Article

Indigenous Community Networking in Hawai'i: A Case Study

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Abstract
Shaping digital inclusion policy and practice to meet community-defined goals requires more than access to digital devices and connectivity; it must also enable their effective design and use in local settings. For the Nation of Hawai'i, a *Kānaka Maoli* (Native Hawaiian) organization with a land base on the island of Oahu, these activities are closely associated with broader goals of nation-building and sovereignty. In this article, we document how the Nation of Hawai'i is conceptualizing its community networking project as an example of an Indigenous organization's efforts to frame community networks as a means to generate a "sovereignty mindset" among its members, as well as share resources and experience among community members and with other communities in Hawai'i and beyond.

Keywords
community networks; digital divide; digital inclusion; digital inequalities; Indigenous media; Indigenous peoples; Indigenous sovereignty; Native Hawaiians; rural broadband

1. Introduction

For hundreds of years, the islands of Hawai'i have served as vibrant communication hubs: Long before European settlers arrived, *Kānaka Maoli* (Native Hawaiians) exchanged information between islands by canoe (Shay, 2018). King Kalākaua had telephones installed in 'Iolani Palace several years before the White House. Today, these activities continue as Hawaiian communities are deploying telecommunications as a component of nation-building, and addressing access and affordability divides that persist in the islands (Maka'awa'awa, 2019; Winter et al., 2014). The Indigenous organization Nation of Hawai'i frames these communications networking initiatives as expressions of Native Hawaiian sovereignty, including in the context of digital connectiv-

ity (Morgenstern, 2021). Echoing the spirit of building housing, water, and electrical infrastructure on their land, sovereignty activists are establishing their own Internet systems, answering calls for Indigenous self-determination in the information age in Hawai'i that have been in existence as early as 1995 (Crawford & Bray-Crawford, 1995).

In this context, we contend that the networking activity in the community of Pu'uhonua o Waimānalo contributes to efforts to theorize how "sovereignty" relates to digital data, platforms, and infrastructures, particularly in diverse Indigenous contexts. As Couture and Toupin (2019) discuss, Indigenous scholars and activists relate sovereignty to their larger struggles to reclaim control over lands, bodies, and cultures. They also identify another stream of digital sovereignty linked to social

movements, pointing to examples of free and open-access hardware and software—including decentralized community networks—as efforts to build alternatives to commercial technologies (Antoine, 2020; Beaton & Campbell, 2013; Wemigwans, 2018). A third reading of digital sovereignty relates to values of independence, control, and autonomy, as reflected in the capacities of groups to engage in innovation and technological development and in their attempts to secure ownership and control of digital data and infrastructure (see First Nations Information Governance Centre, 2014; Kukutai & Taylor, 2016; McMahon, 2014; Roth & Audette-Longo, 2018). We build on these observations to demonstrate how sovereignty activists in the Nation of Hawai'i are addressing these issues.

We note that some Indigenous organizations in Canada and the US have built and operated their own digital infrastructure for several decades to serve the development needs of their communities and citizens (see, for example, Carpenter, 2010; Duarte, 2017; First Mile Connectivity Consortium, 2018; McMahon et al., 2014; Roth, 2014; Sandvig, 2012). In rural, remote, and Indigenous contexts, these projects demonstrate infrastructure deployment in areas with a limited case for private sector investment, while retaining community ownership and control of infrastructure and services.

Our focus here is on how the Nation of Hawai'i conceptualized, planned, and implemented a community network. While we include interviews on adoption and use, it is too early in the development process to fully evaluate the network's impacts. Therefore, our analysis focuses on how the Nation of Hawai'i utilized a framework of digital sovereignty in their development of a community-owned and operated network.

1.1. The Native Hawaiian Context

Despite their reputation as a paradise of abundance, the islands of Hawai'i contain deep social, economic, and political inequities (Silva, 2004; Trask, 1999). As Aikau and Gonzalez (2019, pp. 1–2) write:

While this place is indeed beautiful, it is not an exotic postcard or a tropical playground with happy hosts. People here struggle with the problems brought about by colonialism, military occupation, tourism, food insecurity, high costs of living, and the effects of a changing climate.

These inequities are expressed in digital contexts; for example, in 2021, 34% of Native Hawaiians and 35% of non-Hawaiians reported insufficient access to digital devices and Internet connectivity (Imi Pono Foundation, 2021). For those households struggling economically, almost one in three have no Internet service. As in other regions and communities around the world, Covid-19 made these differences even more significant.

