Developing Readiness for Community Networks in the Middle East and North Africa

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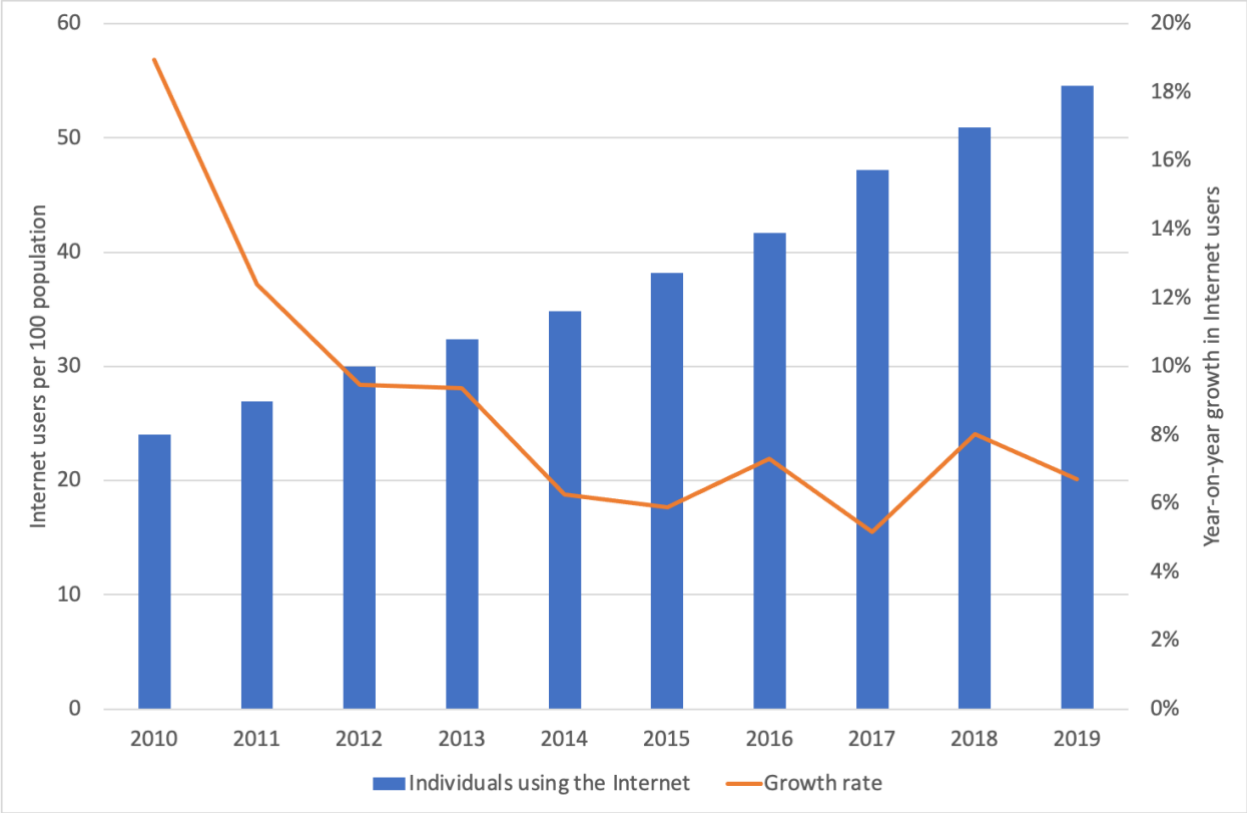
Introduction

The Internet is for everyone, creating opportunities for people to connect with one another, to learn, and to work. With the Internet, businesses can start and develop and governments can deliver services, while increased Internet usage in a country delivers economic growth and helps to achieve the United Nations' Sustainable Development Goals. The COVID-19 pandemic has underscored this. The increased reliance on the Internet during periods of lockdown and confinement have highlighted the need to ensure everyone has access to the Internet.

The Middle East and North African region has experienced impressive growth in the availability and adoption of the Internet in recent years, with a number of the Gulf States at the global forefront of new fiber broadband and 5G mobile networks, along with near universal adoption of the Internet. However, other countries in the region are lagging further behind (Figure 1). As of 2019, average Internet adoption in the region was at 55%. While this is slightly ahead of the global average, a significant challenge is that the growth rate is steadily falling—with the realization of an Internet for everyone being pushed ever further into the future.

1 I would like to thank Nermine El Saadany, Hanna Kreitem, Hana Sabbagh, and Amr Hashem of the Internet Society for their leadership and inputs on this study. I would also like to thank members of the Internet Society community for their inputs to a survey and during a workshop, and in particular Sharaf Azzain, the president of the Yemen Chapter, for his description of a new community network in Yemen.

Figure 1: Internet adoption and growth in Arab States2 (Source: ITU, 2021)



There are several reasons for low adoption rates and for the slowing growth rate in adoption. These include that the Internet is not affordable for many people with lower incomes, that the quality of the Internet is poor, and a lack of confidence among potential users in their digital skills to go online. This holds in areas that already have mobile or fixed broadband coverage, including in dense urban areas with high levels of poverty.

However, a more fundamental reason is a lack of availability of Internet access in a geographic area. The Internet is not always commercially viable in areas with high cost of deployment or low-income levels among the population. This is often true in rural areas with lower population concentration, typically below the average income levels in the country. However, in urban areas where there is access it may not have the quality people need to fulfill their needs or it could be unaffordable for people with lower incomes.

