

On Being a Research Computer Scientist

or what it's like to be a lifelong learner

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November 14th, 2017

University of Hawaii at Manoa
Slippery Rock University of Pennsylvania

Introduction

What People Think I Do

COMPUTER SCIENCE



1100110011001000000
0110010101110010 01
00000110000101110000
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10110111001100111001
1110010 01110111011
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0110010101110010 01

What my friends think I do



What my mom thinks I do



What society thinks I do



What clients think I do



What I think I do



How to java

Google Search

I'm Feeling Lucky

What I really do

What I actually do

- Working to obtain PhD in Computer Science
 - With an emphasis on Big Data
 - Distributed sensor networks
 - Distributed computing
- Research Assistant for Infrasound Laboratory
 - Design and develop systems for capture, analysis, and reporting of infrasonic signals of interest

How I Got Here

Summary of My Life Until Now

- Graduated High School
 - Somerset, PA 2007
- B.S. in Computer Science (w/ minor in Theatre)
 - Slippery Rock University of PA, 2011
- M.S. in Computer Science
 - University of Hawaii at Manoa, 2015
- Ph.D. in Computer Science
 - University of Hawaii at Manoa, Present

How I Got Here

High School

High School

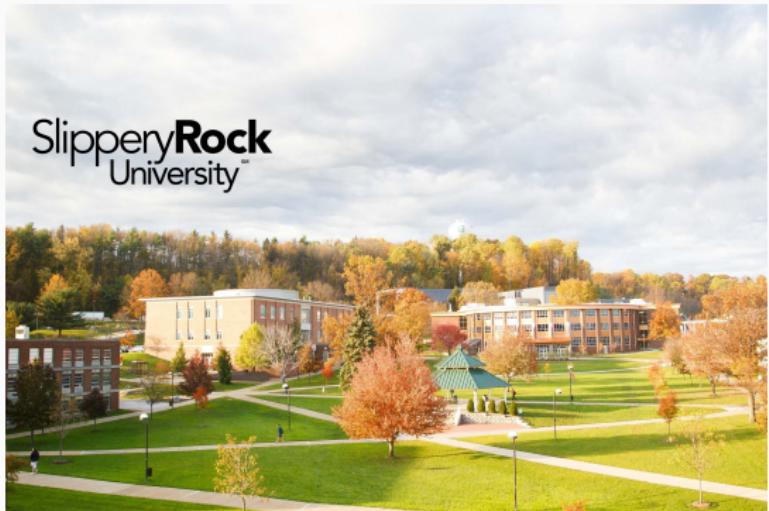
- No Formal Education in Computer Science
- Some self taught Python
- Web technologies for cool AIM profiles
- Band Geek
- Theatre Geek

How I Got Here

Undergraduate Education

Slippery Rock University of Pennsylvania

- Small class sizes
- *Close* to home
- Ski slope
- State school



Slippery Rock University of Pennsylvania



Slippery Rock University of Pennsylvania



Slippery Rock University of Pennsylvania

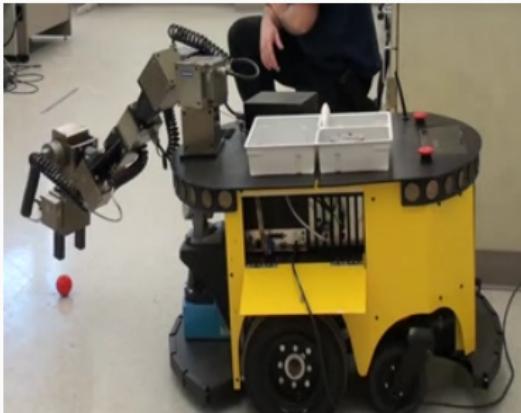


Undergraduate Computer Science

- Computer Science is NOT making video games
- Computer Science *is*
 - Algorithms
 - Data structures
 - Software Engineering
 - Operating Systems
 - Artificial Intelligence
 - Mathematical
 - ...
 - *Social*

