ELE476 Week-2 GNU Radio

Murat Sever
ytregitim@gmail.com

Outline

GNU Radio Intro

GR Companion

GR Flow Graphs

Signal Exploration with GR

GR with Sound Card

GNU Radio

- We will use GNU Radio to
  - analyze & simulate signals
  - teach signal processing
- So let’s learn how to use it first!

GNU Radio is…

- A signal processing library
- Designed for real-time
- The software part of an SDR
- Not a radio application
- The tool to **build your own** transceivers
- **FOSS**: Free and Open Source Software

GNU Radio

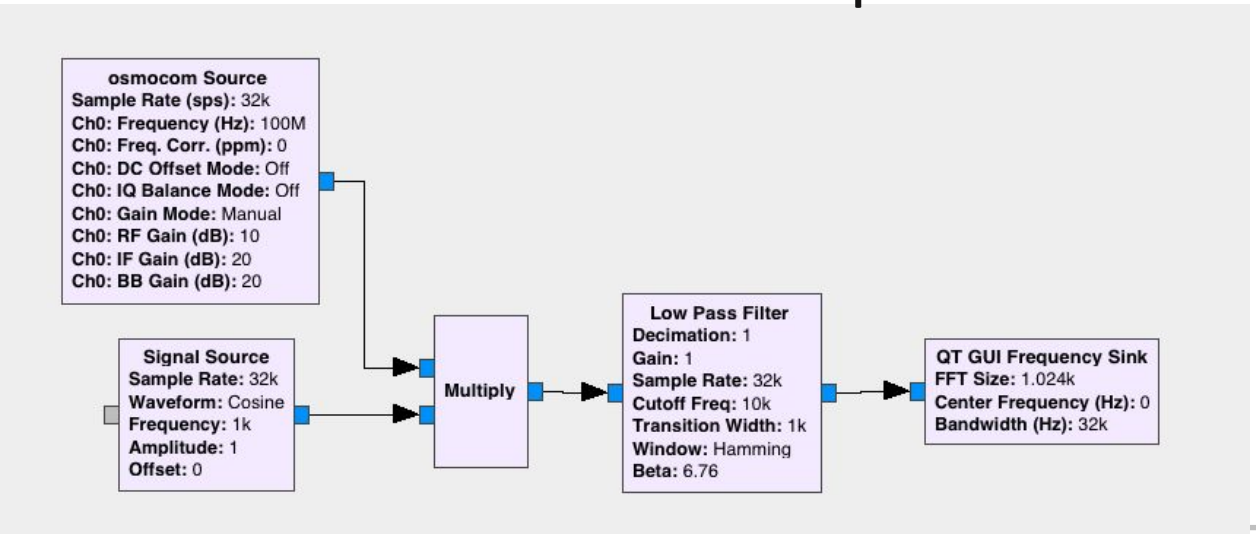
- GNU Radio is an open source framework to do DSP for radio (communications, RADAR, radio astronomy...).
- Also useful for applications that do similar computing (even particle accelerators!).
- It comes with:
  - A GUI application called “GNU Radio companion” where systems can be implemented by dragging and dropping blocks onto a canvas (making a “flowgraph”)
  - A rich library of processing blocks accessible both through GNU Radio companion, and C++ and Python APIs
  - A “runtime”, that moves data between these blocks and runs the code of each block
- In the GNU Radio ecosystem there are out-of-tree modules, which implement new blocks that don’t fit into or exist in the in-tree library
- There are also full applications that use GNU Radio for their DSP (for instance, GQRX, or QRadioLink)

GNU Radio

- Open-source framework for SDR and signal processing
- Founded by Eric Blossom in 2001
- Block-based dataflow architecture
- Each block runs in its own thread
- Data flows through a graph called a Flowgraph
- Blocks are nodes in a Flowgraph, and perform operations and signal processing
- Signals normalized between -1.0 and +1.0
- Similar in concept to MathWorks SimulinkTM
- Running C++ and Python under-the-hood
- Can write code directly, or use the GNU Radio Companion (GRC) graphical tool

