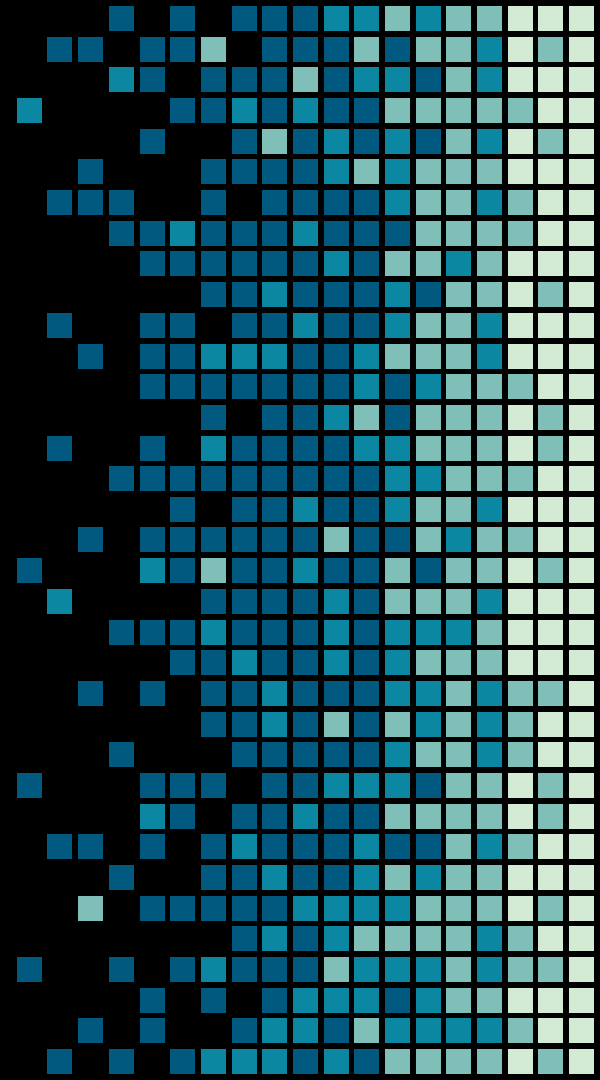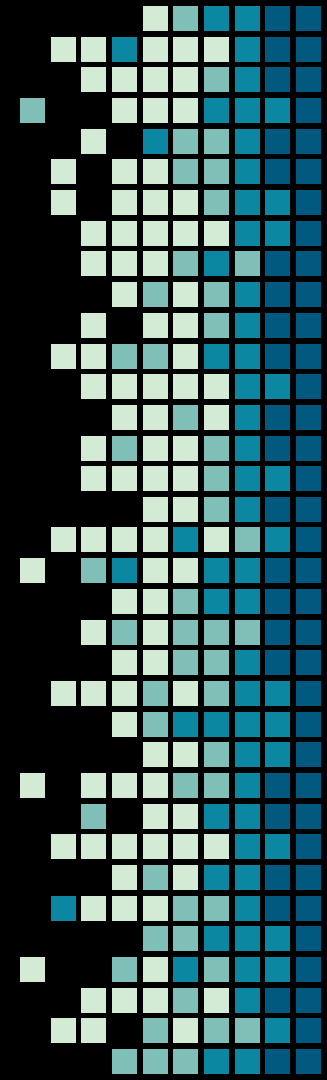# Project 9

Resources & Environment

Overview

Phase 1
Focuses on the development and the setup of the experiment using:

- GNU Toolchain
  - GCC
  - Make
  - Bash
- GNU/Linux
- C++ STL
- BOOST C++ Library

- NetBeans 8.2
- XeThru SDK
- Debian / Linux
- SCM
  - Git
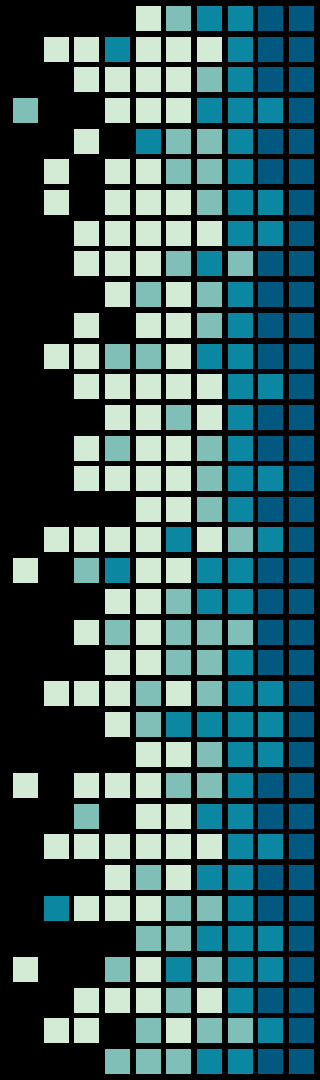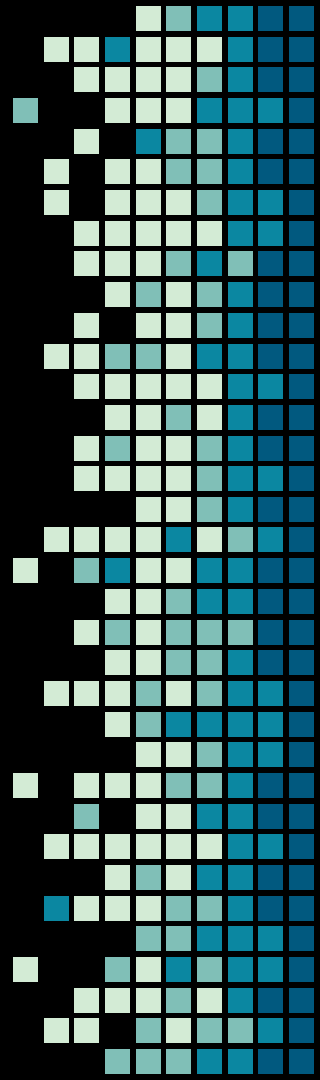 - Bitbucket.org