Artificial Intelligence Robot

- Used genetic algorithms to *teach* a robot to pick up a ball
- Machine vision/image processing utilized to find the ball
- Wrote a script interpreter
 - Programming language for the robot
 - Could perform movements in parallel
- <https://www.youtube.com/watch?v=xoBVfaHHHcI>



Boulders Computer Cluster

- Used 8 recycled Intel blade servers to build a computer cluster
- A single master server managed all slave nodes
- Operating system loaded on each slave via PXE
- HPC via message passing interface (MPI)
 - MapReduce
 - Apache Spark
 - *...and many more...*

Other Undergrad Activities

- Vice-president of ΥΠΕ
- President of Computer Technology Club
- Student Advisor to the Dean
- Minor in Theatre

After Graduation



How I Got Here

Graduate School

What is Graduate School?

- Education beyond your bachelor's degree
 - Masters, Ph.D, M.D., Ed.D., etc
- Generally funded through teaching/research assistantship
- Specialization of your field
- Research focused
- Expects publishing and attending conferences
- Novel contribution to the field (Ph.D.)

Master's Degree

- Specialization in your field
- Comprehensive project or
- Master's thesis
- Graduate classes

Teaching Assistantship (TA)

- ICS 211 - Intro. to Programming II
 - 5 Semesters
 - Run programming lab
 - Design homework assignments (sometimes)
 - Grade homework assignments
 - Run lecture (when needed)

Research Assistantship (RA)

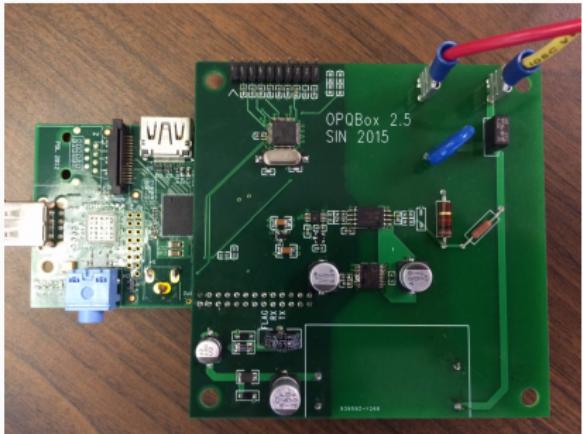
- Paid to perform research
 - Income ~\$25,000/yr
 - Tuition waver ~\$22,000/yr
- Many more opportunities than a TA
- OpenPowerQuality - 1 Semester
- Infrasound Laboratory - Current

Characteristics of Big Data

- Volume
- Variety
- Velocity
- Value

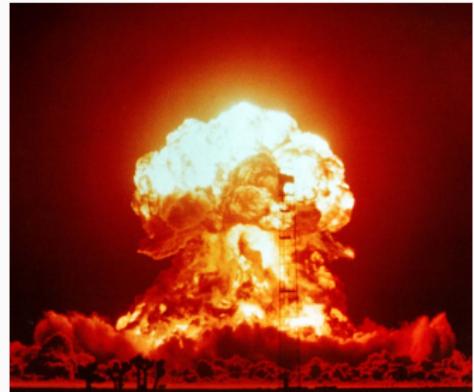
OpenPowerQuality (OPQ)

- Open source distributed sensors and framework
 - Detects PQ problems
 - Stores raw data in cloud
 - Performs analytics
 - Reports PQ info to users

