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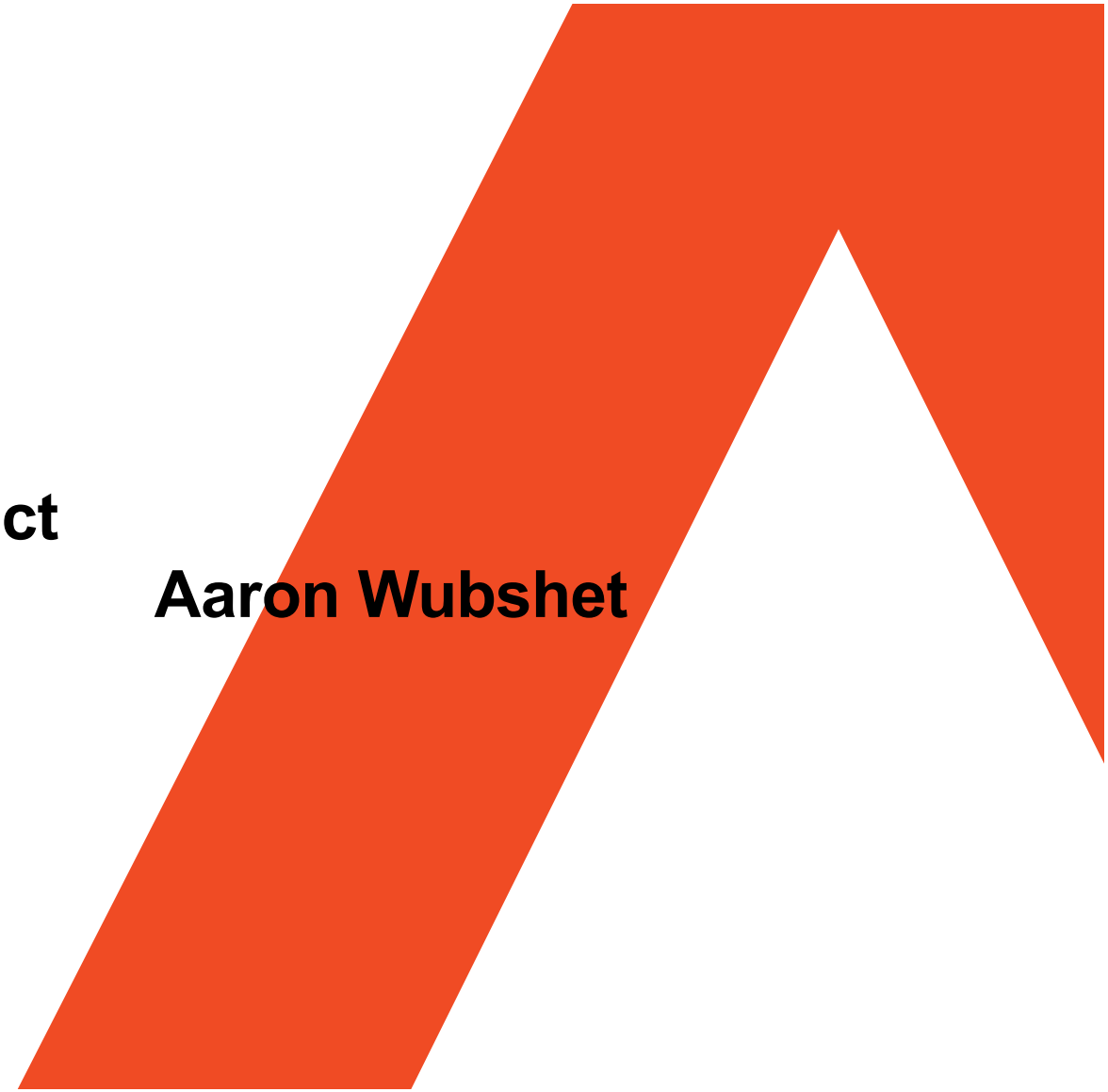
USRP Testbed
Plant A SEED Project

Aaron Wubshet



Agenda

- Project Overview
- Materials
- Results & Demo
- Lessons Learned
- Summary

Project Overview

- Software Defined Radio (SDR)
  - Minimize dedicated hardware to make upgrading a matter of pushing a firmware update to the system
  - USRP (an example of SDR)
- Exploration and Synthesis
  - Explored applications of such systems (cellular networks, GNSS, WiFi, etc)
- Series of miniprojects to get accustomed with GNU radio and working with USRP(explore DSP properties)
- Week 1: Downloading software/familiarizing myself with Linux
- Week 2: Downloading drivers and networking hardware correctly
- Week 3: implementing GNU radio flow graphs/downloading GSM base station software
- Week 4: implementing GSM base station using OpenBTS

