# GNU Radio

mehdi sajjadi

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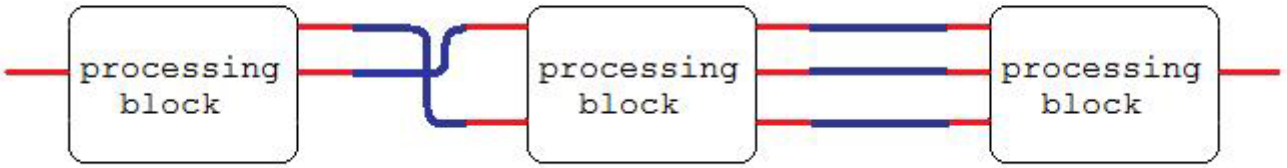
# What is GNU Radio?

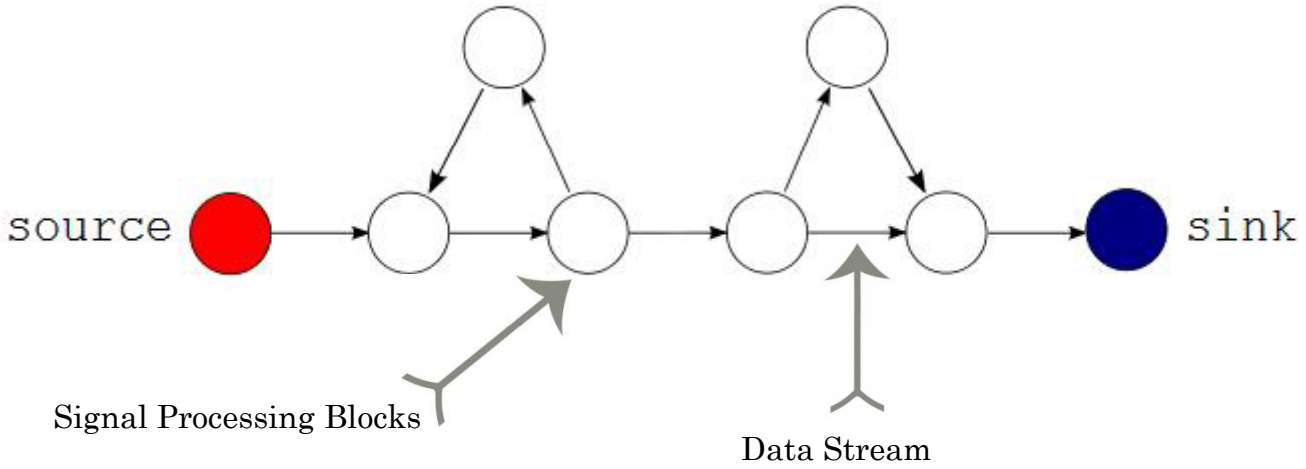
- An open-source software toolkit
- Design & Implementation of Radio systems

Two main set of tools:



# What is GNU Radio?

- Radio system designer



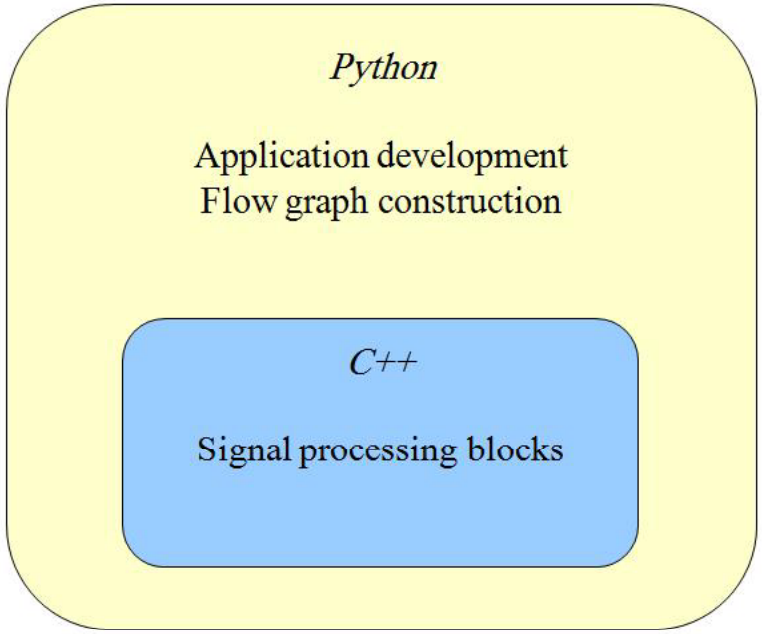
# History:

- SpectrumWare Project in MIT
  - Pspectra Code
    - one of the first toolkits available to design basic software radio applications.


