An investigation on Community Networks: Challenges, Regulations, and Solutions

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*Abstract*—Background: There are many ways to deploy a network in a community. However, the process in which how a community network is deployed could be based on the community’s location or infrastructure. Based on the community’s location or infrastructure, we can find out what are the challenges and how to solve these challenges. Other than that, there are also regulations that are in placed to standardized community networks.

Methods: In this study, we will investigate on community networks. Online journals, online articles, and/or books will be use to carry out this study. A comprehensive investigation will be done based on the information that we have obtain to determine the challenges, regulations, and solutions in a community network.

Keywords – community, networks, community networks, investigation, challenges, regulations, solutions, UCTS

# Introduction

What are community networks? Community networks are information infrastructure, services, applications, and content to support activities and/or business of underserving communities with infrastructure built, managed and used by local communities, oftentimes in areas that are financially unattractive for mainstream internet service providers. In layman’s term, community networks provide internet access to remote areas or underserved communities such as in rural areas. Majority of community networks architecture follows a wireless technology designed. With this design, the network users may still achieve online transactions, including communicating with others via online messaging or online calling, and to bring Internet-related services to those areas. A network whose infrastructure is developed, maintained, controlled, and administered by a community-driven organization or by a community itself by gathering their existing assets and cooperating with partners to accelerate and grow the community’s activities is a wireless community network, also known as community-based Internet service providers [1].

There are two fundamental components in a community network. Firstly, is the physical components and infrastructures such as transmission medium, computers, and the technology required to form an internet connectivity. For most remote areas or rural communities, the finances limit the range of options for physical framework. Other than that, another component in a community network is the social info-structure. Social info-structure consists of the ongoing process of engaging people in the benefits of having an Internet access and. With new possibilities and capabilities, people in the community learn how to work together to share and realize potential benefits of internet connectivity for the common good [7].

# Models of community networks

## The Freenets

Freenets started with the goal of offering free local dial-up internet connectivity to anyone who would otherwise go without such connectivity, and establishing a public platform for online discussions.

Freenets were internet networks committed to providing people with Internet connectivity in a day when this service was still new and would otherwise not be accessible to most residents. As technology becomes more advance, Internet access is less costly and more available, the goals of Freenets was questioned and it needed to be changed. This change came in the form of offering enhancement of collective value and collaboration capacity [6].

## The Community Website

With the appearance of the World-Wide-Web (WWW), it brings with its graphical user interface web pages and in the era of graphical user interface, numerous people saw the collaborative text-based Freenets as out-of-dated text-based systems. A community network’s latest paradigm was a community-sponsored Internet archive of interactive and graphical web pages, with hyperlinks to resources from community organizations and businesses.

As WWW was still new to the people in the community, the technology was still confusing to them as there were no specific communications component in the community network. Despite that there were free web conferencing tools available online for the community to use, they just use it to post their email addresses. Other than that, Confusion also arose from the presence of several city websites in one city as the official website of the city [6].

## Community Learning Centres, also called Community Technology Centres

Computer labs were in these learning centres, it was designed to teach and guide community members on how to operate computers and the Internet by supplying computers and Internet access to those community members that might have no chance of experience using a computer and the Internet. While the learning centres were, and are, certainly great to have around but often the learning centres does not felt like a real community network, community interaction component, or use of online learning. Many community networks, however, created learning centres to provide training to the citizens in the community. Opinions on these Community Learning Centres differ from each person in the community as it was vague on which or what “community curriculum” would most benefit the citizens in the community [6].

## The Community Education Network

Systems were created in schools or colleges that were explicitly to provide online training modules and guidance concerning the use of computers and Internet, and other related and relevant subjects. By this time, developing online collaborative skills was an indispensable skill that the community members need to learn so a collaborative community network may be created and due to this reason, educators and a handful of educated community members were attracted to the systems [6].

## The Community Public Forum

After the appearance of the World-Wide-Web (WWW), this uncommon model was modelled after the original Freenets, was dedicated to create public forums that was used for discussions and was based mainly on assisting civic collaboration through web-based text systems, or older text-based systems, or a combination of both. The outlook of freedom of speech will most probably depend on how the masses use these public discussion forums and decision-making tools. Therefore, everyone needs to learn how to use computers and the Internet to be able to obtain information freely on the web [6].

# Challenges of a community network

Establishing a community network comes with a set of challenges. These challenges exist due to multiple reasons such as humans, technical, and technology. By understanding these challenges, we may be able to create solutions by eliminating the source itself such that these challenges would not even exist in the first place.

## Human error

Throughout the ages, humans have been the cause in some of history’s greatest challenges such as the 2008 Global Financial Crisis, the crash of NASA space shuttle, the Challenger, and recently the spread of the pandemic, Corona Virus or COVID-19. Humans are very volatile and unpredictable, varying and distinct amongst themselves. Hence, science, math, or technology factors aside, the human factor still plays a huge role in the success and/or failures of those sectors.