Community networks are an increasingly popular solution to these challenges. They provide connectivity in underserved and un-served areas. These are Internet networks that are developed by and for their communities, and which can play an important role in providing access and capacity building where there is little or none. Rather than waiting for the Internet to eventually reach their community and meet their needs, the communities build a local network to reach the Internet.

2 Arab States is the ITU regional classification that corresponds with MENA.

For over a decade the Internet Society has promoted the development of community networks all around the world. With this paper the Internet Society seeks to develop readiness for the emergence of community networks in the MENA region.[3] It is important that community networks operate within the relevant regulations in their countries. However, it is also important that policymakers and regulators recognize the benefits of community networks and adapt policies where feasible to enable them to develop. This paper aims to highlight the need for community networks in the Middle East and North Africa and the beneficial policies that can create an enabling environment for them.

Community networks offer significant benefits. First, the community network provides access to the Internet to communities where commercial service providers are unable to deliver connectivity within their business models. This allows the people who live there to realize the full benefits of the Internet for work, education, government services, entertainment, and communications, among other uses. Second, more deeply, a community network is not just *for* community members, it is developed *by* the community members. It provides training in developing and operating a network and it offers services that can be used in other communities or for more training and job opportunities.

Establishing a Community Network Typically Requires Support at Three Levels.

- Community level: This includes those wishing to use the Internet, as well as those willing and able to develop and operate the network. There must be demand among the users for Internet access, which must sometimes be developed, and training in digital skills to use the Internet. In addition, the developers of the network require technical knowledge and training.
- National level: This includes policymakers, regulators, and the telecommunications operators. Ideally, these stakeholders understand the benefits and needs of a community network and make the environment ready for their efficient and affordable development. However, in many countries it is still a new concept, and developing readiness is essential.
- Catalysts: Stakeholders are needed to promote the development of community networks in their country, acting as a bridge to help develop demand for the networks at the community level while creating readiness at the national level. Internet Society chapters in countries often take this role, which can also be taken on by individual champions. This paper provides an example of how this is taking place in Yemen.

The Internet Society has identified significant demand for Internet access in rural and urban areas in the MENA region that could be addressed with community networks. While we could only identify nascent efforts at developing community networks, we have found communities interested in

3 For more information, see https://www.internetsociety.org/issues/community-networks/

developing them, along with organizers who can help to catalyze the development. This report is targeted at the national level to help to create the environment in which community networks can be developed. (The Internet Society has other resources to help catalysts and communities develop the network once the environment is ready.)

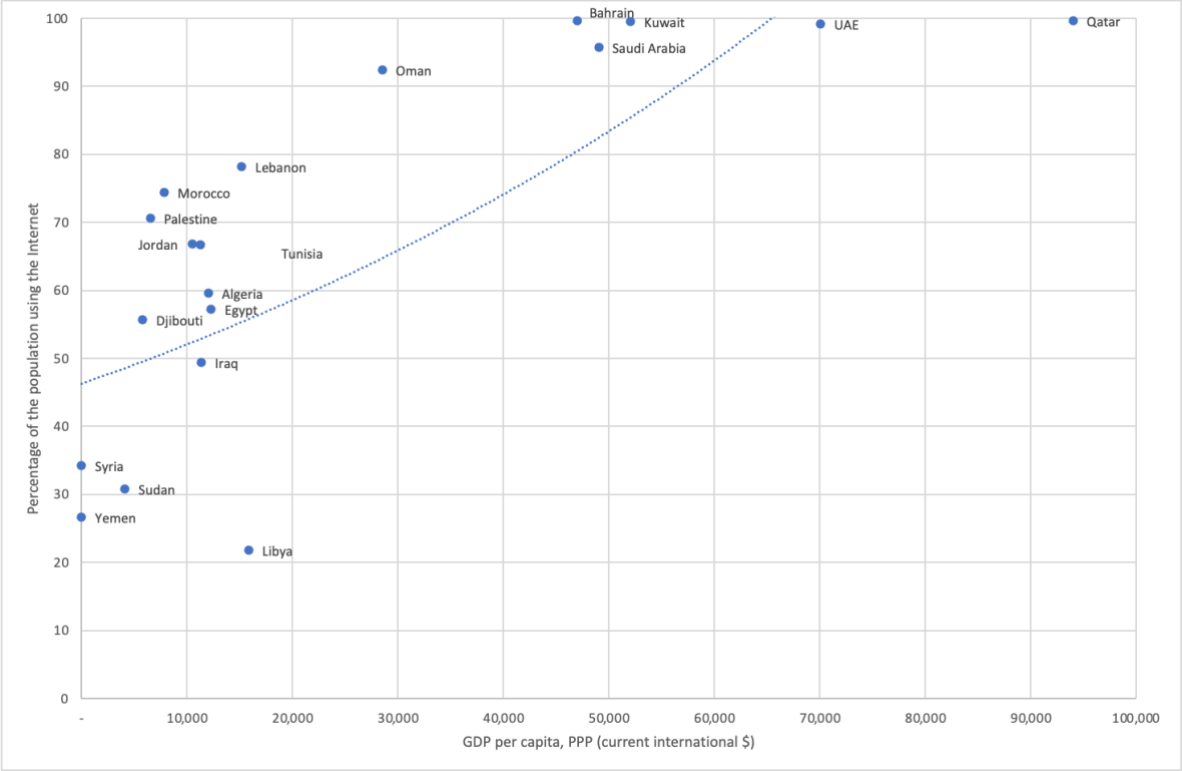
Situation in the Middle East and North Africa Region

The digital divide in many countries in the region is significant, based both on the affordability of Internet access as well as the cost of deploying access in rural areas. In this section we highlight the countries in which Internet access is lagging, and nascent efforts to fill the demand with complementary access solutions.

