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Generating different type of waveforms

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What is Gnu radio?

GNU Radio is a software library, which can be used to develop complete applications for radio engineering and signal processing.

Introduction

GNU Radio is a free and 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.

GNU Radio is licensed under the GNU General Public License (GPL) version 3. All of the code is copyright of the Free Software Foundation. While all the applications are implemented using python language while critical signal processing path is done using C++ language.

Idea behind GNURADIO

The goal is to give ordinary software people the ability to 'hack' the electromagnetic spectrum, i.e. to understand the radio spectrum and think of clever ways to use it.

Why GNURADIO

Instead of purchasing multiple expensive radios, a single generic radio can be implemented using gnu radio software and with support of minimal hardware to receive and transmit processed signal at required frequencies and any data type can be passed from one block to another i.e.it can be in bits, bytes, vectors, bursts or more complex data types

Since the performance critical blocks are implemented in C++ using processor floating point extensions the developers are able to implement real-time, high-throughput radio systems in a simple-to-use, rapid-application-development environment.

One can use it to write applications to receive data out of digital streams or to send data into digital streams, which is then transmitted using hardware. GNU Radio has filters, channel codes, synchronisation elements, equalizers, demodulators, vocoders, decoders, and many other elements which are called as blocks that are typically found in radio systems.

Features

The main features of gnu radio are **flexibility** and **configurability.**

Extending GNU Radio is also quite easy, if you find a specific block that is missing you can quickly create and add it.

In digital communication and transmission, different types of waves are used this involves sine wave, square wave and saw-toothed waveforms.

Each type of wave has its own properties which are considered during transmission.

Examples:

Sawtooth waves are known for their use in music. The sawtooth and square waves are common starting points used to create sounds with subtractive analog and virtual analog music synthesizers

Square waves are universally encountered in digital switching circuits and are naturally generated by binary (two-level) logic devices. They are used as timing references or "clock signals", because their fast transitions are suitable for triggering synchronous logic circuits at precisely determined intervals

All naturally occurring waveforms are sine waves, waveforms of type square wave are used as clock pulse.

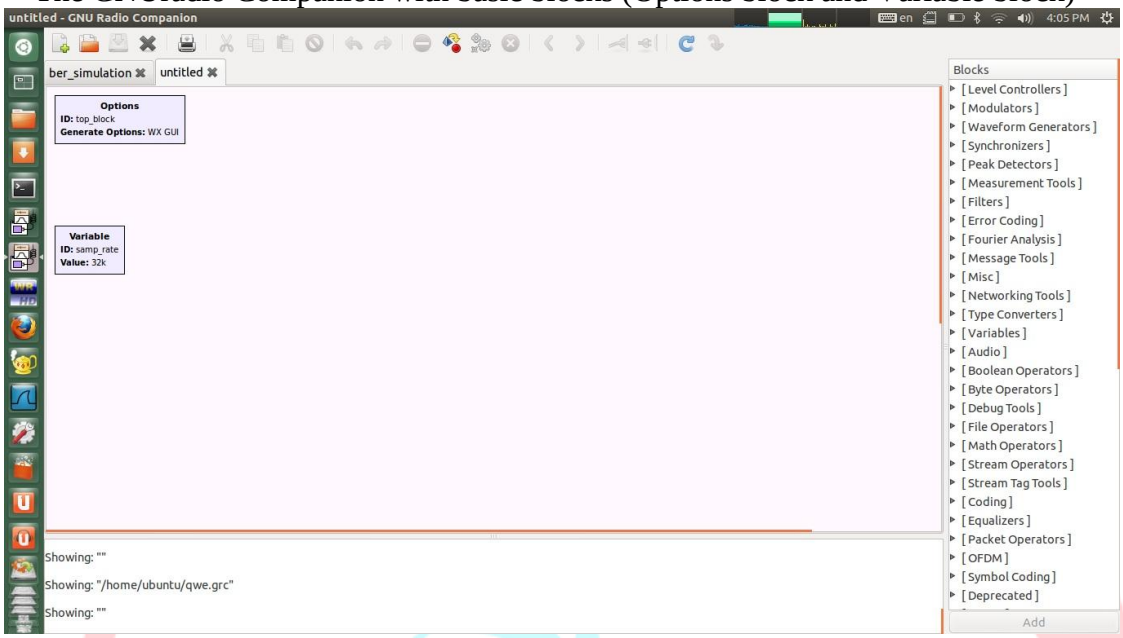
In this tutorial gnuradio software is used to generate the different waveforms. Four different types of signal source is used to generate sine, square, triangle, saw-toothed wave forms.

The GNU Radio Companion (GRC) is always a good choice to create flow graphs, provided that all the blocks you need are available in GRC.

