RFSoC for RF Environment Monitoring

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Background

- The RF Spectrum is becoming increasingly congested with interference (RFI), making it difficult to achieve high-fidelity measurements
- Our clients at MIT Haystack Observatory are researching RFI mitigation techniques
- Portable, easy-to-use tools for RF environment monitoring would help with RFI mitigation research
- Xilinx RFSoC board shows particular promise for monitoring because of:
  - Wide bandwidth
  - Relative low cost
  - Ease of development and use

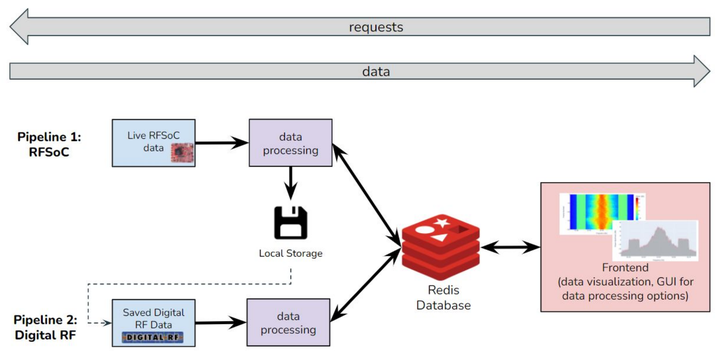
Overview

- The goal:
  - An interactive web application with a variety of RF spectrum monitoring tools, utilizing the RFSoC board
  - The app should be extendable to serve future research needs
- Key features:
  - A web-based dashboard with colorful, interactive graphs displaying frequency spectrum RF data
    - User can change axes, track min/max points, and change color scheme
  - Live streaming spectrum data from the RFSoC board
  - Downloading raw data from the board
  - Playback of stored data
    - User can play, pause, and rewind Digital RF data
  - Metadata for all data is displayed

Methods

- Three main components:
  - Front end for visualization and user interactions
  - Database for passing commands and data
  - Back end for data processing
- All the components are modular and can be run in different locations
- The Dash framework is used for the interactive dashboard front end
- A Redis database is used for communication between the front and back ends
- Python scripts are used for controlling the RFSoC board, using the PYNQ framework
- Additional Python scripts are used for processing stored data
- RF data is stored in the Digital RF data format, which was developed by our clients

System Block Diagram



Application Interface

Future Work

- Additional filtering and processing scripts for the RFSoC
- Extending the web application to work with other software-defined radios
  - The front end interface was designed to be generic and not specific to any particular board
- Additional interactivity features for the graphs

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