At the same time, *Kānaka Maoli* and other residents of Hawai'i are engaged in resurgence and revitalization initiatives toward restoring *ea*, that is, "the breath and sovereignty of the *lāhui* [assembly], *'āina* [land], and its people" (Aikau & Gonzalez, 2019, p. 2). Goodyear-Ka'ōpua (2016) describes *ea* as an emergent concept encompassing diverse practices. While the term originally referred to political independence and state-based forms of sovereignty in the 1840s, the meaning has since expanded to encompass the environment and relations among humans and non-humans, "the mutual interdependence of all life forms and forces" (Goodyear-Ka'ōpua, 2016, p. 5). *Kānaka Maoli* practice different paths to *ea*. Goodyear-Ka'ōpua (2016, p. 12) writes:

Hawaiian social movements have been, at their core, about protecting and energizing *'Ōiwi* ways of life: growing and eating ancestral foods, speaking the native language, renewing relationships through ceremonies, making collective decisions, and simply remaining on the land.

In the late 1970s and early 1980s, some Hawaiian movement leaders began "articulating an explicitly nationalist agenda and calling for sovereign control of a national land base" (Goodyear-Ka'ōpua, 2016, p. 14; see also Goodyear-Ka'ōpua et al., 2014). While the Nation of Hawai'i is not the only group seeking autonomy and control over their lands, or involved in ongoing independence efforts (McGregor, 2010), we focus on their activities here as context for their establishment of a community network. In 1993, some 20,000 *Kānaka Maoli* and supporters converged on 'Iolani Palace, the Hawaiian Kingdom's seat of government, to listen to a series of speeches on Hawaiian history and self-determination. At the same time, the People's International Tribunal, Ka Ho'okolokolonui Kānaka Maoli, brought the US to trial for its armed invasion of Hawai'i in 1893. A tribunal of distinguished international human rights experts and advocates found the US guilty of its violations against *Kānaka Maoli* and the nation (Blaisdell et al., 2014; Boyle, 2015). Professor Haunani-Kay Trask and colleagues at the University of Hawai'i at Mānoa's Kamakakuokalani Center for Hawaiian Studies produced critical media works that served to make the findings of Hawaiian historians and political scholars available to a broad audience (see Puhipau & Lander, 1993; Trask, 1999).

During these events, one of the Hawaiian independence leaders Pu'uhonua Dennis "Bumpy" Kanahele organized a 15-month occupation of Kaupō Beach in Waimānalo, O'ahu. According to the Nation of Hawai'i, participants with genealogical ties to the land's original owners sought to establish a permanent encampment and made land claims as heirs to the rightful ownership of the land base (Nation of Hawai'i, 2018). In June 1994, "Bumpy" Kanahele ended the occupation of Kaupō Beach to form the Nation of Hawai'i on the state-owned *mauka* (mountainside) agricultural lands in the valley adjacent

to the Koʻolau Mountains in the *Ahupuaʻa* (communal land tenure system) of Waimānalo. Members of the organization cleared the densely forested lands to build infrastructure and houses without assistance from the state or federal governments (Nation of Hawaiʻi, 2018).

With a population of approximately 80 people living in 15 houses, this land is now known as Puʻuhonua o Waimānalo and remains the headquarters of the Nation of Hawaiʻi (which claims "citizens" throughout the state of Hawaiʻi, as well as Indigenous people elsewhere in the world). Puʻuhonua o Waimānalo is a project of Aloha First (a non-profit organization), while the land base is provided through a 55-year lease from the state of Hawaiʻi. As "Bumpy" Kanahele describes it: "We're kind of like the refuge for everybody, the Puʻuhonua for everybody." In Puʻuhonua o Waimānalo, the Nation of Hawaiʻi continues its *ea* work through activities ranging from growing *kalo* (taro) to ecommerce:

> Puʻuhonua o Waimānalo is both a hope and a promise for a better future for Hawaiians—one where we can get back to the land and *mālama* [take care of] it in the way that only Hawaiians can—with the proper cultural and spiritual foundations and with a focus on bringing our people home. (Nation of Hawaiʻi, 2018, p. 5)

1.2. The Telecommunications Context

It should be noted that, despite its distance from the continental US and other population centers, Hawaiʻi is a key node in global telecommunications networks (Starosielski, 2015, p. ix). Both the state government and the University of Hawaiʻi have a long history of ICT4D initiatives and programs dating to the 1970s, including PEACESAT, ALOHANET, and other projects to link Hawaiians to each other and the island states of the South Pacific (Hudson, 1990; Omandam, 1996). In addition, the Pacific Telecommunications Council, a non-profit organization founded to "meet a growing need for the development, understanding, and beneficial use of telecommunications in the Pacific area" is headquartered in Hawaiʻi where its annual conference is held (Wedemeyer, 1983, p. 12). However, these telecommunication initiatives did not involve Indigenous ownership or control of the networks.