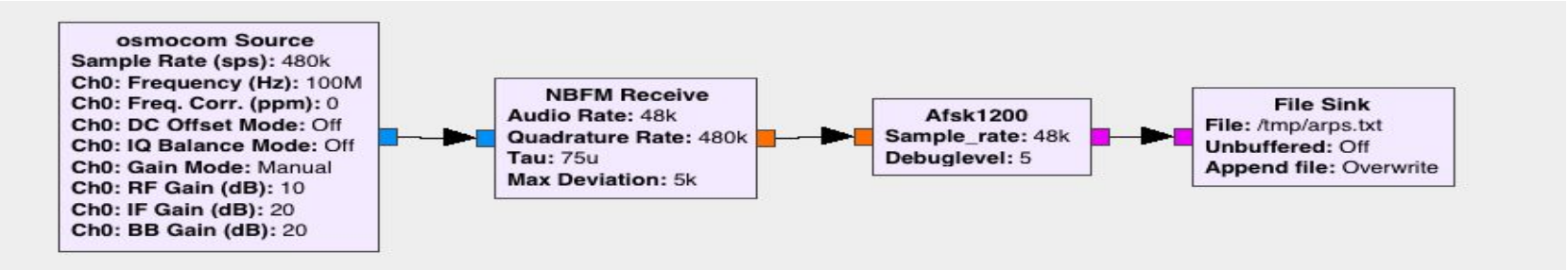
Basic Concept: Flow Graph

- Transceivers are implemented as *flow graphs*
- Similar to Simulink / schematics
- Define structure and parameters of *blocks*



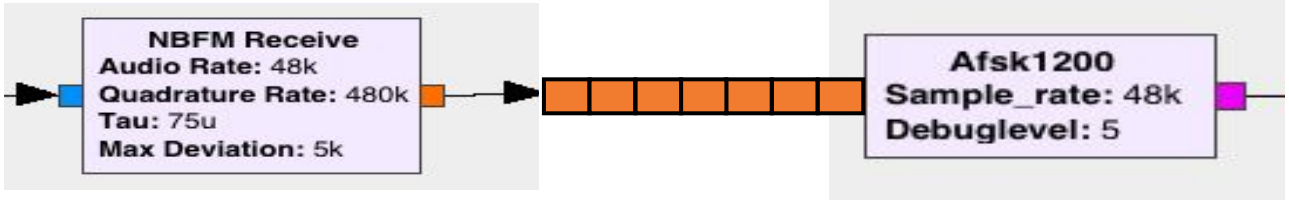
Basic Concept: Block

- Written in C++ or Python
- Implement one logical step
- Each block run in separate thread

