

Personal Experience Deliverable

Background:

In September 2017, Hurricane Maria devastated Dominica, St. Croix, and Puerto Rico. The category five hurricane left first responders, communities, and disaster management facilities overwhelmed and disconnected from the world. Once flights started to resume, both government disaster resources and non-profit disaster-relief organizations began their journeys to Puerto Rico to render aid. I was one of the many volunteers deployed with the non-profit organization Information Technology Disaster Resource Center (ITDRC), whose goal is to “harness the collective resources of the technology community to provide no-cost information, communications, and technology solutions to connect survivors and responders in crisis.”¹ ITDRC deployed multiple waves of volunteers to Puerto Rico to do both assessment and recovery work of critical telecommunications infrastructure. I was on my spring break from college when I received an email that ITDRC was looking for volunteers. I filled out the ITDRC volunteer forms and started packing my bags and equipment right away. On January 5th, 2018, I boarded a flight to Puerto Rico to assist with the recovery and re-establishment of critical communications infrastructure.

The Adventure Begins:

On the approach of the landing, I was stunned by what I saw. Seeing the true devastating path of the storm first-hand/with my own eyes was unbelievable. It seemed like every house for miles was just tarp roofs and there were piles of storm debris everywhere. Upon arrival, I was picked up by the team leader and brought to our operations center, the same place where the Federal Emergency Management Agency (FEMA) was staying, at the GNV La Suprema Ferry. The United States government had contracted this Italian ferry vessel to house the many disaster-relief workers and volunteers. Each day, we joined briefings and received our orders from FEMA on what critical sites needed our assistance and dispatched out from the ship.

Puerto Rico's Communication Infrastructure

Puerto Rico's undersea cable infrastructure is used for providing high-speed connectivity. The landing stations for undersea cables are concentrated on the northern side of Puerto Rico (Cordova et al., 2020). As for the wireless infrastructure in Puerto Rico, it is mainly supported by aerial fiber-optic cables. These aerial fiber optic cables are strung on utility poles and are extremely susceptible to severe weather, high winds, and hurricane damage (Cordova et al., 2020). Puerto Rico's public safety systems make use of fiber-optic cables and microwave dishes to transmit their signals. These public safety systems and networks are critical to 911 emergency response and government response in the aftermath of disasters (Cordova et al., 2020). After the storm passed through, it was reported that 50 percent of the public safety interoperability communications system was not operational (Cordova et al., 2020). The Federal Communications Commission (FCC) reported that more than 91 percent of cellular towers were out of commission and the main fiber landing station was flooded, causing major internet data outages island-wide.² It is said that essential services such as electricity, water, and telecommunications are critical to human well-being and the functioning of modern society, making them complex socio-technical systems (Van der et al., 2018).

On the island of Vieques, my fellow teammates and I were met by the Oficina Municipal de Manejo de Emergencias (OMME) of Vieques who gave us a ride around the municipality and showed us the extensive damage to both public safety communications and public communications infrastructure. OMME lost all dispatching and call intake abilities as their two-way radio equipment was fried by a generator power surge and damage to the antenna tower. This left them in a very difficult situation; if the responding units needed backup or got injured, the dispatch center would not know. They tried using cellphones and various cellular carriers for getting dispatching and call intake back up, but still had issues with the inconsistent cellular connection. This led to many issues including the problem of how to get the new phone number out to the public. If anyone needed to be in contact with OMME for an emergency or needed medical help, they would have to go to the physical OMME building. The OMME weren't the only people that faced these issues; we also saw it with police, ambulance stations, and hospitals without internet and telephone service in the multiple municipalities (municipios) of Cataño, Dorado, Morovis, and Barceloneta.

The island only had one hospital, the *Family Health Center Susana Centeno*. The hospital had no electricity after the hurricane passed until Tesla installed a temporary solar farm to help power some of the essential medical equipment. The staff tried to operate out of their building as long as they possibly could until it was shut down due to standing water, lack of electricity, and mold threatening the health and safety of everyone there.³ The hospital had to start running out of giant military-style tents outside the main building before moving to a temporary building that was a few blocks over. This heavily reinforced concrete building was also used as a shelter during and after the hurricane hit. This building had no internet or cellular data connection for the hospital staff to run their computers and access the Internet.