Evidence of the Digital Divide

While a few countries in the region are reaching near universal adoption of the Internet, a digital divide still exists both among countries in the region, and within countries. As shown in the following chart, Internet adoption is broadly correlated with per capita income. The Gulf States, with the highest income levels, are all above 90% Internet penetration, with several nearing 100%, while other countries struggling with significant security challenges are still below 50%.

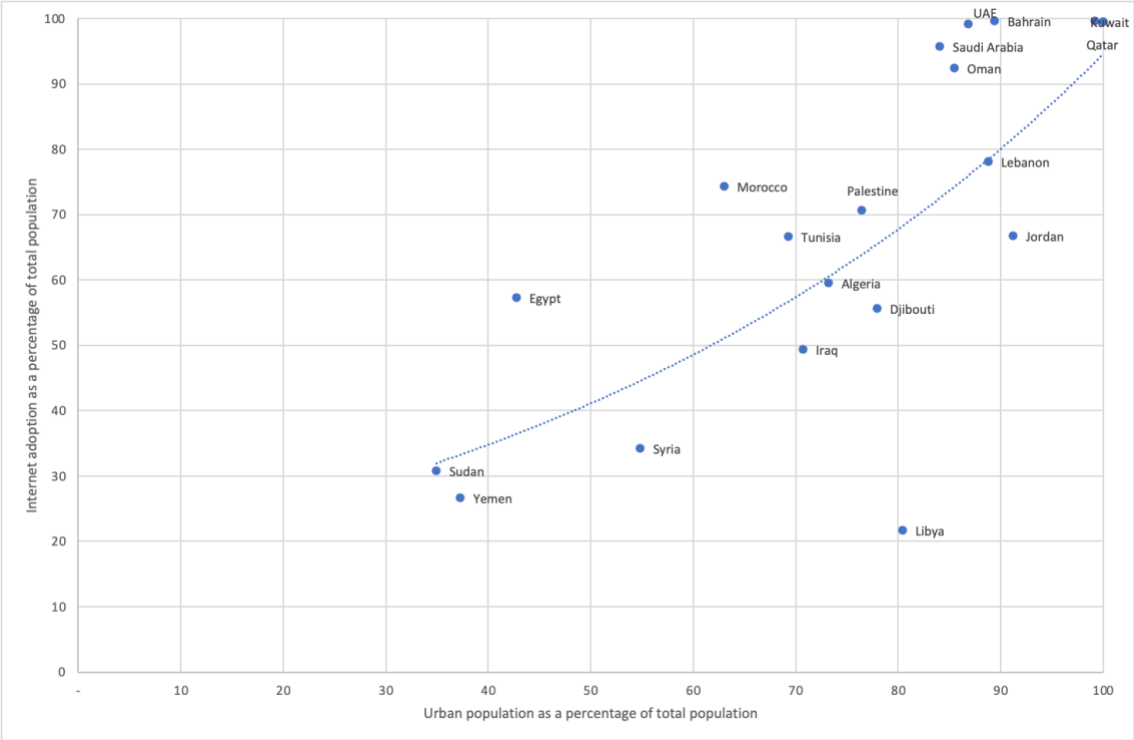
Figure 2: GDP per capita and Internet Adoption[4] (Source: World Bank, ITU, 2019)



4 GDP is not available for Syria and Yemen.

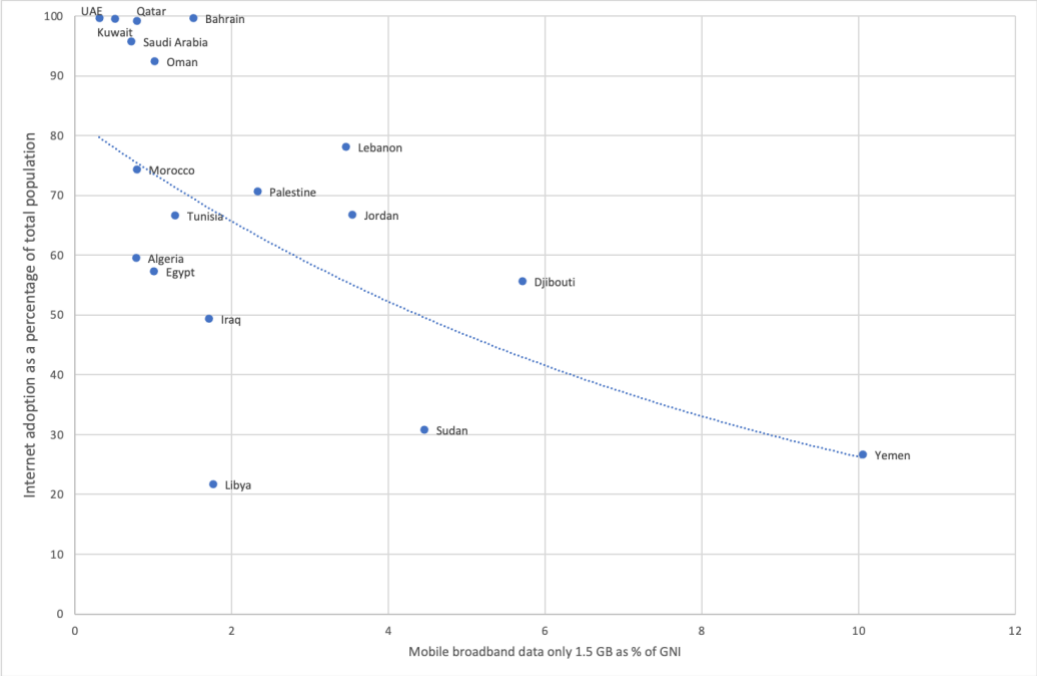
While income levels clearly have an impact on overall Internet adoption, availability is also important. Availability is impacted to a large degree by the cost of deploying networks set against the income levels of the population. The cost of deploying to urban populations is lower than in rural areas because of the density of users who can be reached. The chart below confirms that the level of urban population in a country is positively correlated with Internet adoption.

