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Efficient collaboration between government, citizens and enterprises in commons telecommunication infrastructures

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Abstract

Public administrations, citizens and enterprises are the three key players for the construction and management of any commons infrastructure. This paper discusses the interrelations between them, under the lens of the ongoing netCommons project, an H2020 research project entirely devoted to multi-disciplinary research on Community Networks (CN). In June 2016 netCommons organized a workshop in Barcelona (Spain), to share views and discuss how these three actors can strengthen ties among them to contribute to the growth of community networks. The workshop analyzed tools ranging from governance strategies and regulation to implementation (at deployment and operation level) of networking infrastructures. Special attention was devoted to optical fiber, a key technology for achieving the coverage and penetration targets of the European Digital Agenda. Based on the experience and the work done so far, the workshop expanded the knowledge about this type of collaboration and identified specific lines of action to make CNs more efficient in the future. The workshop was divided in three panels: governance, regulation, and implementation, with participants from the research field, public administration and practitioners that daily build CNs. We report about the topics discussed and some of the lessons learned during the workshop.

1 Motivation

For the last century telecommunications has been a key infrastructure for societal development. The traditional model has been public or private enterprises in charge of developing, maintaining, operating the infrastructure and also providing services to customers: all citizens, anywhere in a territory. These infrastructures have been the core of a tussle between three key actors: citizens, companies and organizations willing to communicate, governments and public administrations with the mandate of regulating the public space and the rights of citizens and consumers, and the private interests of the service providers, typically driven by business interests. In the last decade, local initiatives have developed citizen-driven cooperative and self-organized efforts to develop network infrastructures for digital sovereignty and ensure the rights of communication and participation in the digital society: to connect the unconnected, or to provide sustainable and inclusive alternatives. As context matters, in this workshop we have focused on the European scenario and particularly in the scope of Spain and the guifi.net community network. Successive workshops in different regions and community networks will allow us draw a comparison across them.

The aim of the workshop¹ was to build a shared understanding and find ways to optimize the interaction among these three actors, with the ultimate goal of optimizing the development of community networking infrastructures. Based on the experience and the work done so far, the workshop had two concrete objectives: i) expand knowledge about this type of collaboration and ii) identify specific lines of action to make them more efficient in the future. During the meeting these challenges were analyzed and discussed successively from the point of view of governance², regulation, and its implementation, dedicating to each block a total of one and half hour with a set of short presentations and one panel session.

¹<http://netcommons.eu/?q=content/workshop-community-networking-infrastructures>.

²Links to videos of each session (with English subtitles for non-English talks): S1 Governance, S2 Regulation, S3 Implementation.

This report reviews highlights of the discussions at each session, reflects on what was learned at the workshop, and lists working topics that resulted from it. We appreciate the voluntary contribution of the people and organizations involved. We accept contributions to clarify any aspect of the report that may appear in future versions.

Disclaimer: This report is based on various notes taken during the workshop. It does not purport to reproduce in detail all debates and interventions, that may be imprecise and incomplete. None of the messages conveyed in this report may in any way be interpreted as stating an official position of the involved organizations.

2 Introduction

The workshop was opened by Jordi Via from the Barcelona City Council, as city commissioner in charge of the cooperative, social and solidarity economy (the title, compared to the one used by its predecessors, already implies a change of socio-economic model). Mr. Via highlighted the need to consider sustainability in terms of individuality, society and ecology. According to him, economic activity, beyond the traditional business practices, must include self-organizing community economies to address specific societal needs, going beyond the public-private collaboration also considering public-community. Clearly there are difficulties to overcome, of formal and regulatory nature, but we should not just accept traditional practices as the only immutable normality.

Renato Lo Cigno, the General Coordinator of the netCommons project, from the University of Trento gave an overview of networking infrastructures, the role and achievements of self-organized community efforts, and the interest to understand community networks from a research perspective. He also introduced the netCommons.eu research project.

