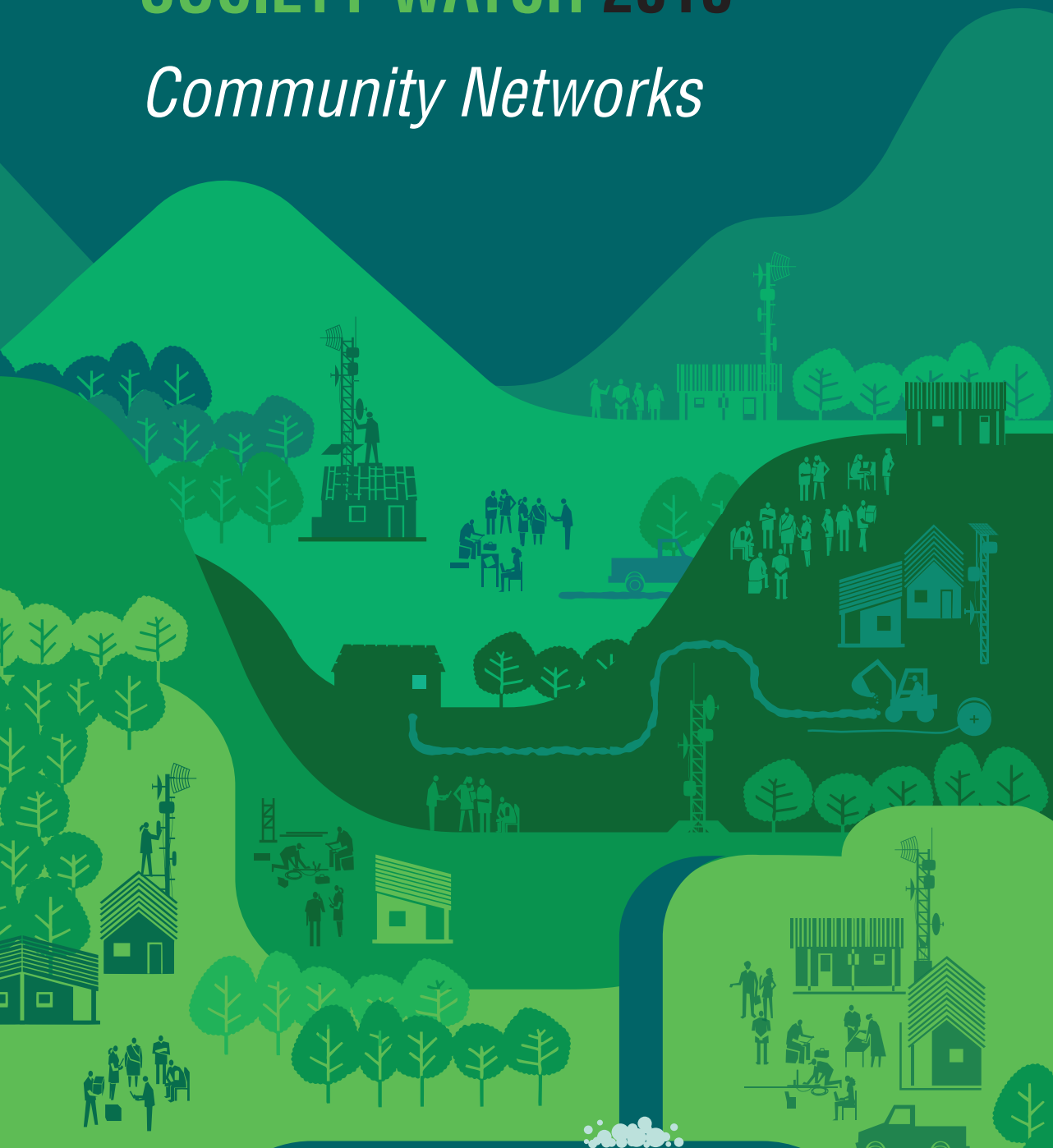
GLOBAL INFORMATION SOCIETY WATCH 2018

Community Networks



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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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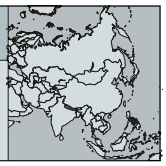
NEPAL

CONNECTING HIMALAYAN VILLAGES IN NEPAL TO THE OUTSIDE WORLD: THE TALE OF THE NEPAL WIRELESS NETWORKING PROJECT



National Innovation Centre
Mahabir Pun
https://www.nicnepal.org and nepalwireless.net

Introduction

This report describes the experience of the Nepal Wireless Networking Project (NWNP), a grassroots initiative in remote Himalayan communities in Nepal. Launched in 2001 in Nangi, the project has been extended to more than 200 villages over 17 years. It is currently the only community network in Nepal – although others are emerging and looking to draw on NWNP's experience.

The initial objective of NWNP was to address the dire need for communication services in the remote mountain villages. At that time, in 2001, there was not a single village that had modern telecommunications and transportation facilities. Instead, villagers had to walk several hours – or even days – to exchange messages, or just to make a phone call. Most people in the villages were not aware of the potential offered by either computers or the internet.

