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Meshing with Data: Hacking Communications Solutions following Natural Disasters

Freshwater Initiative student Jimmy Phuong is a UW School of Medicine PhD Candidate in Biomedical Informatics and Medical Education studying computationally intensive, data-driven knowledge discovery in health research. He is currently facilitating the collection of spatio-temporal, socio-demographic data in Puerto Rico following Hurricane Maria. In June 2018, he had the opportunity to participate in Meshing with Data, a 43-hour hackathon which brought together computer scientists, software engineers, and other scientists to innovate solutions to communications problems following natural disasters. Here, he describes the hackathon experience.

On a recent trip to Puerto Rico, I had the opportunity to engage with stakeholders, community members, and university researchers directly affected by Hurricane Maria in 2017. Many of these people described how they understood the water quality and health issues following Maria, but disrupted communications channels made communicating these risks slow, irregular, and delayed. Community response required faster communications to be effective.

At this time, I learned about the upcoming Meshing with Data hackathon, which would bring together computer scientists, software engineers, and other scientists to innovate solutions to major communications problems following natural disasters. This event is designed to crowd-source existing engineering expertise through applied interactive workshops. When I learned about this event, I was excited because if anyone could come up with helpful solutions, I thought, it would be the engineering community, problem-solvers that they are. Workshops at the hackathon included lectures on blockchain technologies, internet of things, decentralized architecture, crowd-source platforms, and design thinking, all of which might be creatively applied to mass communications problems.

But looking at the event schedule, I realized that representation for domain expertise focused on computer engineering only. After Hurricane Maria, many communities spent months concerned about drinking water availability. Without power, hospitals and medical aid were severely exhausted, and aid could not be deployed to many places due to remoteness, broken roads, or flood. This needed to be addressed, so with the help of Dr. Christina Bandaragoda, we wrote a successful Earth Science Information Partners (ESIP) Lab proposal that supported my travel to attend the Meshing with Data hackathon as an advocate for water and health sciences. Other parts of the award include support for community participation in cyberinfrastructure design by Puerto Rican stakeholders, as well as travel for Puerto Rican colleagues to attend the Freshwater Hackweek on UW campus (planned for UW Spring Break 2019).

The Meshing with Data hackathon took place in Bayamón, Puerto Rico at a facility known as Engine-4. Engine-4 is an incubator space for start-up companies, but to me, it felt a bit like a bunker with thick concrete walls. Beside it stood a weather-damaged stadium that is currently used as a FEMA disaster recovery center. Strewn about the parking lot were remnants of fallen lamp posts. I learned that following Hurricane Maria, Engine-4 served as an “internet plaza,” an oasis with generator-powered electricity and internet access.

On the first day of the hackathon, I was struck by the diversity of expertise and career stage in the room. I stumbled through pleasantries in Spanish with undergraduate students, other graduate students, mid-career software engineers, and a few people in cryptocurrency technologies. Hoping to put my water and health science expertise to use, I formed an awesome team with a motley crew: a CEO for a cryptocurrency company, an undergraduate in chemical engineering turned computer engineering, and an undergraduate in computer engineering with drone expertise.

Together, we sprinted through the 43-hour hackathon, working to develop a minimum viable product that might serve as a solution to communications problems following natural disasters. Like other hackathons that I've completed in the past, teams were motivated by a monetary prize for the most innovative, functional, and feasible product. 43-hours is a long time; that sort of sprint takes its toll on the body by way of mental and physical exhaustion. Tums were necessary!

Once the hackathon started, our team designed our product iteratively. We thought about ways to use drones to establish a mesh communication network over a large region. For example, with drones flying over affected areas, distributed community members might report their current condition, which would be relayed from the drone back to response teams: flooded, not flooded, downed trees, food needed, medical attention required, etc. We thought it might be easy for community members to communicate these messages with visual codes, or emojis, and then translate those messages into a visual map of high-level need areas for dispatch responders.

With each passing hour, our product idea was refined further. Meshing with Data hackathon mentors were available around the clock to bounce ideas and provide feedback, which was invigorating! Ultimately, our unfinished end product used a open-source mesh network software called Byzantium. Though more accomplished entries won the cash prize, our diverse team ended up generating some great ideas that still have many possibilities left unexplored.

Thanks to the ESIP funding, I am excited to propose similar contingency projects at future WaterHackWeek events in an effort to spark innovations in the water resource scientific community.

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