Materials

Hardware

- Ettus Research USRP2
- Dell Inspiron i7
- USB-to-Ethernet dongle
- Cellphones

Software

- GNU Radio
- ImageMagick
- UHD
- OpenBTS
- Ubuntu 14.04

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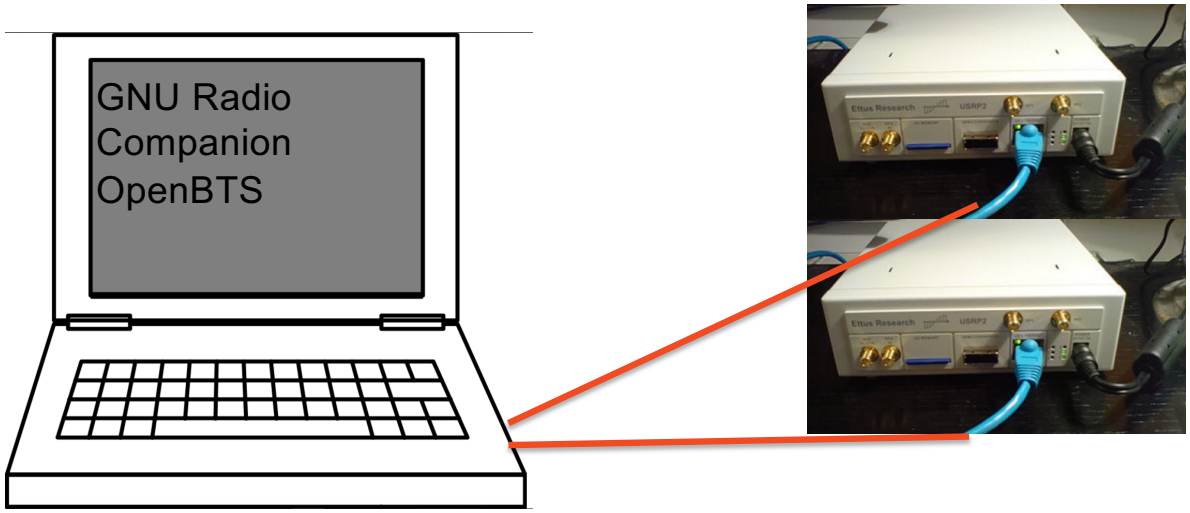
Dual USRP Setup



Results and Demos

Simple GRC Implementations

GRC GUI

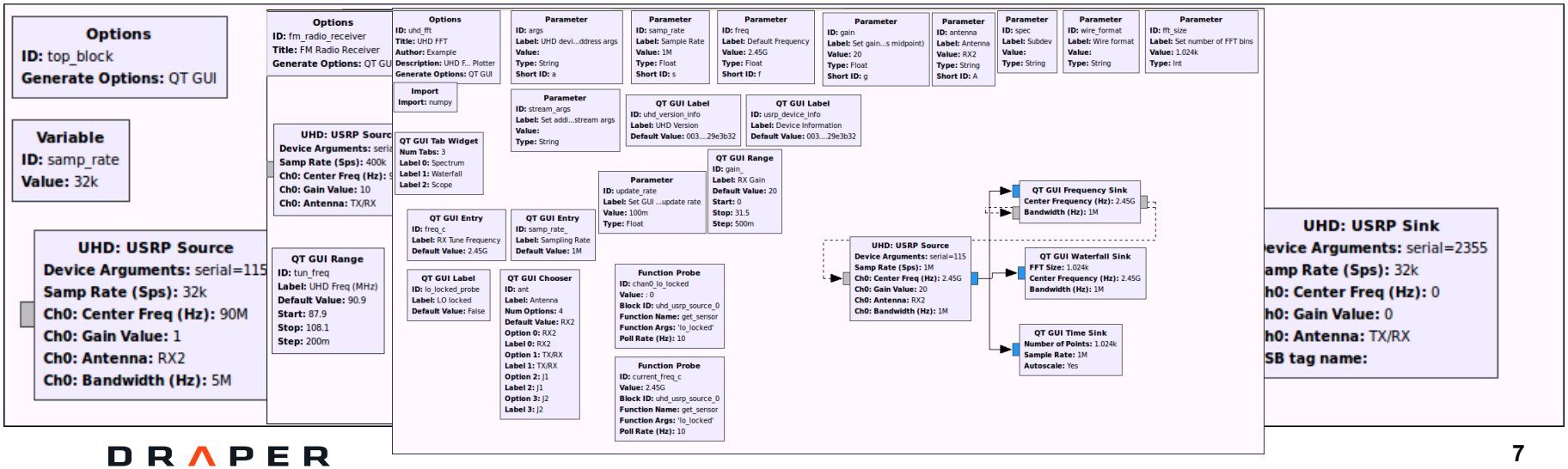
- Spectrum analyzer
- Dynamic control after flow graph is executed