- GNU Radio Started in 1998 by Eric Blossom
- In 2004 a complete rewrite of the GNU Radio was completed

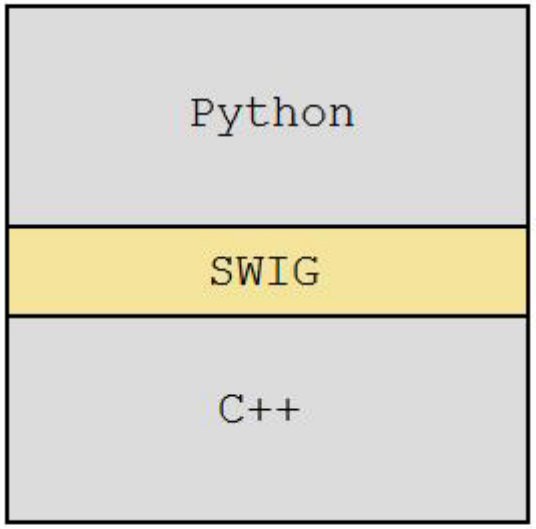
# Programming Languages:

- python™
  - Simple , Powerful
  - Scripting language
  - Implementation of a flow graph is easy
  - Mainly used for :
    - Defining , Managing flow graphs
    - GUI
- C++
  - Performance Critic applications
  - Signal Processing Blocks
    - In fact C++ classes



# SWIG ( Simplified Wrapper and Interface Generator ):

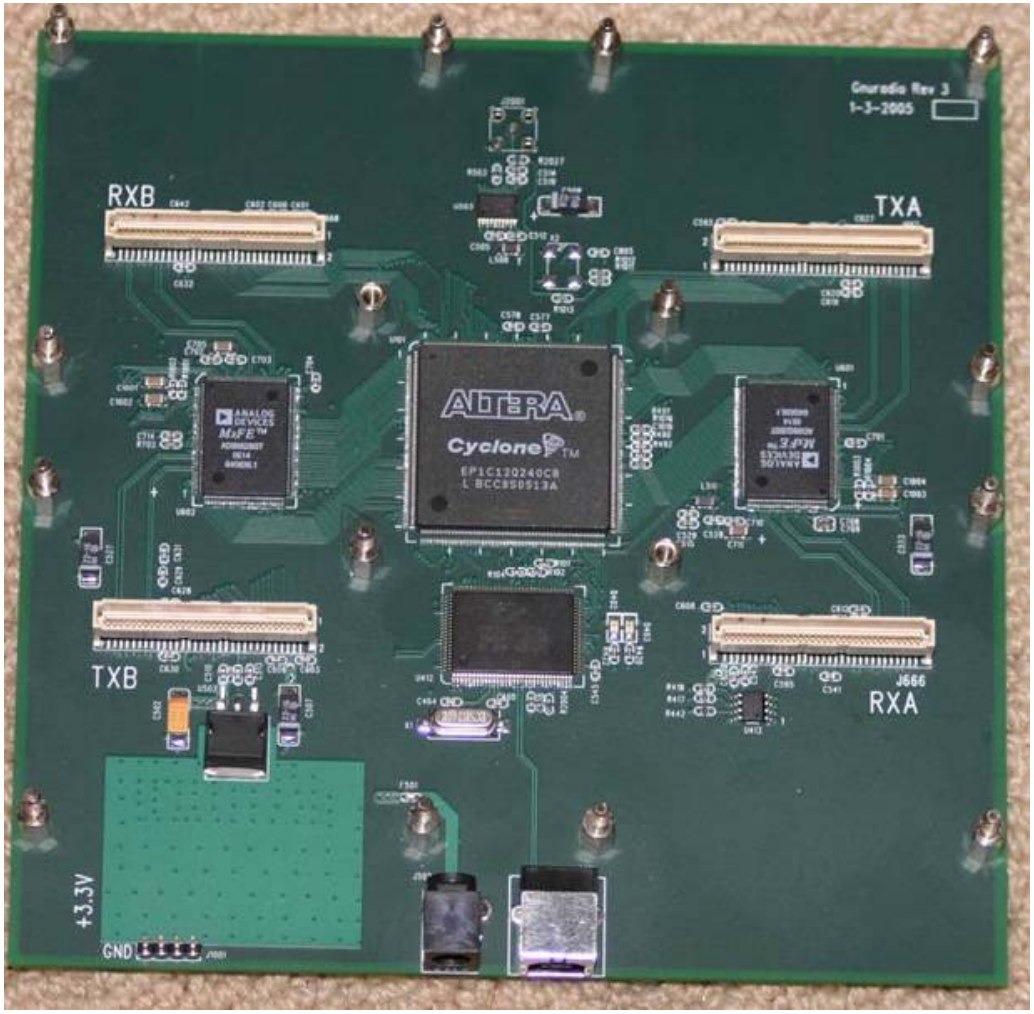
- SWIG connects programs written in C and C++ with scripting languages ( Python in our case )