The advent of the Covid-19 pandemic further highlighted the importance of reliable and affordable broadband to access essential services and resulted in increased attention to broadband by state and federal departments and agencies. For example, the federal Consolidated Appropriations Act of 2021 included several provisions that address broadband deployment and digital inclusion. Its Emergency Broadband Benefit program to reimburse internet service providers (ISPs) for providing broadband service and devices to low-income households was succeeded by the Affordable Connectivity Program of the Federal Communications Commission (FCC), which implemented additional subsidies for broadband services to low-income and Tribal households in 2021. The Act includes USD 1 billion in funding to expand access to and adoption of connectivity on Tribal lands, including those of Native Hawaiians.

This policy and funding environment has catalyzed a nascent community networking movement supported through the Broadband Hui, a community of practice dedicated to digital equity activities in Hawaiʻi (see https://broadband.Hawaii.gov/broadband-hui). The Broadband Hui's activities are reflected in the Hui's Digital Equity Declaration (at https://www.broadbandhui.org). This enabling environment of state and federal policy and funding has increased awareness of the potential of broadband connectivity across the Hawaiian islands—including through community networks.

2. Case Study: Purpose and Methodology

The purpose of the case study was to document the process of planning and implementing the community network, to collect preliminary data on the usage of the network, and to understand how the project relates to the values of *Kānaka Maoli*. Our research questions are:

- How do leaders and citizens of the Nation of Hawaiʻi conceptualize local Internet infrastructure?
- How does this understanding shape the ways they are building, operating, and sustaining a local Internet system?

The authors consist of a team of non-Indigenous community-engaged researchers and leadership from the Nation of Hawaiʻi collaborating on a participatory action research project. This approach builds on past work employing participatory and Indigenous methodologies to co-design and implement research activities with Indigenous communities and organizational partners (see, e.g., O'Donnell et al., 2016). Team members from Puʻuhonua o Waimānalo are involved as co-developers of research design, project administration, and community engagement, as well as sharing their expertise about the Nation of Hawaiʻi and their development and application of *ea* (sovereignty) to their work. They are also co-authors of this article. With respect to research processes, we utilize a mixed-method approach that draws on primary data, including household surveys, interviews, an in-person focus group, and document analysis. We employed a case study method (Yin, 2018) to investigate the perspectives of members of the Nation of Hawaiʻi (and the organization's leadership in particular) by compiling data from these multiple data sources. Household surveys, interviews, and focus group questions elicit data about perceptions, adoption, and use of the community network. For example, survey questions asked participants to identify how they used the network as well as any technical challenges that they faced, while

the focus group expanded upon specific factors influencing use, such as perceptions of access and affordability, thoughts about usage and impact, and impressions of technical support. Interviews with Nation of Hawaiʻi leaders and network managers provided important information about the vision and goals of the network, relationships between the network and broader sovereignty and nation-building goals, and reflections on challenges and solutions. Interview data was supplemented by information drawn from written documentation collected between 2019–2021 by network managers. See Table 1 for a chronology of project research activities. This study was reviewed and approved by the Research Ethics Board at the University of Alberta.

Because of Covid-19 restrictions during the study, we hired and trained a local researcher remotely to conduct 10 *hale* (household) surveys. Surveys consisted of 40 questions modified from the 2020 ITU Household Internet Access Questionnaire (International Telecommunication Union, 2020). Responses were collected using a tablet pre-loaded with a survey data collection app and shared with university-based researchers through the app for analysis. The local surveyor signed a confidentiality agreement to protect the privacy of respondents. Following ethical standards, respondents were not required to answer every question. Respondents received a USD 10 gift card as an incentive to participate. Survey data were analyzed using basic descriptive statistical analysis.

Data were also collected from 90-minute semi-structured interviews with network managers and Nation of Hawaiʻi leaders and a 90-minute in-person focus group held with eight community residents. Both the interviews and the focus group were recorded and transcribed. Finally, we conducted a thorough review of documents associated with the community network; these included mission and vision documents, technical manuals, troubleshooting logs, and presentations. We sorted and categorized the data thematically and prepared a chronological narrative of the early phases of the community network. We present highlights from this analysis here, with a specific focus on issues related to *ea*. Our observations are further supplemented by participant observation during several field trips to Puʻuhonua o Waimānalo.

We note several limitations to our study, including the small sample size of our household survey data

(although there are only 15 households in the community), the difficulties of collecting data through remote methods, and the personal engagement and relationships of our team members (which may have biased responses from community participants and leaders). Covid-19 significantly affected the timing and scope of our project, which may have impacted the ability of participants to recall certain details. The three university-based researchers are not *Kānaka Maoli* and have a limited understanding of *Kānaka Maoli* research methodologies or notions of *ea* (Goodyear-Kaʻōpua, 2016; Oliveira & Wright, 2016). However, they worked closely with community team members to mitigate these limitations. Direct quotes from these co-authors ("Bumpy" Kanahele, Brandon Makaʻawaʻawa, and John Kealoha Garcia) are presented throughout the text and come from transcribed interviews.