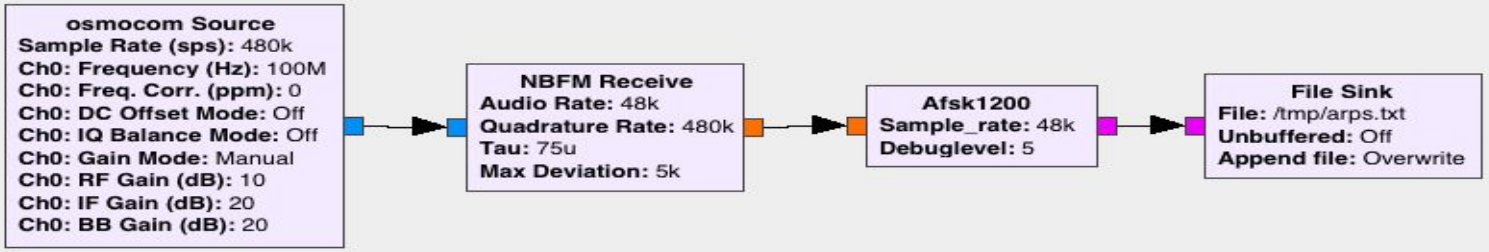


Data Streams

- Samples are buffered



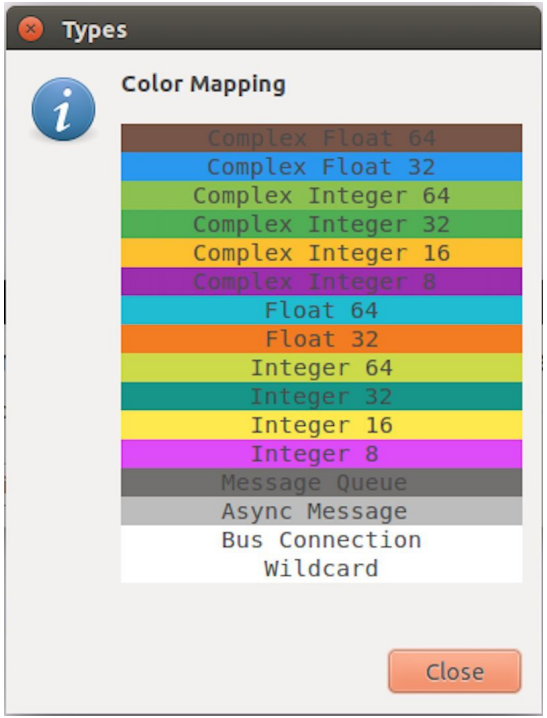
- Data types are color-coded



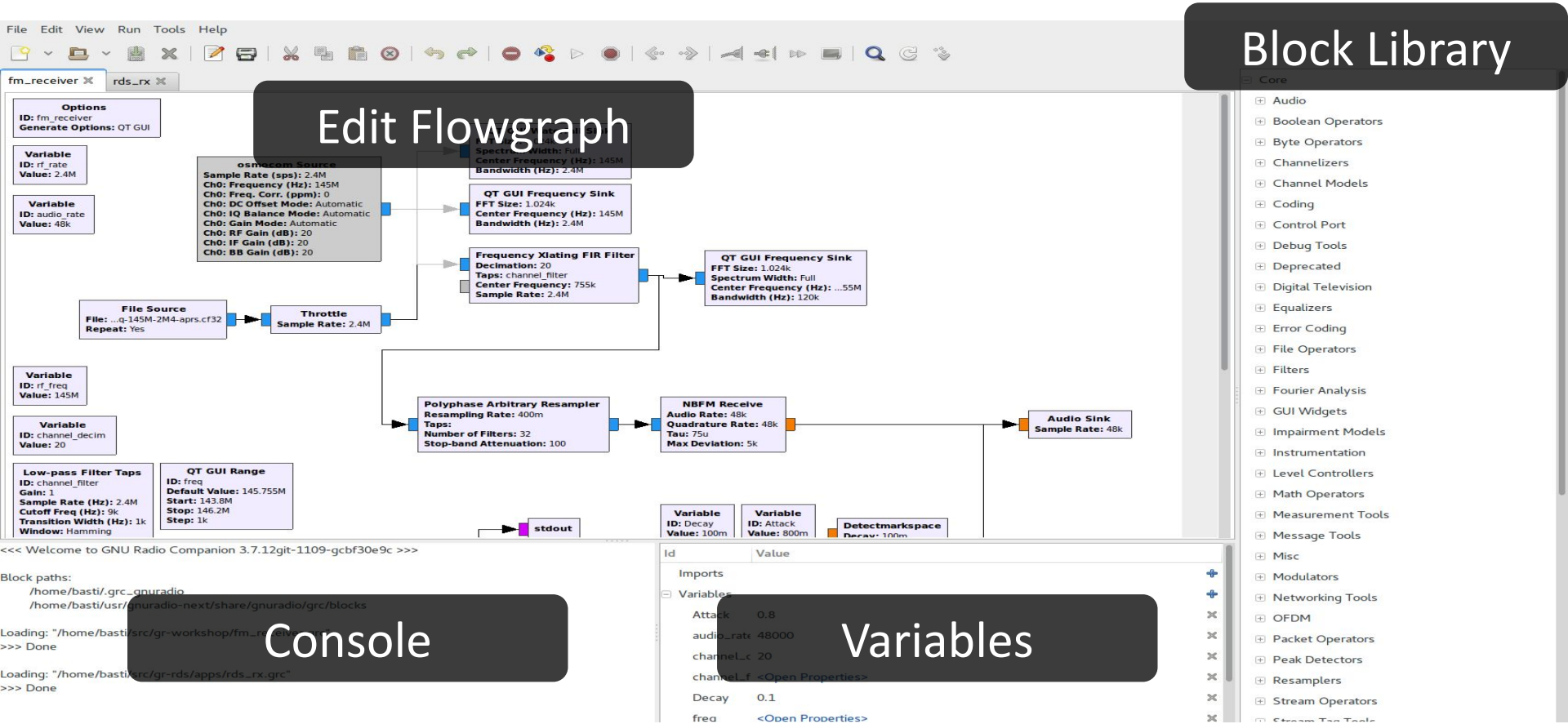
Complex Float Byte

Color Types

