APC ISSUE PAPER

NETWORK INFRASTRUCTURES THE COMMONS MODEL FOR LOCAL PARTICIPATION, GOVERNANCE AND SUSTAINABILITY

By Leandro Navarro

EXECUTIVE SUMMARY

Network infrastructures provide connectivity, a critical resource for our digital lives, and are therefore key for social inclusion and public participation. There are many technical, economic and operational ways to provide internet connectivity. In this paper we describe a model to develop network infrastructure as common property, governed under the principles of common-pool resources. The model is based on the principles of cooperation instead of competition – because universal connectivity can only be achieved if everyone has the right to create their own connectivity. There are many examples of how communities have succeeded in organising to achieve this. The result is local community network infrastructures that are open, sustainable and adapted to local conditions, which can produce abundant connectivity and support local socioeconomic development, everywhere and for everyone.

Leandro Navarro has a background in computer networks and telecommunications. His main focus of research and social activism is around commons in the context of universal access through community networks, community clouds, and circular economy models for digital devices. He was a co-founder of APC member organisation Pangea.org, an internet service provider for social organisations and activists in Barcelona. He is also an associate professor at the Technical University of Catalonia. Email: leandro@pangea.org

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INTRODUCTION

Network infrastructures are critical resource systems that provide local and global connectivity to enable social inclusion and participation. Digital content and services can develop and thrive on top of these infrastructures. Given the function of these infrastructures as public resources to communicate and provide access to knowledge, they should be accessible to all members of society. Network infrastructures can involve diverse actors, businesses and ownership models: for example, licensed mobile networks, fixed-line commercial internet service providers (ISPs), international internet carriers, private open access network operators, internet exchange points (IXPs), public network operators, and content and service providers of various kinds. The global interconnection of these is the internet. The diversity and the choice that these alternatives offer are good ingredients for sustainability.

The governance of the internet involves global and regional arrangements, but it is at the local level where discussions and agreements become specific, and where communities, neighbourhoods, towns and regions must make decisions on how to manage internet access infrastructure in a way that makes sense for them. This means adopting or developing policies and regulations, defining societal needs, planning to fulfil those needs, and selecting the different elements of local network infrastructures. In addition, it is necessary to define the governance of the resource itself, including information sharing, communication, coordination, and conflict resolution.

In this issue paper, we discuss local network infrastructures and how they can be productively managed and governed as open commons. We argue that given the limitations of market competition in achieving universal access, local network infrastructures, based on principles of non-discriminatory open access and open participation, are essential for achieving universal social inclusion.

MISSING MARKETS: THE LACK OF COMPETITION

The growing adoption of data networks as a public good, and the fact that they are sometimes the only option for communicating with many other people and accessing most information, have promoted the view that internet access is an essential service (sometimes called a "universal right", not to be confused with "universal service", which we are far from delivering). Yet the deployment and operation of networks and services requires investments that involve economies of scale. The concentration of consumers in urban areas makes infrastructure investment in these areas commercially feasible (profit oriented). As the population density decreases and the distance from major cities increases, or the economic capacity of customers decreases,[1] the margin for commercial exploitation decreases or becomes negative.

To provide these services to every citizen, in particular in remote areas that are generally underserved and may not be in the market economy, public administrations have developed policies that promote and try to ensure a minimum level of service for all citizens independently of their location. These policies range from subsidies to network operators in exchange for offering services in these areas, to public investment in the development of complementary network infrastructures, or the definition of public (regulated) prices for key services. Several governments have gone as far as to declare access to the internet a universal right.[2]

However, network infrastructures are still in most cases under the control of the former telecommunications monopolies transformed into telecom incumbents. These entities control the market offer and have strong lobbying mechanisms in place to influence regulation and discourage competitors that might affect their present or future business results. Except for the most developed urban areas, the most common situation is a lack of competition, defined as "market failure". The typical "market" structure is rather disappointing, with one or a few large telecom providers acting as oligopolies and exercising cartel practices, which justifies public intervention.[3] Furthermore, we find increasing horizontal and vertical integration with content provision – large multinational operators owning all the network elements in many countries, including international submarine links, often combined with the bundling of streaming TV channels with broadband access service provision.

