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From community networks to shared networks: the paths of Latin-Centric Indigenous networks to a pluriversal internet

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ABSTRACT

This article examines, with ethnographic lenses, the emergence of shared networks in the Tseltal and Zapoteco communities in Chiapas and Oaxaca (Mexico). 'Shared networks' are first-mile signal-sharing practices that articulate interconnection infrastructure and values of coexistence to, in the cases studied, extend the internet to areas where the services of existing larger internet service providers are unsatisfactory or unavailable. It argues that by infrastructuring their own local networks and interconnecting to the global internet, Tseltal and Zapoteco people are effectively internet codesigners, building Latin-Centric Indigenous networks and shaping internet governance from below. When comunalidad values, supported by unlicensed frequencies of the electromagnetic spectrum, towers, radio antennas, houses' rooftops, routers, and cables, intersect with the values of the internet service providers and their policies, hybrids emerge. Shared networks are a result of what these hybrids enact and constrain, as well as evidence of the vivid struggles for a more inclusive and pluriversal internet.

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Introduction

This paper is an invitation to understand internet interconnection infrastructure, focusing on the strategies of Tseltal and Zapoteco communities in Mexico to access the internet. Deciding to transform the poor or absent Internet connectivity in their territories, they autonomously engaged in processes of 'infrastructuring' by building their own interconnection arrangements to physically connect to the larger internet. I borrow the term 'infrastructuring' from participatory design scholarship, where 'information infrastructure is viewed as constantly 'becoming' (Karasti, 2014, p. 3), in that design is a continuous activity, a 'process of inscribing knowledge and activities in new material forms' (Karasti, 2014, p. 3). Focusing on the internet infrastructuring efforts of Tseltal and Zapoteco communities in Abasolo, Chiapas, and Guelatao de Juárez, Oaxaca, this paper aims to examine internet access through a bottom-up approach, shedding light on the work of Indigenous design in the process.

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First, it argues for the network status of *shared networks*, which are built by Indigenous people but are non-discernible from the standpoint of an internet routing system. According to internet technical standards, networks are owned by autonomous system operators and identified with autonomous system numbers. Unlike these recognized and identifiable internet networks, the Indigenous networks studied here work under arrangements of power that are not captured by such standards. Consequently, Indigenous networks are rendered invisible in the internet routing system. However, as already noted, 'the question is perhaps not just what is a network but what it means to treat something as one' (Dourish, 2017, p. 172). Recognizing Tseltal and Zapoteco networks as internet networks means expanding the conventional actors within internet governance – governments, corporations, technical bodies and civil society – to include Indigenous communities and to make visible their power struggles in internet governance debates.

These shared networks also illuminate the emergence of a pluriversal internet within internet access and internet inclusion debates. In decolonial terms, 'pluriversal' actions challenge universal understandings of the world, accounting for multiple knowledges and epistemologies (Escobar, 2018; Grosfoguel, 2011). This paper shows how, at the moment of internet interconnection, Tseltal and Zapoteco internet initiatives give birth to a pluriversal internet by embedding *comunalidad* (communality) values¹ in their networks while ignoring the internet service providers' (ISPs) terms of service. I analyze this phenomenon within the framework of Latin American hybridization and *ch'ixi*,² arguing that Tseltal and Zapoteco efforts to internet to the larger internet form hybrids and *ch'ixi* that help us understand the politics of internet interconnection infrastructure from an Indigenous standpoint.

Both 'Latin America' and 'Indigenous' are terms whose usage requires reflection. From a decolonial perspective, these terms are historically situated and emerge with the invention of the America, or the 'New World,' in the fifteen century (Mignolo, 2005; Quijano, 2000). This work uses the term Indigenous as the interviewees and authors refer to themselves and their communities in this way, re-signifying its colonial origins and the subaltern meanings that it originally alluded to. This work also argues for a Latin-Centric understanding of shared networks for recognizing the complex layer of resistance that affects Indigenous self-determination in the region. 'Latins,' like 'Indians,' is also the result of an othering process, but one that detached new elites descendent from Europeans in the 'New World' from their 'Indian' and African origins (Mignolo, 2005). However, to assume a Latin identity nowadays is to recognize and re-signify such racialization. It is a means to recognize a global South lens emerging from South-South solidarities that connects social groups in the margins of neoliberal societies (López, 2007). In the context of Indigenous people, the coloniality that marks Latin America also became part of who Indigenous people are through hybrids and *ch'ixi* arrangements.