3. Findings

3.1. Documenting the Evolution of the Puʻuhonua o Waimānalo Community Network

Prior to the launch of the community network, residents of Puʻuhonua o Waimānalo had limited connectivity available through 4G cellular hotspots—an option described as convenient but slow, limited, and expensive, with restrictive data caps. Residents also accessed the Internet in places outside the community including fast food restaurants, coffee shops, at the houses of friends and family members, at work, and at school.

This situation began to change in November 2019, when participants, staff from the Internet Society (ISOC), and some residents of Puʻuhonua o Waimānalo participated in a community network training and deployment initiative as part of the third annual Indigenous Connectivity Summit (ICS; Buell, 2019). Funded and organized by the ISOC, the initiative involved a series of pre-conference online training webinars, followed by two days of discussion and presentations on the island of Hawaiʻi and hands-on technical training and the launch of the network at Puʻuhonua o Waimānalo on Oahu.

"Bumpy" Kanahele and Makaʻawaʻawa, respectively the head of state and deputy head of state of the Nation of Hawaiʻi, participated in this project. Reflecting on their experience, they noted ISOC's sharing of technical expertise and described how the event catalyzed further

**Table 1.** Chronology of Puʻuhonua o Waimānalo community networking project research.

Date	Project research
November 2019	Indigenous Connectivity Summit held in Hilo and Puʻuhonua o Waimānalo
2019–2020	Project agreements were established, as well as ethics and Covid protocols
2020–2021	First round of data collection (surveys, interviews)
November 2021	Second round of data collection (focus group)
2022	Data analysis and write-up

engagement with the state of Hawai'i and businesses such as Hawaiian Telcom (the incumbent provider). According to Maka'awa'awa: "This is probably one of the first and best relationships we've ever built with the state of Hawai'i." They described the event as important not only to connect the community but also to improve their relationships with other groups and organizations.

They also highlighted how the project was facilitated by the Nation's independent political status. Maka'awa'awa noted: "The state [of Hawai'i]...pretty much let us manage what we manage on our land, so the state has no involvement [beyond supporting negotiations for backhaul] with any of the things we're doing on our Nation". The network development was facilitated by the state of Hawai'i and involved negotiating access to Hawaiian Telcom's fiber backhaul and preparing a fiber connection to the community network infrastructure. Within the community, the system utilizes a fixed wireless network (5.8 Ghz unlicensed spectrum) that redistributes bandwidth from Hawaiian Telcom's two backhaul fiber links (2 x 1GB circuits). Figure 1 provides an overview of the community network coverage.

During the build, Nation of Hawai'i residents and ICS participants connected 10 *hales* (houses) out of 15 and several community buildings using fixed wireless transmitters (see Figure 2). Residents appreciated that it was hands-on and not too technical, and enjoyed working in groups alongside people from other communities. As one resident commented during the focus group: "They lived in the same kinds of communities as us. They dealt with the same kinds of problems as us. And that's why it was easier to do the training like that."
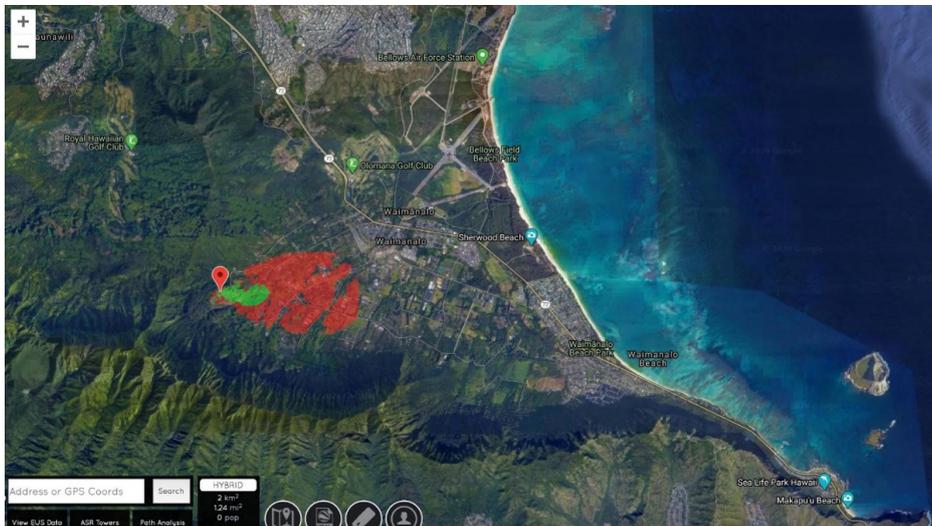
Figure 1. Google Maps satellite image showing the connectivity footprint of Pu'uhonua o Waimānalo community network.