# HARDWARE:

- In the beginning, combination of:
  - Cable TV Modem ( RF FE )
  - 20 MSample/s ADC
- USRP ( Universal Software Radio Peripheral ):
  - Designed by Matt Ettus
  - 4 × ADC : 12 bits & 64 MSample/s
  - 4 × DAC : 14 bits & 128 MSample/s
  - FPGA : Altera EP1C12 ( open-source code )
  - USB 2.0
  - 4 × Daughter Boards
  - DC to 2.9 GHz

# HARDWARE:


Gnuradio Rev 3
1-3-2005
RXB
TXA
ALTERA
Cyclone
TM
EP1C12Q240C8
TXB
RXA
J666
+3.3V
GND

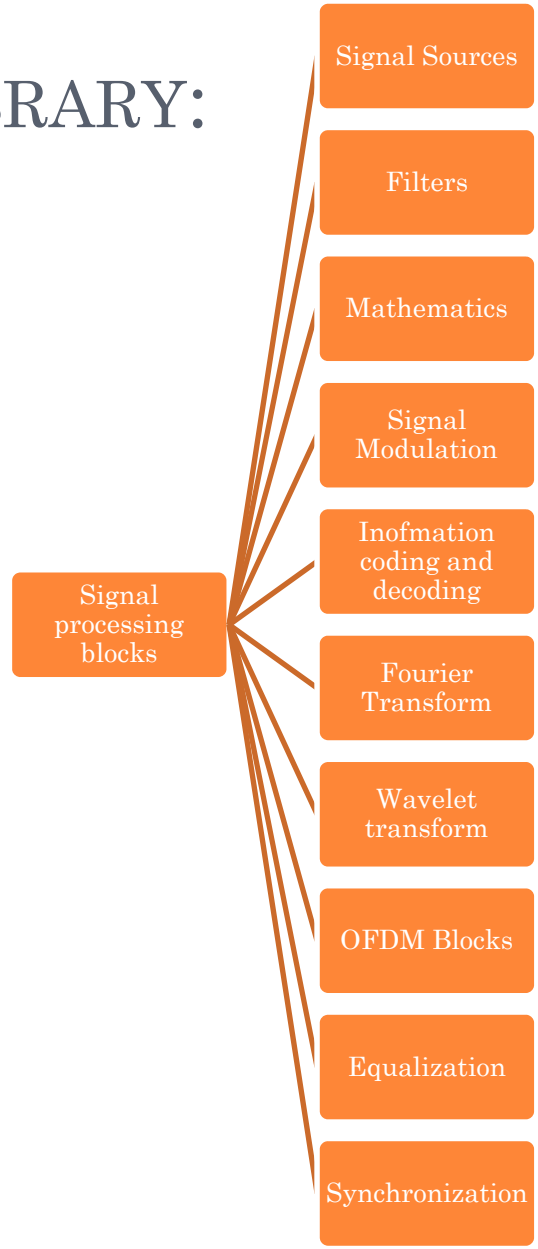
# HARDWARE:

- USRP2 ( September 2008 ) :
  - More powerful FPGA ( Xilinx Spartan 3-2000 )
  - 2 × ADC : 14 bits & 100 MSample/s
  - 2 × DAC : 16 bits & 400 MSample/s
  - Gigabit Ethernet interface

# DSP Blocks Library:

- Extensive Library ( 200+ ) of DSP Blocks (C++)
- New blocks can be added
- Other libraries can be integrated
  - GSL , FFTW, NumPy ,…
- Each Block:
  - Number of inputs/outputs
  - Type of input/outputs