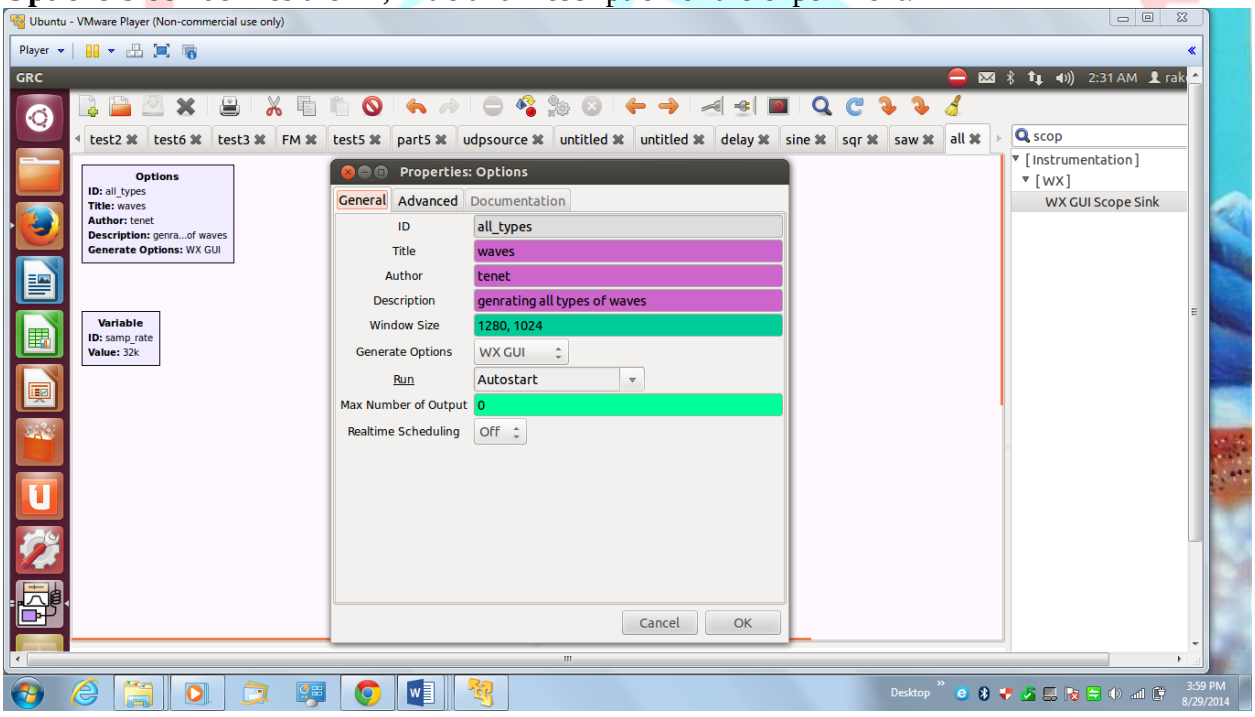
First, launch GRC by typing gnuradio-companion on a terminal or command line. This will launch the GRC graphical environment.

A very important thing to observe is the use of the only one sink this is graphical sink which has four inputs (number of inputs can be varied as per the requirment).

1) To generate different type of wave form using only software
   The GNUradio Companion with basic blocks (Options block and Variable block)

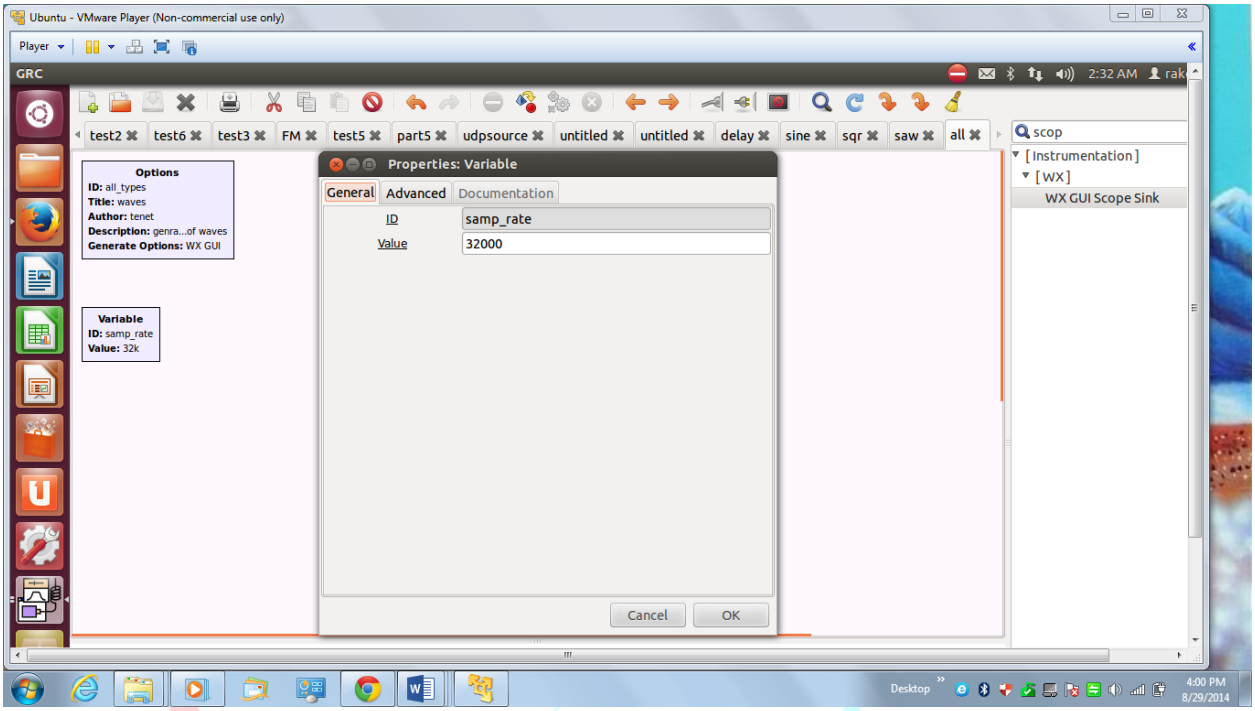


Options block defines the ID, Title and Description of the experiment.