3 Governance of networking infrastructures

The first session, chaired by Maria Michalis from Westminster University, included four short presentations about governance models: a) one general introduction to the commons governance model, b) the telecom infrastructures in Catalonia, c) the optical fibre infrastructure in a mountain region (Garrotxa), and d) the guifi.net governance model.

Communities and the governance of a common network infrastructure

The first presentation by Leandro Navarro from Polytechnic University of Catalonia, introduced and summarized the ideas about commons, and how that applies to network infrastructure commons, with more details in (Navarro, L. et al., 2016). A commons develops around a resource (the common-pool resource or CPR) that belongs and is managed (self-governed) by a community. The CPR consists of a core resource which produces a limited quantity of extractable fringe units. In our case, the core resource is the network, which is nurtured by the network segments that participants deploy to reach the rest of the network or improve it, and the fringe unit is the connectivity they obtain.

According to the hypothesis of CPR models, these models, properly managed, maximise efficiency (the product –connectivity in this case– obtained with a minimum amount of resources involved) and ensures long term sustainability (otherwise, they are prone to depletion). These self-regulation regimes deal mainly with non-excludable and rival resources, as self-regulation can promote sustainability and adaptability and prevent congestion.

The commons can be fragmented into different subtypes. Ostrom (Ostrom, 2008, 1990) developed her framework based on the analysis of case studies from local, mostly environmental or natural commons and extended her study with cases from knowledge commons, cultural and digital commons (Hess & Ostrom, 2011), composed by a resource, a community, legal rules, interaction (commoning), outcomes, evaluation. Scholars further extended this work in an attempt to systematize knowledge commons with another collective volume (Frischmann, Madison, & Strandburg, 2014), infrastructure commons with the example of internet congestion and network neutrality (Frischmann, 2012), and internet/spectrum commons (Benkler, 2002).

These extensions of Ostrom’s framework look into the nature of the resource, of the community, the criteria of success, failure and vulnerability, and finally its political purpose, in aspects such as the importance of the commons for democracy and freedom. The study of digital commons, with the major examples of free software and Wikipedia, gave rise to commons-based peer production (Benkler, 2006).

The “tree” of the commons has several branches: natural, knowledge and code, and artificial material commons. We look into *artificial material commons* as complex systems where peer production is applied to build some specific, material, resource pool (or system) that is critical for a community as a supporting infrastructure. There is no clear cut between the natural commons and the artificial material commons, but a continuous transition whereby more and more value of the commons is related not to the management of a

given natural resource, but to the complex engineering manipulation of the artificial material resource that is built and maintained.

In the past, networking infrastructures were considered a club good (excludable and virtually non-rival as a commercial service) provided by for-profit ISP to those fortunate to be in coverage areas and willing to pay the service fee. Community network infrastructures are a social response to the wide recognition of connectivity as a basic human right, and therefore the network infrastructure connecting people becomes non-excludable, and also rival, as the capacity of a network is limited with respect to the connectivity extracted by its users.

There are different stakeholders in community network infrastructures: volunteers, professionals, public administrations. That leads into different bundles of rights, related to different levels of participation ranging from access for contribution or consumption; management for coordination and decision making; governance for the definition of the regulation; and different coordination mechanisms among participants. Common property regimes seek regulating preservation, maintenance and consumption of the resource, and typically result in agreements, licenses, and stipulations such as conflict resolution or cost sharing mechanisms; rules for access, usage, contribution; structures for supervision and decision making.

In our daily life we often question ourselves about who our devices and our networks work for: Who own them, who feed them, who decides about them, who controls them?. If the answer is not clearly us, then we should think if the digital world where we live is a democracy or a corporatocracy (Zuboff, 2015; Balkan, 2016), and how to amend it.

Governments and telecom infrastructures in Catalonia

The second presentation was from David Ferrer i Canosa from the Government of Catalonia, Secretary for the Governance of the Information and Communication Technologies. Mr. Ferrer discussed about important factors from the point of view of public administration, the European Digital Agenda 2020 (DA) as a framework that defines a series of milestones, and how that impacted the development of telecommunication infrastructures in Catalonia. The DA defines that before 2020 all European citizens must have access to at least a 30 Mbps broadband connection and 50% of people must have access to a 100 Mbps Internet access.