# DSP Blocks Library:



# DSP Blocks Library:

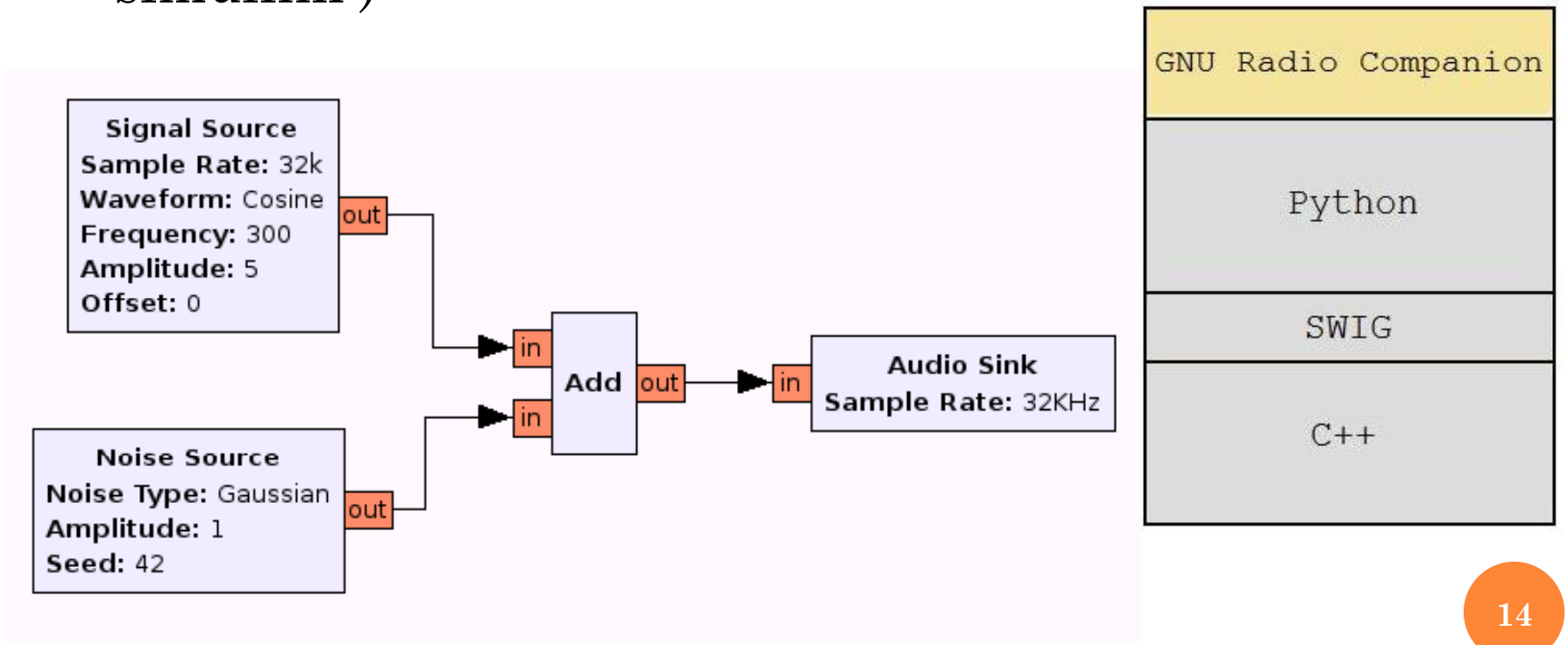
- Modulation:
  - AM
  - FM ( NBFM , WFN )
  - SSB
  - PSK , DBPSK , DQPSK ,D8PSK
  - QAM ( 8 , 16 , 64 , 256 )
  - CPM , CPFSK , GMSK
  - FSK
  - OFDM
- Error correction codes:
  - Viterbi , Reed-Solomon , Turbo codes
- Various channel model/impairment simulation

# GUI ( Graphic User Interface ) :

- WXGUI :
  - Based on wxPython
    - Oscilloscope
    - Histogram
    - FFT Sink
    - Waterfall
    - Constellation
- QtGUI
  - Based on Qt

# GRC ( GNU Radio Companion ) :

- A graphical tool for creating signal flow graphs and generating flow-graph source code ( like simulink )



# WHAT IS THE NEXT:

- Current GNU Radio Architecture:
  - "PHY Layer"
  - Continuous stream of data
- Higher layers
  - Packet data
  - M-Blocks
- Version 3.3 :
  - Current architecture + Message passing architecture

# AND:

- GNU Radio has a long way to become commercial
  - Software is still under development

# Other Projects:

- DttSP
- OSSIE

# Thank You