

The Applications of a Software Defined Radio In Space

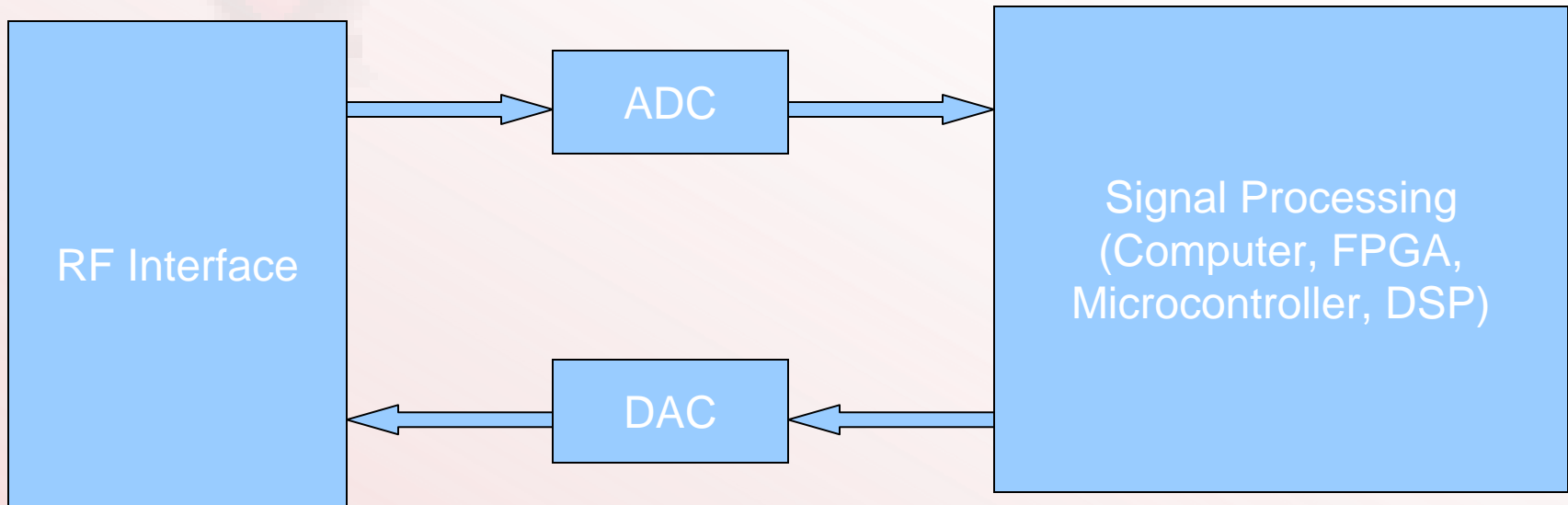


Matthew Barousse

Trey Oliver

CAPE 2 - Software Defined Radio Subsystem

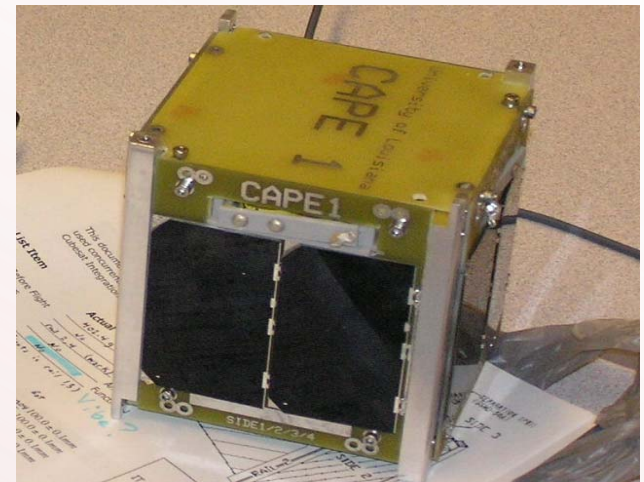
- A Software Defined Radio (SDR) utilizes software routines to accomplish necessary functions.



- **Software Defined Radio**
 - Implementation of radio functionality in software.
 - Minimized hardware footprint.