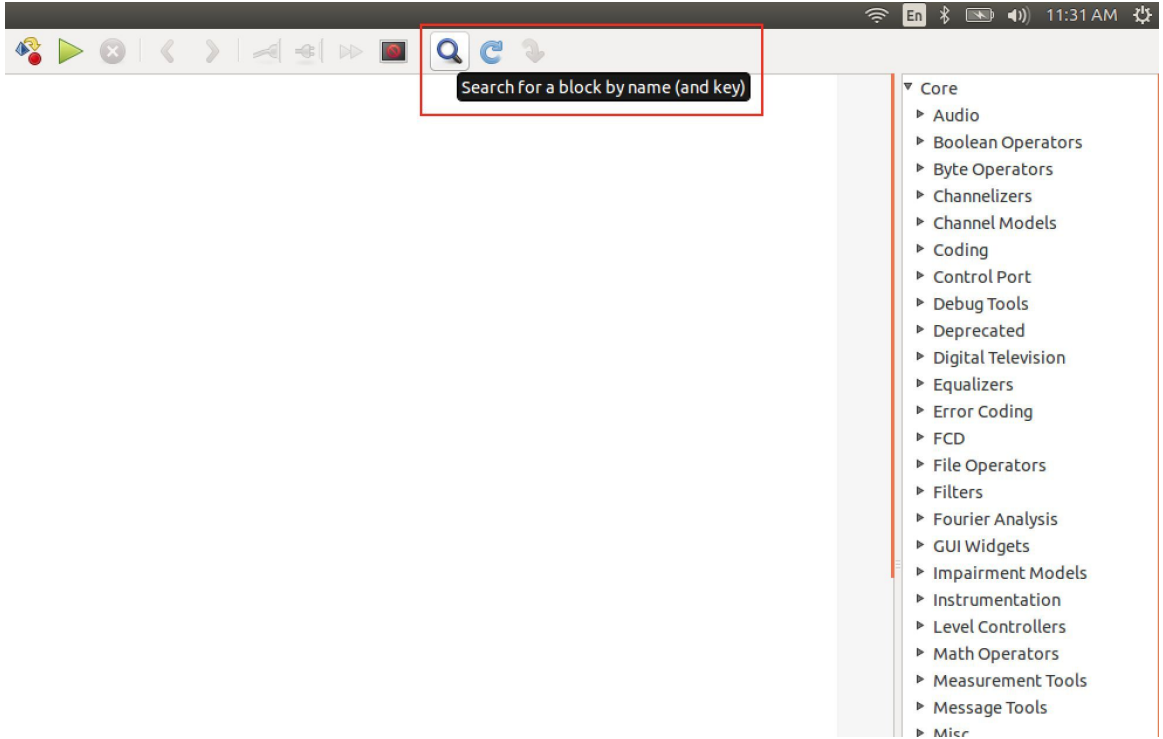
Click on menu item Help->Types



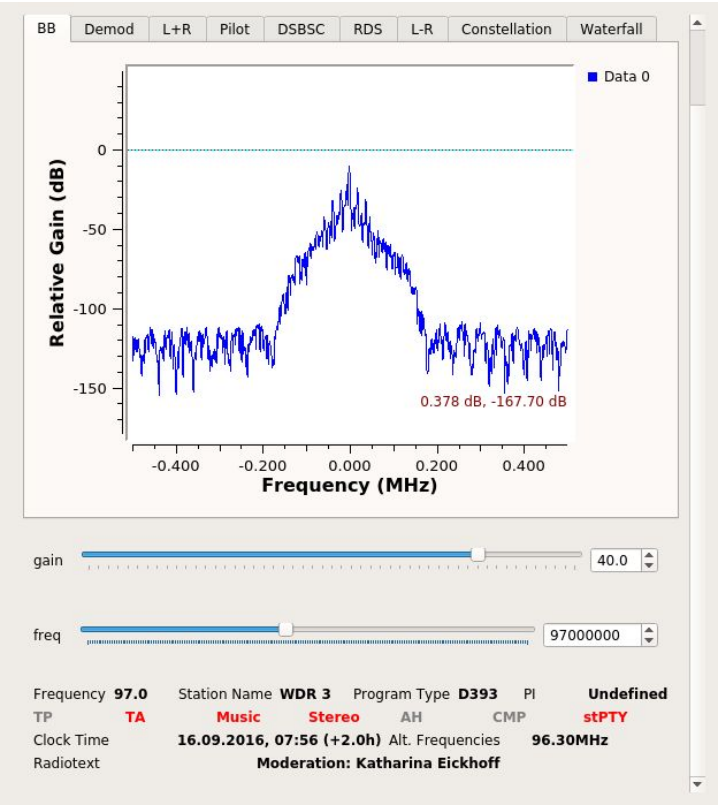
GNU Radio Companion

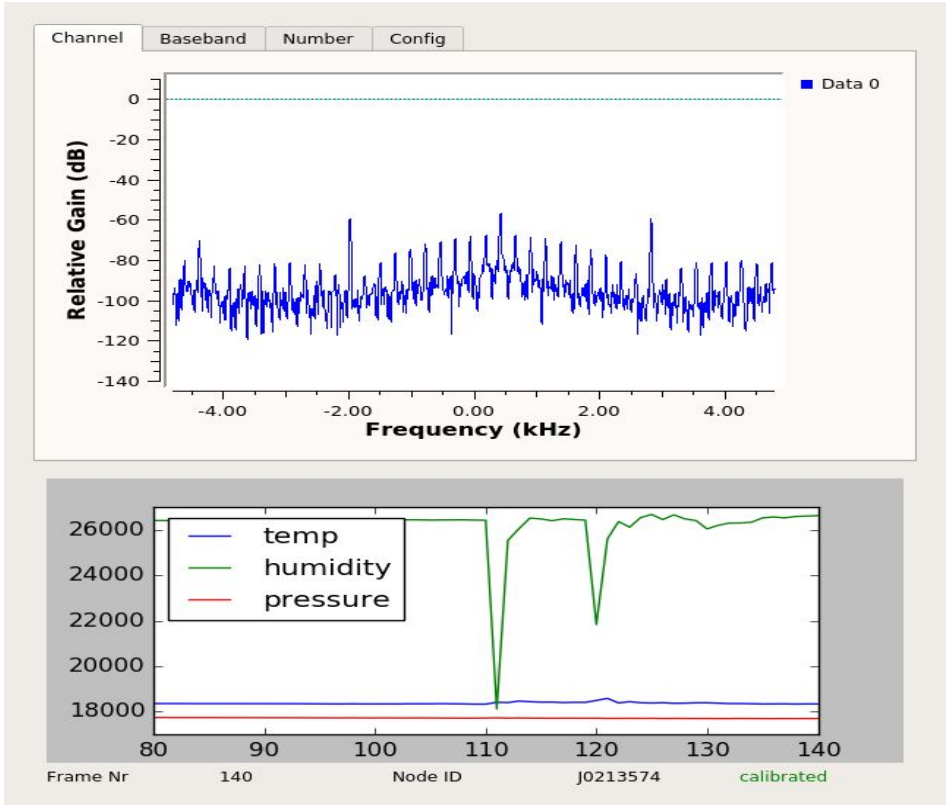


Search Blocks

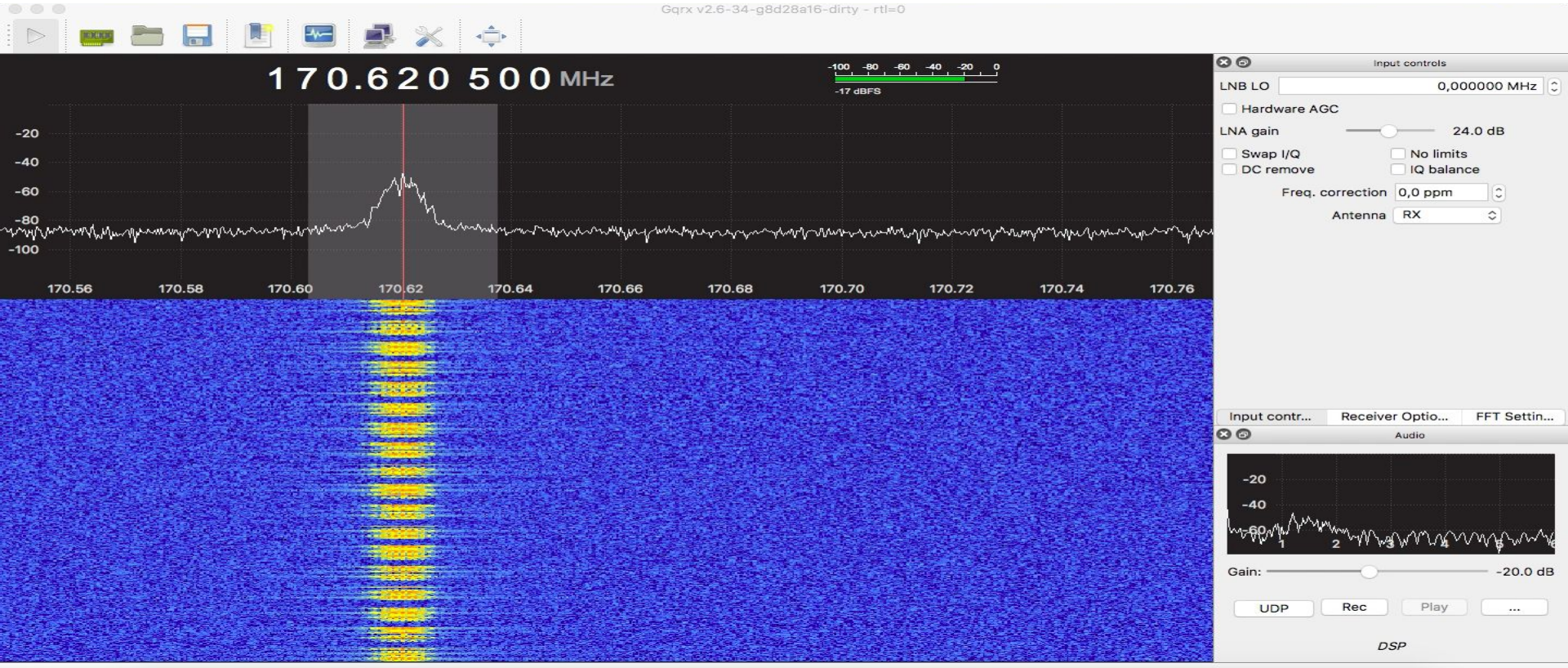


