TELECOMMUNICATIONS RECLAIMED:
A HANDS-ON GUIDE TO NETWORKING COMMUNITIES

MÉLANIE DULONG DE ROSNAY & FÉLIX TRÉGUER (EDS.)

Acknowledgements
The research presented in this book, the writing residency and the editing process were funded by the Horizon 2020 programme of the European Union (Grant Number 688768), project netCommons Network Infrastructure as Commons (netcommons.eu).

The production of this book was co-funded by the European project netCommons (see above) and published with the additional support of the Internet Society (Jane Coffin) and the Association for Progressive Communications (Flavia Fascendini and Carlos Rey-Moreno).

ISBN
978-92-95113-15-2

Published by Internet Society
Printed in the USA
2019

You can download this book at **www.netcommons.eu/telecommunications-reclaimed**

Editors
Mélanie Dulong de Rosnay, CNRS
Félix Tréguer, CNRS

Authors
Panayotis Antoniadis, NetHood
Ileana Apostol, NetHood
Virginie Aubrée, University of Trento, University of Paris Nanterre
Adam Burns, free2air
Mélanie Dulong de Rosnay, CNRS
Maria Michalis, University of Westminster
Jürgen Neumann, Freifunk.net
Ramon Roca, guifi.net
Félix Tréguer, CNRS

Contributors of stories
Benjamin Bayart, FFDN
Bruno Spiquel, SCANI
Pierre Crémault, Franciliens.net
Leonardo Maccari, University of Venice
Arthur Messaud, La Quadrature du Net
Mireia Roura, eReuse.org
Oriane Piquer-Louis, FFDN

Illustrations and layout
Sarah Viguer

Booksprint facilitator
Andreas Wichmann

Peer review
Christian Fuchs, University of Westminster
Renato Lo Cigno, University of Trento, University of Brescia
Bruno Spiquel, SCANI

Copy editing
Lori Nordstrom, APC

Publication production support
Cathy Chen, APC

Panayotis Antoniadis, NetHood

Panayotis Antoniadis is co-founder of NetHood Zurich. He has a transdisciplinary profile combining computer science, distributed systems, economics, urban studies, and the politics of the internet. He contributes to various research and action projects like Langstrasse200.ch (L200), INURA.org, 5im5i.ch, NeNa1.ch, Openki.net and CNSIG.info.

Mélanie Dulong de Rosnay

Mélanie Dulong de Rosnay, PhD in law, is associate research professor at the French National Centre for Scientific Research (CNRS) since 2010 and director of the CNRS Centre for Internet and Society (CIS CNRS) which she co-founded in 2019.

Virginie Aubrée

Virginie Aubrée is a PhD candidate in law at the Centre of Research on Public Law, at the University of Paris Nanterre since 2018. Her research focuses on on the digital commons. She is volunteer and a member of Franciliens.net, a French community network, and of the digital rights advocacy group La Quadrature du Net.

Ileana Apostol, NetHood

Ileana Apostol (PhD in Urban Planning, University of Southern California) is a researcher of contemporary spatial production, proposing a dialectical take of urban research and design pedagogy, and co-founder of NetHood Zurich. To provide citizens the right to the hybrid city she bridges transdisciplinary research with neighbourhood action. Ileana has taught urban planning and design in Los Angeles at California Polytechnic University and at the University of Southern California, and in Bucharest at the University of Architecture and Urbanism.

Ramon Roca

Ramon Roca is co-founder and the president of Fundació Privada per a la Xarxa Oberta, Lliure i Neutral guifi.net (The Foundation for the Open, Free and Neutral Network - guifi.net). He has always been involved in IT social projects. In 2003 he set up the first link of what a few months later became the guifi.net community network.

Juergen Neumann, Freifunk.net

Juergen Neumann started working with information technology in 1984 and since then has been looking for ways to deploy ICT in useful ways for organisations and society. As a consultant for ICT strategy and implementation, he has worked for major German and international companies and many non-profit projects. In 2002 he cofounded www.freifunk.net, a campaign for spreading knowledge and social networking about free and open networks. Freifunk is globally regarded as one of the most successful community projects in this field.

Adam Burns

Adam Burns is an internet and community network pioneer with a passion for disintermediated, peer-to-peer, human-centric communications. He founded free2air, Europe's first open public community wireless network and has contributed to many other local network initiatives in Africa, the Middle East and Australia. He is currently the Chief Information Security Officer for Media in Cooperation and Transition (MiCT), where he trains information security best practices to journalists and media practitioners and develops emergency broadcast radio systems.

Maria Michalis

Maria Michalis (Ph.D. in Communication Policy) is Associate Professor in Communication Policy at the University of Westminster, London. She is an expert on European Union media policy, and author of "Governing European Communications" (Lexington, 2007) and numerous book chapters and academic journal articles.