Figure 2. Pu'uhonua o Waimānalo community network installation during the 2018 Indigenous Connectivity Summit.

After the network installation, the Nation of Hawaiʻi developed a vision and mission statement to guide the ongoing operations and maintenance of the community network that covered access, applications, innovation, and the focus on nation-building and *ea*. Conceptually, these goals are framed as connected phases of network maturation. Access comes first and refers to building and maintaining physical connections to the Internet. As the project gains maturity, access expands to applications and uses. Innovation involves engaging community members in activities such as communications, research data collection, training, and policy. Since 2019, the network management team has been documenting network operations, including speed test and usage data, as well as reports from residents and site observations. Network manager Garcia noted the importance of documentation through this process: "We have the technical expertise. We have the ability to figure it out....Formalizing a lot of that process is going to be what I think allows us to continue to learn from it."

3.2. Applications and Uses of the Community Network

In the focus group, residents reported that they use digital services for a variety of purposes, namely for entertainment or education, to connect socially, conduct business, shop for products and services, and create music and art.

In household surveys, residents said that access to the Internet was very important for these and other purposes and that their usage increased during Covid-19, especially during the lockdown. Community members also noted several uses specific to their goals of language and cultural revitalization, such as taking online language classes and sharing information about the Nation and its sovereignty efforts with people around the world.

While a follow-up survey and additional data collection will be necessary to determine the social, cultural, and/or economic impacts of this usage, we can consider these findings part of the "chain of inference" of ICTD impacts. For example, e-commerce may result in increased revenue for community members; online education may lead to opportunities for further education or employment, and music, art, and social connections may strengthen Indigenous culture (Hudson, 2006).

Residents also noted that digital connectivity also brings challenges, including online safety, security and privacy breaches, and misinformation. Many expressed concerns related to negative impacts on children and increased exposure to spam.

4. Discussion: Digital *Ea* in the Context of the Nation of Hawaiʻi

Throughout this research, leaders and network managers—and, to a lesser degree, some community members—noted how the Nation of Hawaiʻi's goals of practicing *ea* intersects with their broadband development work. This section documents the different ways in which people in Puʻuhonua o Waimānalo are framing the community network project in relation to *ea*.

First, the community network project is perceived as a means and expression of cultural revitalization tied to the legal basis of the Nation of Hawaiʻi's claims to sovereignty, for example by connecting the community network project to broader efforts to restore the *Ahupuaʻa* communal land tenure system. In its documentation the Nation of Hawaiʻi (2018) stresses the importance of this system in relation to the occupation of stewardship of their land base, describing it as serving as "a living testament to the power of *ʻāina* (land), place and space to Hawaiian identity" (p. 5). They state these lands serve as "a safe space for our people and a physical reminder of the power of *ʻāina* and the peace, joy and contentment that comes with caring for it in a *pono* (just) way" (p. 5).

Garcia further connects their community networking efforts to this system, stating: "We have the ongoing journey of reconciling and restoring the *Ahupuaʻa* system...an ancient land division system that was fractured when the overthrow happened....We were self-sustaining for many generations." These and other links demonstrate how the Nation of Hawaiʻi is conceptually linking the practices of *ea* with their deployment and ongoing operations, maintenance, and use of the community network.

Second, sovereignty work is framed as building and operating communications infrastructures as autonomous, but also recognized by government agencies like the FCC or the state of Hawaiʻi. Makaʻawaʻawa explained that "sovereignty and control over your lands allow you to move a lot quicker. It's not like we're reckless. We're more careful than anybody else would be because it's our land and it's our people that we're trying to give better access to." This approach recognizes the Nation of Hawaiʻi's sovereignty while also requiring collaboration and negotiation with the state of Hawaiʻi and the US government. For example, the Nation is working to secure formal licensing as an eligible telecommunications carrier, which in many cases is a requirement for government funding or subsidies. The Nation was also involved in negotiations with the FCC to secure access to the Tribal priority spectrum (FCC, 2020). As Garcia put it:

> It is like a dance: We are co-existing with the state [of Hawaiʻi], but also building our Nation and network with our own people, without asking permission. This enables us all to live in harmony. We are working at addressing the lack of access facing our people, the continuing inequity. We are not against the FCC; if anything, we want their help to get further access, and to advance the [community network] project.