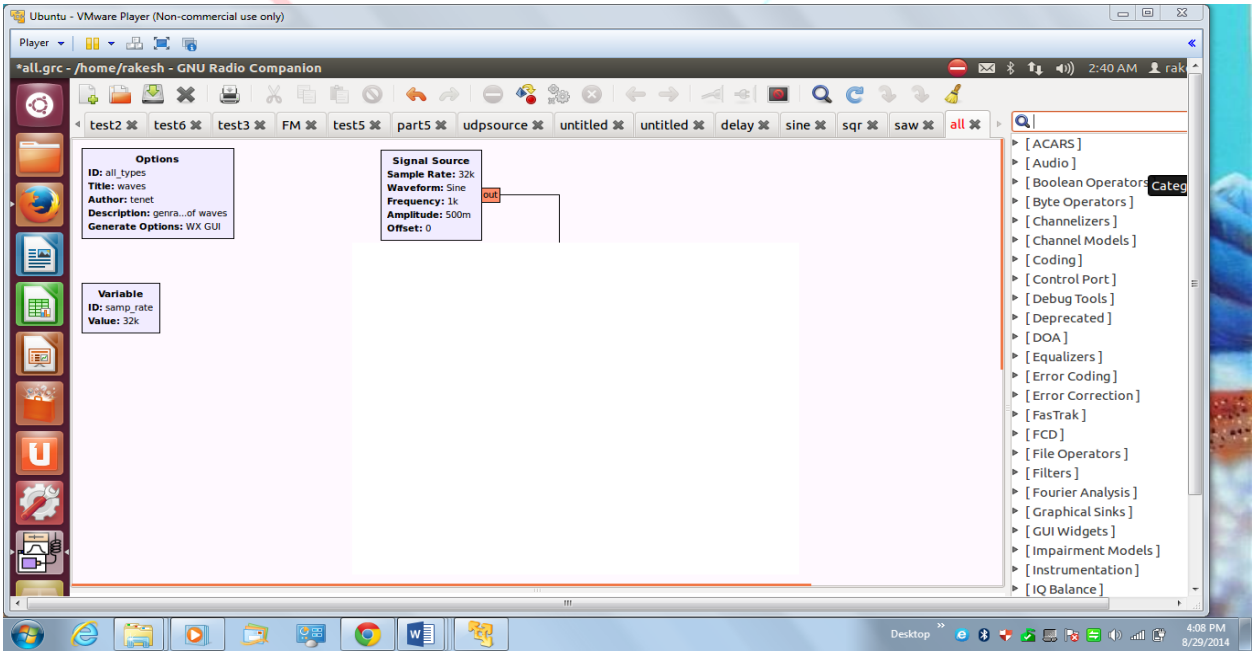


Variable Block defines to declare variables globally. This block maps a value to a unique variable. This variable block has no graphical representation. The variable can be referenced (by ID) from other blocks in the flowgraph.