Overview

Phase 2
Builds on the research & development from phase 1

- Computing Power
  - Memory
  - CPU
- heterogeneous Computing
  - GPGPU
    - OpenCL
    - CUDA (NVIDIA)
    - Xeon Phi (Intel)

- Parallel Computing
  - OpenMP
  - Cilk Plus
  - TBB
- Distributed Programming
  - MPI

GNU Toolchain

- GCC Version 7.2+
  - Supports C++17
  - C11
- Make
  - Parallel build
  - Speedup compilation
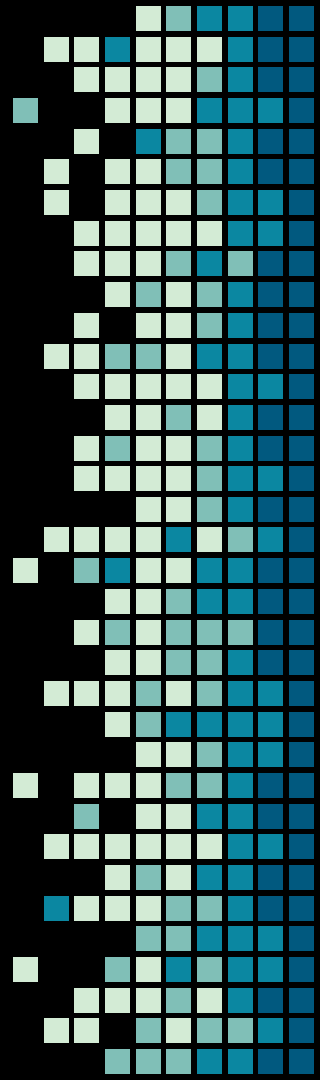 - Declarative build file

BOOST C++ Library & STL

- BOOST - Near standard library for C++ development
  - Provides vast amount of core libraries not necessarily included in the standard library
- STL - Standard Template Library
  - data structures
    - std::vector, std::set, std::map, std::unordered_map, etc
  - Algorithms
   - std::find, std::transform, std::copy, std::partition, etc
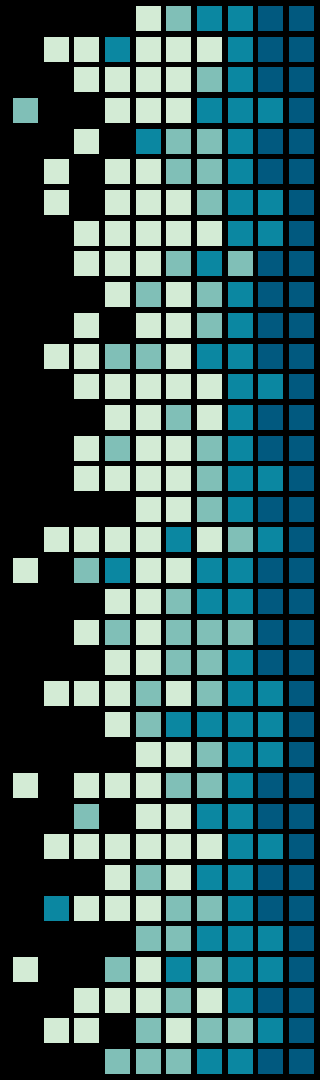
NetBeans

- Version 8.2
- IDE - Integrated Development Environment
  - Supports syntax highlighting, rapid development, auto completion, templating, and many more features
- Most powerful IDE
- Dark UI - Easy on those weary eyes
- Other features include
  - Debugging
  - Profiling
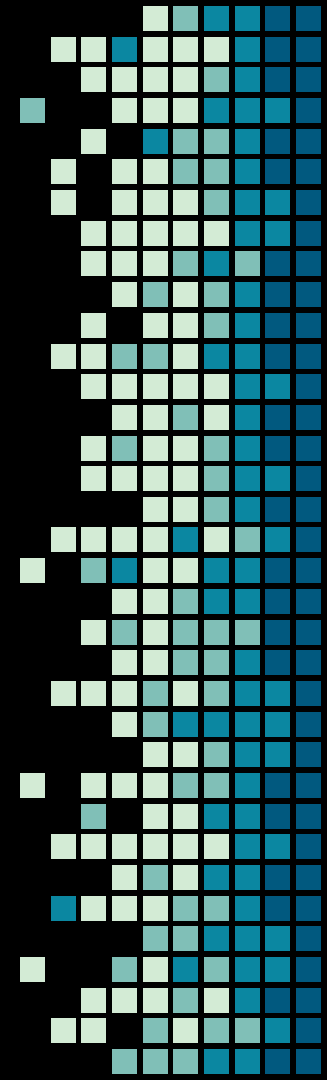 - Remote compilation
  - Multiple cursor support!