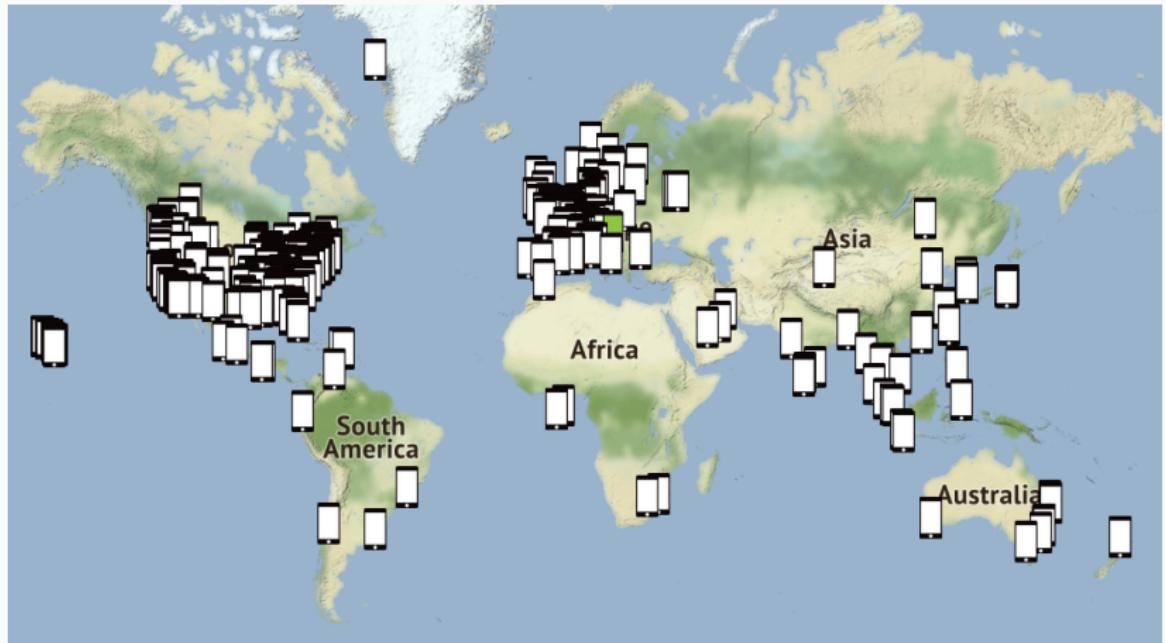


Infrasound Laboratory

- Sound <20 Hz
- Generated by large movements of air
 - Volcanoes
 - Explosions
 - Storms
 - Aircraft
 - Rockets



Infrasound Network



Lokahi Framework

- Data acquisition
- Data storage
- Data analysis
- Reporting
- Privacy / security

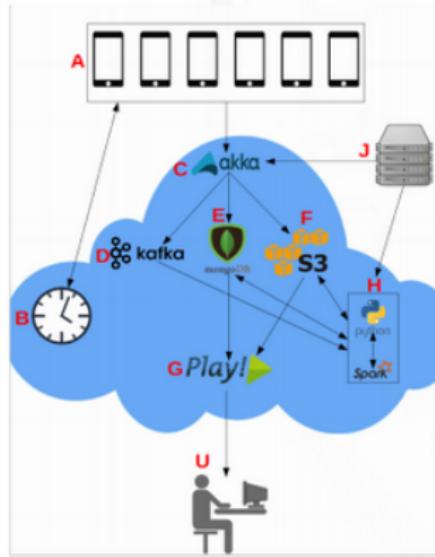


Figure 1- Diagram of the interconnected technologies that make up the Lokahi framework

- Distributed Sensors
- Time Synchronization
- Distributed Data Acquisition
- Distributed Data Buffer
- Distributed Persistence (Meta-Data)
- Distributed Persistence (Payload)
- Web Server/System Health Metrics
- Distributed Analysis
- Legacy Sensors