FM Radio Receiver

- Tunable wideband FM receiver
- Filtering and gain functionality

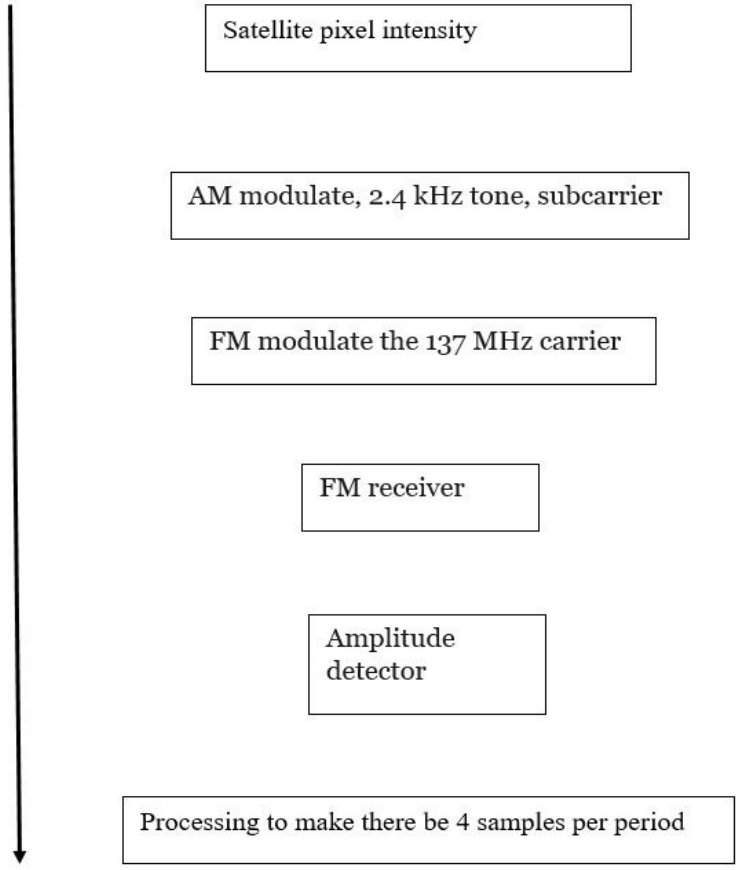
Proof of Concept Transceiver Set up

- USRPS on different networks
- One transmitting, one receiving



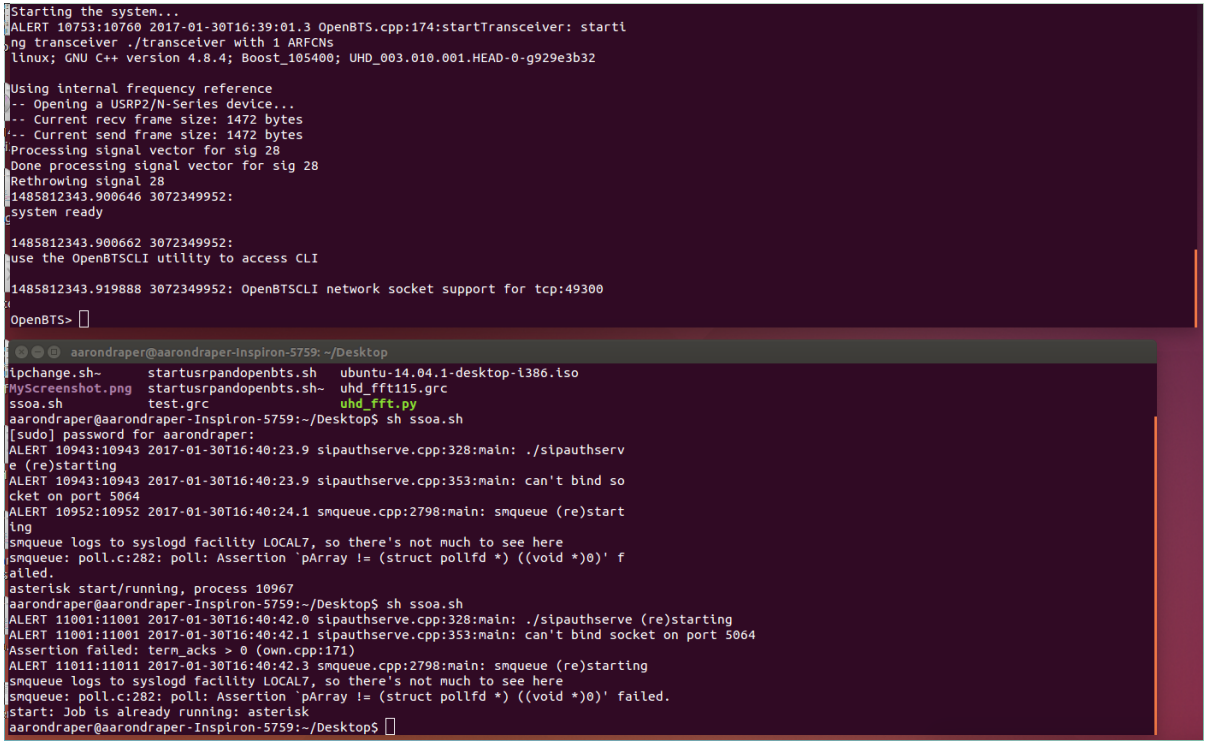
Advanced GRC Implementation

- National Oceanic and Atmospheric Administration automatic picture transmission (NOAA APT)
- Operation frequency: 137Mhz
- Circular polarized antenna needed
- Pixel intensity modulates a 2.4KHz tone
- Amplitude detector: 2.4 kHz audio tone to pixel intensity on an 8 bit gray scale



OpenBTS: Cellular Base Station Implementation

- OpenBTS
  - Software-based GSM base station
- Required services