Figure 3: Urban Population and Internet Adoption (Source: World Bank, ITU, 2019)



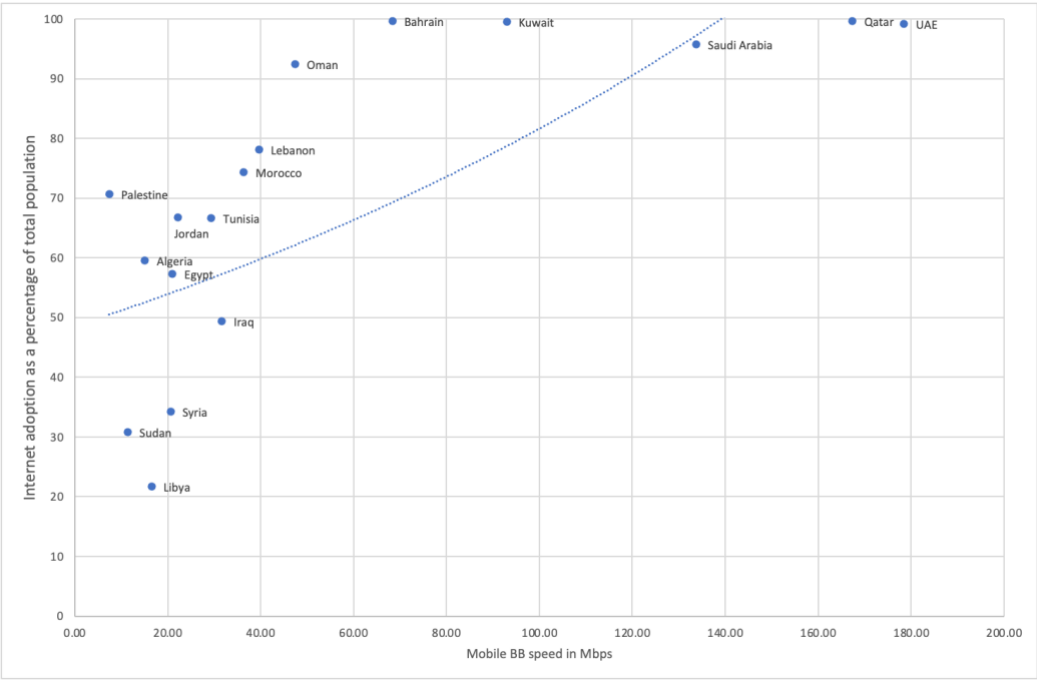
However, even in urban areas where there is availability, adoption may be low because of affordability. The following chart shows that there is a negative correlation between the cost of a typical broadband package as a percentage of average income and the adoption of broadband. In Yemen, for instance, the mobile broadband data package is 10% of average income, and adoption is under 30%.

Figure 4: Mobile broadband affordability and Internet adoption[5] (Source: ITU, 2019/2020)



Finally, there is a positive relationship between the quality of the services, as measured by download speed, and the adoption of Internet, as shown in the following chart.

Figure 5: Mobile broadband speed and Internet adoption[6] (Source: Ookla, ITU, 2021/2019)



5 Affordability data is not available for Syria.

6 Broadband speed is not available for Djibouti and Yemen.

Of course, there are multiple layers of causation across these charts. Countries with lower income levels tend to have lower urban populations, so broadband will be more expensive and less affordable to the average user. With less demand and fewer users, there is typically less investment in low-income countries, so that broadband speeds are lower. In sum, all these variables correlate with low Internet adoption, and highlight areas and regions where community networks may be most impactful—in rural areas where broadband is not available, or more generally where broadband is available but not affordable, and where broadband speeds are slow.

It is worth stressing that areas where community networks are beneficial include urban areas, even in wealthy countries. As an example, the NYC Mesh network provides Internet access to 800 households in underserved areas in New York City.[7] The network is developed, operated, and maintained by volunteers. The costs of the equipment are covered by the household if they can afford it, and they suggest a monthly donation to cover the running costs. The network started in 2014 with Internet Society support and has negotiated free access on city buildings for nodes, but otherwise is self-supporting by the community.

Alternative Efforts to Bridge the Digital Divide

In our efforts to identify community networks in the region, we saw a very interesting emerging example in Yemen (see box), which highlights what a determined community, led by a local champion, can achieve with government acceptance. However, we also identified several efforts of private individuals to offer shared Internet access to lower subscription costs that demonstrate the benefits that community networks could bring, but that ran counter to local laws and regulations and were ended.