This article, thus, seeks to connect the notions of hybridism and coloniality – concepts rooted in the lived experiences of Latin America – with *ch'ixi* and *comunalidad*, concepts derived from Indigenous experiences. This proposed linkage recognizes that the decolonial theory of the region does not wholly encapsulate 'the various Latin American variants of critical reflection on colonization and decolonization' (Cusicanqui, 2012, p. 98). Any decolonial account needs to be pluriversal in itself, given that the very act of decolonizing presupposes an opposition to Western universality (Mignolo, 2005).

The experiences discussed here with Tseltal and Zapoteco knowledges substantiate this pluriverse, illustrating ways to elucidate epistemologies from the global South, and how to 'learn from the South and with the South' (Santos, 1995, p. 508). As an Afro-Latina, my interest for explicating the multifaceted broader contexts of inequalities in internet access throughout Latin America crucially relies on this understanding.

Materials and methods

This study uses ethnography of infrastructure (Star, 1999) to study internet access and interconnection, illuminating the sociopolitical aspects of infrastructure governance and design among Tseltal and Zapoteco people. I look at interconnection infrastructure arrangements specifically because they shape the moment when local networks – including Indigenous networks – become constitutive of the larger internet by *interconnecting* to other networks already part of it. This research asks: What *is* internet interconnection, from the standpoint of Tseltal and Zapoteco local networks? How have these communities built and maintained their internet access in the context of digital inequalities, and how can the materiality of their infrastructure be understood from the local communities' standpoint?

My focus on the materiality of internet interconnection emerges from scholarship in internet governance, which closely examines technologies' and infrastructures' attributes – or affordances – in order to investigate their politics vis-à-vis other actors (DeNardis, 2020; Musiani, 2015; Musiani et al., 2016). Latin American and Indigenous scholarship – including Tseltal- and Zapoteco- authored books, theses, and dissertations – add local perspectives to the discussion of infrastructure in this paper.

During 15 weeks of fieldwork in Mexico, I conducted participant observation at the International Forum on Indigenous and Communitarian Media, held in the city of Oaxaca in August 2017, where numerous presenters showcased radio and internet infrastructure projects. In that event – co sponsored by the telecommunication regulator Instituto Federal de Telecomucaciones (IFT) – speakers openly demonstrated their solutions to the absence of telcos and government in their territories, and even received recognition for their achievements. I asked some of the forum's participants if I could observe the infrastructures that they had built to improve their Internet connectivity. In the present paper, I examine two of these sites – a Tseltal *pueblo* in Abasolo, Ocosingo, in Chiapas, and a Zapoteco *pueblo* in Guelatao de Juárez, in Oaxaca³ – which I visited about two weeks after the forum.

I selected these sites based on the prominence of their internet infrastructuring efforts in their communities, and have continued to follow ongoing developments for more than four years at the time of writing. As part of this project, I conducted more than twentyfive in-depth interviews in 2017 with a variety of interlocutors in Chiapas, the state of Oaxaca, and Mexico City. I talked to communication activists, academics, nonprofits, telecommunications regulators, and internet companies' representatives. My main interlocutors during fieldwork were the young adults Mariano Gómez in Abasolo, and Denis Mendoza in Guelatao, as well as Humberto Morales in Guelatao. Our conversations occurred in Spanish. I include photos taken while visiting in-site interconnection arrangements to help further contextualize and analyze the infrastructuring processes at place. Some basic information on connectivity from these territories illustrates both critical state governance practices over Indigenous data (Córdova, 2018) and the flagrant marginalization of Indigenous peoples. While access to broadband has been a constitutional right in Mexico since the Telecommunications Reform in 2013 (Mexico, 1917 [2018]), both Chiapas and Oaxaca states have some of the lowest connectivity rates in the country: between 0% and 20% of the states' residents have access to the internet at home. For comparison, 76% of Mexico City's residents are connected to home internet. Nationwide, the rate is 43% (IFT, 2017, p. 29).

As of 2005, Abasolo had a population of 2,884, and Guelatao de Juárez 544 (SEDESOL, 2005b, 2005a). Both towns are located in Indigenous regions where 88.3% and 85% of the population, respectively, were estimated to be living in poverty in 2015 (CONEVAL, 2019). While Indigenous people represent 10.1% of the Mexican population (CONEVAL, 2019), only 6% of the country's residents speak an Indigenous language. Among these, Tseltal is one of the most frequently spoken, with almost half a million native speakers (INEGI, 2010). The Tseltal population consists of more than 689,000 people, mostly in Chiapas, and the Zapoteco population consist of 813,000 people, mainly in the state of Oaxaca (INPI, 2020b, 2020a). Given the size and diversity within these Indigenous communities (e.g., Nader, 1964), it should be emphasized that the experiences described in this paper are not intended to be uniformly or universally representative of Tseltal and Zapoteco peoples.