Félix Tréguer

Félix Tréguer is an associate researcher at the CNRS Centre for Internet and Society (CIS CNRS), a postdoctoral fellow at the Centre for international studies (CERI Sciences Po) and a founding member of the association La Quadrature du Net (LQDN).

List of authors 6
Foreword 15
List of acronyms 22

Part I. WHAT ARE COMMUNITY NETWORKS? 24

1. Introduction 27
Story # 1: FAQ or community networks in a nutshell 29

2. Meet some great community networks! 33
2.1. consume.net London, United Kingdom 33
2.2. Freifunk Germany 34
2.3. guifi.net Spain 39
2.4. Fédération FDN France 40
2.5. Sarantaporo.gr Greece 43
2.6. ninux.org Italy 45

3. The 'Network' in Community Networks 49
3.1. Nodes 49
3.1.1. Routers 49
3.1.2. Clients and servers 51
Story # 2: The trend toward (de)centralisation and how community networks can help decentralise, with the help of Free Software 53
3.2. Links, Backbone, Gateway 54
3.2.1. Links and backbones 54
3.2.2. A gateway to the internet 55
3.3. Similarities and differences with other main resources 56

4. The 'Community' in community networks 59
4.1. What community? 59
4.2. Community and the notion of space 61
Story # 3: L200 a hybrid neighbourhood node in central Zurich (Ileana Apostol) 62

Part II. WHY ARE COMMUNITY NETWORKS IMPORTANT? 64

5. Introduction to community networks philosophy 67
5.1. Direct, decentralised ownership and self-governance 67
Story # 4: Appropriating the PicoPeering Agreement (by Jürgen Neumann) 69
5.2. Direct interconnection and local interaction 70

6. Learning and experimenting 71
Story # 5: Learning together leads to further philosophical & political views (by Adam Burns) 72
Story # 6: From computer research to Community Networks (Leonardo Maccari) 73

7. Community networks and Human Rights 75
7.1. Censorship 75
7.2. Net Neutrality 76
7.3. Privacy and surveillance 77
7.4. Enabling digital rights 78

8. Solidarity and the right to the city 81
Story # 7: Sarantaporo: bringing mountainous communities closer together (by Ileana Apostol) 84

Part III. WHAT DO I NEED TO START A COMMUNITY NETWORK? 86

9. Things you should consider when starting a community network 89
Story # 8: Bootstrapping a community network 89

10. Keep in mind various aspects of sustainability 93
Story # 9: A few hints from guifi.net on making a good start (by Ramon Roca) 96
Organisation: making the community sustainable 96
Economic sustainability: funding community networks 96
Political sustainability: agreeing on a basic set of values 97
Story # 10: Minimising the ecological cost of community networks (by Mireira Roura) 98

11. Finding support 101
Story # 11: Joining forces in hybrid spaces: the Battlemesh encounter (by Panayotis Antoniadis) 103

12. Self-teaching resources: a short collection 111

Part IV. HOW TO START A COMMUNITY NETWORK? 114

13. Seeding nodes in a community network 117
Story # 12: The story of groundzero (by vortex) 118
The host 118

The wireless card 118
Connectors, cabling & antenna 118
Client connections 118
Story # 13: Seeding the first Freifunk nodes (by Jürgen Neumann) 121
Story # 14: Kickstarting guifi.net (by Ramon Roca) 122

14. Explore your technical options 125
14.1. Gateway to the internet 125
14.2. Nodes and links 126
14.3. Wireless 126
14.4. Fibre 127
14.5. Servers 129

15. Start organising your community 131

16. Decide on your legal status 133
16.1. Why should you consider incorporating your community network? 133
16.2. What are the different legal statuses that you may consider? 134
Story # 15: Guifi.net becoming a foundation (by Ramon Roca) 135
Story # 16: When a community networks becomes a cooperative (by Spyou) 137
Story # 17: Freifunk getting a legal status (by Jürgen Neumann) 139
16.3. Should I formally register as an internet access provider? 140
Story # 18: Registering to telecom authorities: an easy way to become a legitimate stakeholder (by Pierre) 141

17. Consider your revenue models 143
Story # 19: An example of small scale ad hoc economic model for community networking: free2air (by Adam Burns) 145
Story # 20: The cost structure of Freifunk (by Jürgen Neumann) 146

Part V. HOW TO GET A COMMUNITY NETWORK REALLY RUNNING? 148

18. Monitoring and managing your network 151
18.1. Why monitor? 151
Troubleshooting 152
Network Planning 158
18.2. What to Monitor? 158
Story # 21: Tools, knowledge & self-management: with great powers come great responsibility (by Adam Burns) 160