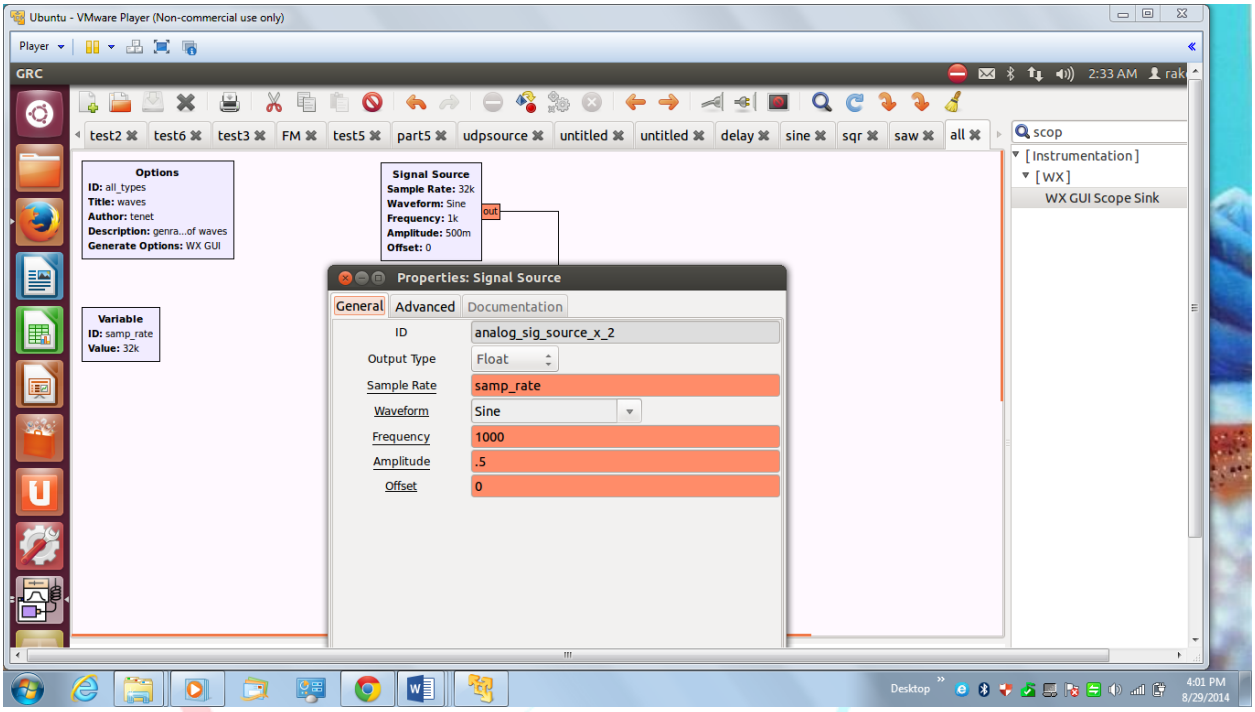
- ID = samp_rate
- Value = 32000Hz



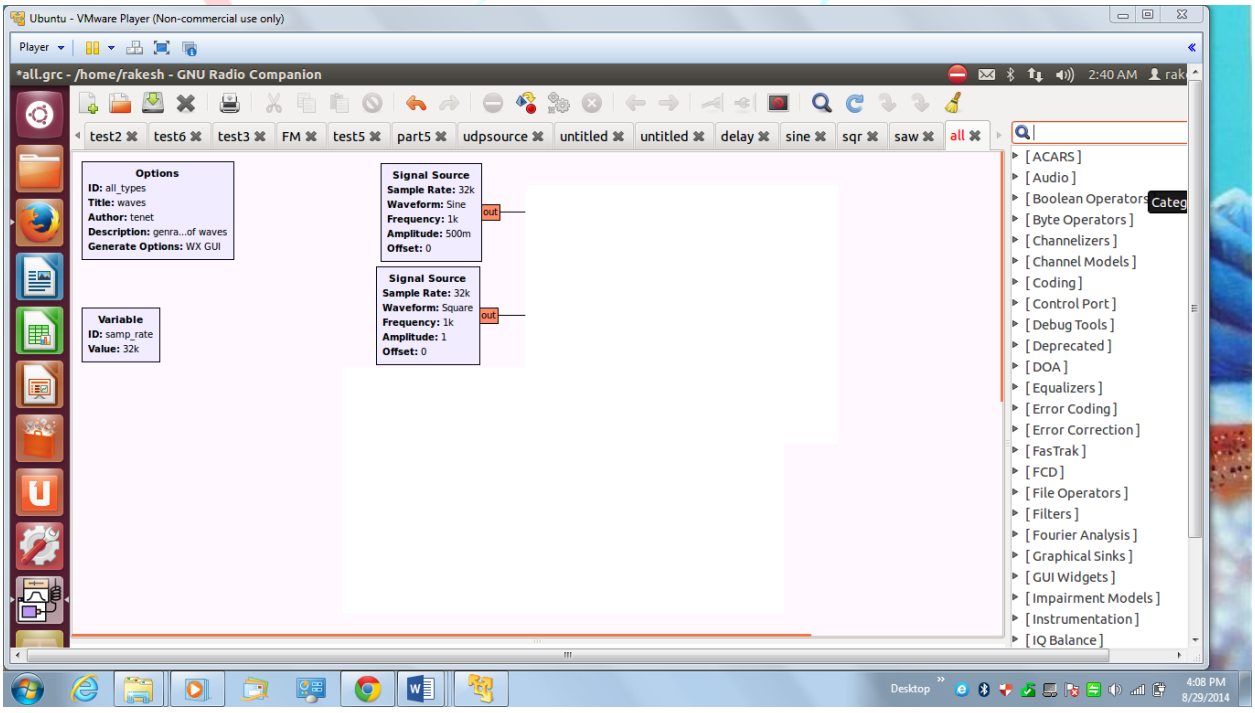
Signal source is a wave form genrator. Very first block genrates the sine wave, second block genrates the square wave, third block genrates triangler wave and finaly fourth block genrates the sawtooth waveform.



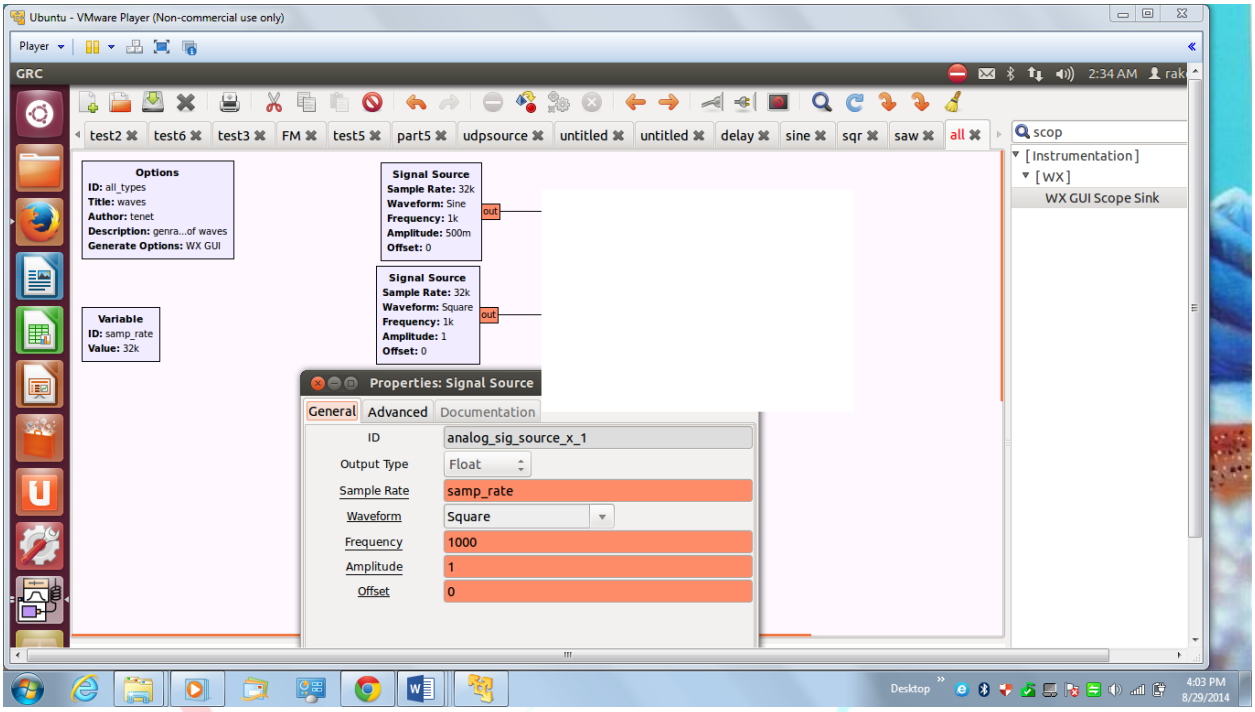
ID:analog_sig_source_x_0
Output type: float
Waveform: sine
Freq: 1000
Ampl:0.5