In a community network, a cooperative community is essential in constructing a successful community network. However, to have a cooperative community we must know what does a community means. Does a group of people living in geographical proximity considered a community or is a community formed by any group of people deciding on a decision to help each other for the greater good. Other than that, within any geographical community there are bound to be differences, such as each person has their own special hobby, different ethnic and religious belief, as well as various other community of interest. Moreover, knowing how a community functions and what the community wants is vital as we can build the community network with what the people in the community need and want. Therefore, we can have a community network that will be truly helpful for its people rather than having a network that does not help the community in any way or form.

## Technical challenges

There is an immense risk when doing maintenance to a wireless telecommunication tower during the rainy season caused by the severe rains and thunderstorms, this dilemma will most probably increase due to the worsening effects of global climate change. The community networks supported by respective organizations have to store replacement parts or extra equipment along with a system backup file as the safety of the wireless equipment is not guaranteed and restoration on the network might need to be done if any damages occurs. This increases the burden on ISPs and organizations either small or large, as these will increase their cost in establishing a community network.

Other than that, purchasing a leased line from any ISP is a long and tedious process. Small organizations that cater Wi-Fi connectivity in remote areas are the most affected by this time-consuming process, as for these small organizations every second and every penny counts due to them having not much of a budget compare to large organization. The purchasing of a leased line process may take about three-to-four months or even longer as it requires three-level coordination with all stakeholders who are providing the backhaul bandwidth.

## Lack of technological infrastructure and knowledge

Rural or remote areas communities are usually located far from a city where infrastructures are abundant whether it be commercial infrastructure or technological infrastructure. Community network tends to rely on existing infrastructures that are available in the community or nearby the community. Without any existing infrastructures, it would be a challenged to try to build a community network as there would be extra cost to build the community network as infrastructure must be constructed before any network and equipment can be installed and/or setup.

Other than that, people living in the community where the community network will be setup might not have the proper knowledge on how the community network and the Internet works or how it will benefit the community. In this respect, no matter how advance a technology is, if the person that will be using it have no proper knowledge on how to use the technology, the person might not be able to see the benefits of the technology and how it will help the community in improving their lives, hence the technology might be useless to the people in the communities. Furthermore, some rural or remote areas communities might be wary of the new technology as they never use it. So, it might be difficult to introduce the concept of a community network to the people living in those communities.

# Regulations

Similar to other projects in the world, to setup a community network everyone involved must follow strict guidelines and policies, abide to existing laws whether if it is local or international, and adhere to any regulatory bodies or agencies. This is because, all stakeholders want to have a quality and safe product for the end users to experience. Other than that, to avoid clashing with the authorities, and to avoid getting sued or fine a hefty amount we must follow the law at all time. Other than that, improper or complicated policies, regulations, and regulatory changes might hamper the growth of community networks which in then might not be able to digitally connect everyone in the country. For a country, it is important to get everyone digitally connected so that everyone in the country will have equal opportunities which will create a fair playing field for everyone to compete in.

## Public policy and regulatory environment issues for community networks

For any community networks to succeed, it relies upon an assortment of factors such as strategy of an organization and the cooperation of the members of the community, but also on a friendly policy and regulation environment. With that said, public policies and regulations at the state, national, and/or international levels may directly or indirectly effect the chances of setting up and operating a community network. To put this into perspective, law makers may place data retention obligations on network operators or demand that the users of the network can be identifiable, and these requirements may threaten the development of community network. As some community network operators could be an undefined community that may not have the ability to do data retention and the network users may not be identifiable.

Most countries around the world lack clarity or specific policies and regulation for community networks, which in then might create additional challenges. Information regarding community network policy and regulation is not easily accessible or that the knowledge of these policies is limited within regulatory bodies or relevant authorities. Furthermore, the spectrum management authority of a government in a country does not allocate specific spectrum for community networks. However, plenty of countries have allocated a handful of spectrums for unlicensed use which community network may take advantage although, unlicensed spectrum bands can be either general purpose or application specific. Community networks that uses these unlicensed spectrum lack definitive regulations or functional guidelines set by the appropriate organizations. Due to this, aids from the Universal Service and Access Funds (USF) are not accessible to community networks, which in then harms digital inclusion.

## India: Policy and regulatory environment

The Indian government has been working on a number of approaches to resolve aid for Internet connectivity. In fact, in 2004, it announced the Broadband Policy of the Government of India, which defined broadband as: “an always-on data connection that is able to support interactive services, including internet access, and has the capability of the minimum download speed of 256 kilobits per second (kbps)”.

In 2012, the Indian government introduced a new policy with a vision to revolutionize India into an empowered and inclusive knowledge-based society with the assistant of telecommunications as the catalyst, which is the National Telecom Policy (NTP). The aim of NTP is “to provide secure, reliable, affordable, and high-quality converged telecommunication services anytime, anywhere for accelerated, inclusive socio-economic development”. The NTP focuses on rural and remote areas and the importance of having a dependable and stable telecommunications services in those areas, and mandated more affordable high-quality broadband and telecom services throughout the country to digitally connect the country. NTP does not identify community networks as a means to provide the last mile connectivity even though that the policy worked toward establishing the “right to broadband”. Other than that, NTP also did not establish community networks or public Wi-Fi hotspots for the growth of rural Internet penetration in India [4].