NetBeans

NetBeans – Formatting
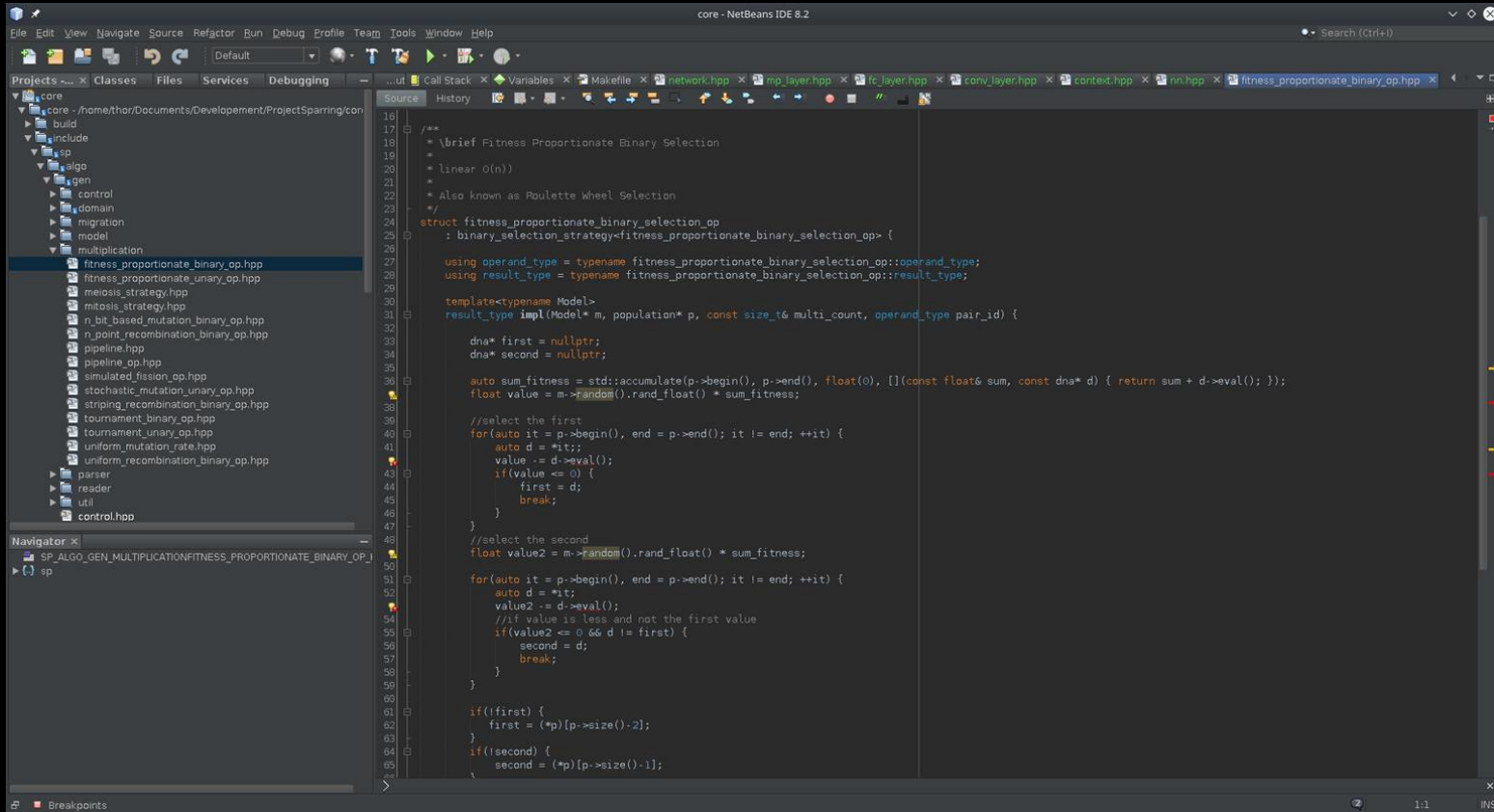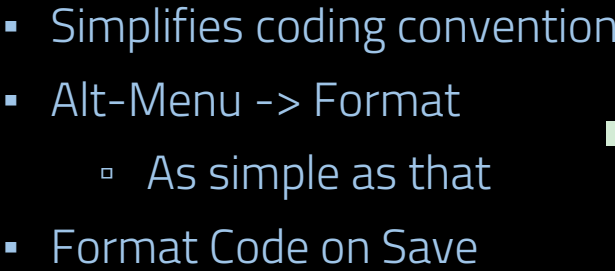
- Simplifies coding convention
- Alt-Menu -> Format
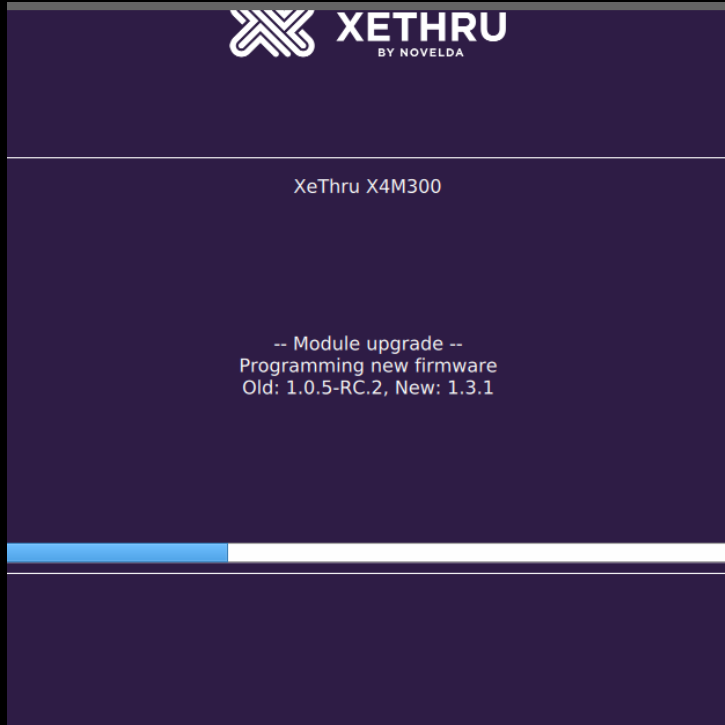   - As simple as that
- Format Code on Save