Lokahi Framework - Sensor Details I

RedVox	System Status	RedVox Groups	Downloads	RedVox Reports	Generate RedVox Report	Privacy Policy	achriste@hawaii.edu ▾			
1637160009	2017/11/13 23:00 UTC	0	0	28.39, -80.67	453790	81481	800	iOS	800	Details
1637165001	2017/11/13 22:59 UTC	0	0	19.72, -156.06	523166	91321	80	iOS	800	Details
1637165002	2017/11/13 23:00 UTC	0	0	19.72, -156.06	305332	51276	80	iOS	800	Details
1637169001	2017/11/13 23:00 UTC	0	0	19.70, -156.03	88079	13939	800	iOS	800	Details
1637634001	2017/11/12 12:05 UTC	2095		19.72, -156.07	91265	0	800	Android	800	Details
1637635001	2017/11/13 23:00 UTC	0	0	19.73, -156.05	136220	0	80	Android	800	Details
1637650001	2017/11/13 23:00 UTC	0	0	19.72, -156.04	224088	201945	800	Android	800	Details
1637650002	2017/11/13 07:13 UTC	946		19.74, -156.06	246658	222014	800	Android	800	Details
1637650003	2017/11/13 23:00 UTC	0	0	19.72, -156.04	268092	235435	800	Android	800	Details
1637650004	2017/11/13 22:59 UTC	0	0	19.72, -156.04	91479	66688	800	Android	800	Details
1637650005	2017/11/13 22:59 UTC	0	0	19.72, -156.04	97147	78424	800	Android	800	Details
1637650006	2017/11/13 22:59 UTC	0	0	19.71, -156.04	79349	60729	800	Android	800	Details
1637650007	2017/11/13 22:59 UTC	0	0	19.71, -156.04	81651	66012	800	Android	800	Details
1637650008	2017/11/13 23:00 UTC	0	0	19.72, -156.04	111649	82192	800	Android	800	Details
1637650009	2017/11/13 23:00 UTC	0	0	19.72, -156.06	86730	62484	800	Android	800	Details
1637650010	2017/11/07 22:15 UTC	8684		19.71, -156.04	39355	35240	800	Android	800	Details
1637660001	2017/11/12 12:04 UTC	2095		19.71, -156.03	202559	192171	800	Android	800	Details
1637660002	2017/11/13 23:00 UTC	0	0	19.73, -156.05	208567	200908	80	Android	800	Details
1637660003	2017/11/13 22:59 UTC	0	0	19.72, -156.05	187605	174884	80	Android	800	Details
1637660004	2017/11/13 23:00 UTC	0	0	19.72, -156.05	140300	128898	80	Android	800	Details
1637660005	2017/11/13 22:59 UTC	0	0	19.73, -156.06	37087	32286	80	Android	800	Details

Lokahi Framework - Sensor Details II

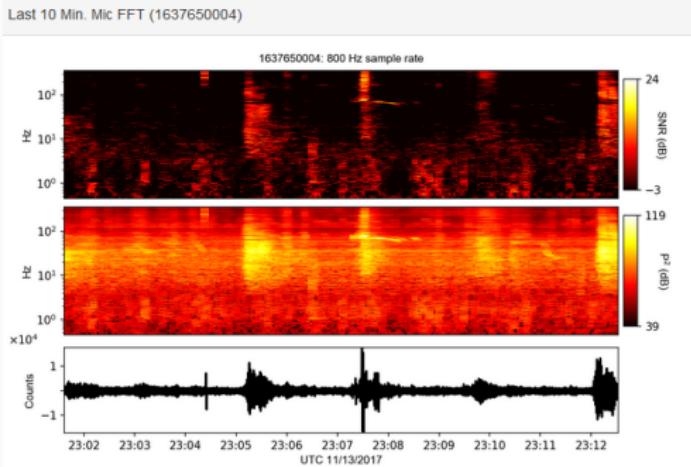
Redvox Device Details (1637650004)

Device ID	1637650004
Truncated UUO	1630346389
Last Received	2017-11-13T23:12 UTC
Min Ago	0
Location	19.71,-155.03
Altitude (m)	21.0
Speed (m/s)	0.0
# Mic	91488
# Bar	66703
Mic Sample Rate	800
Bar Sample Rate	1
Operating System	Android
Device Name	Nexus 5X 1.0 C4 0.0
Mic Sensor Name	INTERNAL MIC
Bar Sensor Name	BMP280 pressure
Time Sync Server	192.168.1.105:9875
Data Server	redvox.local:9000