He described several governmental mechanisms focused on improving telecommunications services and the availability of infrastructure for these services.

The management agreement for telecommunications infrastructure approved in the end 2014, aligned with the Broadband Cost Reduction European Directive (Directive 2014/61/CE -not yet transposed into the Spanish legal framework), is a policy to reduce the cost of deploying high speed electronic communications networks. It enables that any telecommunications operator may request the use of any infrastructure owned by the Government of Catalonia for the deployment of telecommunication services. The government agreement includes roofs, that enables any mobile operator to locate mobile base stations in any buildings or assets owned by the Government of Catalonia.

Other related projects are Catalonia Connect, launched in 2007, which promotes expanding the coverage of services such as digital terrestrial television. It shows the difficulty of universal coverage: one antenna (Collserola in Barcelona) can cover 65% population in Catalonia. An additional 9 broadcast centers can reach 87%, but 500 more centers would be needed to reach 99% coverage. These locations can support other services such as mobile telephony.

There are sectoral initiatives in fiber infrastructures for the scientific, agri-food, industrial (mostly automobile) sectors. The MEITEL agreement in 2008 that takes into account the deployment of telecom infrastructure in any public infrastructure works.

The Open Network of Catalonia (XOC) is a high capacity open-access network to connect the offices of the Government of Catalonia. The excess capacity generated by this deployment is offered to all wholesale operators (3,800 Km fiber reaching 244 municipalities and covering a potential 5.8 million inhabitants). One important difference in the services provided by XOC, with respect to the incumbent operator, is that XOC services are only rated in terms of capacity independent of distance. This is key to facilitate the deployment and development of telecom services in any covered area at the same cost, therefore supporting the development of infrastructures anywhere. In contrast, the incumbent operator charges differently in terms of capacity and also distance to the largest urban areas. Similarly there's ongoing work to take advantage of the public water infrastructure (Catalan Water Agency) to facilitate the deployment of telecom infrastructures.

Public intervention in Telecom services is subject to strict rules of competition. One mechanism was concession (XOC), another for the access section is the definition of public prices for the rental of space in ducts in public space.

Many aspects of open networks to be improved in Catalonia, and the Catalan government is determined to address them. The main targets are that all over Catalonia we should have availability of high capacity telecom services under equal conditions and at low prices. That should allow alternative operators to deploy infrastructure and services to ensure coverage and compete in terms of service.

The goal of consolidation towards big telecom operators with the intention to compete against the US and Asian operators might have the opposite effect. In Spain consolidation has led to only three operators, and the three of them have raised prices. That consolidation seems to contradict the goal of a strong market to reach the objectives for 2020 to have equal access in the territory to infrastructures and generate competition. Administrations at all levels (municipalities, regional government, national, European) should engage in guaranteeing access to infrastructures with competitive pricing that promotes competition and competitiveness of these services.

The guifi.net governance model

The third presentation was from Roger Baig Viñas from the Fundació Guifi.net. He introduced a community networking perspective, developed from the experience of guifi.net. Like other community networks guifi.net is a citizens' initiative. There are different business models to develop networking infrastructures, and he presented the guifi.net model. The model is based on the principles and practices of commons collaborative economy, the common pool resource (CPR) governance model, the commons, and sustainable design.

He described a layered functional model of telecom services: the passive layer, the infrastructure operation layer, and the service layer that provides the services people use. There are different models to regulate the competition for the different functions: with different actors for each layer (functional separation), actors covering two or the three layers (vertical integration). guifi.net proposes a commons format, a cooperative model to develop an open, free and neutral network infrastructure, for the lower two layers, with services provided by multiple actors, either professional or voluntary-based.

guifi.net started in rural areas, in the mountains, and eventually reached Barcelona, where traffic exchange is performed and international carriers arrive.

guifi.net is about managing a communal infrastructure, with multiple stakeholders and roles. Governments are in charge of organizing the public space and the rights of citizens, such as access to basic internet services. There are professionals providing services offering service guarantees in exchange of service fees. There are volunteers that can participate in all aspects of the network. This has some requirements in transparency and participation process, since we can not build a commons without being open and transparent.

