Frame Decoder for Consultative Committee for Space Data Systems (CCSDS)
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Methodology

- An SDR is a “radio in which some or all physical layer functions are software defined” (IEEE Definition).
- A radio is any kind of device that wirelessly transmits or receives radio frequency (RF) signals in the radio frequency.
- An SDR is a radio communication system where components that have been typically implemented in hardware are implemented in software.

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Algorithm

The algorithm uses a state machine to decode the frames.

• The state machine:
  1. STATE FLAG SEARCH
  2. STATE HAVE FLAG
  3. STATE HAVE HEADER

• The algorithm will look for the flag indicating the beginning of the payload and the end of the header.
• This flag is created by a correlator that will consider a user-configurable threshold value.
• After the flag is locked, the algorithm will start processing the frame.

Applications

- GNU Radio is a free and open source development toolkit that provides signal processing to implement software radios.
- It can be used with low-cost external RF hardware to create software defined radios, or without hardware in a simulation-like environment.
- GNU Radio applications are primarily written in Python and C++.

USRP

- The Universal Software Radio Peripheral (USRP) is a computer-hosted software radio designed by Ettus Research.
- The USRP connects to a host computer via high-speed Gigabit Ethernet.
- Using the open source Universal Hardware Driver (UHD), we can run GNU Radio applications using the USRP.

GNU Radio

- GNU Radio has a generic packet decoder block that is not optimized for CCSDS frames. Using this generic packet decoder will add bytes to the CCSDS frames and will not permit for bit error correction using Reed-Solomon.
- The CCSDS frames consist of 256 bytes, including a 32-bit sync marker (0x1ACFFC1D).
- This frames are generated by the Space Data Processor and GNU Radio will perform the modulation and framing operations, including frame synchronization.