Last refreshed: 2017-11-13T23:12:40.995Z

Device Location

Lokahi Framework - Sensor Details III



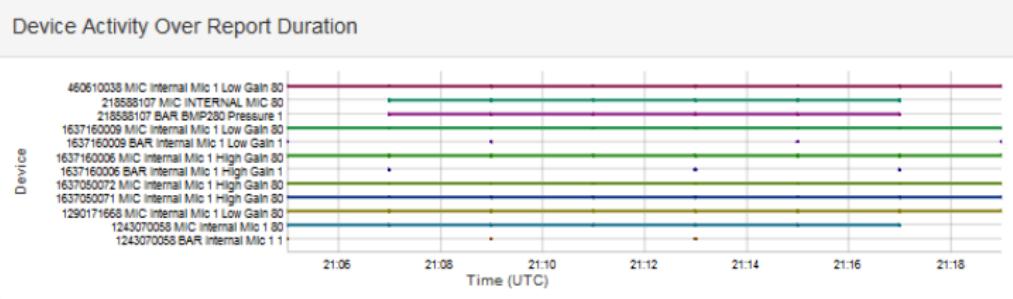
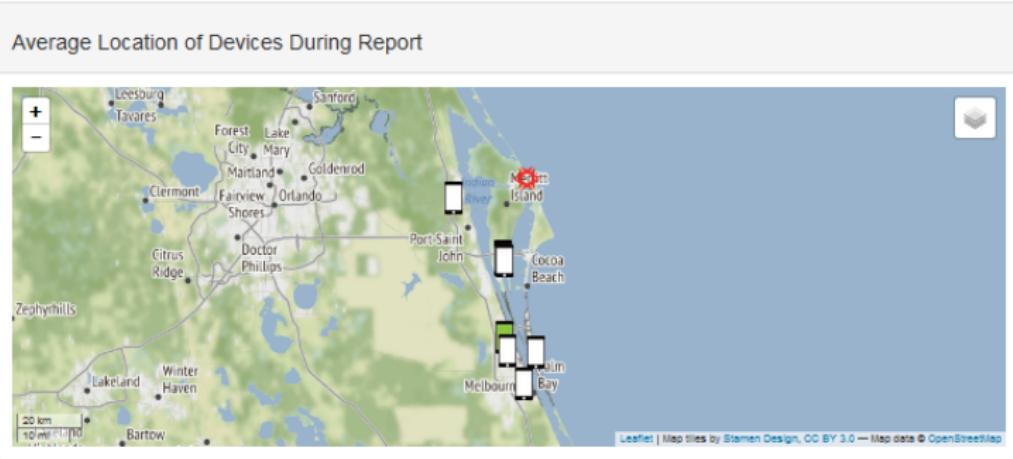
Lokahi Framework - Sensor Details IV