Several tools have been developed: the community license defines the rights and obligations of the participants. It is a viral license: anyone who enters the network must accept and it basically says: "since I could enter the network that was open free and neutral, I can not deprive others to use my network node to join the network". From this license we build all the other tools that we need to govern ourselves.

Sustainability is critical in a commons. Well-governed economic activity will produce resources that will allow us to be sustainable. We must ensure that a part of the profit of those who are taking advantage of the common good is reinvested in it, so that the common good will not die. Stakeholders should understand that re-investment is good for them because otherwise the common good will be depleted. This is the economic compensation system, where CAPEX and OPEX costs are compensated among participants in an area. This is calculated from costs to return the investment, so it is not a price agreement to limit competition (collusion) but to promote the sustainability of a commons resource and promote participation. This is described in more detail in (Baig et al., 2016).

In guifi.net we bring the concept of commons in telecommunications infrastructure through a commons and collaborative economy. We believe that our model is disruptive with facts, and not only words. We have proven that this works and we're working on it every day, and every day we grow. This is necessarily transparent and non-discriminatory. It is also efficient because now we know the costs. Participating in all this we have also learned what things are worth and their detailed real costs. We are a case of good practice and we are also internally detecting best practices which lead us ever more to consolidate this. It is totally organic and something essential: it is not speculative.

4 Regulation and legislation

The second session moderated by Melanie Dulong de Rosnay, CNRS, aimed at better understanding the legal surrounding of CNs, with four presentations on the hurdles created by regulation for CNs in Europe, on the legal framework the administration has to implement for operators in Spain, on a commons-based model of infrastructure sharing allowing cohabitation between all actors, and finally on a local experience of implementation.

Regulation and Community Networks

The first presentation was by Félix Tréguer, CNRS and netCommons.eu. He described specific cases where regulation may inadvertently be creating hurdles for CNs, by excluding CNs from public networks. He also

discussed ways of lifting unnecessary regulatory burdens, such as promoting open Wi-Fi. For instance in the 2012 EU Radio spectrum policy program, there is a mechanism where member states in cooperation with the Commission can use unallocated spectrum for developing mesh community networks. He suggested offering direct public support to these digital inclusion initiatives and at the same time inviting CNs to the policy table.

Legal aspects in Spain

The second presentation was by Olga Díaz, Head of the Legal Department in the Localret Consortium. She focused on defining the regulation framework or “corset”, and the need to interpret or in some cases modify (by the ministry and regulator) the rules for public administrations in a) operating or providing service (operator), and b) regulating the use of public space.

An administration should act under the principle of private investor when considering the initial investment, its return, and expected performance such as private investor.

In the first case of service provision: if the public administration yields to a private operator to exploit an infrastructure, then the administration becomes anyway an operator from the legal perspective.

The “Electronic communications networks” mentioned in the 2014 telecom law, regarding services to the public (not just internal or self-service), does not consider the public works such as ducts, pipes as “communications network”. However, even though the 2014 law regulates this, details are not yet developed.

The 2014 telecom law restricts public admin beyond what is considered self-service for their workers (which does not force them to become an operator). It also includes libraries (Internet access) and schools, including internet access telecenters in public schools.

Establishing a public administration as an operator has to be done through setting up an operator as a separate company. It must respect the rules as private operator in that it should not affect competition (e.g. with free-of-charge services). It should also consider market failures (if they are present, a public administration can then provide services). Private operators should have access to this infrastructure.