XeThru

- Version 2.5.2
  - Consists of multiple different component, libraries, demos, visual and console tools
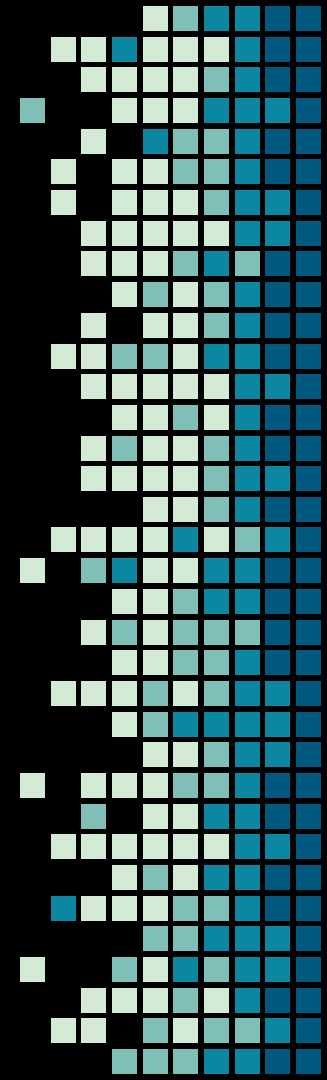 - Provides for data gathering, i.e. sampling and data format support.