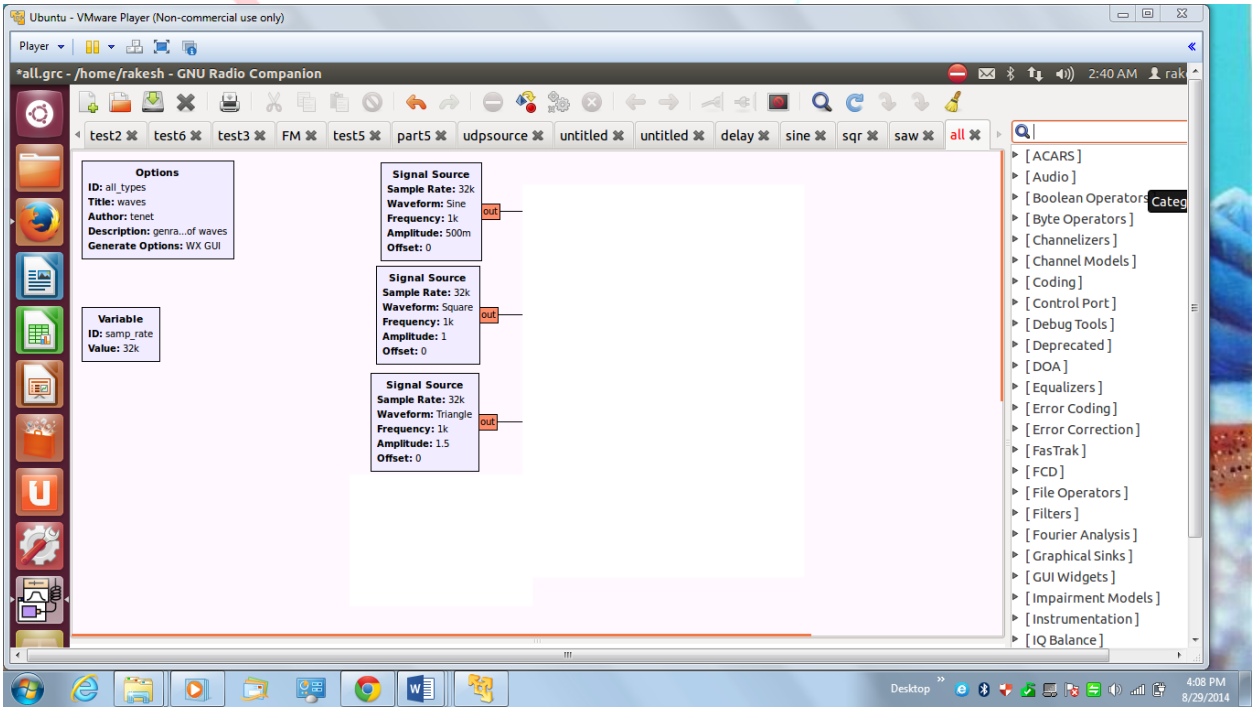
Signal source (2nd)



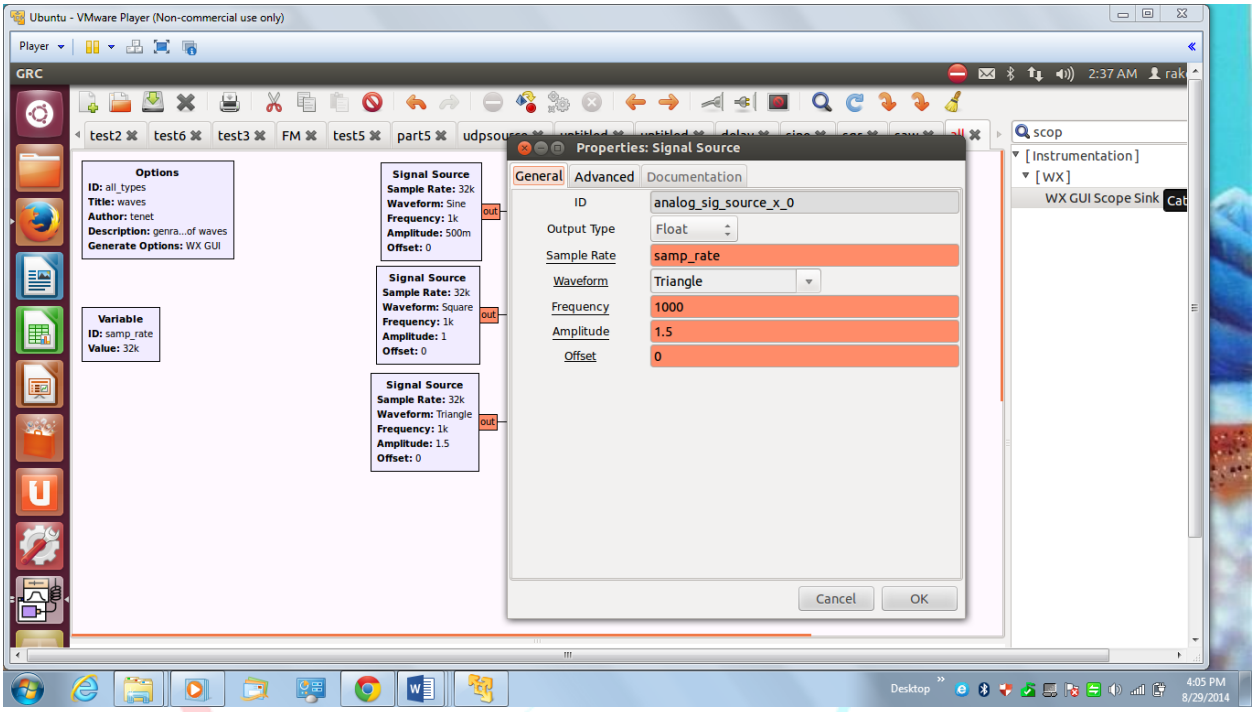
ID:analog_sig_source_x_0
Output type: float
Waveform: square
Freq: 1000
Ampl:1