The route to connect to the existing fiber was trenched by the community prior to the 2019 ICS event, using their own equipment. As Makaʻawaʻawa put it:

We had to trench our own fiber optic, which could be a problem for other communities. For us, it wasn't—because we have machines. We have operators. We have people that dig plumbing lines and stuff. That's a normal thing for us. It wasn't any issue trenching for our people. We just had to make the time and schedule it.

He further described how these activities demonstrated sovereignty to the Nation's citizens:

The kind of stuff we do over here, not everybody is able to see and touch and feel and do, and they just get one little taste of it. That's why we're doing what we're doing….We've got to just keep building…because it's not just hopes and dreams. This is physical lines being drawn in the sand, infrastructure, all of that kind of stuff.

Third, the community network provides a means for the Nation of Hawai'i to interact with other governments, for example through policy engagement. The Nation is already active in international fora, including the United Nations. During Covid-19, they reported to the UN their activities using a connection established through their community network. On Oahu, the network management team is engaged in a community of practice through the Broadband Hui (see Section 1.2), and one of its sub-committees is focused on Hawai'i community networks. As a result of this involvement, the network management team is more engaged in and aware of policy issues such as the FCC's Tribal priority spectrum and funding availability.

The Nation of Hawai'i is also engaged in policy through its ongoing work with ISOC. They have given testimony to support proposals to fund broadband at the State level and have participated with ISOC on national-level policy development and at subsequent ICS events. Maka'awa'awa highlighted how their work includes a focus on sharing stories of their efforts with policymakers:

These people that create these policies, they're not actually living through these experiences of how you can take a community that has no Internet access and all of a sudden give them Internet access and see how the community changes. Then, also, me, as a person, understanding how important Internet access is now and seeing how people are getting funded by doing a lot of this work. It just makes you more aware that we need to be more engaged and sharing those stories and making sure that our policymakers and our politicians realize that we're watching.

Fourth, the Nation of Hawai'i representatives suggest that the community network allows their citizens to connect with one another, and with the Nation's government, in a virtual space free of physical borders and politi-

cal jurisdictions. For example, Maka'awa'awa pointed out that the Internet enables the Nation's citizens to connect with one another and participate in political activities such as elections:

Right now, sovereignty for us as Hawaiians and a lot of Indigenous people is limited to physical boundaries and limited to political jurisdictions and political obstacles, whereas the Internet is free. The Internet goes through borders. To have a presence on the Internet and to have our people be able to have access to that presence is a form of sovereignty that we need to not only foster but expand upon.

Fifth, and finally, the project can inspire residents to actively engage in the deployment and operations of projects such as the community network, including as volunteers. The network management team frames this call to action to both address digital inequities and generate energy for local innovation and entrepreneurship, including through shared ownership and stewardship of the community network as a utility managed by the Nation's citizens.

During the focus group discussion, one community member stated: "I guess, 'cause our dynamics here are different, 'cause if you grumble about it, chances are you are going to have to go and help to fix it." As Garcia put it:

The integrity of the connection is important for the residents who are in the Nation….It's almost like the duty of keeping the connection up and running. It's like my *kuleana*. *Kuleana* in Hawaiian is responsibility, but it's more than just "I've got to do this." It's more like it's my ancestral calling….It is because we're all *ohana*, we're all family. We're not coworkers. And it's the difference between going to a place of work—it's more of "hey, I want to teach my entire family how this thing works," because there's not very much separation between what we do for a living and day-to-day stuff. That's the cornerstone of self-determination.

While they support and encourage these ideas, the Nation of Hawai'i team recognizes that a gap remains between the rhetoric of increased communication and community engagement and the challenges of enacting those practices. In the next section, we summarize the technical, operational, and sustainability challenges that they faceat this stage of the community network's evolution.

5. Technical, Operational, and Sustainability Challenges

As in many community networking initiatives, the startup phase of the Pu'uhonua o Waimānalo network has experienced numerous challenges. Community networking initiatives around the world experience issues related to technical, operational, and sustainability considerations

(Lithgow et al., 2022; Song et al., 2018). This section provides examples of these challenges, including how the team is utilizing the *Kānaka Maoli* concepts of *ea* and *kuleana* to frame responses and solutions led by community members.

5.1. Technical Challenges

From 2019 through 2021, the network management team identified three key technical challenges: network design issues, power/energy issues, and equipment damage (including weather and human tampering).

Network managers identified several design limitations in early iterations of the network, for example in signal coverage, speed, and latency. To address these challenges, network managers engaged in ongoing network improvements and upgrades, including adjusting the antennas for the wireless system and installing updated equipment. They also expanded the network in 2021 to add four additional *hale* (households).