The project might have been just a dream, if social activist and team leader of NWNP Mahabir Pun had not written an email to a BBC group forum[1] out of curiosity, asking for help from volunteers to connect a Himalayan village. BBC subsequently published an article on his work.[2] To his surprise, he received an overwhelming response from volunteers around the world. The idea of NWNP started to materialise after that.

With the help of volunteers using the then-emerging Wi-Fi technology, the villagers in Nangi informally started NWNP in 2001. After doing various phases of trial and error for one and a half years using quite basic indoor Wi-Fi devices and homebuilt antennas, they managed to get the connection to work in the village. As the network grew, the project started to receive media attention, and funding from individuals started coming. As a result, a simple project that was started to connect a village in a mountainous region ended up offering education and telemedicine, and an opportunity to generate income through local e-commerce platforms, to communities in remote regions of Nepal.

Policy, economic and political background

When NWNP was launched, there was great political instability in Nepal due to a Maoist insurgency. As a result, Nepal's government policy for the development of wireless networks was very strict. At that time, the import and use of any kind of wireless networking equipment in Nepal was illegal. Because of this, the equipment was brought with the help of international volunteers and university students. After the restoration of democracy in 2006, NWNP lobbied with the association of internet service providers (ISPs)[3] and demanded that the 2.4 GHz and 5.8 GHz frequencies on the ISM band be de-licensed. As a result of this the government de-licensed those frequencies in September 2006.

A second regulatory obstacle was that to become an ISP in Nepal, it was necessary to pay a huge licence fee. NWNP lobbied the regulatory body, the Nepal Telecommunication Authority (NTA),[4] to reduce the licence fee. As a result the NTA issued a new law that made the licensing procedure simple. It also reduced the fee to just 100 Nepalese rupees (around USD 1) a year for those who want to work as rural ISPs. These regulatory changes helped community networks to easily get licences in Nepal, and also to legally provide internet access and IT services in the rural areas.

An innovative experience

NWNP certainly has had an innovative and interesting beginning to share with wireless communities around the world. Back in 2001, while villagers in Nangi were looking for different ideas to bring the internet to the remote mountain communities using Wi-Fi technology, most of the engineers and experts in the communications field had told them that it was not possible to make a long-range wireless link using normal Wi-Fi routers. Their main concern was the lack of funding to buy high-end equipment

1 BBC. (2004, 25 May). Wi-fi lifeline for Nepal's farmers. *BBC News*. news.bbc.co.uk/2/hi/technology/3744075.stm

2 BBC. (2001, 22 October). Village in the clouds embraces computers. *BBC News*. https://news.bbc.co.uk/2/hi/science/nature/1606580.stm

3 ispan.net.np

4 https://nta.gov.np

and the distance of over 40 km that the radio signal had to cover to connect Nangi to the nearest city, Pokhara.

Despite negative feedback from the experts, the NWNP team members decided to continue conducting field experiments using basic equipment, such as a 2.4 GHz indoor wireless router with 60 MW transmitting power, normal switches, and solar power sources. These devices were donated by individuals from abroad. At the beginning, NWNP had to even use home-built dish antennas because these were not available on the market.

After conducting several field experiments over a period of one and a half years, in May 2002, the NWNP team managed to connect the village to the city of Pokhara using a dial-up internet service. The technical experts, who were sceptical of the project, were amazed because – technically – it was not possible to make a 40-km link using indoor routers and home-built antennas, especially when the area is surrounded by high mountains.

NWNP has now acquired powerful wireless equipment for connectivity, and has rolled out to more than 200 villages in 15 districts of Nepal. Solar power systems have been installed at the repeater stations to make the networks robust and reliable. The project is gradually adding various applications and services for the benefit of the villagers.

Technical configuration

NWNP was started from scratch, and was built gradually over a time span of about 17 years – and it is still growing. The project has set up base stations in three cities, Kathmandu, Pokhara and Gorakha, to which the villages are connected. The base stations have routers and servers that are linked to the internet through a leased optical fibre line. From the base stations, a series of repeater stations have been built on the mountain tops to connect different villages. The access points on the mountain tops work as relay stations that distribute the internet to end-users in the villages. All the villages are connected to the access points through point-to-point or point-to-multipoint wireless links.

High-speed backhaul radios operate on a dedicated core local-area network (LAN) that reaches from the base stations to different districts through the relay stations. The longest point-to-point link NWNP has made is 59 km from one mountain top to another. The distance between an access point and end-users ranges from 2 km to 10 km. The villages that are connected to the network are divided into different sub-nets to manage the network smoothly. Routers have been installed at each of the relay stations. These provide DHCP[5] services to end-users and serve as interfaces between the backbone, wireless LAN (WLAN), and local distribution LANs.

For the point-to-point backhaul links, unlicensed 5.8 GHz wireless devices made by different companies have been used. However, for the last-mile connectivity and for the hotspots, 2.4 GHz wireless devices are being used. These devices using unlicensed bands are now easily available on the market. This is affordable equipment that can be used to bring broadband services to rural areas. However, the main constraint of using 2.4 GHz and 5.8 GHz frequencies is that it requires a clear line of sight to connect the rural areas, whereas the villages in mountainous regions are scattered across a diverse topography. Furthermore, if there is a big tree, small hill or mound or harsh weather along the path of the radio waves, the signals get blocked or the signal strength decreases drastically. Because of these hindrances, NWNP is facing some problems in its efforts to connect the most remote villages using wireless equipment in the 2.4 and 5.8 GHz bands.