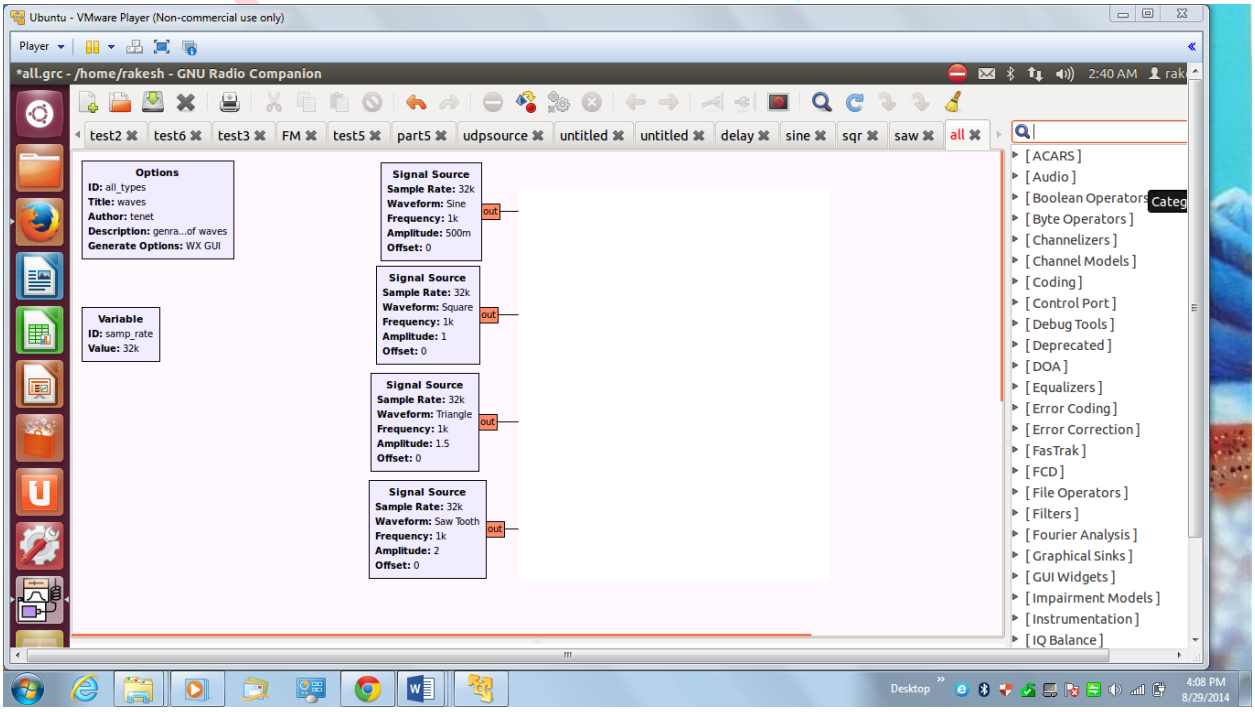
Signal source (3rd)