The second challenge relates to the reliability of electricity in the community, specifically the impacts of unpredictable power outages and surges. These issues affected network reliability and damaged equipment such as routers that had to be replaced with more resilient equipment. Diagnosing and addressing these challenges involves close connections with community members. Some problems are caused by old wiring and an unstable electrical supply, while others relate to the conditions in the houses such as the limited number of power outlets in homes. The team is exploring alternative energy solutions not only for the network but for the residents and community activities.

The third challenge is damage to equipment by factors outside of the community's control (such as weather) and by people tampering with the network—for example, by splitting connections, installing different routers, and unplugging devices. As Garcia explained:

> We started noticing a lot of our [equipment] just [wasn't] connected. And so, we went into those homes and noticed that the nearest electrical outlet in the house is behind the dresser in the kids' room, half hanging out. And so, when the GameBoy needs to be plugged in, Internet gets unplugged….These houses started as tents and then evolved into cement pads. And we're hopefully in the process of rebuilding some of these homes with proper equipment.

While physical security is important to protect sensitive (and expensive) networking equipment, solutions are often framed with reference to a partnership with the community, including suggestions for training to support engagement among community members in ongoing operations and maintenance; rather than impose penalties on residents for damaging or unplugging equipment, the team communicates the importance of shared network stewardship.

5.2. Operational Challenges

Over the past two years, the network management team has determined that many challenges may be due to limited communication with and among community members, as well as a general lack of knowledge about the operations and maintenance of the network. For example, in several instances of network outages, users did not reach out to network managers. Maka'awa'awa explained further:

> After you create your network, [you need to focus on] staying engaged with [community residents], making them a part of it, making them feel like they can come up to you with any issue. What we found is that, when some of their systems went down, people just—they didn't reach out. They didn't call. They didn't let us know. I think sometimes we have to do the checking in.

These lessons sparked increasing focus among the Nation of Hawai'i and network managers to involve community members in reporting issues and outages. They now frame the community network as a project that encompasses social as well as technical activities closely tied to the participation and engagement of the Nation's citizens. As Maka'awa'awa put it: "Ultimately, it's the people that manage [the community network], and then it's the end users that keep the network going. So, this is different from you being a customer to Hawaiian Tel[com]." He went on to connect this to the broader goals of the Nation; that the way to keep the network going is through partnerships and involvement with community members. In short: "We're holding up the network together….That's part of the sovereignty that we're trying to exercise, because we understand sovereignty on a different level, because we're on the ground building our nation, not just talking about it in the schools and all that. We're doing it in real time."

These issues are reflected in responses from community members in surveys and focus group discussions. Residents noted their interest in getting involved and suggested that more young people be trained to operate the network. They connected these activities to broader goals and values of autonomy and self-determination. As one focus group participant put it: "I think…that's what this community network provides. It provides a lot more independence. It can be as wide as you want it to be. If you're willing to do the work, to learn, to come to meetings.''

Looking ahead, the Nation of Hawai'i and community members plan to continue meeting to discuss how to work through these challenges together. Ideas expressed have included increased community involvement in data collection, hosting regular meeting updates, and group discussions about solutions.

5.3. Sustainability Challenges

As of the end of 2022, the community network continued to be managed on a volunteer basis. Garcia and Maka'awa'awa, who live outside of the community, act as virtual network operators and are often on-site in the community. They have been joined by two volunteers who live in the village and act as the ground crew, monitoring community outages, addressing minor outages, and communicating with the network managers as needed.

ISOC currently provides funds that cover operating costs, primarily to pay Hawaiian Telcom for two 1 GB circuits. Costs beyond this backhaul are minimal—for example, cell tower management fees and email and web-hosting services. Vendors and ISOC paid for or donated any replacement equipment. Electricity bills are covered by individual households, while the network itself does not require substantial energy costs.

The network management team is considering options if ISOC stops providing funding support, and is exploring means for the network to be self-sustaining while remaining affordable to residents.

Ideas include charging households a nominal fee for services, selling services to out-of-community residents, and generating income from providing training and support services to other community networks in Hawai'i. Other ideas include recruiting a sponsor for the community's monthly agriculture and crafts market that would pledge to cover Internet costs for the month, or including expenses for the network in the monthly housing rental fees paid by residents. The household subscription model seeks to balance network sustainability with affordability, taking into consideration the ability of households to pay. The network management team has also looked into external funding support for the community network including applying for a federal grant as part of a broader USD 3 million application from several groups in Hawai'i for digital equity and infrastructure funding. If awarded, this federal funding would support network infrastructure improvements, including solar generators, as well as a broadband training facility and funds for ongoing training for network administrators. The funds would also enable the team to hire network management staff and to consider expanding the project to include networks in four other communities.

6. Preliminary Conclusions and Future Initiatives

Dennis "Bumpy" Kanahele said:

> Our mission was always sovereignty of our people and our identity, our politics, our economics, our social culture.