This has been recognised as a critical challenge by the International Telecommunication Union (ITU),[4] which

1 As in the case of a subsistence economy, which is based on natural resources to provide for basic needs and is non-monetary.
2 For more information, see: https://en.wikipedia.org/wiki/Right_to_Internet_access
3 European Commission. (2014). *Guide to High-Speed Broadband Investment*. ec.europa.eu/regional_policy/en/information/publications/guides/2014/guide-to-high-speed-broadband-investment
4 International Telecommunication Union. (2008). *Trends in Telecommunication Reform 2008: Six Degrees of Sharing*. https://www.itu.int/pub/D-PREF-TTR.10-2008

explores and proposes options based on the principles of separation and sharing, to be managed by governments through legislation, regulation and subsidies. The most important recommendations are:

- Extending access to fibre backbones: Open access to bottleneck or essential facilities (such as fibre infrastructures), which encourages the development of multiple providers of any size and scope, and promotes investment in high-capacity infrastructure for unserved or underserved areas.
- Mobile network sharing: An equivalent to the previous recommendation but applied to the mobile network, for both passive and active elements[5] of the network.
- Spectrum sharing: Promotion of the spectrum "commons", with administrative licensing,[6] unlicensed bands, and commercial or technical measures such as dynamic spectrum access[7] or cognitive radio.[8]
- International gateway liberalisation: Such as liberalisation of access to submarine cable systems, avoiding any anti-competitive control from incumbents.
- Functional separation: Also known as operational separation, creating separate business divisions within operators, or structural separation, creating separate legal entities, so as to avoid concentration and cross-subsidisation.
- Cost sharing: Such as infrastructure sharing and "dig-once"[9] requirements.
- User sharing: Sharing of a computer, mobile access, internet link or content, across a group of people, such as in schools, libraries and other public access spots such as telecentres or shops, by offering wholesale access for a group of users to backhaul providers.

5 According to broadband research, the structure of a modern network service consists of three interdependent layers: a) the passive infrastructure, b) the active infrastructure, and c) the delivery of service, as illustrated in Figure 1. In the Open Systems Interconnection (OSI) model, the passive infrastructure corresponds to layer 1 (physical), the active infrastructure corresponds to layers 2 (data link) and 3 (network), and the delivery of services includes the remaining layers (from transport to application).

6 Public administrative control of the spectrum assigned to a user or a licensee, in contrast with market-based methods of trading spectrum rights, or technical protocols.

7 Selective and dynamic access and usage of unused spectrum.

8 A radio that can sense the electromagnetic environment to dynamically adapt and vary its operating parameters.

9 A cost-saving policy granting ISPs access to public "rights-of-way". It can also mandate the installation of conduits for fibre-optic cable during road construction, or help coordinate ISP installations while roads or streets are dug up.

For instance, responding to the first recommendation, the European Commission has introduced the cost reduction directive (2014/61/EU), with measures to reduce the deployment cost of high-speed electronic communication networks.[10]

Each of these measures can help develop new models that can make a great difference in the expansion of the coverage and usage of data networks for the socioeconomic benefit of every person in the world. However, in most cases and countries, these recommendations have not been implemented after nearly a decade since they were first proposed.

