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A BRIEF INTRODUCTION TO GNU RADIO



Software Defined Radio (SDR)

- “[A] software radio is a radio system which performs the required signal processing in software instead of using dedicated integrated circuits in hardware.” (gnuradio.org)

What is GNU Radio?

- “GNU Radio is a free & open-source software development toolkit that provides signal processing blocks to implement software radios. It can be used with readily-available low-cost external RF hardware to create software-defined radios, or without hardware in a simulation-like environment.” (gnuradio.org)

GNU Radio Basics

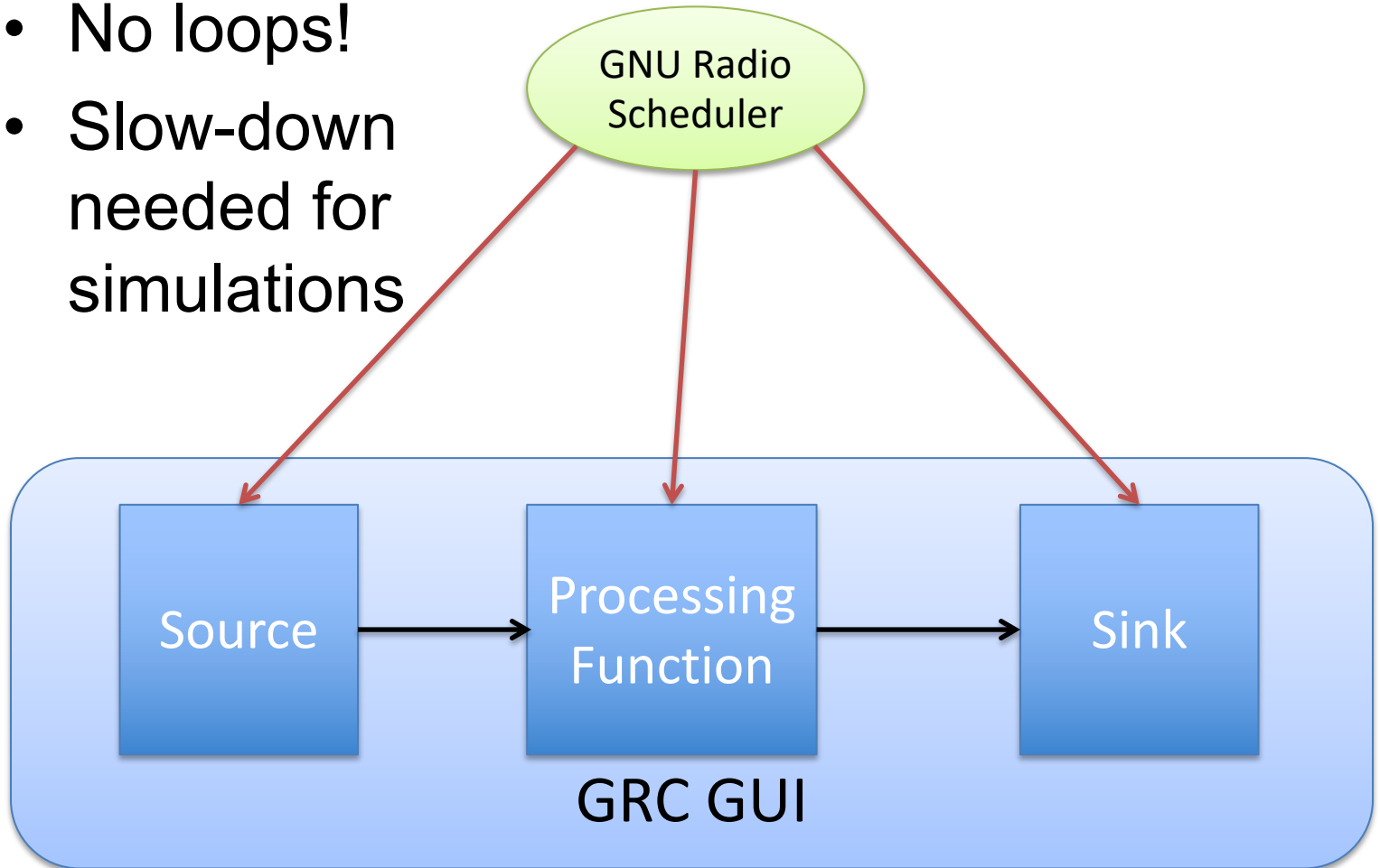
- Programs written in GNU radio are called “flow graphs”
- Flow Graph
 - Sources
 - Function blocks
 - Sinks
- Each flow graph must have at least one source and one sink

