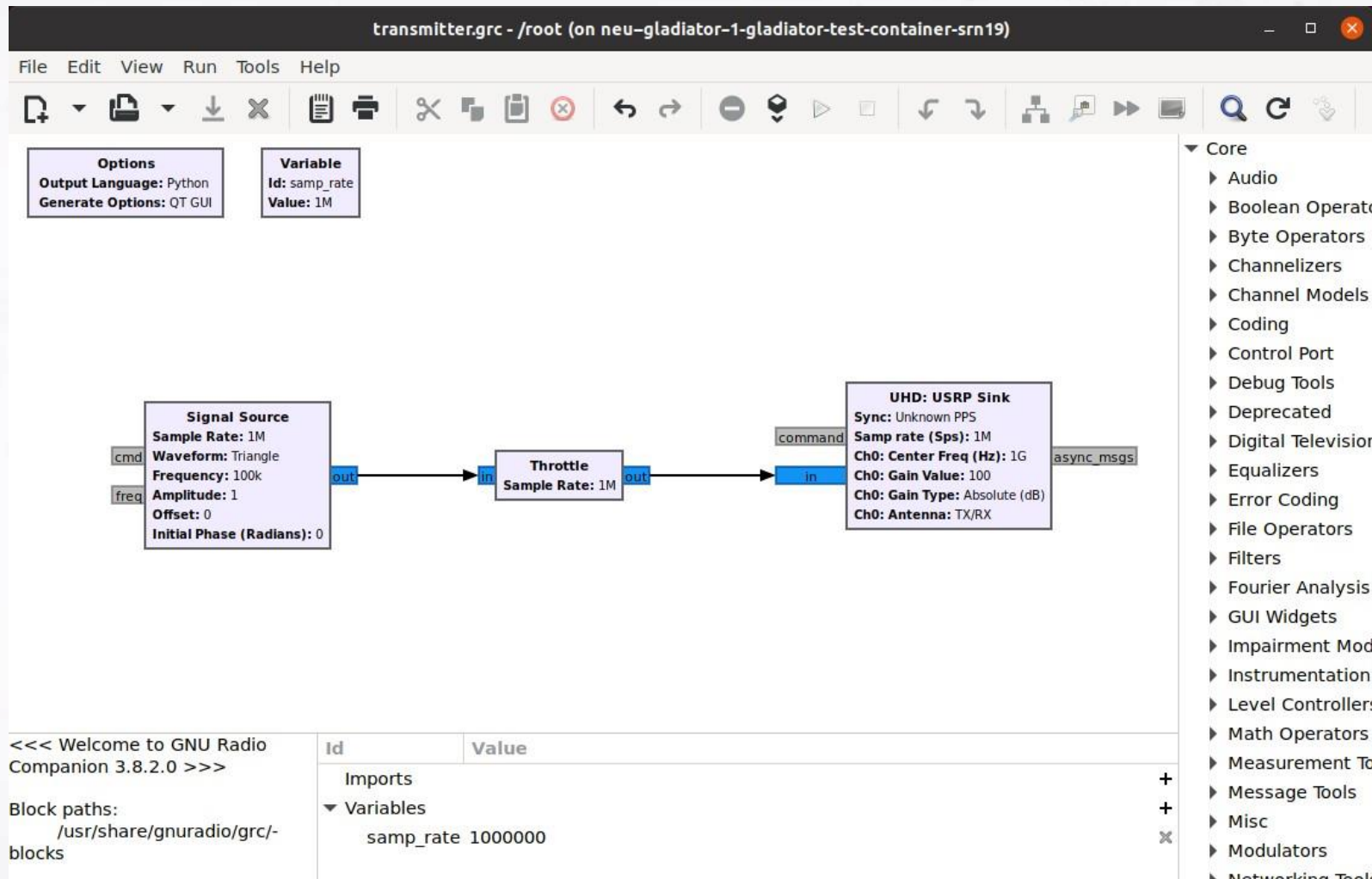
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- In both terminals:
  - update the FPGA image;
  - start GNURadio companion:

```
#> ./flash_fpga_x310.sh
```

```
#> gnuradio-companion
```

# Design the transmitter



# Design the receiver

receiver.grc - /root (on neu-gladiator-1-gladiator-test-container-srn20)

File Edit View Run Tools Help

Options  
Output Language: Python  
Generate Options: QT GUI

Variable  
Id: samp\_rate  
Value: 1M

UHD: USRP Source  
Sync: Unknown PPS  
Samp rate (Sps): 1M  
Ch0: Center Freq (Hz): 1G  
Ch0: AGC: Default  
Ch0: Gain Value: 100  
Ch0: Gain Type: Absolute (dB)  
Ch0: Antenna: RX2