Comunalidad and the fight for coexistence

The history of Indigenous populations in Mexico is marked by insurgency against cultural assimilation processes (Muñoz, 2005). The history of Abasolo, for example, includes land conflicts between Indigenous people and squirearchy (rural landowners), and, as more recently documented, organized peasant movements in the 1980s (Gómez Méndez, 2016; Gómez Ramírez, 1999). The municipality of Ocosingo, where Abasolo is located, was one of the bases of the Zapatistas' uprising in 1994 against constitutional neoliberal reforms (Schmal, 2004), a historic and living social movement that helps understand the pluriverse in practice (Grosfoguel 2017 [2006]). In Abasolo, colonial imprints are still visible within the centrality of the Catholic church in the community; the church's presence dates from 1570 (Gómez Ramírez, 1999). In a telling coexistence, local mountains bear Tseltal names; corn and water have feast days; and most of the population lives by farming, especially coffee, motivated also by demand outside the *pueblo* (Gómez Méndez, 2016).

The written history of Guelatao also dates back to the sixteenth century, similarly entangled in conflicts, violence and, in the 1980s, a historical movement against the state's concession for a company to continue exploiting the woods in the region (Martí-nez Luna, 2006). These movements led to the development of numerous communication projects oriented by communal values, including audiovisual productions exhibited at the historical Rio Earth Summit in 1992 and two local radio stations, the XEGLO in the 1990s, and the *Estéreo Comunal* in 2000. All of these projects were inseparable from struggles for autonomy and justice in the region (Martínez Luna, 2010).

Today, the *pueblo* is marked by dirt roads in the margins of paved ones, and unfinished houses contrasting with other constructions, all surrounded by astonishing green hills. Guelatao's residents are proud of its cinema, museum, music school band, and – from the perspective of the Mexican government – remarkably low levels of social disadvantage (Vega Estrada et al., 2012, p. 11). Concerns about the effects of developmental policies in the territory appear expressed in local circles, particularly in regard to food sovereignty (Martínez Luna, 2006).

The history of Guelatao includes the singular fact of being the land of Benito Juárez, Mexico's president with Zapoteco origins in the nineteenth century. Also from Guelatao is the Zapoteco anthropologist Jaime Martínez Luna, a theoretician of the term comunalidad, along with Mixe Floriberto Díaz Gómez and others (Sánchez-Antonio, 2021). Comunalidad defines 'the way of living and thinking' (Martínez Luna, 2015, p. 44) of the pueblos, encompassing four elements: the territory - the Earth; the authority of assemblies to take decisions under the political system known as usos y costumbres (uses and customs); voluntary services and the collective work in the communities known as tequio; and fiestas (celebrations) and rituals (Díaz Gómez, 2004, p. 368). As elucidated at the International Forum on Indigenous and Communitarian Media, comunalidad does not end in formal institutions. Instead, it involves a 'horizon and utopia-' a general, although diffuse, cultural understanding-, and works differently in different communities, like democracy in Western societies (Aquino Moreschi, 2013, p. 12). In this sense, it is useful to think of *comunalidad* in terms of 'a structure, a form of social organization and a mentality' (Maldonado Alvarado, 2013, p. 22), all being negotiated as societies are transformed in contact with neoliberal, gender, generational, and migration issues, to name a few (Aquino Moreschi, 2013; Guerrero Osorio, 2013; Vásquez Vásquez, 2013).

As a framework in the present research, *comunalidad* synthesizes values that define who *we are* in relation to *others* and vice versa, a tool for 'mutual recognition' (Guerrero Osorio, 2013), where community is meant to be 'geometrical,' involving territory, collective history, language, and types of community systems and organizations, as opposed to the 'arithmetic' Western communities, 'a simple aggregate of individuals out of their egocentric isolation' (Díaz Gómez, 2004, p. 367). I interpret this distinction as guidance against perpetuating epistemic colonial violence and the urgent need to not Westernize Indigenous initiatives, thereby disregarding their own meanings. I use this rationale to frame Tseltal and Zapoteco internet networks not as inwardly-oriented 'community networks,' but as more fundamentally *shared networks*.

Why shared networks?