Definitions

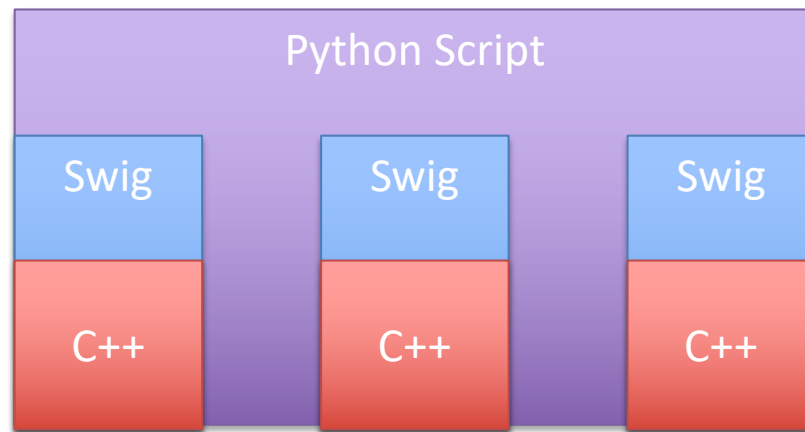
- Source
 - No inputs
 - At least one output
- Function
 - At least one input
 - At least one output
- Sink
 - No outputs
 - At least one output