QT GUI Time Sink  
Number of Points: 1.024k  
Sample Rate: 1M  
Autoscale: No

<<< Welcome to GNU Radio Companion 3.8.2.0 >>>

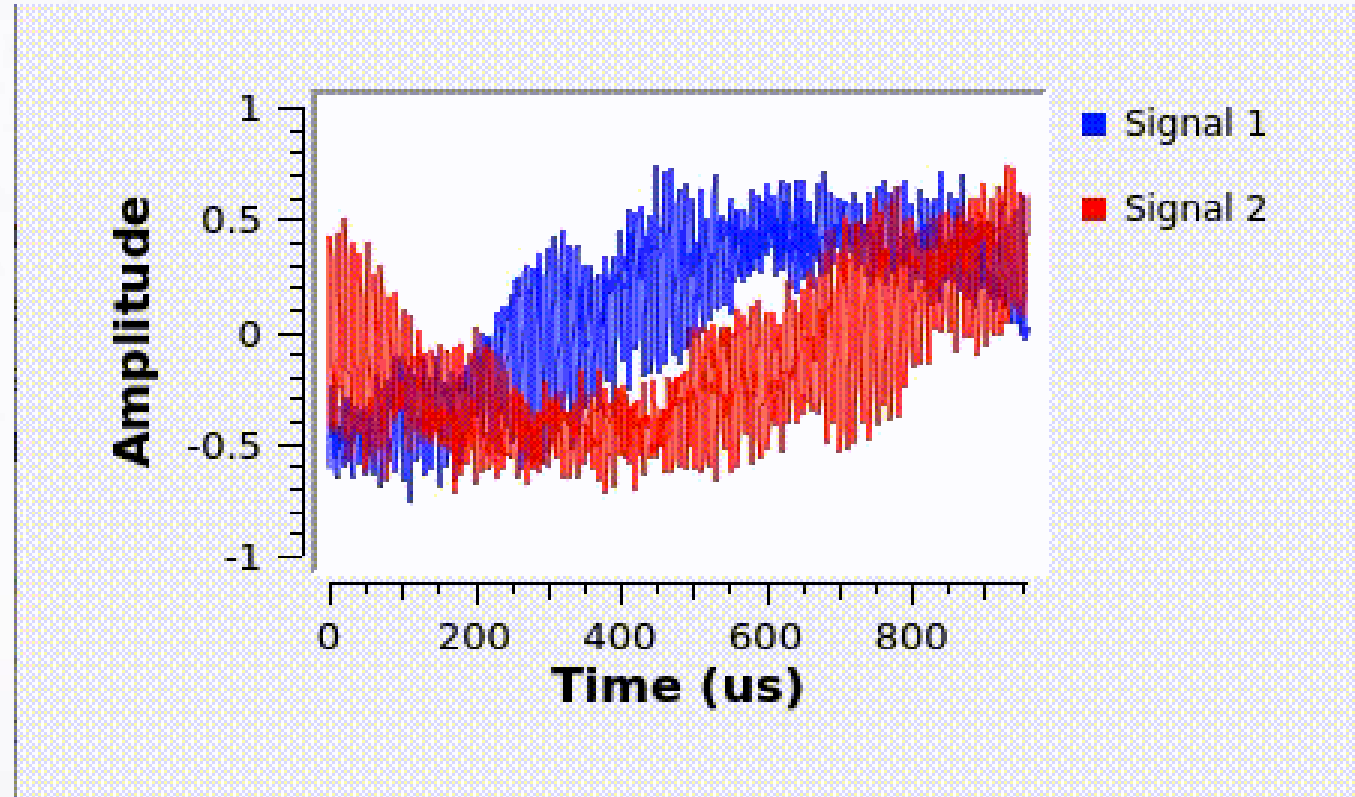
Block paths:  
/usr/share/gnuradio/grc/-  
blocks

Id	Value
Imports	
Variables	
samp_rate	1000000

- Core
  - Audio
  - Boolean Operators
  - Byte Operators
  - Channelizers
  - Channel Models
  - Coding
  - Control Port
  - Debug Tools
  - Deprecated
  - Digital Television
  - Equalizers
  - Error Coding
  - File Operators
  - Filters
  - Fourier Analysis
  - GUI Widgets
  - Impairment Models
  - Instrumentation
  - Level Controller
  - Math Operators
  - Measurement Tools
  - Message Tools
  - Misc

# Observe the spectrum in rx

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# References

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- Accessing Colosseum Servers:
  - <https://colosseumneu.freshdesk.com/support/solutions/articles/61000253362-accessing-colosseum-resources>
- SSH configuration and File Proxy access setup
  - <https://colosseumneu.freshdesk.com/support/solutions/articles/61000253369-ssh-proxy-setup>
- File transfer using scp and rsync:
  - <https://colosseumneu.freshdesk.com/a/solutions/articles/61000253365>
- Transferring base image from NAS to local machine:
  - <https://colosseumneu.freshdesk.com/support/solutions/articles/61000253371-transferring-the-base-lxc-image-from-the-nas>
- Details on LXD commands and configuration:
  - <https://colosseumneu.freshdesk.com/a/solutions/articles/61000253368>
- Local container creation:
  - <https://colosseumneu.freshdesk.com/a/solutions/articles/61000253428>
- File proxy upload:
  - <https://colosseumneu.freshdesk.com/support/solutions/articles/61000253372-upload-an-lxc-container>
- Installing Colosseum CLI and taking a snapshot of your container
  - <https://colosseumneu.freshdesk.com/support/solutions/articles/61000253397-colosseum-cli>



**Thanks for the attention!**  
**Questions?**