XeThru - X4M300

XeThru – Firmware Upgrade

Updated firmware of sensor from 1.0.5-RC.2 to 1.3.1 due to software incompatibility
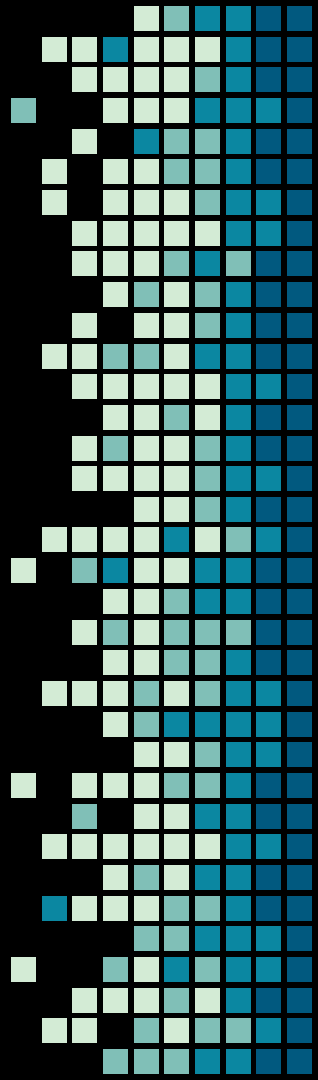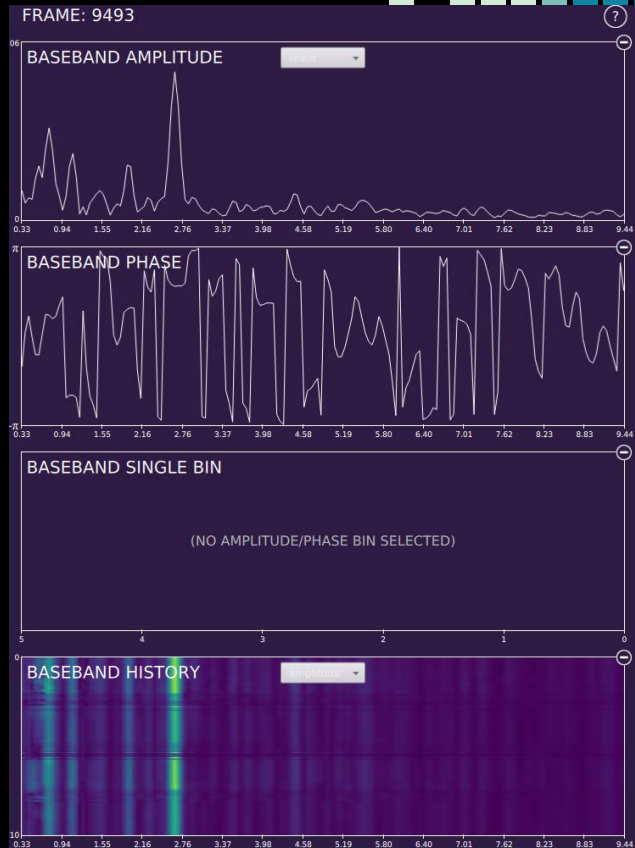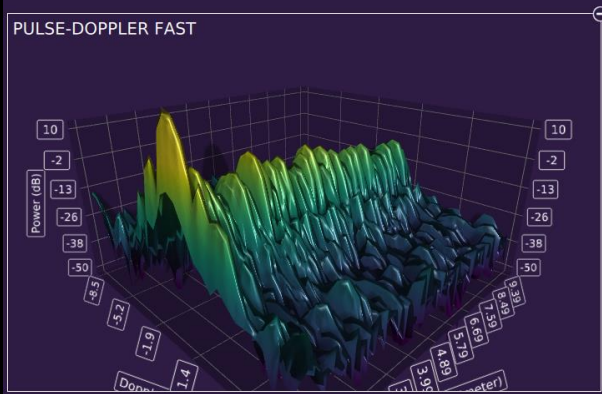
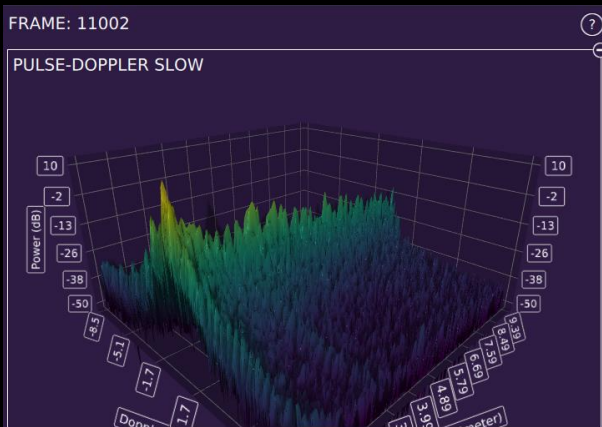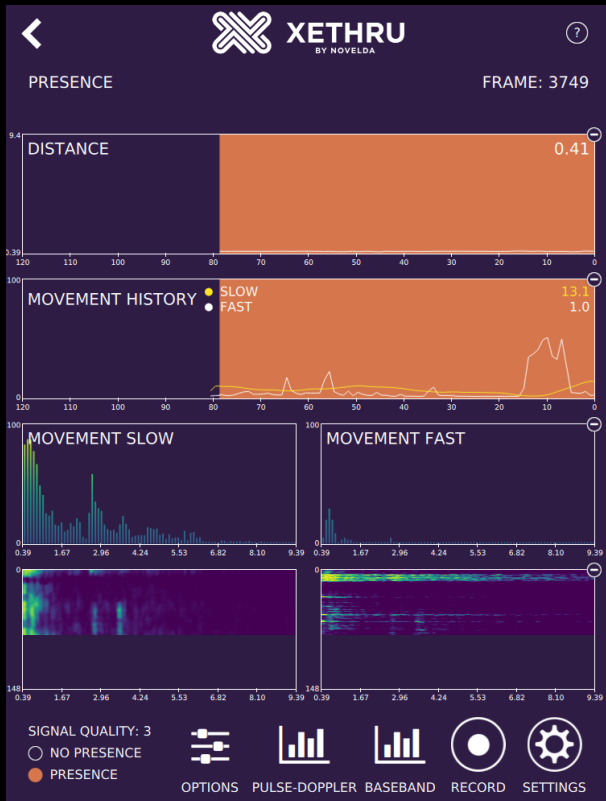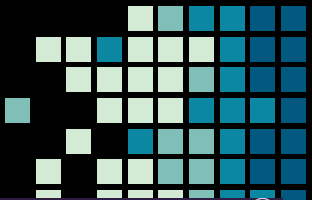# XeThru - Explorer

XeThru comes with simple visual explorer tool that helps visualize the information that the sensor gathers. Also provides simple method of recording data into XeThru data format.
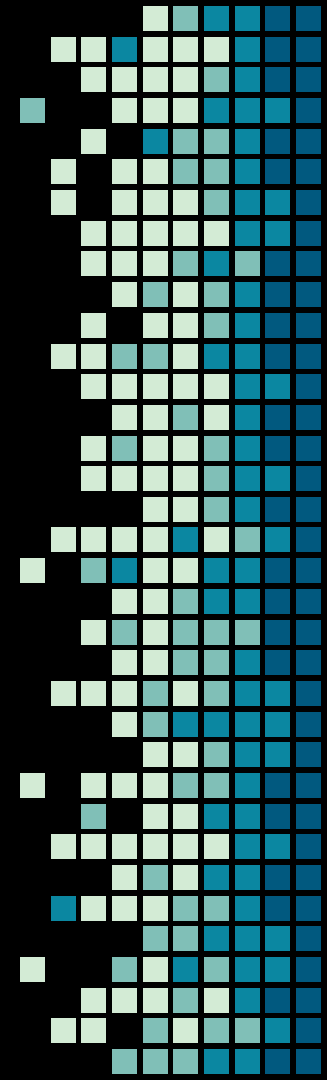
XeThru – Explorer (Visual)

XeThru – Data Format

Available data

- Baseband AP
- Presence Single
- Pulse Doppler

2.1 Baseband Amplitude/Phase

Filename: xethru_baseband_ap_{YYYYMMDD_hhmmss}.dat

This file contains amplitude / phase baseband data in binary format.

Data output rate is the frame rate.

Name	DataType	Description	Comments
FrameCounter	unsgined integer(32)	A sequential counter from the radar data. Incremented for each data message.	
NumOfBins	unsigned integer(32)	Number of bins in data set.	
BinLength	float	Length in meters between each bin.	
SamplingFrequency	float	Chip sampling frequency in Hz.	
CarrierFrequency	float	Chip carrier frequency in Hz.	
RangeOffset	float	Start of first range bin in meters.	
Power	float array	Array of NumOfBins float values of the signal power.	
Phase	float array	Array of NumOfBins float values of the signal phase.	