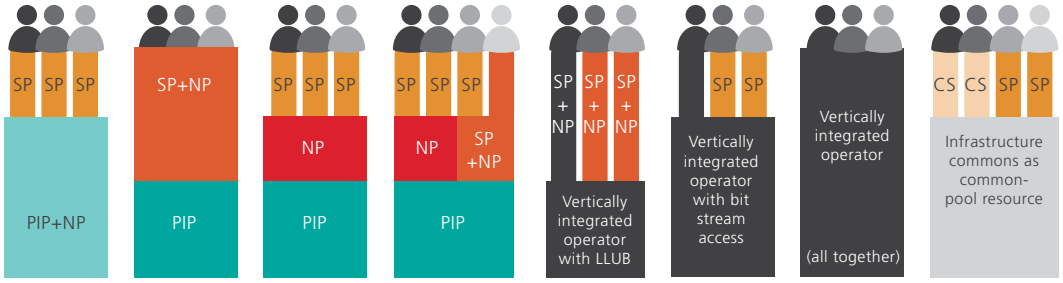
MODELS OF NETWORKS

The typical business models of modern data networks follow one of the structural models depicted in Figure 1. Nevertheless, in some cases (and countries) functional or structural separation is in place to prevent anti-competitive, discriminatory behaviour by incumbents. The ultimate goal in these cases is to promote cooperative cost-sharing schemes to reduce the cost of deploying infrastructures of any kind (telecom-related and others such as roads, water and electricity infrastructures that require expensive civil works), and promote competitive market offerings to widen the choice and reduce the cost of services to customers.

The models differ in the functional separation across layers, as recommended by the ITU, ranging from vertical integration across all layers in *e, f, g*, partial separation in *a, b, d*, and full functional separation in *c*. The models also differ in terms of alternatives and therefore competition in each layer, except the passive infrastructure, which tends to involve a single actor (the physical infrastructure provider) in charge of deploying and operating either the backbone or an access area. While all models except *g* offer alternatives in service provision, only *d* and *e* provide alternatives in network provision. In contrast, cooperative models (*h* in the diagram) are excellent ways to develop infrastructures that cannot be developed by a single participant, such as a monopoly service provider, or that are too costly to replicate and just left to competition in order to scale. Diverse types of

10 European Parliament and Council. (2014). *Directive 2014/61/EU of the European Parliament and the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks.* https://ec.europa.eu/digital-single-market/en/news/directive-201461eu-european-parliament-and-council

FIGURE 1. Different types of division and separation across the three service layers[11]



PIP: Physical infrastructure provider
NP: Network provider
SP: Service provider
LLUB: Local loop unbundling
CS: Community service

local cooperative schemes fit and build on these cases. The most typical are open access networks (OANs), community networks and IXPs.

In OANs[12] anyone can connect to anyone in a technology-neutral framework that encourages innovative, low-cost delivery of services to users. In other words, multiple providers share the same physical network. In many cases, these OANs are publicly owned and rely on public-private partnerships. The service is defined and governed by the public partner but implemented and operated by one or multiple private partners. Municipalities sponsor or build the physical infrastructure (fibre optic lines, wireless access points, etc.) offering wholesale access, and independent ISPs operate in a competitive market using the same physical network to provide retail services. One of the most well-known examples is the open access network in Stockholm run by the public company Stokab,[13] which follows the *d* model in Figure 1, and has a recognised socioeconomic impact in the metropolitan area of Stockholm.[14]

Community networks are network infrastructure commons, built by citizens and organisations which pool their resources and coordinate their efforts, characterised by being open, free and neutral.[15] They are open because everyone has the right to know about and participate in them. They are free because the network access is driven by the non-discriminatory principle; thus they are universal. And they are neutral because any available technical solution may be used to extend the network, and the network can be used to transmit data of any kind by any participant, for any purpose. The tech-nologies employed vary significantly, ranging from very low-cost, off-the-shelf wireless routers and access points (Wi-Fi, GSM) to expensive optical fibre equipment.[16]

One representative example is guifi.net,[17] a free, open and neutral, mostly wireless telecommunications community network, with over 34,000 active nodes (as of December 2017), the majority being located in Catalonia and Spain. The network is self-organised and operated by the users, utilising unlicensed wireless links and optical fibre links.