According to some cases investigated by the competence regulator (CNMC report), open Wi-Fi Internet access provided by public administration in public places to the public, limited to 256kbps, is not considered anti-competitive (CNMC, 2014).

Regarding regulation of access to the public domain, operators can occupy public space. Tenders are prohibited since everyone can get access on equal terms. Pipes, poles, etc. are supporting elements to which administrations need to facilitate access. This can not be done exclusively and should be on an equal footing, according to Art 37 of the Spanish Telecom law (MINETUR, 2016). Local authorities should allow the usage of lamp posts, buildings, etc. in the same conditions as these are provided to private operators. However, if an entity is introducing a communications element, even a passive fiber, it becomes an “Electronic communications network”, and then the public administration should be constituted as an operator.

In summary, public administrations should work under a) the principle of neutrality (equal terms, competition) with respect to regulating access to public space by operators, and b) under the principle of private investor when being involved in providing any service, to respect market competition (unless there is a “market failure” situation or the service is less competitive i.e. limited in speed or other ways).

Fibre infrastructure in a mountain region (Garrotxa)

Francesc Canalias i Farrés, Director of the Consortium for the Environment and Public Health of Garrotxa (SIGMA) shared his experience of infrastructure deployment in a rural area³ with a large natural park, about 25,000 inhabitants, and also several industries.

The model is based on an initial investment (and initial deployment) that is contributed by the public administration, and later on recovered from the private entities that connect to the network infrastructure. That seems a feasible model helping to accelerate the availability of network infrastructure in that area.

A community networking perspective

The fourth presentation was by Ramon Roca i Tió, President of the Guifi.net Foundation. He explained how electronic communications or telecommunications are services with an increasing effect on society in general, affecting all areas from the formative development of people and leisure as well as areas of economic production and business. They are also a pillar for supporting intelligent public services. Accelerating the existence of the best technology offering at the best possible cost is therefore a key factor in the development of our society and public services and of the competitiveness of companies in the territory.

Roca described the “Universal Format” infrastructure deployment model as generic (for all possible uses and for all business models, not enforcing or discriminating any specific). The aim is to adapt the new European and state regulatory framework at a local level in a clear and stable way in order to:

³<https://en.wikipedia.org/wiki/Garrotxa>

1. Comply with European directives and the applicable legal order at the level of the state and Catalonia, while developing competences that are typical of municipalities in the related issues, and ensuring transparency and non-discrimination.
2. Facilitate the deployment of access networks to next-generation telecommunications services with the maximum possible speed and efficiency, stimulating and ensuring the efficiency of investment, while ensuring its sustainability based on use and minimising the cost to the public administration and citizens and society, in general.
3. Facilitate the deployment of the necessary connected infrastructures (sensor devices, etc.) to develop new and better smart public services (lighting, waste management, security, mobility, etc.).
4. Provide access for citizens and society in general to a varied and affordable offering of telecommunication services of the highest quality and capacity, regardless of location, without conditional business models that develop from the private sector, ensuring its diversity and avoiding market dominance situations or speculation that would harm that diversity.

The scope of application is regarding the competence of the city council related to the infrastructure capable of hosting next-generation telecommunications services or its components.

In short, the government should facilitate access to these infrastructures in objective, transparent, and non-discriminatory conditions, never in an exclusive or preferential manner for a determinate operator, forbidding the granting of access through tendering procedures, and according to the existing regulatory framework.