In one of the first interviews I conducted in Mexico City, Erick Huerta, a lawyer working on Indigenous connectivity issues,⁴ explained that what telecommunications companies call 'last mile' – referring to the last piece of infrastructure that connects telco networks to end users – he and the communities he works with call 'first mile.' From the communities' standpoint, this infrastructure is clearly not the end of a path, but the beginning. Beyond the logical reasons for this semantic shift, there was also a political implication. I would later understand it as a call for action based on Indigenous communities' own values: if this was the first mile to a desirable communication infrastructure, Indigenous people could build it themselves. The term 'first-mile' has been in use at least since the 1990s, including in Indigenous communities. First-mile initiatives have been extensively analyzed in the context of communication development, community informatics, emancipatory communication practices, and community networks (Crawford, 2013; De Filippi & Tréguer, 2015; McMahon et al., 2014; Milan, 2013; Paisley & Richardson, 1998; Philpot et al., 2014). These descriptions have pointed to so-called community networks' emergence as a kind of 'counter-power to currently established power structures or incumbents' (De Filippi & Tréguer, 2015, p. 4). In some policy circles, they have been recognized as useful do-it-yourself efforts that enhance market competition. As the director of the Alliance for Affordable Internet put it: 'While it is important to continue supporting competition at all levels of the sector, the reality is that public access and community networks are an important aspect of broadband *market health and resilience*' (Jorge, 2019, p. 9, emphasis added).

Furthermore, community networks, along with 'wireless community networks' and 'grassroots community networks,' have been simultaneously associated with the redemption of subversive values from the internet's early days, and promoted as alternative solutions to areas where investments from the private sector are deemed unviable or are unsatisfactory (Crawford, 2013; De Filippi & Tréguer, 2015; O'Flaherty, 2018). A representative of the Internet Society, an organization that works on many fronts to expand connectivity policies worldwide, says:

At the Internet Society we are interested in promoting community initiatives in these unprofitable places. We can think of it as a return to the academic origins of the Internet, where everyone makes the effort to 'reach' the Internet instead of waiting for the Internet to reach us. (O'Flaherty, 2018, p. 238, own translation)

These perspectives seek to reconcile deep-seated conflicts of interest under the term community networks, overlooking the inherent contradictions and power relations at stake (for exceptions see De Filippi & Tréguer, 2015; McMahon et al., 2014). In contrast, through their infrastructuring of shared networks, the Tseltal and Zapoteco people are exercising their right to coexist, embedding infrastructures in values and traditions that are *not* rooted in the mainstream history of the beginning of the larger internet and which should not be co-opted in this direction.

In the context of Indigenous communities, regulatory efforts may still disregard the centrality of Indigenous sovereign territories, even if they lead to effective results (e.g., internet access). For instance, the natural resources necessary for wireless internet to work are constitutive of Indigenous lands (Duarte, 2017). For instance, in Abasolo, I would hear from Mariano Gómez⁵ puts it: 'There are things we already knew about the internet, but we did not know the name. The spectrum, we call air' (own translation). However, such resources are commonly unilaterally regulated by the national government and its agencies.

I adopt the term *shared networks* (*redes compartidas*) instead of community networks, not simply as a descriptor, but as a concept to denote the first-mile sharing practices that articulate both interconnection infrastructure and values of coexistence in extending basic services to underserved areas. In this paper, I focus on signal-sharing efforts to bring the internet to areas where the services of existing larger internet service providers are unsatisfactory or unavailable. As a larger concept, 'shared networks' both

acknowledges the sharing-oriented principles characteristic of these networks and illuminates the interconnection infrastructure that affords and materializes such principles, independent of the instigating actor (a municipality, a collective, a business, etc.). Necessarily, artifacts are actively constitutive of societies' morality (Latour, 2008), and societal values are delegated to infrastructure.

The shared network in Guelatao is presented first, focusing on the formation and design of its first-mile infrastructure. It is followed by the case in Abasolo, examining the sharing principles expanded inside the community. These sites enable us to clearly see Tseltal and Zapoteco communities' participation as internet codesigners. Their values undergird a pluriversal internet, where coexistence – not elimination or replacement of others' values – is key. In this, the research joins the existing literature focused on actors whose participation still needs to be told and emphasized (Costanza-Chock, 2020; McIlwain, 2019).

Case 1—internet infrastructuring by a municipality

Humberto Morales is a network technician at a university in the region. He engages in voluntary service for the municipality and was the coordinator of the internet project deployment. Voluntary public service such as his is known as tequio, one of the pillars of *comunalidad* that characterizes Guelatao (Mendoza Bautista, 2017). In a room of his house, Humberto described his journey to improve the community's internet to me. Before developing their own wireless network to bring internet service into the community from another city, residents had first requested service improvements from Telmex, the Mexican telecommunications incumbent, and the only ISP available in town until 2014.

As an incumbent, Telmex was responsible for 57.7% of the internet provision in the country, together with its sister company, Telnor (IFT, 2017, p. 27), both under the control of América Móvil. Humberto recalled that the internet service Telmex offered was slow and unsatisfactory, delivering 100 Kbps (kilobits per second) of download and 10 Kbps of upload. In response to the community's request, the company indicated that it had no financial incentive to improve its service. Guelatao community representatives also sought to use the Federal Electricity Commission's infrastructure, as there was a substation in the vicinity. The agency had deployed its own nationwide optical fiber network to support its electrical system (Flores-Roux et al., 2009), and could allow for the design of a wired solution in the municipality, but this request was also unsuccessful.