Another example of network infrastructure commons are IXPs, physical infrastructures through which ISPs and content delivery networks (CDNs) exchange internet traffic (peering) between their networks, which are autonomous systems.[18] In most cases, the switching infrastructure is built and managed as a common pool resource (CPR), according to the *h* model in Figure 1, although the governance may be centralised or participatory. IXPs and community networks are quite comparable, with the main difference being that IXPs connect larger entities only and community networks focus on individuals and

11 Adapted from Forzati, M., & Mattsson, C. (2013). *Twenty years of open fiber network in Stockholm: A socio-economic study.*
12 Battiti, R., Lo Cigno, R., Sabel, M., Orava, F., & Pehrson, B. (2005). Wireless LANs: From WarChalking to Open Access Networks. *Mobile Networks and Applications, 10,* 275-287.
13 Felten, B. (2012). *Stockholm's Stokab: A Blueprint for Ubiquitous Fiber Connectivity?* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2114138
14 Forzati, M., & Mattsson, C. (2013). Op. cit.
15 The Declaration on Community Connectivity by the UN IGF Dynamic Coalition on Community Connectivity (DC3) provides more details: http://hdl.handle.net/10438/19401
16 Avonts, J., Braem, B., & Blondia, C. (2013). A questionnaire based examination of community networks. *2013 IEEE 9th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob)*, 8-15.
17 https://guifi.net/en
18 https://en.wikipedia.org/wiki/Internet_exchange_point

households. However, the difference blurs as they expand, with the examples of guifi.net and HUBS[19] in the UK, which are both community networks and de-facto regional IXPs.

INFRASTRUCTURES AS COMMONS

The common property or common pool resource (CPR) governance model is a traditional and recognised model for shared resource systems.[20] Open commons are expressly open for participation by any stakeholder that is willing to contribute to their sustainability in exchange for the benefits it can extract (networking, computing, storage and services). In contrast with natural commons such as fisheries or forests that are given and limited, open commons are extended by new participants as they contribute the required resources to expand the capacity and coverage of the infrastructure. Participation is not limited to accessing the resource system for consumption or contribution, but it is also open for participation in management, and in the definition of its governance rules. Moreover, the commons, open or limited due to capacity, are self-organised structures; therefore, their sustainability depends on and benefits from contributions from all participants.

According to Ostrom, a CPR typically consists of a core resource that provides a limited quantity of extractable fringe units. In our case, the core resource is the network, which is nurtured by the network segments that the participants deploy to reach the rest of the network or to improve it. The fringe unit is the connectivity that participants obtain. Resilient CPRs require effective governance institutions to keep a long-term direction, as they can be faced with accommodating many actors and changes in a complex system. The long-term direction is defined as sustainability in remaining productive or operational under the fundamental principles of the CPR.

According to Frischmann,[21] public goods and non-market goods, such as network infrastructures, generate positive externalities (or positive effects) that benefit society as a whole by creating opportunities and facilitating many other socioeconomic activities. Therefore, open network infrastructures have great social and economic value, although their benefits are sometimes hard to measure. An infrastructure that is cooperatively managed and sustained can leave a greater margin for added value activities and local impact than commercial network infrastructures that are developed competitively and typically oriented to extract service fees from users. This makes a great difference in developing regions or communities, where affordability is a key constraint on effective, meaningful internet access.

EFFECTIVE LOCAL GOVERNANCE

Two principles are fundamental for governance structures inspired by the idea of a commons:

- Non-discriminatory and open access: Access is non-discriminatory because pricing is determined using transparent mechanisms, typically cost-oriented. Access is open because everybody has the right to join and use the infrastructure according to the access rules.
- Open participation: Everybody has the right to join the community to participate in the construction, operation, provision and governance of the infrastructure.

STAKEHOLDERS

According to roles and interests, several groups can also be identified: i) volunteers, interested in aspects such as neutrality, privacy, independence, creativity, innovation, DIY, or protection of consumers' rights; ii) professionals, interested in aspects such as demand, service supply, and stability of operation; iii) consumers, interested in network access and service consumption; and iv) public administrations, interested in managing specific attributions and obligations to regulate the participation of society, usage of public space, and even in satisfying their own telecommunication needs. Preserving a balance among these and other stakeholders is desirable, as every group has natural attributions that should not be delegated to or undertaken by any other.