Parameters in the baseband amplitude/phase message.

Power is calculated using:

$$power(n) = i(n)^2 + q(n)^2$$

If amplitude is desired:

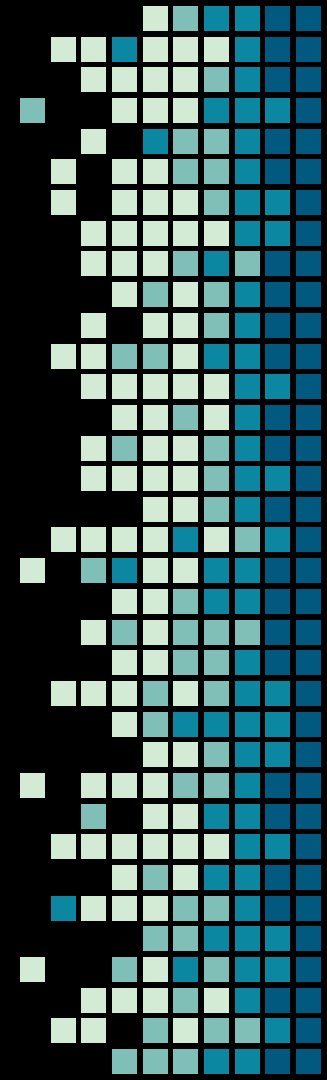$$amp(n) = \sqrt{power(n)}$$

Phase is calculated using:

$$phase(n) = atan2(\frac{q(n)}{i(n)})$$

where n=[0..NumBins-1], i(n) and q(n) are the 2 channels of the complex baseband signal.

Phase is outputted in radians.

Steps to Data Collection

Step 1:

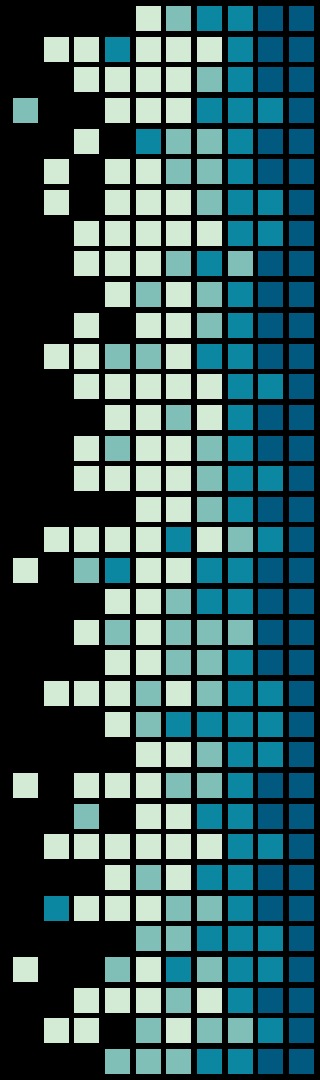   Plan an environment to document

Step 2:

       Set up the sensor in a static location

Step 3:

       Load XeThru software and and record dataset
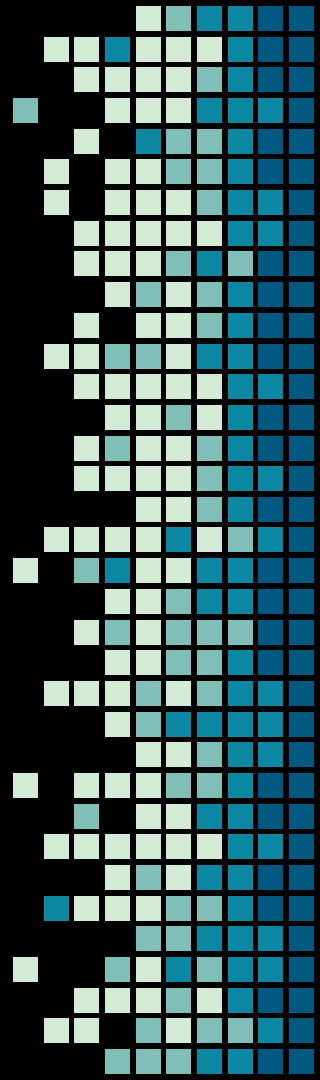
Step 4:

       Log meta-data file inside new dataset directory

Debian 10 / Linux

- GNU/Linux
  - Linux Kernel 4.13 - Fast, Efficient
- No specific OS features required at this point
- APT package manager
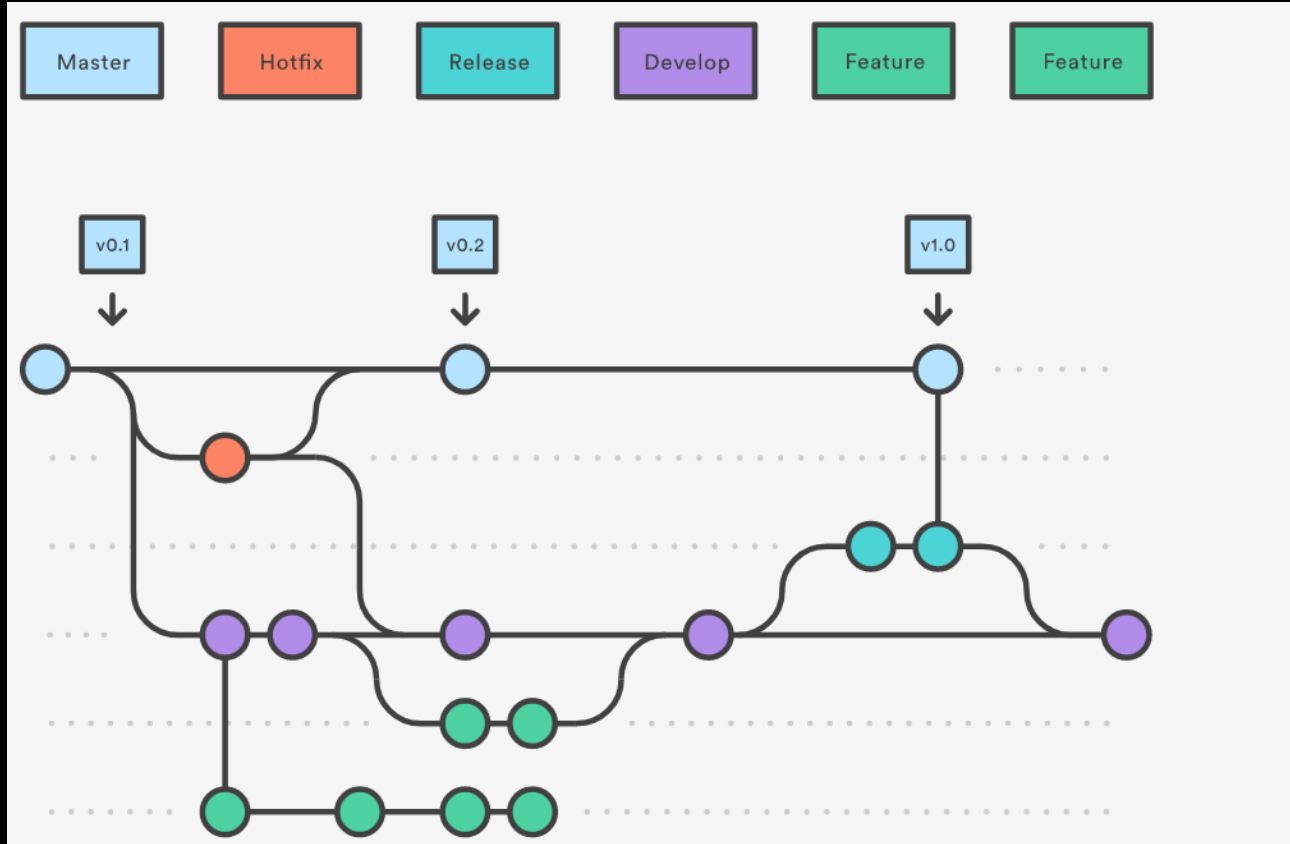- Highly stable and reliable

SCM – GIT

- Source Control Management
  - Created by Linus Torvalds for the Linux Kernel
- Popularized by Open Source Software (OSS)
- Extremely flexible at the cost of complexity
- Most prominent features
  - Cheap Branching
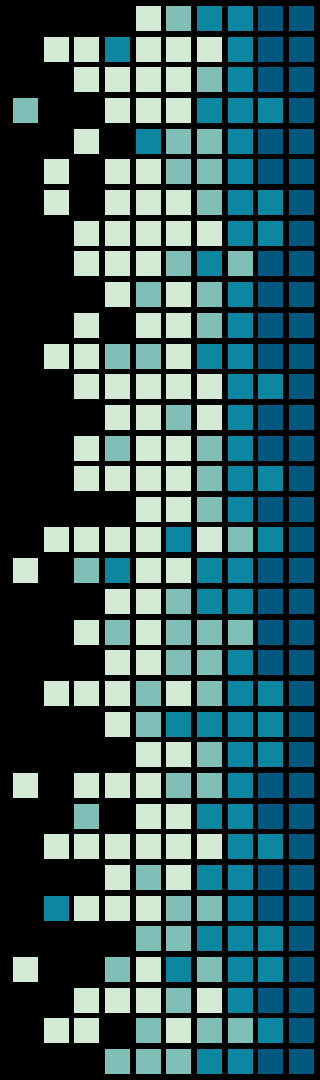 - Decentralized (Distributed)
  - Non-linear development
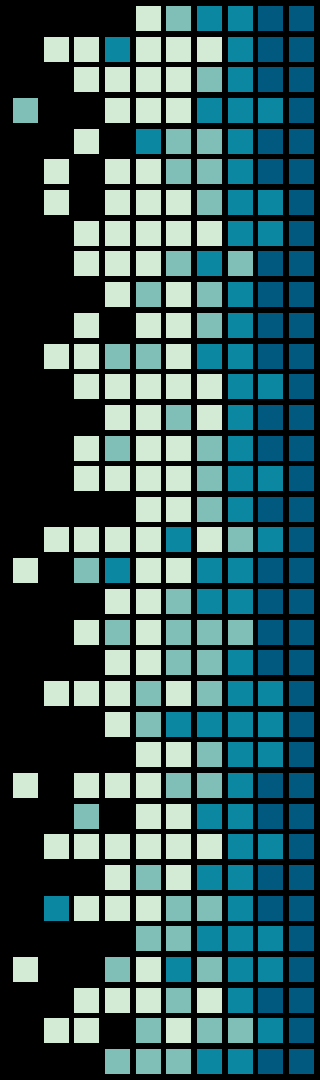
SCM – GIT – Flow Example
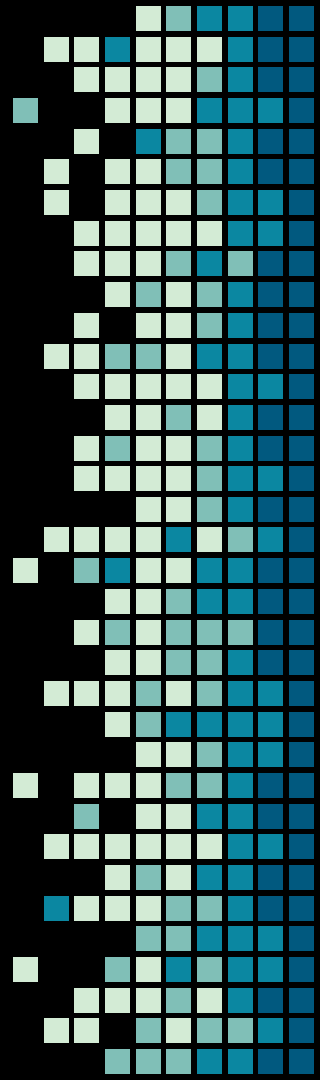
SCM – BitBucket.org