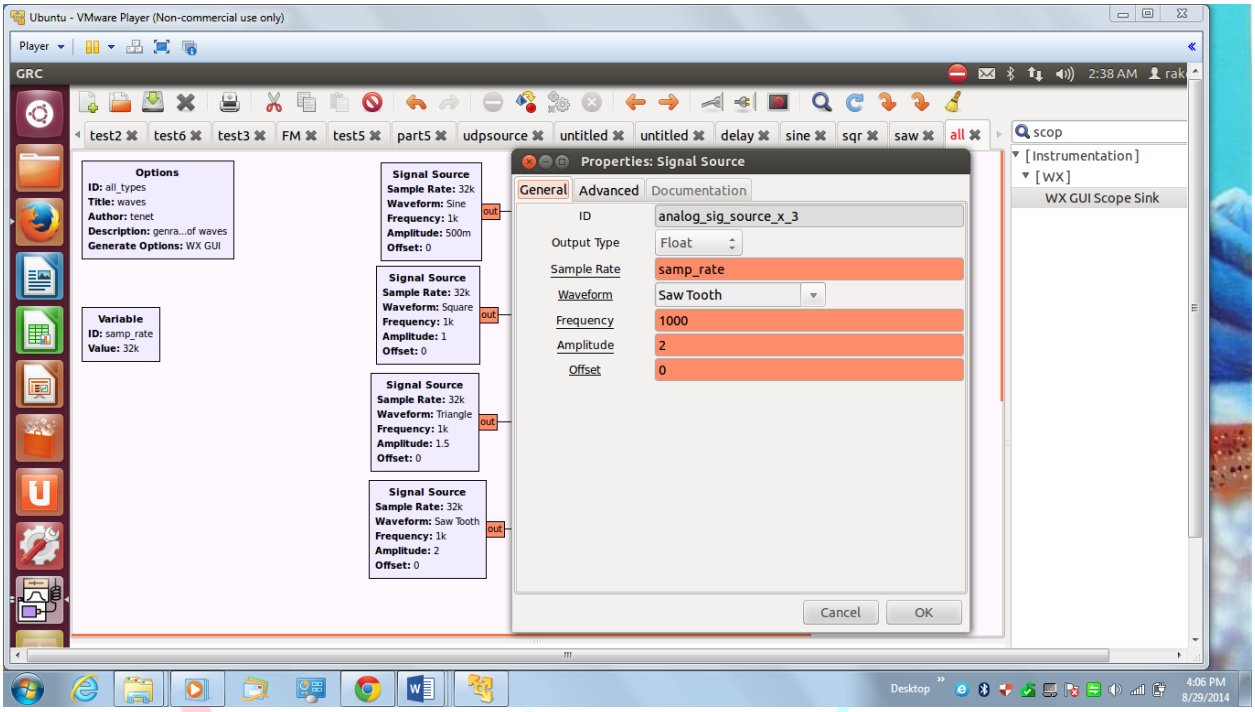
ID:analog_sig_source_x_0
Output type: float
Waveform: triangle
Freq: 1000
Ampl:1.5



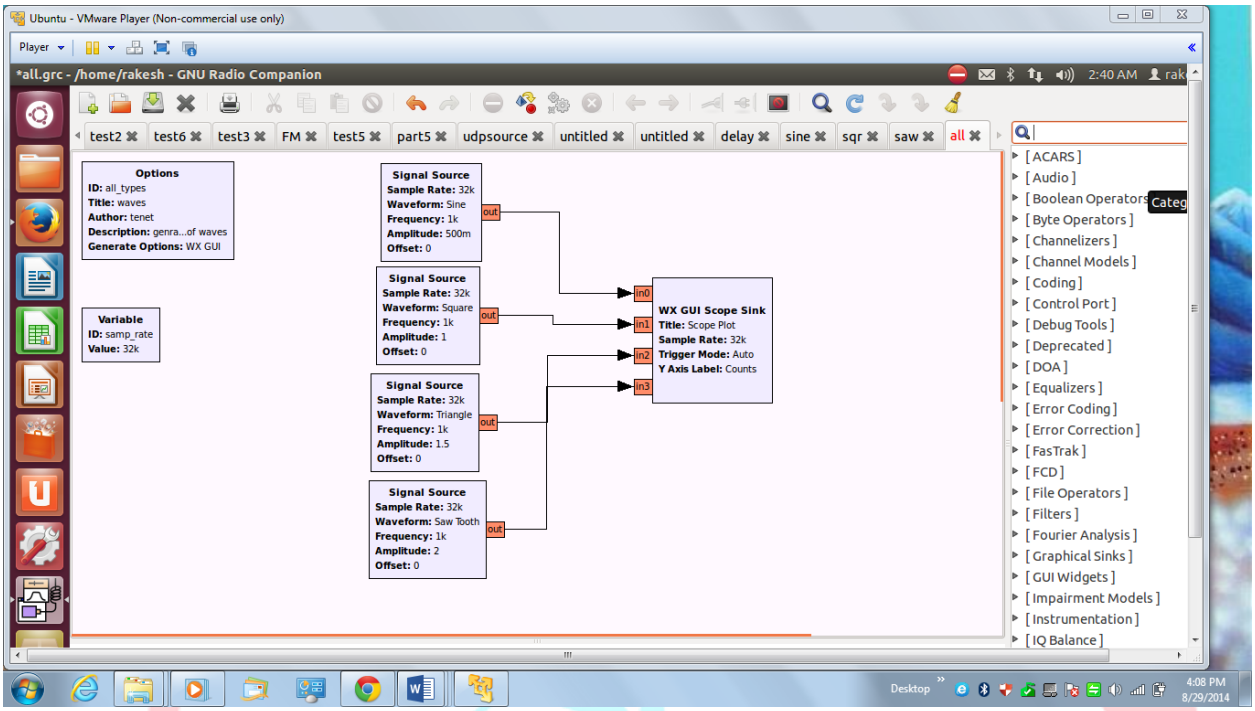
Signal source (4th)