NETWORK INFRASTRUCTURE AS A COMMON POOL RESOURCE

When these fundamental principles are applied to an infrastructure, they result in networks that are collective goods and governed as CPRs.

19 https://hubs.net.uk
20 Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.
21 Frischmann, B. M. (2007). Infrastructure commons in economic perspective. *First Monday, 12*(6). firstmonday.org/article/view/1901/1783

In a complex network infrastructure we can find cooperative and competitive elements that combine with each other. Competition has the cost of duplication, the benefit of provision of alternatives with a reduction of coordination costs, and the risk of losing market share or market failure. In contrast, cooperation has the cost of coordination and consensus, the benefit of facilitating the building of infrastructures that combine the limited resources contributed by each participant, and the risk of interdependency. When cooperation and competition combine, typically we find cooperative schemes in the lower layers that create opportunities for alternatives, with competition and diversification in the upper layers of the network stack. In many regions, the large operators end up competing with a cooperative of smaller organisations that pool their resources to upscale.

THE BUNDLE OF RIGHTS

It is essential to clearly identify the interests and specific tasks of the different stakeholders, and the relevant conflicts of interest, with respect to a common property. As the community managing a commons can be divided into various sub-communities depending on their role, the bundle of rights[22] becomes a useful additional analytical grid to further break down these tasks. The bundle of rights distinguishes:

- Access: The right to enter and connect to the network (contribute resources, link up).
- Withdrawal: The right to "extract resources" from the system (obtain connectivity).
- Management: The right to regulate usage and make improvements.
- Exclusion: The right to determine who will have access and how this right can be transferred.
- Alienation: The right to sell a portion of the resource (e.g. by professional participants selling connectivity to their customers).

In the case of network infrastructures, people who accept the individual participation principles[23] and link up[24] to the network are given access rights and at the same time withdrawal rights (consumption of connectivity). By implicitly or explicitly accepting the collective governance principles, these people have the right to participate in the governance of the infrastructure (management rights). The mechanism for inclusion and exclusion is defined by a deliberation process among the assembly of participants (having the right of management) or by predefined rules, and is generally implemented and automated by a software service to register, enrol and configure the new resource unit (link and router).

EXTENSIBILITY OF THE INFRASTRUCTURE COMMONS AND THE BENEFITS OF CONNECTIVITY

Once a new connection is successful, participants are immediately able to consume connectivity but also to provide connectivity to others connected to their router. Therefore, participants are both consumers and producers of connectivity, and joining also implies extending the resource system in a new location and allowing third parties to extend it beyond. This is an important difference from natural commons, which are not extensible. Exclusion in a fishery or grassland can prevent access to avoid a limited resource from being overused and eventually depleted. Network infrastructures in commons are extensible by the participants, and communities can define procedures to contribute to increase the capacity (e.g. investment mechanisms, participation fees) and avoid congestion as the network expands.

In a few cases, people may link up to a community network using an end-user client device, such a personal computer, server or mobile device but not a router, using a wireless (Wi-Fi or GSM) access point or Ethernet cable. In such cases, these are pure consumers of connectivity that do not etend the resource system. This allows externals or visitors (anonymous or not) to take advantage of the connectivity provided by the infrastructure without any contribution required, as an open-access resource, for the benefit of the local community at large. Sometimes this type of access is provided in collaboration with an institutional sponsor such as a government in locations such as public libraries, schools or telecentres, or during an emergency.

22 Schlager, E., & Ostrom, E. (1992). Property-Rights Regimes and Natural Resources: A Conceptual Analysis. *Land Economics, 68*(3), 249-262.