Following these unfufilled requests, Humberto – along with Saúl Hernández Marcial, Héctor Juan Miguel, and Julio García Márquez at the University of Sierra Juárez – decided to deploy a public wireless network under the municipality's responsibility. This would allow them to contract better service in the city of Oaxaca, signals which they could then bring to Guelatao and its population. The conditions under which this deployment happened are revealing of the role of infrastructure in shaping the contours of internet design.

The first step for the group was to identify the nearest ISP already offering internet service. The plan was ingenious: to contract with that service as if they were a residential client, making agreements with an acquaintance who had a house in the city of Oaxaca where the internet could be installed, and from that house, deploy their own wireless network to transport the internet to Guelatao. Financed by the municipality, the team bought routers and radio and sectorial antennas to initiate collaborations with parties who had the passive infrastructure – towers, posts, etc. – in which to install the devices in the highest and closest points possible to their own municipalities.

This would ensure good signal capacity, which could be affected by natural barriers, including ridges, trees, etc. Collaborators included both local households that were well positioned geographically and companies that had towers already installed for different purposes, such as television service. The agreements involved money, like rental of a tower or a rooftop, and sometimes an exchange of resources that benefitted both parties, like when the internet was shared with the household hosting their antenna.

Interdependency values are embedded in the whole path of the local network. Partnering decisions were constrained by infrastructure logistics: who offered services and where, who could share towers and posts, where it should be set to protect it from natural accidents, and other concerns. As Siles and Boczkowski (2012) summarize, 'users are able to transform the materiality and meaning of artifacts, but the affordances and features of these artifacts also affect their agency' (p. 231). For instance, high geographical points for radio antennas are beneficial for signal capacity, but they also leave them highly vulnerable to electrical discharge, which can damage the equipment and require its replacement. This is part of the costs of technology maintenance (Gonzales, 2015) necessary to keep the internet functional in these territories.

As a result of the project, network access improved from the nominal speed of 1 Mbps of download promised by Telmex in Guelatao – only 100 Kbps as measured by the residents – to 60 Mbps. The devices and antennas now work with the 5 MHz frequency, an unlicensed band that does not require any payment or authorization from the telecommunications regulator. It is also considered more stable than the 2.4 MHz frequency. The latter is also unlicensed but it is more subject to signal interferences because more Wi-Fi devices are connected to it due to its popularity. In the context of shared networks, those major interferences are more important than other technical differences between the two frequencies – including their reach and capacity to traverse objects on the way.

The municipality charges the residents approximately 7.5 dollars (150 pesos) per household for connectivity. The monthly cost for the municipality of the infrastructure built from the city of Oaxaca to Guelatao includes approximately 65 dollars (1.300 pesos) paid to the internet service provider contracted in the capital; 10 dollars (200 pesos) paid for the electricity and the rent of the rooftop on a house in Oaxaca; and 75 dollars (1.500 pesos) paid for the municipality that owns the middle-point land. The total is 150 dollars (3.000 pesos). As of 2020, 30 households were connected, in addition to the public primary school, the public health center, the public library, and the city hall, where free internet is offered; 1.5 Mbps is available to users, a much better speed when compared with the previous measured of 100 Kbps.

This shared network converted an individual residential installation in the city of Oaxaca into a municipal internet program benefitting dozens of people. In terms of *comunalidad*, sharing (*compartencia*) 'is a way of learning about the world and of transforming it: a way of doing it. Sharing is (...) the sanest way to build together' (Martínez Luna, 2003, p. 39). The implementation of the network in Guelatao, along with other policy decisions, are shaped in assemblies formed by people from the *pueblo*. The president of the municipality, assisted by their secretaries, all elected by the assembly, execute the policies as their *tequio* duties. Assembly representatives are mainly men (García, 2011), and discussions about gender and *comunalidad* have become more common recently (Sánchez-Antonio, 2021; Vásquez Vásquez, 2013). The governance of Guelatao's shared network –not only its design – is marked by *comunalidad* and men's *tequio*.

Throughout the paths from a household in the city of Oaxaca to many households in Guelatao, people have domesticated internet first-mile infrastructure as internet codesigners by means of *comunalidad*. Media 'domestication' happens through means of appropriation and 'meaning-making dynamics,' as well as processes of interpretation, negotiation, and incorporation of content into day-to-day routines, taking into consideration the 'broader cultural and social relations' in which media users participate (Siles & Boczkowski, 2012, p. 240).