  - Smqueue
    - Queueing calls and texts
  - SIPAuthServe
    - Database registration of phone numbers
  - Asterisk
    - Call and text routing



Range NETWORKS

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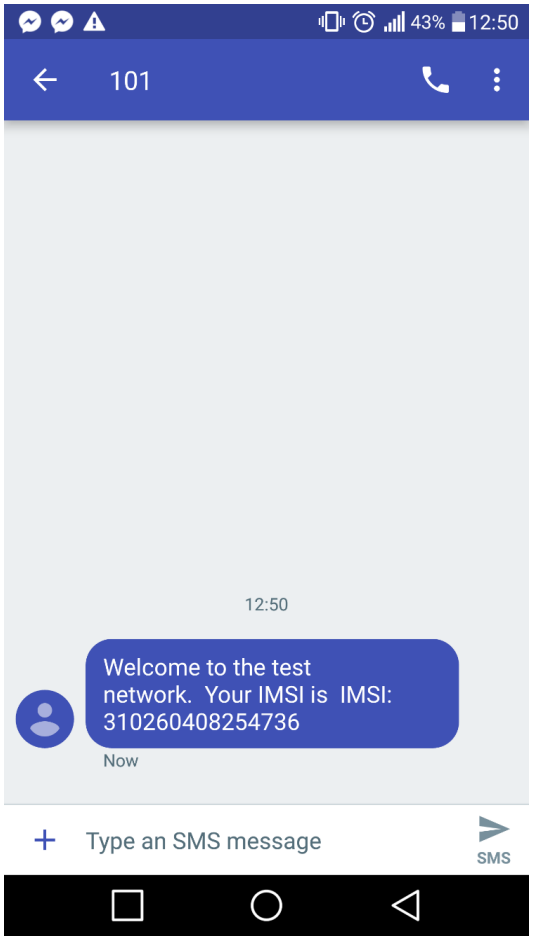
OpenBTS: Results

Text you receive when you successfully register on the network



Issues & Lessons Learned

- Linux & Terminal
  - Bash Files
  - Dependencies
- Network Configuration
  - Stability
- Broken USRP
  - Hardware Limitations
- Antenna Quality
- Interference

Summary: Plant a SEED Program

- 80 hours over 1 month
- Software Defined Radio
  - What
  - Why
  - How
- Next Steps
  - Multiple USRPs
  - LTE Implementation