23 In some communities, these are formalised as a community participation licence that is even legally binding.

24 Expanding the infrastructure commons by adding network nodes (routers) and links in new locations.

There are other beneficiaries of the connectivity that are not involved in or even aware of the governance and collective ownership of the infrastructure, therefore consuming but not participating: guifi.net has given birth to ISPs that on one hand provide internet services to their customers, and on the other hand contribute and consume connectivity from a commons infrastructure.

We can even find squatters, participants that do not follow the community rules and hide from the rest of the community, but use the network infrastructure (to access and withdraw connectivity) with no contribution. This is a risk to the sustainability of the commons.

SUSTAINABILITY PRINCIPLES

In an analysis of the design of long-enduring CPR institutions, Ostrom identified eight principles which are prerequisites for sustainable CPRs.[25] We apply these to local network infrastructures:

1. Clearly defined boundaries: The fundamental principles of open and non-discriminatory access and open participation in the life of the network are translated into instruments such as the community licence, management tools, and specific collaboration agreements with professionals, governments and third parties, which prevent exclusion and regulate open and fair usage of the resources.

2. Rules regarding the appropriation and provision of common resources that are adapted to local conditions: The congruence between appropriation (usage of the network) and provision (expansion of the network) is usually mediated by common network management and provisioning tools that assist in assessing the status of the network, its usage, and cost charging.

3. Collective-choice arrangements that allow most resource appropriators to participate in the decision-making process: Complexity and transaction costs grow as the network grows in size (number of nodes, links, distances, participants). This complexity is managed by social structures with diverse representation from all CPR stakeholders, and open structures for participation such as periodic online or face-to-face meetings, social media and mailing lists.

4. Effective monitoring by monitors who are part of, or accountable to, the appropriators: Monitoring is performed by local trusted senior members of the different stakeholders, that rely on that open data, and coordinate decisions when needed. These decisions are accountable, deliberated, reported in the communication tools, and recorded in a historical ledger.

5. Graduated sanctions for appropriators who do not respect community rules: Each community has its own conflict resolution system with methods to deal with participants who negatively affect the common infrastructure resource.

6. Conflict-resolution mechanisms which are cheap and easy to access: Each community should have its own way to address these conflicts in a cheap, easily accessible, efficient, effective and scalable manner, which enables it to address a wide range of conflicts around the network.

7. Self-determination of the community recognised by higher-level authorities: Each community has its own way to validate and enforce its rules and structures according to the different levels of legislation.

8. In the case of larger CPRs, organisation can be in the form of multiple layers of nested enterprises, with small local CPRs at their bases: Larger communities have subgroups, providing a federated CPR with many aspects in common, and interacting with external organisations at the local and global level in many aspects.

CONCLUSIONS

The internet is a key resource, but it is one that only more or less works for about half of us: it is not available everywhere, and when it is, it is not always affordable or safe, and is often of poor quality. The internet cannot work without accessible infrastructures and relevant content and services. Before even considering access options and alternatives, we need to start with at least one network infrastructure that provides connectivity in a given place. A network infrastructure, the routers and links, is the basic substrate for the development and exchange of content and services.

A critical feature of network infrastructure commons is the potential for crowdsourcing: the idea that anyone can expand the network. This not only creates a sense of "digital sovereignty", and opportunities for participation, but also contributes to local development as it brings in more knowledge, new opportunities for local services

25 Ostrom, E. (1990). Op. cit.

and employment. In the guifi.net network, for instance, many professionals started as volunteers who learned from the network and found a sustainable demand for professional services – with some even forming companies. This feeds the development of a local economy and creates benefits that stay in the community and have multiple economic spill-over effects.

Contributing to commons such as network infrastructures creates social and economic benefits for everyone. Therefore, these public interest activities should be incentivised, and one way to do this is with tax deductions. These deductions are already available in many countries, although accessing them requires legal knowledge and a formal organisational structure.

Cooperative organisations, open to participation, can be very effective in creating local infrastructures, at the lowest cost, that can generate abundant and widespread connectivity, particularly in underserved areas or in a subsistence economy. Governments have a role in protecting and nurturing these to ensure they can maximise societal impact. There are many ways to provide incentives or support in terms of training, advice, funding, etc.