In the region, we uncovered one way to offer Internet service: for an enterprising individual or small group to purchase retail Internet access and resell it to their neighbors. There are examples of this in many countries in MENA with lagging Internet adoption, including Egypt, Palestine, Iraq, Yemen, Jordan, and Lebanon. In many cases, the individuals purchased a significant amount of equipment, including routers, servers, and signal boosters, to sell the service to neighbors. These efforts were shut down by authorities as they did not have a license to offer service and ran counter to the commercial conditions of the Internet access being resold.

While there are legitimate concerns with these unlicensed services, including reliability, quality of service, and security breaches, within them there is an important signal to governments about the demand for affordable Internet access, and the ability of individuals or small groups to deliver such access. The emerging community network in Yemen explored met government conditions to offer

7 https://www.nycmesh.net

service. It was spearheaded by the Internet Society Chapter in Yemen and was described to us by the president of the chapter.

Community Network in Yemen

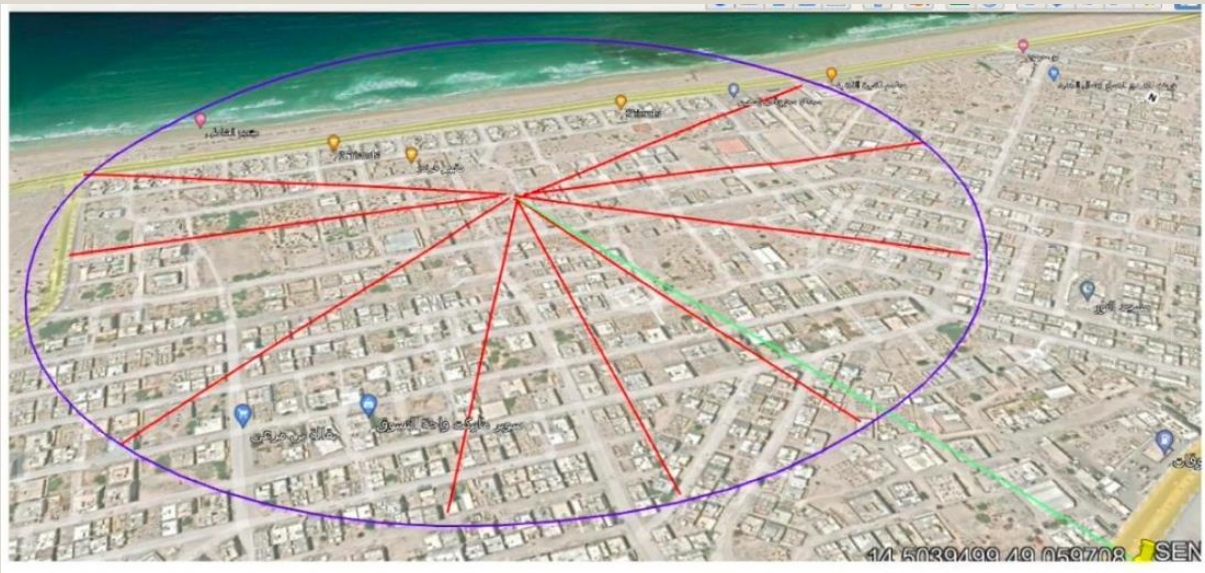
In Yemen there are significant challenges to bringing people online. First, there are areas where the Internet is not available, given the growth in cities and villages with no telecom infrastructure. Even where there is availability, fixed and mobile broadband is unaffordable for most individuals. Further, the general situation in Yemen is unsettled, with poor economics and high inflation. Finally, there are regulatory challenges in accessing licenses for spectrum, with high fees and complicated clearances.

As a result of these complications, the Internet Society Yemen Chapter decided to set up community networks, focusing in areas far from the center of unsettled governorates or cities, where the local authorities offered less regulation complications and a better understanding, and where the local community was willing to play a leading role in overcoming obstacles and implementing the community network.

The Internet society Yemen Chapter took a long time evaluating the areas and exploring the legal and cultural risks in all the alternatives. After extensive research, we chose a newly populated area in Almukala with no telecom infrastructure. We looked for local partner to manage the stakeholders from the community and have a legal permit to operate as an NGO, which proved excellent for the project.

The project will build a community network in the Bajarsh neighborhood in the city of AlMukalla in Yemen. The network will be managed by a local grassroots organization, Watan Foundation for Development and Training, through the Internet Society Yemen Chapter.

The area covered is around one km^2 of the high-density residential neighborhood. As shown in the map below, the area covered is within the purple circle, while the backhaul microwave connection is the green line from the nearest point with optical fiber connection. The area served is home to over 1,500 people and we expect the majority of those to benefit from this project.



The project will make access tokens available to residents of the area for a nominal fee that will feed into the running costs of running the network. We feel strongly that the community network model is one that will help individuals realize the goal of governments to bring people online.