Community networking practices are closely tied to the contexts from which they emerge. Research on such work enhances our theoretical understanding of how digital ICTs support the resilience and sustainability of communities, while highlighting their assets and strengths, as well as potential areas of improvement. Many Indigenous nations, including the Nation of Hawai'i, are examining ways to substantively engage their citizens and members in decisions regarding the development, adoption, and use of digital ICTs. As understood and conceptualized by the leaders of the Nation of Hawai'i, these digital inclusion issues of participation and control are intricately tied to broader questions of sovereignty in political, economic, cultural, and social contexts. As described in this article, these goals are reflected in the group's plans for network planning, deployment, and usage. Moving forward, and pending grant support, the network management team plans to replicate their development process with other Native Hawaiian communities. With the support of organizations like ISOC, Connecting Humanity, and the State of Hawai'i Broadband Office, they plan to continue documenting their process and deepening engagement with the community members who ultimately will be in charge of managing the community network—as well as many other aspects of the Nation.

In the four years since the network was first deployed in Pu'uhonua o Waimānalo, the network management team and the Nation of Hawai'i have learned not only about the structure and operations of the physical network but also about how ongoing operations and maintenance activities are closely tied to engagement with their citizens. By framing these connections in reference to *ea*, i.e., sovereignty in the specific context of the efforts of the Nation of Hawai'i, this project helps continue efforts to understand how community-led connectivity initiatives contribute to community cultural, political, and social development.

Conflict of Interests

Authors Rob McMahon, Heather E. Hudson, Brandon Maka'awa'awa, John Kealoha Garcia, and Dennis "Bumpy" Kanahele have volunteered for the ISOC's annual ICS, which is a policy advocacy forum focused on Indigenous connectivity. Garcia serves as a member of the Advisory Committee for the Indigenous Connectivity Institute, which plans the ICS. Authors McMahon and Hudson have also worked on other projects for the ISOC as paid research and evaluation consultants and contributed to policy and regulatory consultations in Canada related to Indigenous connectivity as paid consultants and unpaid volunteers. Maka'awa'awa, Garcia,

and "Bumpy" Kanahele are involved in the Nation of Hawai'i and Pu'uhonua o Waimānalo, which are projects of Aloha First (a formal 501(c)3 non-profit organization). The community networking project described in this article received funding from the ISOC to compensate for their time on this and other community networking projects in Hawai'i.

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Brandon Maka'awa'awa is the vice president of the Nation of Hawaii, the oldest Hawaiian independence organization in Hawaii. He assists President Dennis "Bumpy" Kanahele in the day-to-day operations of the village of Pu'uhonua o Waimānalo, the Nation's sovereign land base, home to 90 Hawaiian Nationals. Brandon also leads the Nation of Hawaii's delegation to the United Nations Permanent Forum on Indigenous Issues, where he has given interventions on Hawaiian national sovereignty, peaceful coexistence, reconciliation, economic development, and innovation. Brandon is also the president of Na Po'e Kokua, a non-profit organization that advocates for the development of more affordable housing options for Hawaiians. Brandon advocates on behalf of the Nation of Hawai'i at all levels of government on different issues impacting Hawaiians and their rights.

John Kealoha Garcia is a Native Hawaiian entrepreneur, humanitarian, and award-winning creative director based in Honolulu, Hawai'i. As Minister of Foreign Affairs, 2nd vice president for the Nation of Hawai'i, John Kealoha's work encompasses international relations, economic development, and government logistics. He was voted one of Hawaii's top new media influencers, with design accolades from the Society of Professional Journalism and the American Advertising Federation. His latest venture, Exchange Ave, is an Ahupua'a inspired digital economy with a mission to pioneer an Indigenous-led economic framework centered around shared abundance and peer-to-peer social exchange. John Kealoha sits on the board of Aloha First and is a founding board member of the Connect Humanity Institute, an indigenous owned non-profit organization with a focus on connecting rural and tribal communities to clean and safe Internet access.

Dennis "Bumpy" Kanahele is president and head of state of the Nation of Hawai'i, and CEO of Aloha First. A respected Hawaiian leader and advocate for the restoration of the independent nation-state of Hawai'I, he gained national attention in the 1980s for his involvement in the Makapu'u Lighthouse land occupation and the prayer vigil on the steps of Iolani Palace, where he was among those arrested. Kanahele was appointed to the Sovereignty Advisory Commission and worked to find solutions beyond state and federal mandates. Kanahele has been a key figure in advocating for self-determination and self-governance for Native Hawaiians. Kanahele serves on the Board of Directors of the International Indian Treaty Council (IITC) and is actively involved in its mission to restore political, economic, social, educational advancement, and just treatment for all Indigenous, Aboriginal, and Native peoples worldwide.