Furthermore, the implementation of the Universal Service Obligation Fund (USOF) was envisioned by the NTP. USOF is to motivate service providers to supply connectivity in rural areas and/or remote areas of the country. The USOF aims to:

* Incentivise telecom service providers to venture into rural and remote areas;
* Facilitate rural roll out of infrastructure;
* Reduce costs and, hence, end user prices; and
* Telecommunications services that are more affordable.

Thus, it is reasonable to say that understanding of the capability for community networks to address the state goals of the NTP is astonishingly underutilized by the Indian Government at the moment.

## Indirect Policy and regulatory challenges hampering the growth of community networks in India

Lack of sufficient and affordable backhaul connectivity is one of the main topics preventing the expansion of community networks in India and the need for broadband from new users is astonishingly high as the population of India is one of the highest in the world and India population is increasing on a fast rate. Which means that there needs to be a great amount of Wi-Fi hotspots with strong backhaul connections to serve the increasingly massive India population. Currently, India’s Wi-Fi initiatives shows mediocre performance as most – though not all public Wi-Fi has weak backhaul connections. Moreover, a public Wi-Fi system that is robust and reliable would need to be modelled on strong, cross-country, omnipresent optic fibre backhaul that all providers have access to. This can be shared public infrastructure, which can be access by all ISPs or an open access private infrastructure.

To apply for an Internet Service Provider (ISP) license by any institution or individual, they are obligated to cooperate with all the regulatory authorities that controls or related to telecommunication services. In the licensing process, there are numerous institutions involved leading to an increase in waiting time, unnecessary bureaucratic hurdles, and additional costs. In addition, if last mile Internet connectivity is provided by an entity which are a Non-Governmental Organisation (NGO), small organization, or individual, these entities have to become a franchisee of an existing ISP, or share their private Internet connection at the expense of their safety and security due to the ambiguity of the licensing requirements. In case of the franchisee model, user logs have to be stored which means that the NGO, small organization, or individual need to purchase and setup a local data server which in then, adds to the technical burden. Other than that, the franchisee model exceeds the management capability of many NGO, small organization, or individual [8].

Furthermore, the peak of any telecommunications tower must not exceed 5 metres from the roof of an authorized building or 30 metres from the ground, these rules was set by the Department of Telecommunications (DoT) of India. Standing Advisory Committee for Frequency Allocation (SACFA) clearance is required by the ISPs if any telecommunications tower exceeds those measurements. Other than that, ISPs needs the approval of the Airports Authority of India (AAI) if the aerial distance between the tower and an airport is within 7 kilometres. Only ISPs are eligible to apply for a SACFA clearance. NGO, small organization, or individual which are franchisees of an ISPs are not eligible to apply for a SACFA clearance even though they want to establish a telecommunication tower of more than 5 metres. For these reasons, it is a challenge for NGO, small organization, or individual to provide last mile connectivity, creating regulatory grey areas, which may also lead to prosecution under established legislation [4].

# SOlutions

To solve or mitigate the effects of the challenges and regulation detailed above, all respective organizations involved with community networks should have a thorough discussion and suggest solution to the problems or challenges that will make establishing a community network much more effortless and streamlined. This section identifies a set of solutions or recommendations for the aforementioned challenges and regulations.

For human error, is it best that purpose of the community network is transparent and easily understand by the community members. Hence, to avoid any conflict or complications between the community members, a workshop shall be held with the community members to give them the details regarding the community network and how it will benefit and improve the lives of each community members.

The government of a country should encourage and promote rural or remote areas level ISPs as well as major ISPs. To further distribute Internet connectivity and digitally connecting everyone in the country, any NGO, small organization, or individual should be encouraged to become rural or remote areas level ISP. Other than that, to lessen the financial burden of ISPs going into rural or remote areas, these ISPs should be able to apply for service tax exemption. This service tax exemption will further encourage ISPs and organizations to enter rural and/or remote areas villages. Furthermore, when ISPs or organizations deployed, operated, maintaining, and scaling community networks in these rural or remote areas community, they should be able to take funds from the Universal Service Funds (USF) and/or other funding mechanisms. To avoid delay and to minimize regulatory hurdles associated with many current USF parameters, new funding schemes should be encouraged and introduced by the government.

Companies either privately-owned or government-owned and ISPs should cooperate with each other to establish a community network. This is so that, each company can share infrastructure with each other to lessen the cost to establish community networks and accelerate the country growth by digitally connecting everyone. For example, a telecommunication company and an energy company that transmits and distributes electricity throughout the country can work together to establish a Broadband over power lines (BPL) community network, the telecommunication company provide the Internet services while the energy company provide the infrastructure such as electrical pole and power lines.

##### Acknowledgment

This investigation reflects views and opinions on the challenges, regulations, and solution of community networks and community networks provider. Community networks aims to digitally connect everyone together to accelerate a country’s growth and economy. I would like to express my gratitude to all the authors and editors of the articles, journals, and books that I have referred to. Furthermore, I would like to thank the website that provided the materials I need for this investigation.

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