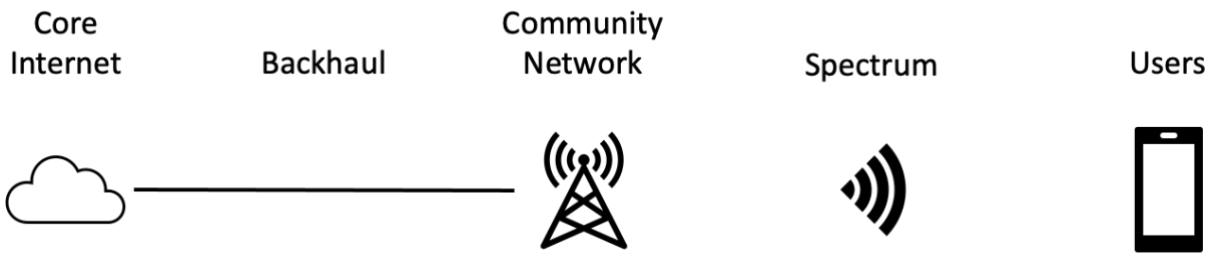
Sharaf Azzain, Entrepreneur and founder of Ultimate STC;
president of Internet Society Yemen Chapter

The topics below help to define what is needed to develop a community network, which consists of both physical network infrastructure as well as human infrastructure to operate and use it. More broadly, a community network needs a license, possibly permits for putting up the network, and funding to establish and keep it operational. An enabling environment helps communities meet these requirements.

Infrastructure for Community Networks

We start with the physical infrastructure, which must be available to deploy the network.

Figure 6: Physical infrastructure of a community network (Source: Internet Society, 2021)



In terms of physical infrastructure, the typical community network is wireless to lower the deployment cost—by not having to run wires throughout the community. Wireless networks require the use of radio spectrum to send and receive data. Community networks often use Wi-Fi to provide access, because the relevant spectrum is unlicensed, and a wide variety of end-user devices already have Wi-Fi capabilities. Otherwise, they may use mobile technology, which covers a wider area than Wi-Fi but requires access to licensed spectrum. Either way, the networks need equipment to operate, and the users need devices to take advantage of connectivity. Finally, the community network needs access to backhaul that reaches the core Internet in the country and beyond.

It is not enough that these parts of the physical infrastructure are available, they must also be affordable.

The specific infrastructure needs of a community network depend, in part, on the technology chosen for providing access and backhaul. In the topics to follow, we offer more information on each of the infrastructure components mentioned.

Spectrum

To deliver Internet access at the lowest cost, a community network requires access to spectrum. The type of spectrum depends on the technology used. The likeliest choices are Wi-Fi or mobile (for instance 3G or 4G). Using mobile spectrum has the advantage that the coverage of the network will reach a wider area than a Wi-Fi access point, which may be advantageous to cover a rural village. On the other hand, mobile spectrum requires access to licenses, which is likely to have a cost, while Wi-Fi spectrum is unlicensed with no cost. The equipment to provide access and end-user devices for both Wi-Fi and mobile are available from a wide variety of competitive vendors.

As noted, **Wi-Fi** is attractive for several reasons. First, the spectrum is unlicensed, avoiding the cost of licenses, which can be significant in some countries. Second, Wi-Fi equipment is readily available and low cost because of the economies of scale from significant levels of production. And finally, many existing devices are already Wi-Fi capable, and thus may already be available to potential users of

the community network, or at least readily available for purchase. While Wi-Fi devices are as inexpensive as any possible devices, they may still not be affordable, an issue we address below.

The common spectrum bands for Wi-Fi are in 2.4 GHz and 5.0 GHz. As they are shared bands, they can become congested. However, that is unlikely to be the case in rural areas where the community network is the first provider of Internet access. In urban areas there may be more usage of these bands outside the community network, but as highlighted in the NYC Mesh example above, such networks can work well even in developed and dense cities.

While all the common versions of Wi-Fi can use these bands, the new Wi-Fi 6E uses spectrum in the 6 GHz band.[8] The advantage of the 6 GHz band is that more spectrum is available in that band, allowing for significantly higher bandwidth. Saudi Arabia is the first country in the region, and one of the first in the world, to designate this band as license-exempt for Wi-Fi 6E usage.[9] Any community networks using that band, once equipment is widely available, would be able to boast broadband speeds rivaling those of fiber networks.

Mobile broadband is also attractive. First, it can be used in lower frequency bands than Wi-Fi, which propagate better, enabling wider coverage. Second, as with Wi-Fi there is a broad choice of equipment and devices, including devices that can convert the mobile broadband into Wi-Fi to create a hotspot that can be used by non-mobile devices, such as tablets and personal computers.

Access to licensed spectrum can be a challenge, both in terms of availability and cost. In many countries mobile spectrum is auctioned to operators, often on a national basis, and at considerable cost. Community networks usually can't afford, and ideally should not need, such access. Innovative approaches have emerged in recent years, which address the needs of community networks while avoiding interference in the frequency bands with other users of the spectrum, such as the examples below:

- The regulator may offer a "social purpose license" to community networks, given their role in connecting the unconnected, and provide a spectrum license involving the frequency needed for the network and in that area, at a favorable cost, or no cost, to help to close the digital divide.
- A mobile operator could share access to its licensed spectrum for the community network. In rural areas where the mobile operator does not provide service, this can be mutually beneficial. The community network can provide service, and the mobile

8 Wi-Fi refers to the IEEE 802.11 technical standards, and the different versions include a, b, g, n, and others, which the Wi-Fi Alliance began to refer to as Wi-Fi 1 through 6.

9 https://www.rcrwireless.com/20210331/network-infrastructure/wi-fi/saudi-arabia-designates-entire-6-ghz-band-for-unlicensed-use-paving-way-for-wi-fi-6e

operator contributes toward closing the digital divide, possibly addressing their coverage obligations.

- Finally, there is dynamic sharing of spectrum, in which the owner of the spectrum license, be it an operator or the government, has the right to primary access while the community network has secondary access, meaning that it has to ensure that it is not causing any interference, which is anyway unlikely in rural areas with little spectrum usage.