Of course, media is formed not only by content, but also by infrastructure, or materiality (Lievrouw, 2014). In *comunalidad* terms, domestication means that 'Just as the cornfield is not the same everywhere, communication will not be the same in all spaces' (Martínez Luna, 2015, p. 33). In Figures 1 and 2, the radio antenna is affixed in a clothesline bar, and the router is placed close to the altar, a sacred space in the house. I asked why the router was in that location, and was told by Denis and his mother that the internet technician had suggested that to receive the best signal from the outdoor antenna. Infrastructure intersects not only with the physicality of the environment, as previously seen, but also with aspects of users' private lives.

Case 2—internet infrastructuring by a social organization

During the International Forum of Indigenous and Communitarian Media, the following explanation was given about the sharing principles embedded in an internet project in Abasolo:

From the daily practices there is what in Tseltal is known as *mankumun*: man is to buy and *kumun* is together. During the Day of the Dead and other festivities, a cow or *wakax* is bought and skinned among all. [A] little part of the meat is eaten and the other part is



Figure 1. A household with an external radio antenna and an indoor router.



Figure 2. A household with an external radio antenna and an indoor router.

divided. We do it for two reasons: the first is unfortunately economic, as it is cheaper to do this because you get more pieces of meat than going to the butcher shop or elsewhere. The other is a matter of living together: while you are preparing the cow, you are talking and there is a relationship, a communication between us, a more spiritual way of living together, something that goes beyond just the act of making it. (Álvarez Malvido, 2017, own translation)

The speaker was Mariano Gómez, an elementary teacher of Indigenous education and one of the founders of the nonprofit Colectivo Ik' Ta K'op (Word of the Wind Collective). The nonprofit built a wireless infrastructure from scratch in a place where neither cellphone nor internet service was available. In 2013, the point-to-point internet became a solution to replace the unstable and low-speed internet. Previously, the region's only option for internet access had been via satellite. Now, the signal comes through a mobile network that members of the Collective built from a municipality where there was already an ISP offering the service, similar to efforts in Guelatao.

The sharing values Mariano Gómez described can be seen in the design of this network, where each device installed in the households becomes a hotspot. The more neighbors have home internet access, the more people outdoors can have access to the internet on the street. The Wi-Fi password is not only provided by Mariano's house - which also works as a cyber-café – but can also be provided by any person with an antenna installed in their home. In other words, this network design enables any household to become an internet service provider and charge for the service if desired, creating a 'distributed governance' (De Filippi & Tréguer, 2015). Arrangements varied, but typically interested people provided and installed the towers, commonly made of bamboo, while the Collective provided the radio antennas. Below, the figures depict the first time that the internet was enabled in the neighborhood of San Martín (Figures 3 and 4).

The Collective charges different amounts for the service, depending on neighbors' involvement. Prices range from approximately 10 dollars (200 pesos) per month for those who just want to be users, to 4–5 dollars (80–100 pesos) for those who can support device maintenance and collaborate in other Collective projects. Families who affirm they cannot pay for the service may have it for free. There is no robust control over how many people have antennas, or how many pay what amount, but payment for services is expected to cover the building and maintenance of wireless infrastructure to bring internet to the territory, similar to Guelatao.

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Figure 3. Bringing internet to the community of San Martín, Abasolo.

Beyond first-mile internet infrastructure, the project also maintained an intranet with locally curated content. This initiative, named IntraBACH, was first developed by a teacher for his students, but the design of the network allowed it to be available to all in the community. The intranet has a range of educational content, including a library of books from Latin America and other parts of the world, movies and documentaries, an offline version of Wikipedia, Khan Academy courses in Spanish, and materials in the Tseltal language (EFE, 2019), all cached in the community's server.



Figure 4. Bringing internet to the community of San Martín, Abasolo.

Abasolo's connectivity project is one more example of domestication that may be not easy to understand from the outside. In regard to the project's focus on local content, a skeptical Facebook post by an outsider said, 'I follow without understanding why it is good that there is an intranet and no open resource on the internet.' Erick Huerta responded: 'Well, you should have some understanding of the priorities of Indigenous peoples and the strengthening of their identities' (Pisanty, 2019, own translation). Indigenous data sovereignty discussions (Kukutai & Taylor, 2016) help understand these priorities, and the meanings of strengthening connections within Indigenous communities. *Comunalidad* also helps interpret these decisions: 'The communal (...) is to communicate from a work shared in reciprocity, not between individuals and nations, but between communities and regions' (Martínez Luna, 2015, pp. 30–31). From an infrastructure standpoint, the internet capacity available in the community and its cost also plays a role. In order to allow more people to use the internet, it is not expected that everything will go online, as this would require better speed and bandwidth. Using only what is necessary is also an important value under the sharing principles.