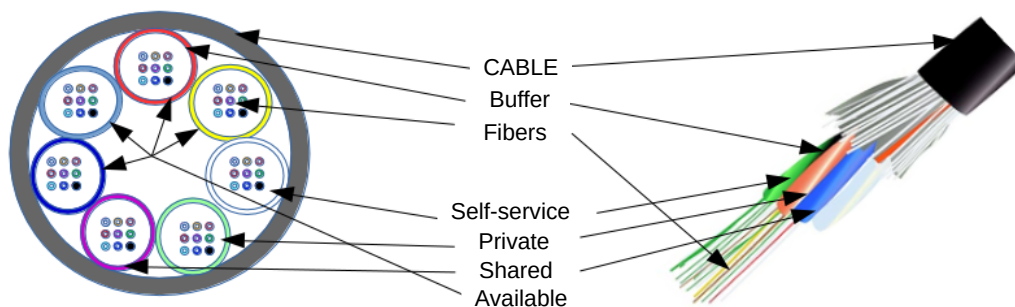


Figure 1: The Universal format for fiber cables

Deployment in Universal format is deployment that simultaneously allows for the three classes of uses (self-service for the city council, private, and shared or common use). To do so, a cable (with several buffers, buffers with several fibers) is divided into three parts, one for each use. At the start, each part has a minimal structural unit. The rest of the free structural units will be available for upgrades for those who need them, and who have irrefutably proved that they have exhausted the initially reserved capacity. See the figure 1 for an example of the initial distribution of the reserves of use of an optic fiber cable in three parts (self-service for the city council, private, and shared), using fiber tubes as the minimal structural units.

This model has been developed as a template for a municipal ordinance. The purpose of this ordinance is to serve as a basis for municipalities to regulate the deployment of infrastructure that could be used for advanced networks, which is the responsibility of the city council.

5 Implementation: Challenges in carrying it into practice

The third session moderated by Leonardo Maccari, University of Trento, aimed at raising the challenges in deploying and managing network infrastructures from the experience in specific cases. There were four presentations from different scopes: European broadband infrastructures, public financing from the European Commission, Barcelona from the City Council, the guifi.net Foundation in Spain.

European Broadband infrastructures

Wolter Lemstra, Senior Research Fellow at the University of Delft, described an analysis of the development of broadband network infrastructures in Europe (Lemstra & Melody, 2014). The whole European communication panorama started with a very vertical market, in which each country was dominated by a single public incumbent. The market was then privatized, transforming the incumbent into private companies, and trying to make them compete with newcomers, which should have made it possible to create a wealthy single European market. Even under these premises we have to observe that technologically, the starting point of each state is different from

one to another. In many countries the legacy telephone lines were ubiquitous, but not, for instance in new member states, which are today jumping to high-speed cellular networks. Or, in some countries cable TV was present, while in some other it was completely absent. This already suggests that the idea of a single European market should not lead to think of a single technology for broadband connectivity. Since there is nothing like a single trajectory from zero-bandwidth to high-bandwidth, there is space for different approaches, that may well generate from non-Telco actors.

A lot of bottom-up initiatives, which we may not be aware of, because they are not called "community networks" explicitly are spread around Europe. Some of them are no-profit, some are small local companies, every one apparently tried to adopt the right organization to succeed in its own environment.

The difference between a Telco and a non-Telco approach, is generally in the more proactive approach that the latter offers. Bottom-up initiatives tend to mobilize people, whether they are small business, municipality initiatives or community initiatives to reach a core of people that can open a new market or enforce a non-market solution. As we have currently recognized that market alone fails to bring universal access, the public administration and the government also have to give incentives for these bottom-up initiatives to flourish.

One of the open issues that community broadband initiatives have to face is the step that leads to scalability. Bottom-up broadband initiatives often start at a small scale to solve the problem of a small community of people. In some cases they become large scale initiatives, some of which have been recently documented (Lemstra & Melody, 2014).

Public financing of European infrastructures

Fabio Nasarre, and Laure Blanchard-Brunac from the European Commission discussed the access to financing instruments in this field in the European panorama. The European Commission is offering several financial instruments that the Commission makes available to let bottom-up broadband grow, including:

- Connecting Europe Funds (CEF) 1B€ from which 150M€ for pilot projects to make them more bankable.
- Juncker plan: 21B€ managed by the European Investment Bank (EIB) in Luxembourg.
- The EC refers to EIB to finance projects. The European Fund for Strategic Investments (EFSI) is a joint initiative of the European Commission and the EIB Group, the Plan will unlock investment of at least EUR 315bn€ over three years.