The key issue is the likely trade-off between cost and coverage, with the higher-coverage mobile networks, which are better suited to rural areas, having greater license costs. On the other hand, in urban areas, Wi-Fi networks using unlicensed spectrum have been successful to complement the broadband coverage of mobile operators.

Backhaul

There are three types of backhaul that can be used to connect a community network to the Internet: fixed, wireless, or satellite. The viability of these depends on many factors, such as: the location of the community network; the availability of the backbone; and its cost. We examine each below.

Fixed — This would typically be fiber optic cables, which provides the highest throughput and reliability of all of the forms of backhaul, with the lowest latency. Where such backhaul is readily available, then the main issue would be accessibility and cost of access. This is most likely to be available in urban areas—in rural areas there may be fiber points of presence (PoPs) in the vicinity, which would need to be reached with additional backhaul solutions. Community networks would require access to the backhaul at affordable wholesale rates.

Wireless backhaul — There are a variety of technologies that could be used for this, including Wi-Fi technology. However, this does not cover long distances affordably because it typically requires line of sight between antennas, and thus a number of towers—with power sources—would be needed to cover long distances. If the distance to a fiber point of presence is relatively short, the cost can be affordable, particularly using unlicensed spectrum. For longer distances, new technologies are emerging that offer fiber-like backhaul in high frequencies that could be allocated without the need for a license.

Satellite backhaul — Finally, satellite is an option to directly reach the most rural locations without the need for fiber backhaul near the communities. Traditional satellites are in Geostationary Earth Orbit (GEO), which adds latency owing to the distance. However, the costs and speed of satellite access are steadily improving, particularly the new Low Earth Orbit (LEO) constellations, which can provide backhaul to a dish attached to the Wi-Fi equipment. In terms of cost, it is typically dependent on the bandwidth used, with no fixed cost other than the equipment, and thus can scale with the network. Such networks should be licensed in the relevant spectrum bands.

The backhaul decision is in large part determined by the location of the community and existing infrastructure. Where fiber is available, it provides the best performance and may be combined with wireless backhaul to get from the fiber PoP to the network. In very rural areas, satellite backhaul may be required, which should improve with the new satellite constellations being deployed. For wireless and satellite, it is important to ensure that spectrum is allocated, particularly for newer, innovative technologies.

Equipment

The community network needs **equipment** to operate the network, both to provide access and for backhaul. In general, the equipment should be both readily available and affordable. In addition, the users of the network will need **devices**, which also should be available and affordable. Finally, in addition to availability, it should be possible to easily maintain the equipment if needed.

The availability of the equipment can depend on several factors. Equipment may need type approval in a country, for instance to confirm that wireless transmissions conform to power limits, and equipment purchased from abroad would need to go through customs. Both issues can add to the cost and time needed to deploy the network. If the equipment is manufactured or already available for sale in the country, then availability is established, and this is not an issue.

In terms of affordability, equipment with broadly used standards, such as Wi-Fi, will be available at a lower cost because of the economies of scale in manufacturing. Equipment imported from abroad may be subject to customs duties, which add to the cost, and any equipment sold in the country may be subject to sales taxes and other levies which increase the cost. This adds to the cost to develop and access a community network, reducing the benefits that can be realized.

A new open model for equipment is developing. For instance, the Telecom Infra Project (TIP) has developed specifications for OpenRAN technology (which can deliver mobile broadband) and for Open Wi-Fi.[10] The specifications can be used by multiple vendors and is open so that networks can use equipment and software from multiple vendors, which can lower the cost of deploying networks. Such equipment can provide significant benefits and should be supported.[11]

The affordability of end-user devices is often a significant barrier to access. These devices are typically imported, and customs duties should be kept affordable or waived to promote access. Likewise, additional levies on sales should be avoided. Devices can also be subsidized using Universal Service Funds.

10 https://telecominfraproject.com

11 https://telecominfraproject.com/openran-bring-285-billion-global-gdp-gains-stimulated-by-tip-initiatives-develop-open-disaggregated/

Readiness for Community Networks

There are also additional requirements to establish and operate the network. The network will need an operating license, which ideally is tailored to the needs of a community network and affordable. It will need trained engineers to deploy and operate the network, and users will need digital skills to access and benefit from the Internet. Last, but not least, funding is needed to establish and operate the network.

Operating License

To establish a community network, in compliance with local legal requirements, there is likely the requirement of a license for many reasons. First and foremost, it is typically a requirement for telecommunications operators, providing both rights and responsibilities. A license would provide the right to access any licensed spectrum to offer service, it might be requirement to access wholesale backhaul, and it could allow access to Universal Service Funds to build and operate the network. At the same time, it would provide the responsibility to comply with relevant regulations relating to privacy, security, quality of service, and other aspects.

It is important to note, however, that a community network differs from traditional telecom operators along some dimensions:

- A community network may offer service to tens or hundreds of users in a limited geographic area, as opposed to traditional telecom operators who may provide service across the entire country, potentially to millions of users.
- A community network may effectively offer service to its members, being open for more people to join them. This is opposed to the public service offered by a traditional telecom operator.
- Community networks are typically nonprofit, as they are often operated by the community using the network, as opposed to the for-profit operators that operate public fixed and mobile networks.
- Finally, a community network is developed to fill a market gap left by traditional operators for whom it is not commercially viable to meet the demands of the targeted customer base.