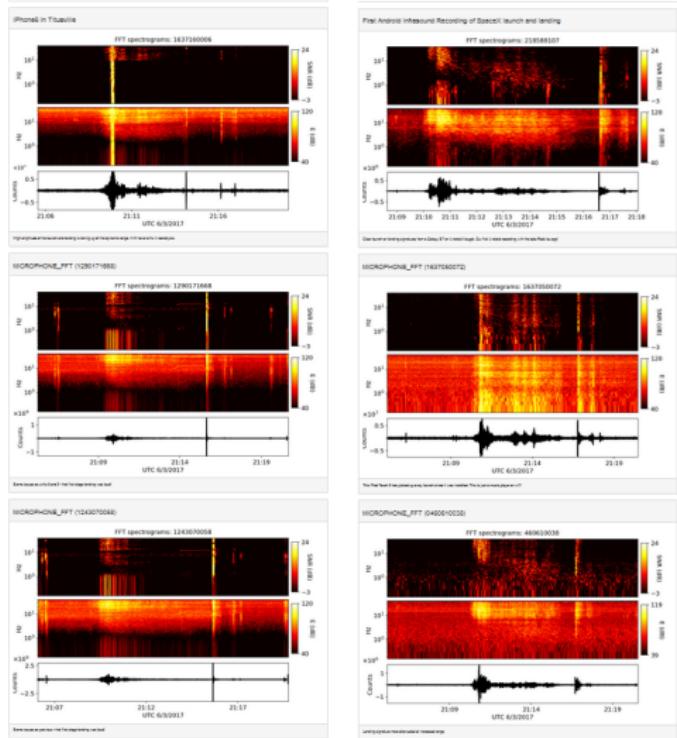
Lokahi Framework - Report I

RedVox Report		Edit Report Metadata	Launch Report	Santza Report	Print View
Report Title	SpaceX CRS-11 Dragon 10563				
Report Description	SpaceX Dragon Launch and First Stage Landing, 3 June 2017. Scheduled launch window: 21:07 GMT (6:07 p.m. EDT) LC-39A, Kennedy Space Center, Florida (28.5033° N, 80.0401° W)				
Report ID	5f6ef64c7f0fa0cc03d9594ea3cc050c				
Created On	Sat Jun 03 22:01:50 UTC 2017				
Event Origin Time UTC	1970-01-01T00:00Z Seconds from the Epoch UTC: 0				
Report Start UTC	2017-06-03T01:00Z Seconds from the Epoch UTC: 14968323600				
Report End UTC	2017-06-03T11:00Z Seconds from the Epoch UTC: 14968524800				
Event Origin Location	25.603338, -80.854333				
Event Origin Height Meters	0.00 meters				
Report Publicly Listed	true				
Device	1637163006 (iPhone/iOS) Distance to Event Origin Kilometers: 22.95 Back Azimuth to Event Origin: 76.94°				
Device	1390717168 Distance to Event Origin Kilometers: 24.58 Back Azimuth to Event Origin: 13.81°				
Device	1343070058 Distance to Event Origin Kilometers: 24.59 Back Azimuth to Event Origin: 15.79°				
Device	1637163009 (iPhone/iOS) Distance to Event Origin Kilometers: 24.59 Back Azimuth to Event Origin: 15.82°				
Device	218558107 (Android Samsung/G7) Distance to Event Origin Kilometers: 46.99 Back Azimuth to Event Origin: 7.41°				
Device	16371630072 (iPad/iRTZ) Distance to Event Origin Kilometers: 52.40 Back Azimuth to Event Origin: 6.48°				
Device	46061033 (iPhone) Distance to Event Origin Kilometers: 52.64 Back Azimuth to Event Origin: 357.86°				
Device	16371630071 (iPad/iRTZ) Distance to Event Origin Kilometers: 80.67 Back Azimuth to Event Origin: 1.77°				
External Link	SpaceX Mission				
Last refreshed: 2017-11-13T23:18:36.975Z.					

Lokahi Framework - Report II



Lokahi Framework - Report III



Just a Digital Plumber



National Labs

- Lawrence Livermore National Laboratory
 - Internship
 - National Ignition Facility
- Idaho National Laboratory
 - Got to tour a nuclear reactor
 - Took measurements at Yellowstone National Park
- Sandia National Laboratory

Conferences

- Ann Arbor, Michigan
- Honolulu, Hawaii
- Minneapolis, Minnesota
- San Francisco, California
- Raleigh, North Carolina



- Requires novel contribution to science
- General Ph.D. timeline
 - Acceptance
 - Qualifying Exam
 - Portfolio
 - **Proposal**
 - Dissertation
 - Defense

Computer Science Fields

Computer Science Fields I

- Artificial Intelligence
- Computer Architecture
- Compiler Design
- Computer Graphics and Visualization
 - Augmented / Visual Reality
- Computer Networks
- Computer Security

Computer Science Fields II

- Concurrency
- Cryptography
- Databases
- Data Science
- Data Structures and Algorithms
- Distributed Systems
- Formal Methods

Computer Science Fields III

- High Performance Computing
- Human Computer Interaction (HCI)
- Image Processing
- Operating Systems
- Programming Languages
- Simulation Modeling
- Software Engineering
- Theory of Computation

Thank You!

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