ITDRC Restoration Efforts:

As I mentioned above ITDRCs' goal is to provide no-cost information, communications, and technology solutions to connect survivors and responders in crisis." This operation was a bit unique and had its challenges, one of which being ITDRC's headquarters is in Fort Worth, Texas and we did not have many resources or volunteers locally in Puerto Rico. ITDRC had to figure out the logistics of flying both equipment and volunteers such as myself to Puerto Rico. ITDRC was able to reach out to partners such Airlink to help with flights, and UPS and FedEx for getting equipment from Fort Worth to Puerto Rico. Once the equipment and volunteers got to the island we began the work of reconnecting critical infrastructure and re-establishing communications so that response and recovery operations could continue and not be hampered by failed communications infrastructure.

On the island of Vieques, we faced difficulty as the only internet connection available was through an official government building. Once we got the go-ahead after two days or so of trying to get approval, we were able to deploy a set of Cambium Point to Point (PtP) Wireless dishes to share that connection to the OMME office and the Port Vieques ferry terminal. Once the mesh network was deployed we were able to set up some Cisco Voice over IP (VoIP) phones which work over WiFi to make calls at the OMME office, now they could make calls and receive emergency calls. OMME was very happy and had received multiple calls throughout the day and night and it was truly an eye-opening experience knowing I just helped bring that line of communication back. Unfortunately, this did not last very long. We got a report from the Port and OMME office that they had no internet connection again. Me and the rest of the team were

back in San Juan as we were restoring the internet and setting up equipment and VoIP phones at local hospitals and police stations, we had to wait until the next day to take the ferry back over to Vieques. The next morning when we got back to Vieques, we checked the main internet connection and dish at the government building and found it was sabotaged by some anonymous actors. The wires were cut at the base of the device and we found rocks that must have been thrown inside the antenna housing. We decided to reach out to the local Dish Cares⁴ Team in Puerto Rico to make a request to get a satellite internet connection set up at the port. Dish agreed to it, but it took another day trip to get them over to Vieques. Once the connection was installed, we set up the mesh network between the port and OMME. They were back online once again and finally could rest on that they had a reliable connection and could help their community.

As for the *Family Health Center Susana Centeno*, as they were operating out of tents, they soon were going to move a few blocks over to what at the time was supposed to be a temporary placement of a concrete building. This building did not have WiFi and was never even wired previously for even ethernet hardwired network connectivity. While we had Dish Cares on the island, they deployed another Satellite connection for us, and then my team and I ran ethernet cables to make some network drops for computer stations. It was hard to run the cables to exact locations where we were told computers were going to be because the hospital had construction contractors coming in behind us to build sectioned-off walls to separate the giant open space into working rooms for the hospital. Other than not knowing exactly how many network lines to run and where they needed to be all, all this was one of the easier sites.

Back in San Juan, we had to address the connectivity issues with police, ambulance stations, and hospitals that were without internet and telephone service as well in multiple municipalities (municipios) of Cataño, Dorado, Morovis, and Barceloneta. One hospital we went to in Cataño had a satellite connection setup previous to our arrival. They just needed us to fix some wiring and set up a few VoIP phones. As for the various police and fire stations, we were able to do similar PtP mesh setups where there were very minimal internet connections left standing. Some of the sites that did not have an option of internet connection sometimes got lucky of having some cellular data availability; we then would setup LTE Modems. For any further sites that did not have either of these available, we used satellite backhauls as last resort. All in all, ITDRC had 40 Satellite connections, six PtP sites, 62 Wireless access points deployed, and 52 phone lines established.⁵

Conclusion:

From my experience and what I have witnessed over the years of volunteering with ITDRC, we have made important changes to help Puerto Rico have stronger and better resiliency. Since Maria, we have recruited many locals in Puerto Rico and have established a cache of equipment. This has helped ITDRC to help Puerto Rico become more resilient, and we were able to deploy faster following the recent earthquakes that have caused damage to the island. With the local teams and cache of equipment, ITDRC was able to set up WiFi and computers for people affected by the earthquakes to use to contact loved ones and report any damages to their homes or businesses. This experience was truly eye-opening for me as I had volunteered and been involved in the disaster-relief field for some time and have not witnessed anything as devastating as Hurricane Maria. This experience also allowed me to find what I wanted to do with my interdisciplinary degree on leveraging technology to help with disaster management and alleviate some of these gaps and make communities more resilient.

References

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Endnotes:

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5. *2017 Annual Report*. ITDRC, Jan. 2018.