Mariano envisions each Indigenous community having a server to build its own intranet and cloud service, enabling anyone to share material locally. Within an internet governance framework, I interpret these servers as local content delivery networks (CDNs). They stand in stark contrast to the global CDNs owned by major big tech content providers. In this project, one can see the conception of a local ecosystem and the rise of a sense of internet governance founded in values of sharing, self-sustainability, and collaboration. As Mariano notes:

If we want to do internet governance, we do not just have to have infrastructure, our antennas, our towers and links. We have to have the logical part, software design. And not only [that]. We also have to produce our own content, our own videos. The Collective, dedicated to the deployment of networks, is not going to start making videos. We do not know how to make videos. But there are other organizations that do. In an organization, I cannot rule the internet by myself. I need several arms and supports to make real internet governance. (own translation)

These types of Latin-centric Indigenous networks – if a name to communicate to others is necessary – remember, enforce, and exercise the *comunalidad*, part of who they are. They elucidate patterns of coloniality rooted in Latin American history without disregarding differences – here marked by the work of Tseltal and Zapoteco people resisting, creating, and transforming the context with their shared networks (For a broader discussion see Canclini, 1989; Cusicanqui, 2012; Galeano, 2004; Pinto, 2018; Quijano, 2007; Ricaurte, 2019). Latin-centric Indigenous networks call attention to the role of Indigenous people as internet codesigners towards a pluriversal internet, one in which the values of *comunalidad* do not claim universality, but coexist with other values when Tseltal and Zapoteco networks interconnect to the larger internet, and can be put in dialogue with other design experiences 'driven by indigenous people' (Winschiers-Theophilus & Bidwell, 2013, p. 253).

Internet interconnection, hybrids, and ch'ixi

To claim their constitutional right to broadband internet access, Indigenous people have to actively engage in infrastructuring to denote their existence, shaping contradictory encounters that are analyzed here as the culmination of a hybridization process. The concept of hybridity in Latin American thought refers to the existence of elements that inherently clash – the traditional and the modern, liberal institutions and authoritarianism, handicrafts and new technologies. This creates a heterogeneous reality that characterizes Latin America to different extents (Canclini, 1989). And while framing Indigenous media as a hybrid is by no means new (Ginsburg, 1991), as already stated, the question 'is not about whether identities are hybrid, but rather about the types of formations that recreate and flesh out these hybrid identities' (Kraidy, 1999, p. 460).

In the context of internet design, these communities materialize a hybrid at the moment of interconnection to the larger internet. Through this hybrid, values of autonomy and self-sustainability – along with the commercial and neoliberal values of ISPs – instantiate means of communication among us, and between us and others. Importantly, values here are assumed to be 'hypotheses' (JafariNaimi et al., 2015) that are not static, but emerge in context, in the face of situations that require action.

In *comunalidad* studies, Arturo Guerrero Osorio uses an image of a river and a whirlpool to represent the contentious but inevitable relations that create *comunalidad*:

The flow of the river and the accidents of the riverbank generate the whirlpool. But the whirlpool achieves its own internal dynamic, different from that of the river in general. It has its own existence, an order 'inside,' relatively stable although shaped by the current from 'outside.' However, we cannot separate the whirlpool from the river. We see *comuna-lidad* as a spiral in the flow of capitalism, a localized way of building modernity. (Guerrero Osorio, 2013, p. 42)

For the Guerrero Osorio, the result of that 'conflict' is both 'resistance' and 'adequacy' by means of communal values. From this perspective, Tseltal and Zapoteco infrastructuring is a collective practice that not only materializes the hybrid, but is also a result of it. In other words, there is resistance in their actions to bring internet to their territories despite the rejection of their formal requests to ISPs; and there is adequacy as well once they are still subjected to the policies of these ISPs due to the infrastructural arrangements in place. Resistance and adequacy based on *comunalidad* express a fight for coexistence shaping contemporaneous communication towards a pluriversal internet.

Another way of thinking through this hybridization is to include infrastructure and its tensions within the debate. In the cases examined above, the Guelatao municipality and the Collective in Abasolo mobilize many resources and respond to limitations imposed by technologies' affordances and interoperability to enable connectivity for their communities, despite ISPs ignoring their requests. Moreover, they establish shared networks that disregard the restrictions imposed by ISPs' policies on signal sharing by design. Telmex's terms and conditions, for example, explicitly state that 'THE CONSUMER acknowledges and accepts that the SERVICE is of a residential character for use in the household, so that THE CONSUMER cannot commercialize, sell or resell the internet service' (Telmex, 2016, p. 4, emphases in the original, own translation).