GUI Output and Instrumentation



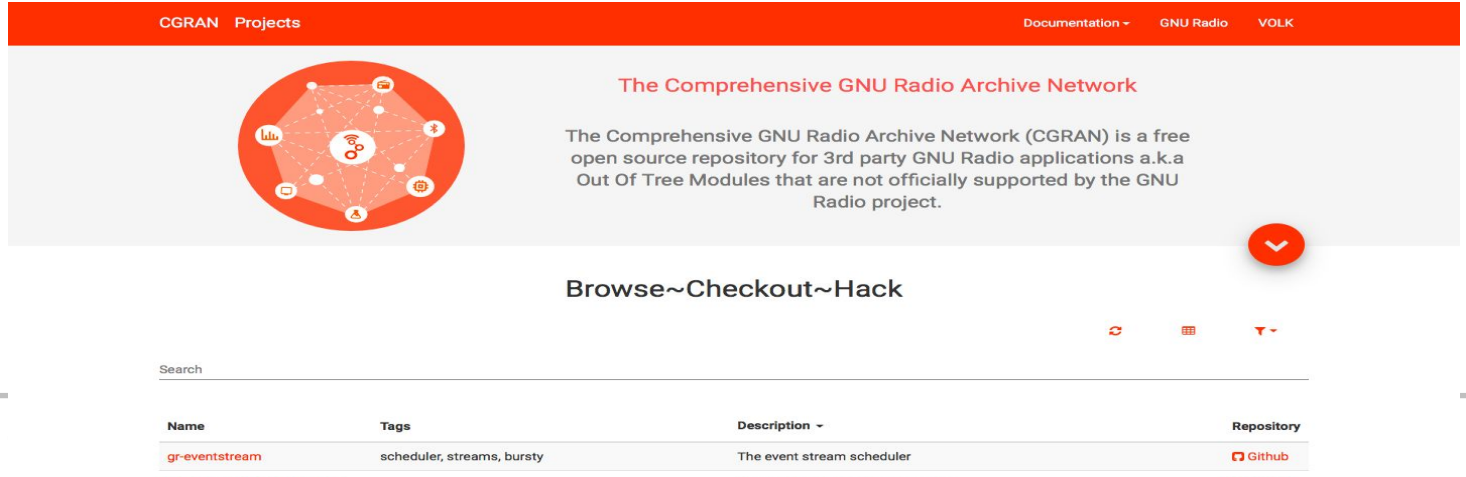


GQRX - a GNU Radio Application

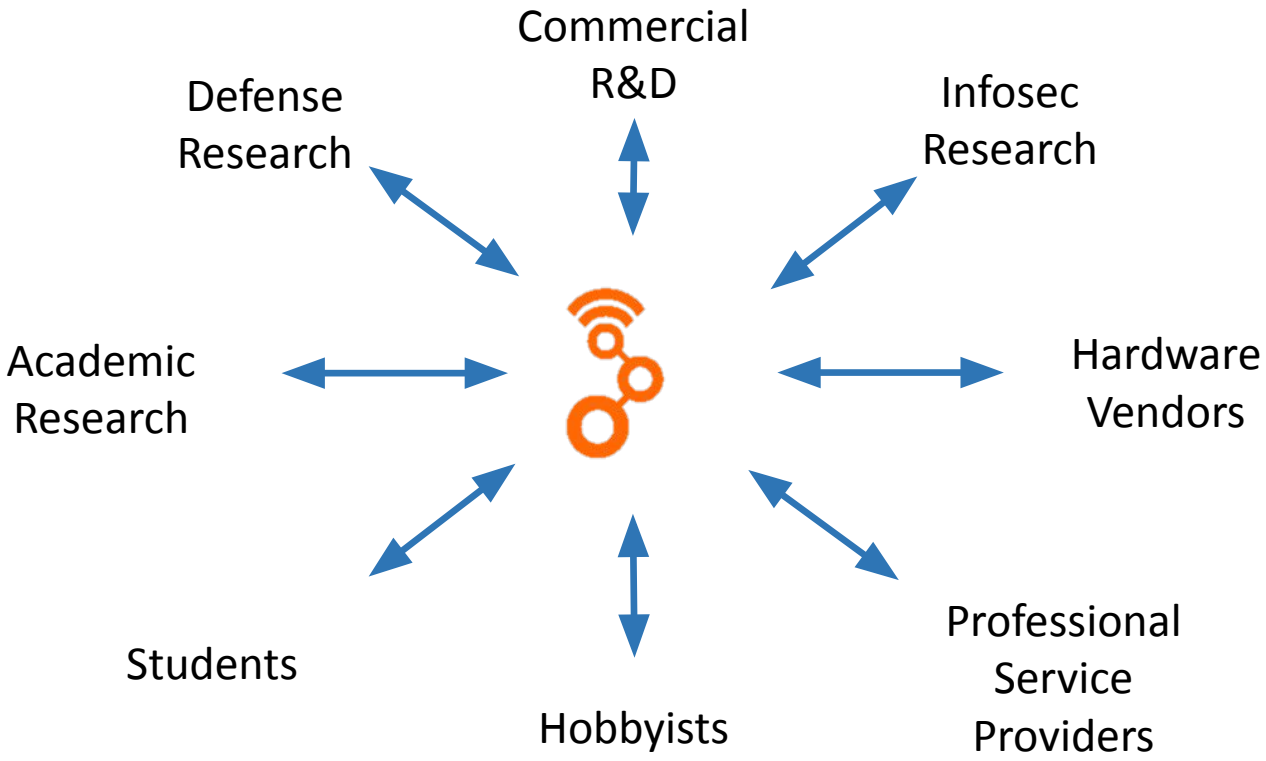


Out Of Tree Modules

- GNU Radio can be extended with OOTs
- OOTs cover more specific functionality