www.bitbucket.org

- Atlassian Product
- Features
  - Unlimited private repositories
  - Tiered pricing
    - Free for teams up to 5 users
- Simple Jenkins integration (Continuous Integration, CI)
- Why not GitHub.com?
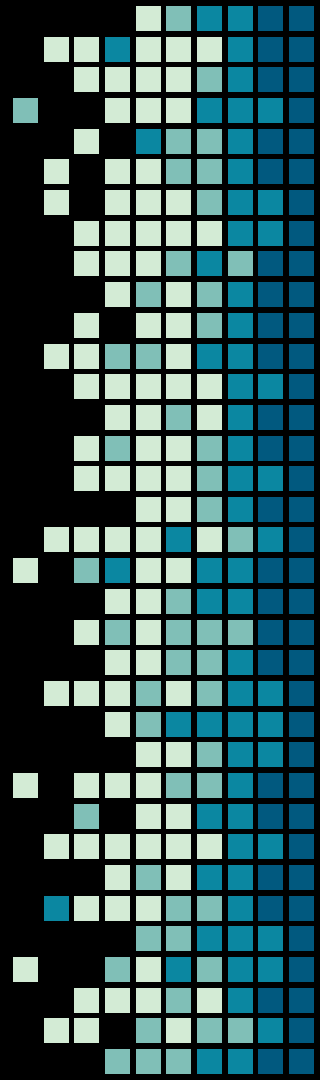 - No simple answer

Research Tools

- PDF Reader
  - Okular (Linux)
  - Most time spent reading research papers, algorithms, implementations and other fun stuff
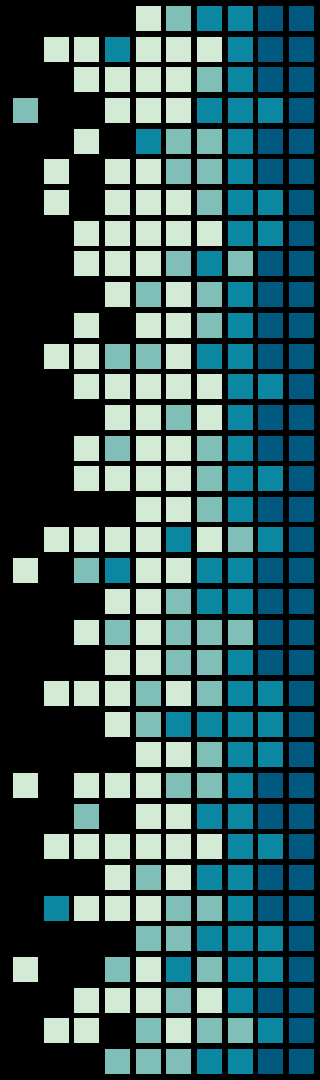
Research Material

- CSUB Library
- Arxiv.org
- Scholar.google.com
- Youtube.com (Lectures, concept tutorials).
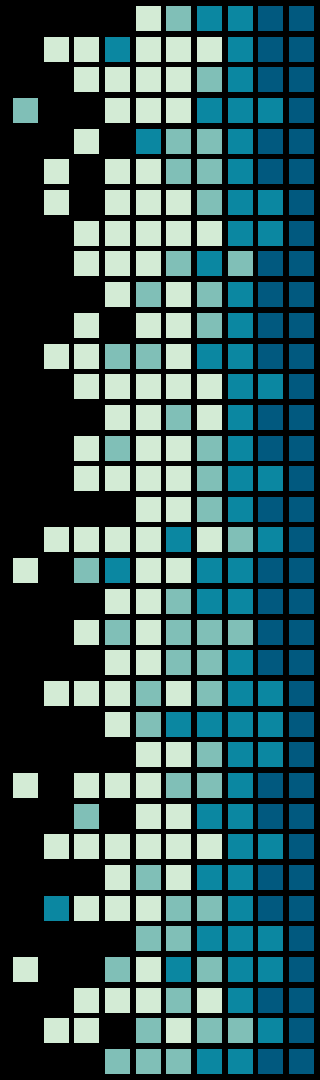- Ocw.mit.edu (Lectures, material, examples).

THE END

To be continued….

We'll take 1 question

Choose wisely

Alright, Maybe some more questions?

Ask away...