GNU Radio Basics

- No loops!
- Slow-down needed for simulations

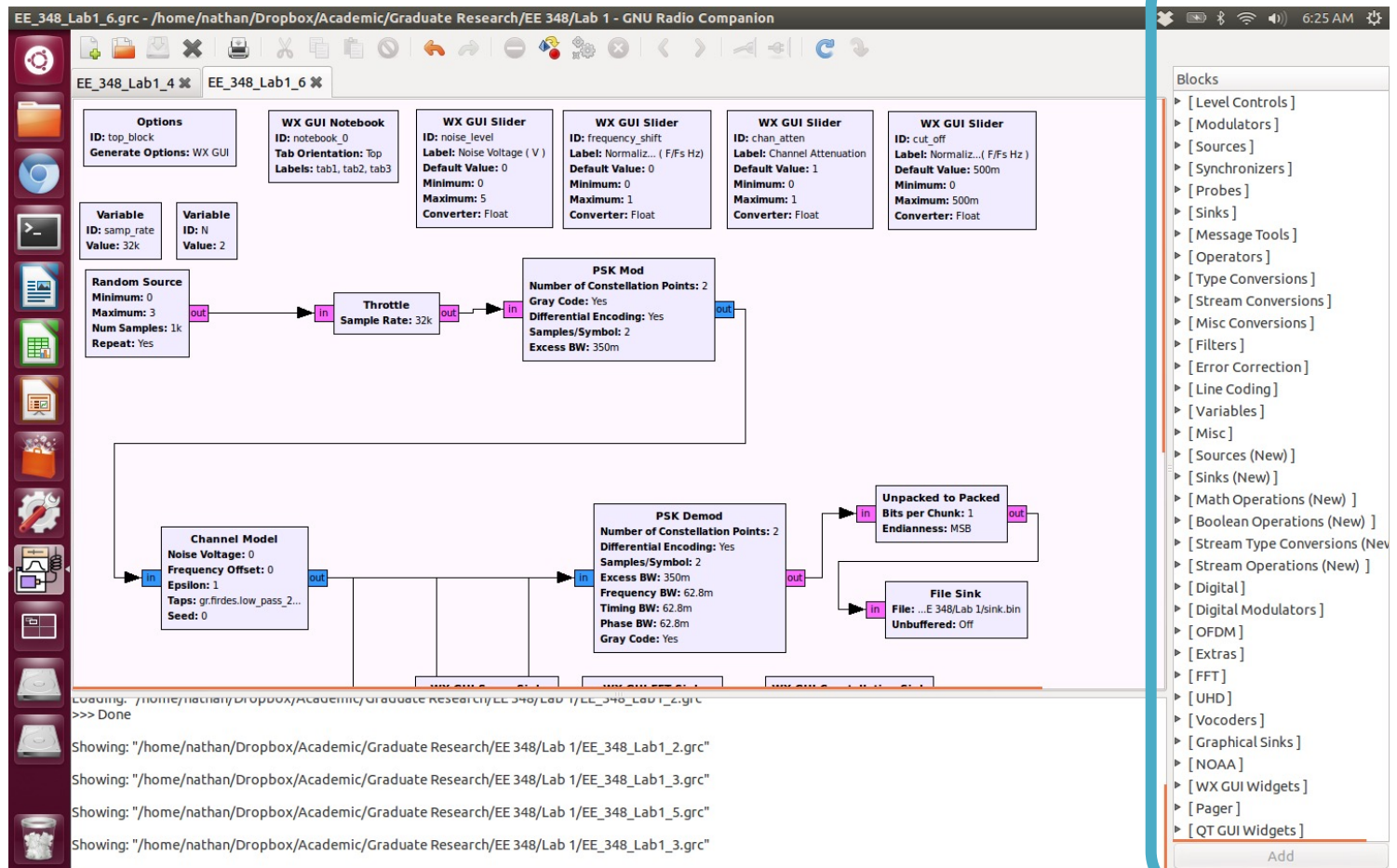