- There is a large number available
- CGRAN is our central database



GNU Radio is used by



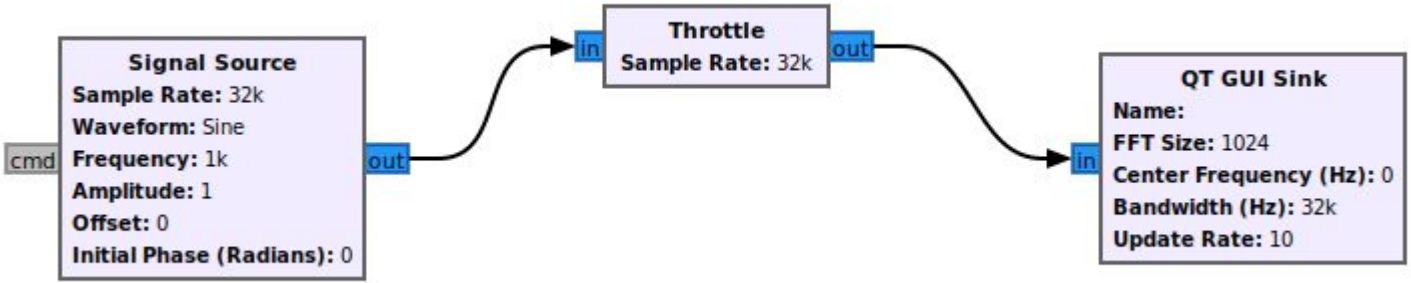
GNU Radio is an Ecosystem

- Active Open Source community since 2001
- PyBombs, OOTs
- GRCon since 2011
- GNU Radio Foundation
- FOSDEM SDR DevRoom
- GSoC, SoCIS, R&S Competition, SDR Academy
- GNU Radio Europe

Learn // Discuss // Connect

- Website: www.gnuradio.org
- Development: github.com/gnuradio
- **Mailing List: discuss-gnuradio@gnu.org**
- Wiki: wiki.gnuradio.org
- Slack: slack.gnuradio.org
- Facebook: gnuradioproject
- Twitter: @gnuradio

Exploration of Signals in Frequency Domain



Thanks!

ytregitim@gmail.com
LinkedIn: murat-sever