Some of these initiatives are accessible from small organizations and are not necessarily tailored to large Telcos and corporations. The presence of these initiatives confirms that the European institutions recognize that there is a space for bottom-up initiatives that can fill the gap left open by the market failures. Many details were given about the procedures and the entry point to start one such procedures. There are challenges for the digital section in preparing projects that can be supported by banks (bankable). The EIB/EC highlighted a one-stop shop advisory Hub: they'll provide advise, mainly in financial aspects. From the 1st June there is a web site where Platform promoters can publish projects, investors can see them⁴.

The City Council and Barcelona

Francisco Rodríguez Jiménez, from the City Council of Barcelona, shared his view about Barcelona, like most large cities in Spain are covered by multiple operators and therefore there is a market, although there are studies that show room for improvement in the available capacity in certain neighborhoods and areas. The city has a corporate fiber infrastructure of more than 500 Km, where the infrastructures are open in equal terms to telecom operators. In 2004 a WiFi infrastructure was started, which required a negotiation with the telecom regulation authority. In the "22@" area there is a neutral infrastructure fiber operator. Municipal conduits can be used by other operators through agreements but also exploring the use of the urban furniture by third parties.

The guifi.net deployment model

Lluís Dalmau i Junyent from the guifi.net Foundation presented the approach of guifi.net for the deployment and maintenance of network infrastructures. We have also to recognize that a key point that distinguishes the for-profit approach from the bottom-up commons approach is not only the financial aspects, but, and most notably the way the resources are organized, shared and managed. Under this point of view the experience of Guifi is probably the one that produced the most in-depth analysis of the "commons" concept and its application to networks. Guifi, interpreted Ostrom principles (Ostrom, 1990) and translated it into and the transparency [NOT CLEAR], definition of roles and a compensation system that accumulates information about expenditure (CAPEX and OPEX) and resource consumption (usage).

⁴<http://www.eib.org/eiah/>

6 Discussion

There are multiple organizational models to develop a networking infrastructure. Beyond the traditional commercial model (investor and profit driven, extractive for the target service consumers), there are commons-driven models that can develop community infrastructures in a cooperative, cost sharing, and self-organized manner. Diversity of models contribute to ensure the availability of connectivity, the development of sustainable networking infrastructures and ultimately boost local socio-economic development. It has parallel features to free software, that create viable alternatives, is developed cooperatively, and can create opportunities to develop higher added-value in the volunteer, in the professional or commercial sector too. Cooperative models have developed ways to create economies of scale (grouping individual entrepreneurs and professionals sharing risks, aggregating costs, sharing infrastructures), create economies of knowledge and tools (sharing the effort to develop know-how, procedures, software tools and services).

Public administrations (city councils, municipalities, and governments at all levels) have the responsibility of regulating the offer of networking services to citizens, the occupation of the public space, preventing discrimination: towards citizens under objectives of fair (universal) service to ensure communication rights, and towards network operators to ensure market rights. Competition should be preserved when available, but the role of public administrations is also to promote the offer or alternatives in cases of “market failure” including public investment. However these interventions should be under the principle of the public administration acting as a “private investor”. In any case the regulation of occupation of public space can coordinate all interested parts under the principles of minimizing cost and impact in that occupation. The Universal deployment format is a proposal for the regulation of the deployment of networking infrastructures for advanced networks through infrastructure and cost sharing.

Coordination mechanisms among private and public organizations, and citizens can help to accelerate the development of sustainable networking infrastructures, for the benefit of all parts and society in general. Different organizational models (e.g. firm, commons, extractive, collaborative), cooperative and competitive schemes, coordinated and regulated by public entities, allow commercial and community operators to develop and ensure everyone can best participate in the digital society.

While most of the ideas are universal, the details can vary across continents, countries, regions, and municipalities. Further work is required to develop universal ideas and generic mechanisms in the light of the local specifics, such as the needs of its inhabitants, geography, history, legal regime, regulation, and other social, economic and environmental factors.

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