As a result, several countries have policies that promote community networks, because they complement the services of the main operators by reaching unserved and underserved areas, while helping to reduce the digital divide. Some countries offer licenses based on the geography or number of users. These licenses can be streamlined, with lower costs than traditional licenses, including less administrative requirements, while maintaining key network responsibilities. In Brazil, for instance, providers with fewer than 5,000 users are exempt from licensing requirements—they must simply notify the government that they are offering service.

Capacity Building

General awareness of the benefits of a community network is necessary at all levels: at the national level, the policymakers and operators should be aware to accommodate community networks; at the community level, local champions are needed to help create awareness at the national level and to develop community demand for networks; and the community members themselves need capacity building to create and use the network.

There are many online resources available at all levels. The Internet Society has already developed a handbook for community organizers to assess readiness for the network[12]. Studies such as this one help identify the policies needed at the national level to create a community network, and online resources are available to help provide digital skills to community members. However, every country has different policies, and every community different needs, and thus the key factor is the catalysts who initiate the dialogs on community networks at the national and community level and can tailor this dialog toward local conditions.

Finally, training is needed to develop and operate the network, and users must acquire digital skills to be comfortable to go online. Training may be provided at existing institutions in the country or through online courses. Digital skills may be provided in schools and universities, and in communities through trainers who can offer courses and hands-on assistance.

Funding

Funding is at the heart of the challenge for both types of community networks: those in unserved areas where deploying a network is not commercially viable because of the low returns; or in underserved areas where there is a network, but the price is too high for potential users. While community networks can be deployed and offered at low costs, they still require funds to start up, run, and remain sustainable. In particular, it is important to not just focus on the cost of setting up the network, which is a one-time expense, but also on the monthly cost to operate it, including the cost of backhaul access. It is also important to have provisions to maintain or replace the equipment, as needed. This is particularly challenging in areas where the population is scarce or incomes are low.

Regardless of the source of the funding, the first step is to minimize the costs needed. A Wi-Fi network is a good choice on those grounds, because the spectrum access has no cost, and equipment can be inexpensive. Equipment costs are impacted by import and sales taxes, which enabling policies can lower as a means to increase Internet adoption and usage. And finally, negotiations with the backhaul operators may lead to discounts on access to help lower the digital divide and potentially help the operators meet coverage requirements.

12 Footnote when the handbook is ready.

Funding may be available through a country's Universal Service Fund (USF), which is established with the specific goal of reducing the digital divide in a country. As a licensed operator, a community network should qualify for funds, which, depending on the country, could go toward deploying and operating the network, or to subsidize adoption by users. Accessing the USF can be done by the community organizers, working with the USF authority.

In addition, the Internet Society Foundation provides grants to set up community networks and access training. These grants have been used to setup community networks all over the world, including in Brazil, Kenya, Georgia, and Greece.[13] Grants may be available from other sources as well. However, it is critical to make sure that there is a business plan for covering ongoing costs and maintenance, whether from user charges or other sources.

Conclusion

The benefits of Internet access are well established and growing (in light of the need for connectivity during periods of lockdown and social distancing). At the same time, the rate of growth of adoption is slowing, as commercial operators have largely focused on areas where take-up will be the greatest. Community networks are a means to bridge the resulting gap, by developing networks from the bottom up, for, and by the community that will benefit. Efforts by policymakers and regulators can help to create an enabling environment, where community networks can emerge and thrive.

Community networks can thrive in both rural areas which are unserved and in urban areas which are underserved. They need physical infrastructure to provide access, and they also need human infrastructure to develop and operate the networks, and users with the digital skills to access the networks. They also need to satisfy regulatory requirements that apply to Internet access providers in their country. The following table summarizes the requirements and regulatory actions that could help networks meet those requirements.

13 See, for instance, https://www.isocfoundation.org/story/three-new-community-networks-are-helping-safeguard-communities-in-rural-brazil/

Figure 7: Summary of Readiness for Community Networks

Elements	Requirements	Policy and regulations
Spectrum	Unlicensed spectrum for Wi-Fi networks	Sufficient unlicensed spectrum, including consideration for allocating spectrum in 6 GHz for new Wi-Fi versions
	Licensed spectrum for mobile networks	Innovative licenses targeted at community networks to keep access affordable
Backhaul	Fixed backhaul	Ensuring that community networks can access fixed backhaul at affordable wholesale rates
	Wireless backhaul	Allowing innovative wireless technologies and corresponding spectrum allocations
	Satellite backhaul	Licensing satellite providers, including notably emerging low earth access constellations
Equipment	Network equipment	Reducing the cost and time for approving and importing equipment
	End-user devices	Reducing import duties and sales taxes to make them affordable
Approval	Operating license	Lowering the cost and requirements for licenses for community networks, or eliminating the need for a license
Training	Operators	Training to develop and operate the network, which could be from existing institutions or online
	End users	Digital skills to help users go online—can be offered through community centers or courses
Funding	Deployment	Enabling community networks to access Universal Service Funds or similar sources to close the digital divide
	Operations	Operations can be covered by contributions from the users, with possible government subsidies

We hope that the example of the emerging community network in Yemen, as well as the desire of individuals in other countries to fill the digital divide with unauthorized Internet offerings, motivates governments to create an enabling environment for authorizing community networks in their countries. These are proven ways to bring users online with affordable access, built by members of the community who are also the beneficiaries. The results will help to fulfill the goals of governments to deliver the social and economic benefits of the Internet to all their citizens.

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