The structure of a flow graph



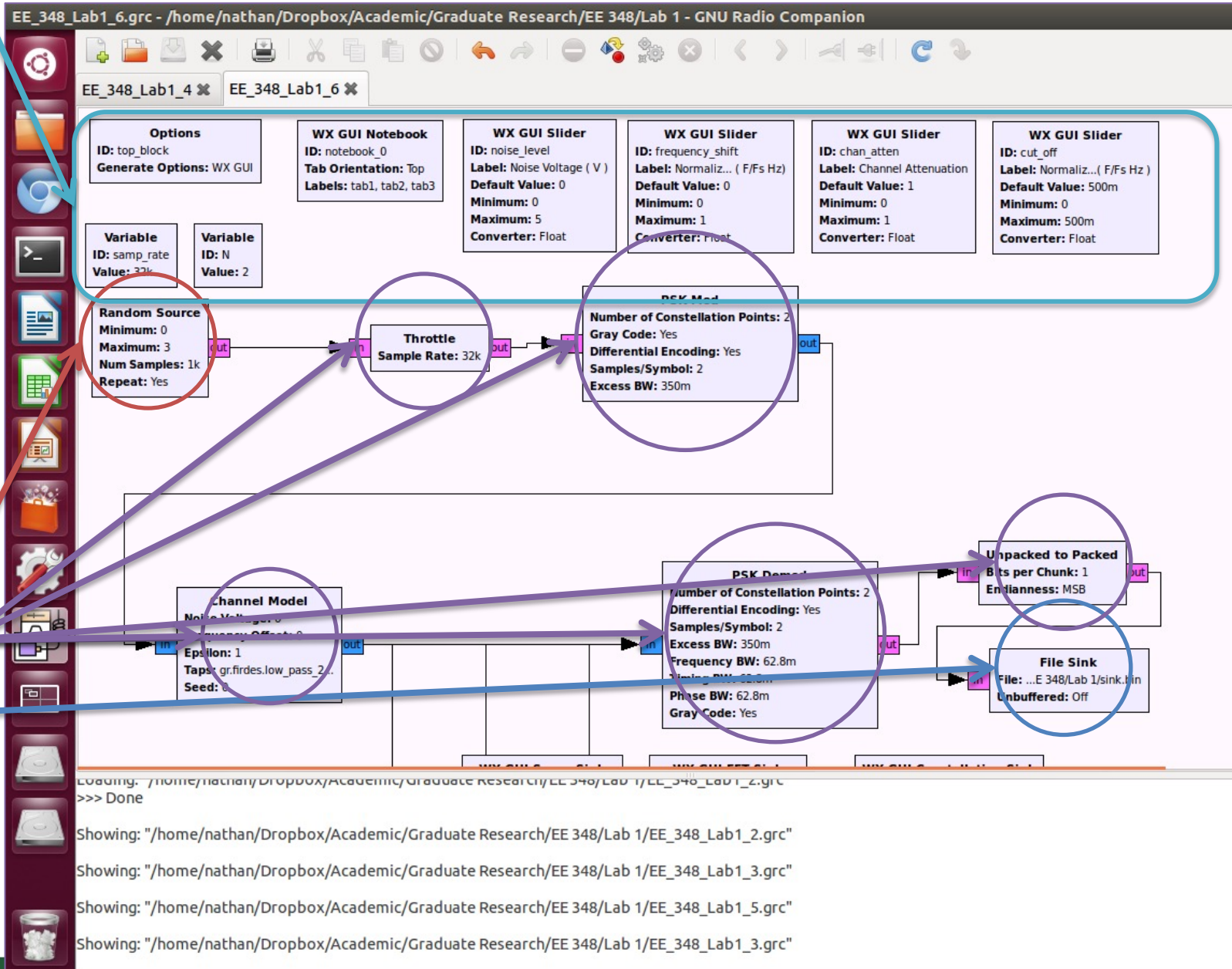
GNU Radio Companion (GRC)