However, the question of power and control remains open, as 'Infrastructure does not grow de novo' (Star & Ruhleder, 2015, p. 381), and infrastructuring is always constrained by previous paths. Looking at the materiality of the infrastructure built as a hybrid, these shared networks do not have substantial control over their internet communication. Instead, they are susceptible to the ISPs' economic power and legal prerogatives, as the companies can shut down the internet at any time – a fact that can be interpreted as one more type of dependence, in Jaime Martínez Luna's terms (Martínez Luna, 2006). Indigenous efforts to build a pluriversal internet are constrained at the very moment of interconnection.

In their position as ISP consumers, Tseltal and Zapoteco communities are directly subject to the companies' policies and possible deep packet inspection, a procedure that ISPs argue is necessary for network management and that leads to decisions over users' traffic for commercial purposes. Monitoring, slowing down, and blocking the sharing of content through peer-to-peer file-sharing platforms are some examples of existing ISP practices (Bendrath & Mueller, 2011). As Jane Summerton synthesizes, 'In actor-networks, control by the dominant actor is accompanied by the loss of autonomy by all others' (Summerton, 1999, p. 96). In Indigenous communication, there is a constant negotiation in favor of a pragmatic right for communication offered through a larger, non-communal internet infrastructure.

From the perspective of internet topology, Tseltal and Zapoteco shared networks do not exist. They are subsumed because they remain under the infrastructure of commercial ISPs. They do not have an autonomous system number as standardized internet networks – including their ISPs – have to interconnect to each other and route their addresses online in the internet routing system. They access the internet through an interconnection arrangement not topologically understood as internet interconnection. This article uses notions of hybridization, *comunalidad* and *ch'ixi* to argue that these shared networks *are* internet networks, and as such they expand our understanding of internet interconnection infrastructure.

Final considerations

Interconnection arrangements that allow the local to become global, and the local to stay local, are key places of hybridization where tensions become explicit. Hybridization and ch'ixi are inevitable and constitutive of what the Tseltal and Zapoteco communities both produce and are. So too with their communication infrastructure, we should learn to not think separately of humans and their values on one side, and infrastructure on the other, as if the former were independently driven. The two are intertwined, co-producing each other along the way.

Is it possible to reimagine Indigenous connectivity projects with more autonomy and less dependency upon the established commercial actors of internet service provision? A design option that could guide such a goal is a prioritization of local and regional connectivity, reducing the number of actors that Indigenous shared networks need to interconnect with. The fight to coexist nowadays extends to decisions about with whom data and data packets should be shared, how, and in which circumstances. The possibility of Tseltal, Zapoteco, and other communities designing technologies and protocols founded on their own values, interoperable with networks that they want to connect to, opens numerous possibilities of design justice to mitigate path dependencies embedded within commercial internet infrastructure, moving it away from a universal towards a pluriversal internet.

Shared networks are a common feature of life in the global South. I grew up seeing my parents and neighbors designing and governing shared water and electricity networks in São Paulo. The *gatos*, as these unstable connections are known, were subject to

shutdowns; the water to limited and nocturnal availability and undesirably low pressure, leading to collective busy dawns on the rooftops to fill up the water tanks. Indigenous internet networks complicate this scenario, as the nature of data and information requires values-oriented discussions that take local understandings and Indigenous self-determination into account to oppose the dynamics of coloniality embedded in data infrastructure. Indigenous peoples are internet governance actors despite the limits of internet topology to recognize their shared networks. Actually, the history of the internet is multiple and diverse, including groups following different paths in the past and in the present. Latin-centric Indigenous networks founded on sharing-oriented principles call attention to just a few examples of internet infrastructuring underway. More generally, Tseltal and Zapoteco participation in internet codesign shows how much we miss when we disregard these internet networks. They illuminate internet governance in practice and embody a vital struggle for a pluriversal internet.

Notes

- 1. The literature on *comunalidad* is mostly in Spanish and citations used in the text are my own translations.
- 2. Silvia Rivera Cusicanqui informs us that the word *ch'ixi* 'has many connotations: it is a color that is the product of juxtaposition, in small points or spots, of opposed or contrasting colors: black and white, red and green, and so on.' (Cusicanqui, 2012, p. 105).
- 3. A *pueblo* is smaller than a town, and can be translated in English as 'village.' I keep the word in Spanish as a way to stress the forms of organization of Tseltal and Zapoteco communities.
- 4. The amount of effort that they have put into such projects, and the current recognition of their achievements by government agencies and international organizations, led the interviewees to demonstrate interest in being named when featured in my work. Some of them are also featured in media outlets. I have not changed people's names within the article for this reason.
- 5. For more information on these projects, see Baca-Feldman et al. (2018); Bloom (2015); Huerta (2018) and Parra, (2015).

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