To identify alternatives, NWNP conducted a pilot project in 2016. The objective was to test the potentials of TV white space using 460 MHz to 478 MHz, and VHF technology using 192.5 MHz to 202.5 MHz. The pilot project connected eight villages using these technologies. NWNP had been issued with a licence to use those bands; however, getting the licences was not easy.

The pilot project is still running and it is working quite well. We found that TV white space signals and VHF bands can travel much greater distances and overcome obstacles, such as buildings and vegetation.

It would have been good to use devices using the 900 MHz band for the last-mile connectivity in Nepal; however, the government has not made it available for community networks. For last-mile connectivity in community networks it is recommended to use the 900 MHz band if it is open for public use.

Community involvement in NWNP

From the very beginning NWNP has been working in remote and rural areas. These areas of Nepal are sparsely populated, and the majority of the inhabitants are subsistence farmers. The poorest and least developed part of the country is in the mountainous region. Most of the young people (between 20 and

5 https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol

30 years of age) leave the villages in search of jobs in the cities or abroad. Because of this, mostly women, children, the youth and old people are living in the villages.

At the beginning, the villagers in Nangi were not even aware of the internet. Therefore, it was a challenge to involve community members in building NWNP. However, it did not take long for people to understand the benefits of having access to an internet connection, especially once they learned to communicate using VoIP, text chat, emails and bulletin boards.

There are many community stakeholders involved in NWNP. These include local schools, healthcare clinics, businesses, local government and individuals. The users of the community networks include farmers, teachers, students, health workers, development workers and local government officials. Users are mostly younger people such as students. This is because the students at the schools get to learn about computers and the internet first hand.

Project management

For the smooth operation of the community networks, network management committees made up of community members have been formed to manage the different services provided by NWNP. The local management committees include members from mothers' and women's groups, social clubs, school management committees, and communication centres.

The key role of NWNP is to provide technical support to build the network and connect facilities such as rural schools, healthcare clinics, community communication centres and local government offices. The servers and routers at the base stations are maintained by the NWNP system administrators. It also provides training for the capacity building of local technicians so that they can build, run and maintain the network smoothly.

Each local management committee appoints a technical person to troubleshoot and fix the technical problems and to provide support for the users in the village. In case the local problem cannot be solved by local technicians, NWNP sends technical team members to help fix the problem.

Because of the above structure, NWNP does not provide services directly to the end-users; instead, the services are provided to end-users through the network management committees of each village. The management committee is responsible for maintaining and operating the network. The project, however, has to generate income for maintenance and operation.

One of the key factors contributing to sustainability is that the rural communities should be involved from the start. If possible, it is important to then transfer the ownership of the network to communities. To ensure financial sustainability, the management committees charge reasonable connectivity fees of about USD 15 to USD 30 per month depending on the bandwidth used. This monthly connectivity fee is a bit expensive for the rural population but has been coming down every year. The monthly fee, paid by the community centres, individual users, local businesses, rural schools and rural clinics, is used to pay for the internet bandwidth cost and to incentivise the technical support team.

Conclusions

Most rural and remote communities in developing countries face similar key challenges, such as poor infrastructure, lack of resources, and a lack of skilled person power. Understanding the local context, and securing the involvement of local and international actors and local communities to complement financial resources, are important.

Governments should also access universal service funds to support community networks and make them sustainable. However, this has not happened yet in Nepal.

Mobile phone services have now penetrated around 90% of the population of Nepal. At the same time, Nepal has a federal system of government now and many of the newly elected state and local governments are trying to introduce ICT-related services in the villages. Because of this, NWNP has shifted its priority from communication service to public services, such as e-education, e-health, e-agriculture, e-commerce and digital literacy programmes. NWNP is now working with eight local governments in developing user-friendly web-based applications and mobile apps which will help to make the lives of the rural population easier.

Action steps

The following key lessons have been learned through the NWNP project:

- Use affordable equipment in conjunction with the 2.4 GHz and 5.8 GHz unlicensed bands to build community networks in sparsely populated areas. These bands are unlicensed in most of the countries in the world.
- Involve local stakeholders, such as local businesses, local community organisations, local governments, and individual community members. They must all be engaged for the creation

of a smooth operation. Likewise, the network should be owned by them.

- Train local technicians for the technical sustainability of the network, so that the community can expand the network when necessary, and troubleshoot the problems in time.
- Produce local content in local languages and integrate digital literacy programmes into the network roll-out plan to help the rural population appropriate the internet.
- Acquire subsidies from the government if possible for community networks. This is helpful at least for a few years at the beginning. It will be difficult for rural and remote communities to build and operate community networks using their own resources.
- Lobby the government to use the universal service fund to support community networks.

GLOBAL INFORMATION SOCIETY WATCH 2018

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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