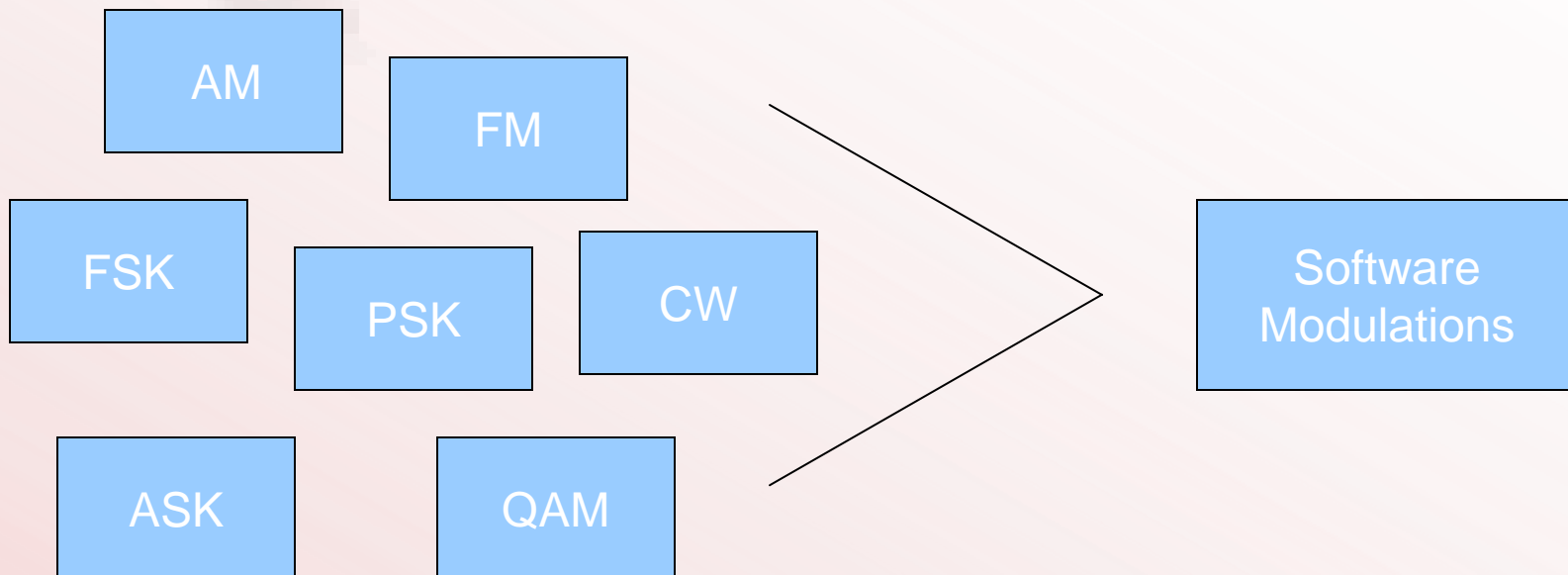
- **Hardware Defined Radio**
 - Composed of mixers, filters, amplifiers, detectors, modulators, demodulators, etc.
 - Superior power efficiency.

- Hardware Radio Limitations
 - Limited broadcast and receive flexibility.
 - Multiple broadcast schemes require a large mass budget on CubeSats.
 - Functionality change requires new hardware design.



Advantages – Why use an SDR?

- Allows for multiple types of radio modulation schemes internal to single system.
 - AM, FM, CW, FSK, PSK, ASK, QAM, etc.
 - Each modulation executed in software.



- Reprogram software in flight.
 - Functionality changes.
 - Addition of alternative modulation schemes.
 - Encryption/Decryption routines.
 - Efficiency improvements in software.
- Ability to update design post-launch.

Advantages – Why use an SDR?

- Terminal Node Controller (TNC)
 - Handles protocol wrapping (AX.25, KISS, etc..)



- May be implemented internal to an SDR.
 - External circuit not required.
 - Update via software for new data protocols

Advantages – Why use an SDR?

- Allows for a smaller hardware design.
 - Complex systems are greatly simplified.
 - Single operational circuit.
- Replace multiple radios with single system.

- Ideal SDR design employs non-existent technology.
- Fairly new technology to CubeSat platform.
- Longer Development Time.

Limitations – Common Disadvantages

- Expensive power requirements.
 - FPGA's and x86 processors.
- New technology enables low-power devices.
 - New generation of DSPs and FPGAs.



- Software Radios are a fairly new technology.
 - Community documentation is rare in relation to hardware radios.
 - Existing hardware radio designs are readily available.

- Research in SDRs is rapidly advancing with enabling technologies.

SPONSORS