List of Blocks



Variables

Flow Graph Example



Source

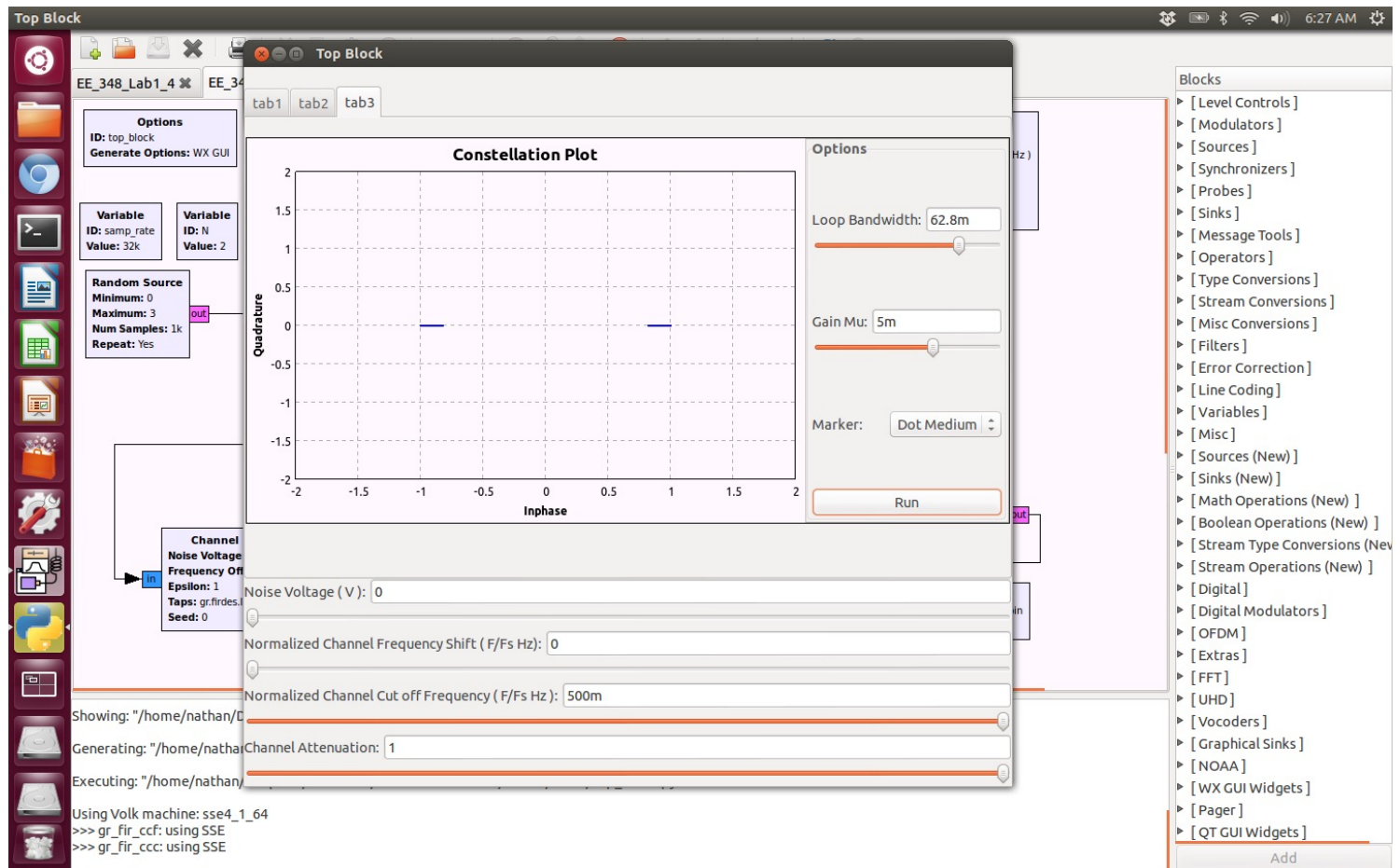
Function

Sink

MISSOURI S&T



GNU Radio Companion (GUI) - Constellation





Lab Setup

- Assignment files from Canvas
- Suggested GNU Radio setup:
 - Linux system – direct installation/dual-boot
 - Win10 WSL based Linux (WSL2 or ver. 2!)
 - <https://docs.microsoft.com/en-us/windows/wsl/install-win10>
 - <https://wiki.ubuntu.com/WSL>
 - <https://sourceforge.net/projects/vcxsrv/> (suggested GUI – open source based)
 - Virtual Box – Run Linux inside VM
 - <http://www.oracle.com/technetwork/server-storage/virtualbox/overview/index.html>

GNU Radio Installation

- Suggested to use build-from-source version instead of prebuild libraries
- <https://wiki.gnuradio.org/index.php/UbuntuInstall>
 - See **Install Dependencies**
 - Then follow Install-From-Sources:
https://wiki.gnuradio.org/index.php/InstallingGR#From_Source
 - Set Python and library environmental settings
(https://wiki.gnuradio.org/index.php/ModuleNotFoundError#B._Finding_the_Python_library) e.g.:
 - **export PYTHONPATH=/usr/local/lib/python3/dist-packages:\$PYTHONPATH**
 - **export LD_LIBRARY_PATH=/usr/local/lib:\$LD_LIBRARY_PATH**

Contact Information

- Maciej Zawodniok
- Email: mjzx9c@mst.edu
 - Flag important
 - With “5430 Lab” in the subject
- Call if urgent

Legacy Installation

- Linux system running GNU Radio
 - Live DVD image – Outdated!!
 - https://wiki.gnuradio.org/index.php/GNU_Radio_Live_SDR_Environment
 - <http://www.wikihow.com/Install-Ubuntu-on-VirtualBox>