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This edition of GISWatch came into being alongside a brand new baby boy. Welcome to the world, Ronan Diga!

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BRAZIL

OFF-THE-GRID, AUTONOMOUS COMMUNITY NETWORKS IN BRAZIL



Fonias Jurua Project

Anna Orlova and Rafael Diniz

<https://fonias.submidia.org/en>

Introduction

To understand how high-frequency radio community networks were developed in the Brazilian Amazon, it is important to reflect on the geographic characteristics and historical and socioeconomic background of Brazilian Extractive Reserves. By drawing on these factors we explain the novelty of our technical solution – building local autonomous connectivity in the Amazon rainforest using digital radio in the high-frequency band – and how it is the most appropriate solution in this context. We put into perspective aspects of available infrastructure and the local context as the main factors defining the solution that can best serve the needs and wishes of the local population to provide information and communication solutions.

Socioeconomic and historical background

The Amazon region, which extends through many South American countries, is one of the least developed in terms of information and communication technology (ICT) infrastructure, as in these areas there is insignificant investment in infrastructure. For many communities here the only available communication technology is the high-frequency radio transceivers that are practical and affordable and have already been in use for decades.

Although the first Amazon digital radio network¹ using the high-frequency radio band in the Brazilian Amazon forest was created in Acre in 2014-2015, high-frequency radio transceivers – bi-directional radio transceivers that allow communication directly between the two transceivers without any intermediate points – existed and were used by the local population for a long time before that. Locals remember the use of high-frequency radio transceivers by the *patrões* (bosses) who owned and managed the rubber plantations in Brazil. Until the early 1980s, the *seringueiros* (rubber tappers) were the many generations of migrants from the

Northeast region of Brazil, along with some indigenous people populating the Amazon rainforest who were often enslaved and forced to work in the rubber tapping industry. Looking to end this oppression and hardship, rubber tappers mobilised with the labour movement and with environmentalists. This led to the liberation of rubber tappers and the establishment of the first (legally recognised) extractive reserve in the Brazilian Amazon in 1990 – the Alto Juruá Extractive Reserve.² As a result of this struggle, rubber tappers claimed their right to live, work and organise their lives themselves on the land where previously they were forced to work in harsh conditions.

Geography of the Alto Juruá Extractive Reserve

The Alto Juruá Extractive Reserve is located in the state of Acre, on the border with Peru, and comprises an area of 506,000 hectares of forests and rivers. It is a federal administrative territory set up as a natural conservancy that allows traditional communities to live and earn their livelihoods, including through natural resource extraction, inside the conservation zone, based on the assumption that their traditional way of life favours and enhances the protection of natural areas.³ Therefore, inhabitants can live from the land and rivers of the extractive reserve; however, they also face the need to find sustainable ways of farming and maintaining their lives inside the reserve without depleting the natural environment. This form of coexistence with the environment would guarantee protection of the forest and of the people living inside the reserve.

For years the main challenge for traditional and indigenous communities of the Amazon forest was being isolated and scattered throughout the forest on their own without any access to communication. The only available means of transportation is by

1 <https://fonias.submidia.org/en>

2 www.icmbio.gov.br/portal/unidadesdeconservacao/biomas-brasileiros/amazonia/unidades-de-conservacao-amazonia/2776-resex-alto-juruá

3 Antunes Caminati, F., et al. (2016). Beyond the Last Mile: Fonias Juruá Project – an HF Digital Radio Network Experiment in Amazon (Acre/Brazil). In L. Belli (Ed.), *Community Connectivity: Building the Internet from Scratch. Annual Report of the UN IGF Dynamic Coalition on Community Connectivity*. https://internet-governance.fgv.br/sites/internet-governance.fgv.br/files/publicacoes/community_connectivity_-_building_the_internet_from_scratch.pdf

rivers and there is no electricity power grid inside the reserve, which leaves people with the option of either gasoline-powered generators or solar energy. Therefore transportation and energy are expensive⁴ and not accessible for the majority of the extractive reserve population.

Precarious public infrastructure in the reserves also makes it almost impossible to access public services. For example, many families receive financial support from the government programme *Bolsa Família*,⁵ through which a monetary allowance is provided to the female head of the household for every child, on the condition that the children attend school. Schools in the extractive reserves are supposed to provide transportation for the children inside the reserve to bring them to school. In practice, however, this often does not work, and instead children are staying at home. This has a direct effect on girls in particular: without any primary education they have no option of continuing their education or being employed outside of their immediate surroundings, and are left with the only choices of early marriage (at the age of 13 or 14) or staying at home to look after the children and the household.