ID:analog_sig_source_x_0
Output type: float
Waveform: sawtooth
Freq: 1000
Ampl:2



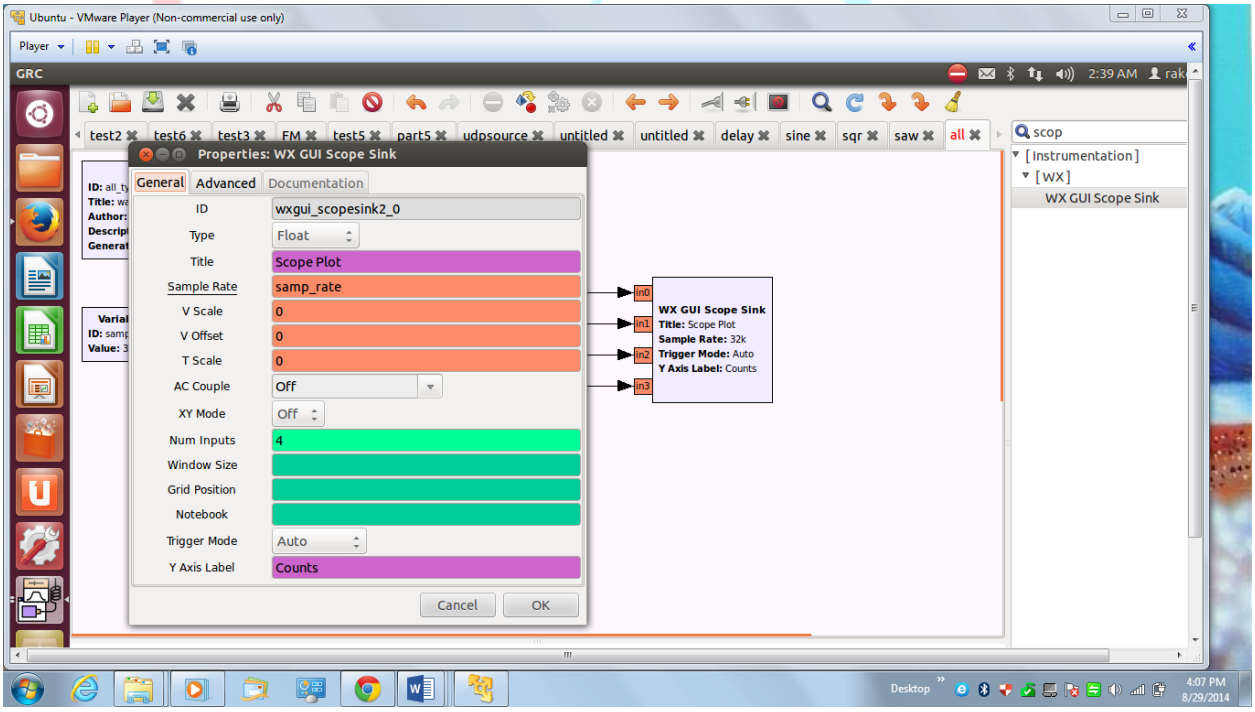
WX GUI scope sink: The WX GUI Scope sink is the destination block of the flow chart. This block is used to view the time domain representation of the output. The simulation output of the received signal is seen with this block.



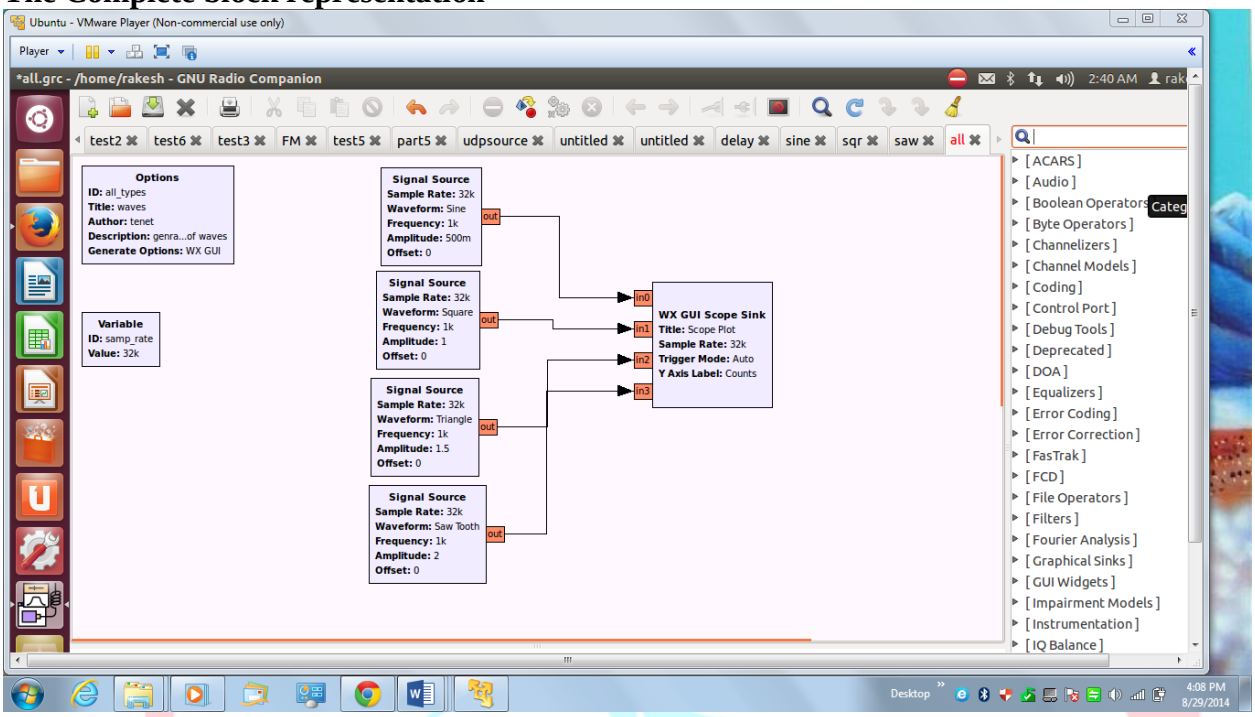
ID: wxgui_scopesink2_0

Type: float

Num input: 4



The Complete block representation



Genrated sawtooth wave (output)