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Challenges

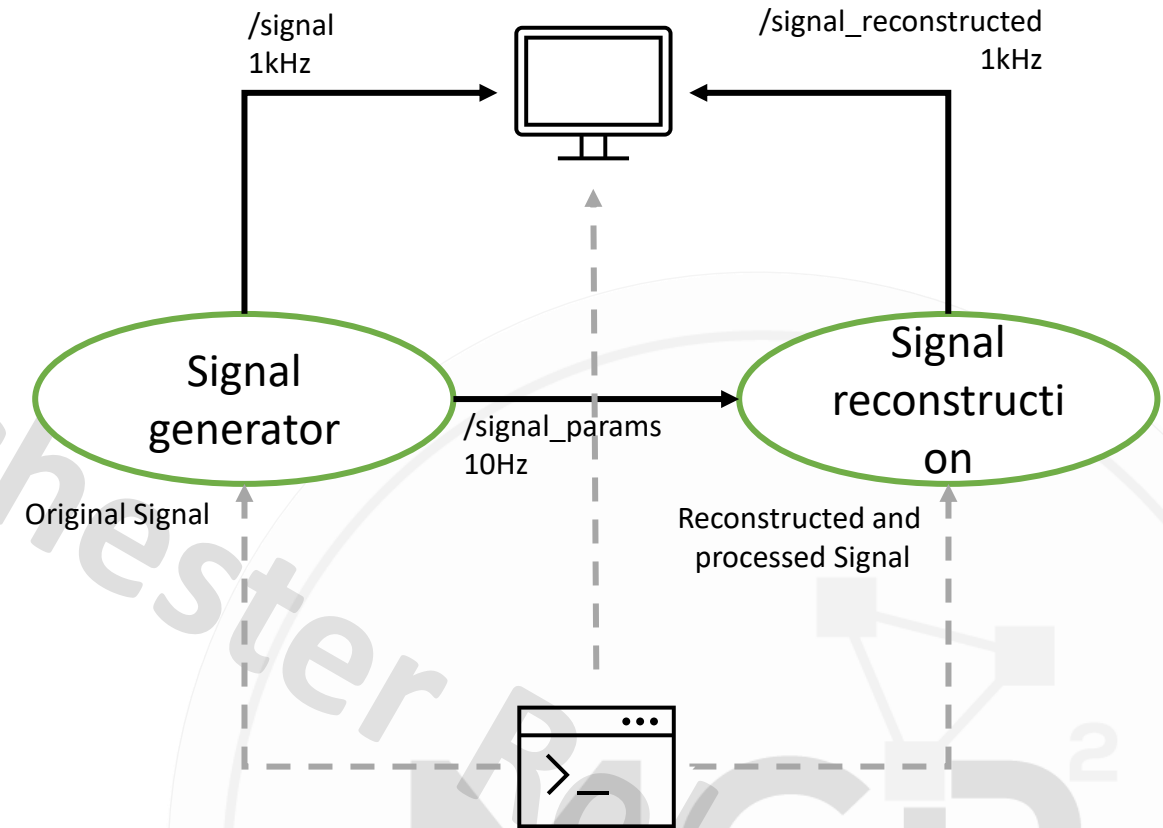
Mini challenge 2

{Learn, Create, Innovate};



Challenge 2

- This activity is intended for the student to review the concepts introduced in the current and previous sessions.
- The activity consists of enhancing the previous challenge.
- The first node will act as a high-frequency signal generator. That will generate sinusoidal, square, or sawtooth signals.
- The second node will act as a signal reconstructor node.
- A launch file must be generated to launch both nodes, and rqt_plot at the same time.





Signal Generator Node



- Make a node called “signal_generator”.
- By default, it should output a 2Hz sine signal with an amplitude of 0.5.
- Create a config file that contains the type, amplitude, frequency, and offset of at least 5 signals (square, sine, sawtooth, ...).
- Generate a topic that generates and publishes a signal a 1kHz rate using a Float32 standard ROS message to a topic named “/signal”.
- Generate a custom message “/signal_params” that publishes at a 10Hz the properties of the current signal
- The parameters can be modified at any given time from terminal. Consequently, /signal and /signal_params should be updated



Custom message



Field	Message Type
Type	1 – sine 2 – square 3 – sawtooth
Frecuency	Float32
Offset	Float32
Time	Float32



Signal Reconstruction Node



- Design a second node called “reconstruction” that subscribes to the “/signal_params” topic.
- Reconstruct the received signal using data from the custom message into a Float32 standard ROS message named “/signal_reconstructed” with a 1kHz frequency.
- If no signal is received, it should output a zero (0).
- The following signal parameters can be modified through the terminal:
 - Amplitude
 - Phase shift
 - Offset



Useful links



- [numpy.sin — NumPy v1.26 Manual](#)
- [scipy.signal.square — SciPy v1.12.0 Manual](#)
- [scipy.signal.sawtooth — SciPy v1.12.0 Manual](#)





Challenge 1



- Make sure to use a launch file and Plot your result
- Use the ROS tool “rqt_plot” to plot both signals.
 - `ros2 run rqt_plot rqt_plot`
- Make a Launch file to execute both nodes at the same time.
 - The Launch file must open the rqt_plot and rqt_graph and plot both signals in the same window.



Rules



- This is a challenge not a class. The students are encouraged to research, improve tune explain their algorithms by themselves.
- MCR2(Manchester Robotics) Reserves the right to answer a question if it is determined that the questions contains partially or totally an answer.
- The students are welcomed to ask only about the theoretical aspect of the classed.
- No remote control or any other form of human interaction with the simulator or ROS is allowed (except at the start when launching the files).
- It is forbidden to use any other internet libraires with the exception of standard libraires or NumPy.
- If in doubt about libraires please ask any teaching assistant.
- Improvements to the algorithms are encouraged and may be used as long as the students provide the reasons and a detailed explanation on the improvements.
- All the students must be respectful towards each other and abide by the previously defined rules.
- Manchester robotics reserves the right to provide any form of grading. Grading and grading methodology are done by the professor in charge of the unit.