Today Amazon rainforest reserves are endangered. With massive territories without any oversight or protection from the army or state, extractive reserves represent an easy target for illegal extractive activities, such as logging, hunting, and the mining of precious metals and other natural resources like oil. After the decline of the rubber tapping industry in Brazil, rubber tappers also needed to find ways of sustaining their lives inside the reserve, and recently many have opted to leave for urban areas in hope of better lives and jobs.

All of these aspects were taken into consideration when our community work began. There was a clear need for a means of communication and information technology that could help locals monitor their territory, mobilise and coordinate their actions, exchange information with the municipal centre and receive assistance with basic services like health care and education. Taking into consideration the lack of any infrastructure and the long distances between communities separated by an impenetrable rain forest and their expressed wishes to use radio transceivers, the solution for community connectivity in this context was to build an autonomous, affordable solution for connectivity using old, existing infrastructure.

The Amazon high-frequency digital radio network in Acre

A high-frequency digital radio network as a solution to provide community connectivity has been implemented and is currently operating in the Brazilian Amazon forest in two states: in the Alto Juruá Extractive Reserve in Acre and in the Terra do Meio region in Pará state.

The Alto Juruá Extractive Reserve has a network of seven radios inside the reserve and one main hub-station in the city of Marechal Thaumaturgo. This network is a result of a long-term collaboration that started in 2013 between traditional and indigenous communities in Acre, and researchers and professors from the University of Brasília,⁶ Sao Paulo State University⁷ and University of Campinas.⁸ The network was developed as part of the academic research project “Fonias Juruá” to provide information and communication infrastructure to rural Amazon communities that are under-served by regular and commercial information and communication networks. It was based on the requests for two-way voice radios from 24 traditional communities in the Alto Juruá Reserve and aimed at engaging locals in the process of political participation and empowerment through joint sustainable experience. At the moment the estimated number of users is around 500 people.

It took four years from the beginning of talks with the community to purchasing equipment and taking the first trip to the extractive reserve where the first six radio stations were installed with the collaboration of community leaders and locals living inside the community. Five of the radios were installed inside the extractive reserve and one station was installed in the city of Marechal Thaumaturgo, which served as a hub to connect and exchange information between all the stations. The idea was that Marechal Thaumaturgo would provide socially and politically important information and news to the extractive reserve that would serve as an incentive to foster communication and the exchange of information inside and outside of the reserve. It was also necessary for people living inside the reserve to talk to their relatives living in the city of Marechal Thaumaturgo, exchange information about local production and prices of goods and services, ask for medical assistance and advice about social services, and access other locally important information. Another important aspect of communication was to report illegal activities taking place in the reserve, such as illegal logging, hunting and mining.

4 Petrol prices are one and a half to two times higher compared to other states of Brazil.

5 www.mds.gov.br/assuntos/bolsa-familia/o-que-e; https://en.wikipedia.org/wiki/Bolsa_Fam%C3%ADlia

6 www.unb.br

7 www.unesp.br

8 www.unicamp.br/unicamp

Today the Acre high-frequency radio network is composed of eight two-way radios – a point-to-multipoint broadcasting set-up allowing every station in the network to receive the transmission and to communicate among each other. This system is autonomous, low maintenance and easy to use by any member of the community after basic training. The solution is composed of standard high-frequency transceivers, common wire horizontal dipole antennas that are positioned to work in near vertical incidence skywave (NVIS) mode, and software-defined radio (SDR)⁹ techniques for digital communications. As there is no power or electricity infrastructure available, each radio station is powered by a solar panel and batteries, making it an environmentally friendly set-up.

Since its inception the network has been in regular use by the local communities without any major problems. In 2016 we successfully accomplished trials with a digital transmission system based on the Digital Radio Mondiale (DRM) standard (this was first attempted in 2015 but was only partially successful). The solution for digital transmission is made up using an embedded computer, an interface to the radio and the SDR software. We managed to send text files and images over the radio in the 80-metre HF band (3545 kHz) to locations 100 km apart.

Comparing the two networks: A look at the Terra do Meio Digital Radio Network

The network in the state of Pará has no formal name, but we refer to it here as the “Terra do Meio Digital Radio Network”. The network operates with a main station set up at the NGO Instituto Socioambiental¹⁰ (ISA), with other independent stations (around 10 stations) in the urban area of Altamira that provide special services and communication. In the rural area of the Amazon forest there are at least 50 stations, meaning that, like the Fônias Juruá network, this network can be considered predominantly rural. The network has been set up by ISA, SDR Telecom¹¹ (a company founded by a member of the Fônias Juruá Project) and the local people of the Terra do Meio region. The network has more than 4,000 users.