We need to learn about, develop and share business models and organisational models to bootstrap and sustain network infrastructure commons. The Internet Society (ISOC) has made great efforts to promote IXPs. APC, in collaboration with ISOC, the netCommons[26] research project, and many other global and local organisations, is developing and preparing training activities to work on these models.

Regarding policy aspects, open spectrum, community spectrum licences and rights of way, the promotion of development and use of open hardware and software, open specifications, and open knowledge (the sharing of "know-how") are some of the enabling factors for the development of commons infrastructures. Protecting the development of community infrastructures is not in contradiction with protecting local businesses of any size. In fact, misaligned protective measures, or the lack of any such measures, can become disincentives for innovation and result in reduced competitiveness, and therefore a risk for these companies, the local jobs they create, and the supporting public authorities.

Citizens who develop infrastructure commons should be supported with regulations and obligations to ensure the right to interconnect the community infrastructure at the wholesale level with other ISPs and telecom providers. In that way, communities can develop their own critical infrastructures, and ensure they are well connected with the world. In fact, interconnection is the spirit of the internet. In contrast, closed network infrastructures are a risk to avoid, as everyone, public and private, becomes a captive of a single provider. In areas with a single provider or no diverse market, infrastructures should be open for sharing, which implies interconnection at cost, not at a profit.

The policy principle that if there is only one network infrastructure in a place it should be shared at cost not only affects private (for-profit) providers, but also public providers. There is no sense in public investment in closed networks (which prevent sharing) and no excuse given the technology available to share pipes, ducts, frequencies and wavelengths, or virtualised traffic.

Overbuilding is a critical risk nearly everywhere in the world. Large telecom providers are tempted to "overbuild": deploy in critical locations to deter or make unfeasible the development of community infrastructures, to protect their investments and preserve present or future markets. The typical situation is as follows: a telecom provider hears about a community initiative in an underserved area, and quickly deploys a few points of presence of its closed network in key locations, but leaves the less profitable areas disconnected. The expected outcome is not serving the community but preventing a community initiative from developing. There is no general or easy solution to this.

Universal service funds and governmental subsidies may seem like a good source of funding in theory, but in practice this is a mine field, good as a principle but unfeasible in most countries. The typical obstacle is that governments prefer to work with a single partner – and that is always the largest telecom provider – and never with several small community networks that depend on their participants. The result is usually poor or even counterproductive, since the target areas and population are not commercially interesting. The communities end up waiting forever with no or bad service, or paying and waiting twice, through wasted public money first hand then through delayed local investment and development of a community network.

Neutrality is a nice term with vague definitions but it is key. As the internet is a public global space, no discrimination in access to infrastructure and content should be the rule; otherwise it should be called the "intranet". Neutrality implies favouring shared infrastructures and guaranteeing no discrimination or blocking of content. The guifi.net Foundation recently proposed[27] two forms of neutrality:

26 https://netcommons.eu

27 https://fundacio.guifi.net/Proposta_programa_electoral

- Neutrality in infrastructures: Preference given to telecommunication infrastructures effectively shared between operators, and without discrimination over proprietary or speculative forms of exploitation. Since there will never be multiple infrastructures everywhere, and it does not make sense for there to be, only by sharing infrastructure can all citizens be able to access a varied and competitive offer throughout a given area.
- Neutrality in content: The guarantee of freedom of expression and opinion on the internet at all times, so that any intervention on content or interruption of communication is always very well justified and restricted to the prosecution of common crime and criminal acts.

We know how to do it. There are examples of successful and sustainable models for infrastructure commons. Nature shows that cooperation is effective even in extreme conditions where competition may not work. Nature also shows the importance of diversity and local evolution to create organisms that adapt to local conditions. We need a neutral environment, in coordination with key local partners, for the development of community network infrastructures to nurture and sustain digital life, everywhere and for everyone.

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www.apc.org info@apc.org

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