In comparison to the Acre community network, the Terra do Meio Digital Radio Network is significantly larger, with around 60 radio stations spread across the region. The Terra do Meio region is also bigger and therefore the network connects many

more communities, creating a high demand for radio use. The daily use of radios is vital to the local population. For example, in some cases when people are travelling to another place in the region they take their radios with them and upon arrival they assemble the radio to be able to talk. At one meeting we witnessed a queue of people waiting to use the radio to talk to their relatives and acquaintances, for personal or business reasons. This potential of the network would not be possible if the network was small. As a result, the size of the network plays a significant part in its usefulness.

Despite the very similar social and geographic contexts, the way the two networks operate is also different in terms of ownership (the way the radios are owned and shared), as well as the economic incentive to use the radios. Here the economic capacity of community members plays a defining role in the ways the radio network develops and extends inside the forest territories, as well as how community members attribute importance to the use of radios. From our observations we can say that in Pará, the use of the network is more economically motivated. People in the communities run daily business over the radios and therefore use it more regularly and more frequently. This factor appeared to impact on the maintenance of the network.

In Acre we observed only one community where the maintenance of the radio was given importance by the members of the community, as opposed to the maintenance support received from the project team. In this community, the head of the household where the radio station was installed had a personal interest in maintaining the station because he was using it for running his own business – in other words, there was an economic incentive. He purchased a new battery at his own expense to keep the radio working when the initial one broke down. This suggests that networks that enable the economic agency of communities have a stronger prospect for sustainability.

Empowering women

There is a clear division of labour in the Alto Juruá Extractive Reserve that was established throughout the years and was defined by the way of life inside the reserve. Most hard physical work like hunting and farming is done by men, whereas women tend to stay at home to cook and take care of the family and the household. However, when it comes to the decision-making process, women take equal part and participate actively.

When one community had a meeting to decide and vote on the house where the radio would be installed, one woman openly voted against her

9 https://en.wikipedia.org/wiki/Software-defined_radio

10 <https://www.socioambiental.org/pt-br>

11 <https://sdrtelecom.com.br>

husband when he proposed to have the radio in their house. In another community women were very proactive at the community meeting, expressing their concerns and asking questions. They became so engaged that they even participated in the process of installing antennas and helping to dig holes and install wooden posts along with men – something that only men did in other communities. The first volunteers to test and use the radio were teenage girls, who appeared less shy than some of the young men who resisted using the radio for the first time in front of everyone else.

Because they tend to take care of household duties, women naturally stay closer to the radio during the day and seem to be more keen to talk and share news with others compared to men.

Action steps

Today one challenge for community networks operating over the high-frequency radio band is the lack of licences for community use. In the Brazilian Amazon many networks or high-frequency radios operate without a licence. Partly this happens because some are not aware that they should have licences as network providers (for example, recently some radios were seized by Anatel – the Brazilian telecom regulator – in the city of Altamira), whereas in other cases the remoteness of the Amazon region and lack of any form of oversight gives a certain freedom for the use of spectrum without licences. There are ongoing discussions and requests from network operators and researchers submitted to the ministry of communication for community-use licences to be formalised; however, so far the ministry has

refrained from taking action towards a new type of licence being introduced. Instead it has asked for working examples of communities operating community networks as a basis for further discussion.

Community networks that want to operate mobile phone networks also cannot use any mobile phone radio bands for their own needs. There are no community licences for this purpose. Nevertheless, Anatel allows, for example, Wi-Fi internet providers to operate without licences, with certain restrictions such as a maximum of 5,000 users and with only certified equipment (Resolution No. 680, 2017, Anatel).¹² Even in these cases, however, community networks fall under the same category as small for-profit network providers.

Today there is a lack of telecommunication access and infrastructure for millions of Brazilian citizens: people living in isolated rural areas without commercial telecoms coverage, and the poor and socially disadvantaged that cannot afford expensive commercial telecom services. As a result, there is a clear necessity to declare and convey the needs of non-commercial network operators for a new type of telecommunication licence for community use at the policy-making level.

Since 2015 a group of implementers and supporters of emerging GSM (mobile telephony), high-frequency radio and Wi-Fi community networks have been working together to advocate for community connectivity at the level of policy making and to establish and articulate the concept of “community network” in the Brazilian telecommunication law. However, there have been no significant achievements so far.

¹² www.anatel.gov.br/legislacao/resolucoes/2017/936-resolucao-680

Community Networks

THE 43 COUNTRY REPORTS included in this year's Global Information Society Watch (GISWatch) capture the different experiences and approaches in setting up community networks across the globe. They show that key ideas, such as participatory governance systems, community ownership and skills transfer, as well as the "do-it-yourself" spirit that drives community networks in many different contexts, are characteristics that lend them a shared purpose and approach.

The country reports are framed by eight thematic reports that deal with critical issues such as the regulatory framework necessary to support community networks, sustainability, local content, feminist infrastructure and community networks, and the importance of being aware of "community stories" and the power structures embedded in those stories.

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