19. Respect the law, protect privacy 163
19.1. Are all data equal? 163
Personal data v. anonymous data 164
Metadata v. content 164
19.2. Inform your community about data processing 166
19.3. Do you have to log your community's communication? 167
Story # 22: La Quadrature du Net stops obeying French data retention laws (by Arthur Messaud from La Quadrature du Net) 169

20. Balance your accounting sheet 171
Story # 23: guifi.net's large-scale compensation system: How can volunteers and professionals work together to build a network commons (by Ramon Roca) 173

Part VI. HOW TO MAKE A COMMUNITY NETWORK SUSTAINABLE? 176

21. Organise your governance 179
Story # 24: How to foster inclusive participation for all? Example from a Community Garden 180
Story # 25: How to take decisions about funding and independence? Example from a community radio station 181
21.1. An architecture of the governance 182
21.2. Design principles for commons 183
Story # 26: Freifunk Memorandum of Understanding (by Jürgen Neumann) 186
Freifunk Memorandum of Understanding 187
Preamble 187
Goals of Freifunk 188
Our vision 188
Principles of Freifunk 188
Technical principles 188
Social principles 190
Proper handling of information and knowledge 190
Forms of organisation 191

22. Fund your upgrades 193
Story # 27: Good practices for funding and upgrades at a large scale implemented at guifi.net (by Ramon Roca) 195

23. Know the law regarding access to infrastructures 197
23.1. Free WiFi hotspots: do I have to password-protect our connection? 197
Story # 28: Freifunk's dealings with the police: don't password protect (unless required by a judge) (Jürgen Neumann) 199
23.2. How can the community access other infrastructures? 200
Story # 29: Guifi.net denounces the non-application of the European telecommunication and competition regulation (October 2018) 202
Story # 30: FFDN's open letter to incumbent operator Orange and Arcep, the national telecommunication authority in France (October 2018) 204

24. Engage in political advocacy 207
Story # 31: Guifi's tractor protest (by Ramon Roca) 212
Story # 32: "Freifunk not fear" campaign on secondary liability in Germany (by Jürgen Neumann) 213

25. Assess your sustainability 215
25.1. Economy 215
25.2. Nature & environment 217
25.3. Politics & organisation 218
25.4. Culture 218

Part VII. APPENDICES 220

A. The Pico-Peering Agreement v1.0 221
Preamble 221
Agreement 221
Definition of terms 222
The PPA in practice 222

B. Terms of Use for Community Networks (netCommons template) 223
B.1. Introduction 223
B.2. Creating a trust-based relationship 224
Article 1: Description of the service & quality 224
Article 2: How to join the community? 225
Article 3: Modification of terms of use 225
Article 4: Price of the service [optional] 225
Article 5: Duration and termination 225

B.3. Ensuring access to our Infrastructure 225
Article 6: What the Community is accountable for 225
Article 7: Open Communication and Net Neutrality 226
B.4. Protecting your privacy 226
Article 8: What data do we collect? 227
Article 9: How do we process collected data? 227
Article 10: Retention of data 227
Article 11: Your rights 228

C. Guidelines to policy-makers 230
C.1. Inviting community networks to the policy table 231
C.2. Lifting unnecessary regulatory and financial burdens 232
C.3. Limiting civil and criminal liability for people sharing internet access 233
C.4. Expanding the spectrum commons 234
C.5. Updating open-access rules on private and public telecom infrastructures 235
C.6. Protecting free software and user freedom in radio equipment 236
C.7. Exploring other measures supporting the development of community networks 238

D. Glossary of legal and technical terms 239

E. Suggested readings 250
E.1. Legal, policy, history 250
E.2. Ethics, social, economic 251
E.3. Technical 253

This book is a guide on how to build a community network, a shared local telecommunications infrastructure, managed as a commons, to access the internet and other digital communications services. It was written collectively by a group of community network pioneers in Europe, activists and researchers during a writing residency week held in Vic, Catalonia in October 2018. It was a time of hard work and fast writing, but also of discussions in a friendly environment.

Meant for a wide audience, the book includes practical knowledge illustrated by several hands-on experiences – a set of 32 real-life stories – as well as legal, technical, governance, economic and policy material extracted from netCommons, a three-year-long research project supported by the European Commission. Its goal is to guide the reader through a set of actions aimed at setting up and fostering the growth of a community network, but also, for policy makers, local administrations and the general public, to create the right conditions to let community networks bloom and flourish.

Starting with presentations of successful community networks, and an introduction to the importance and the role of community networks, it provides step-by-step guidelines and concrete information on the resources needed to start a community network, get it running, and keep it sustainable in the long term. From technical options to economic models, governance choices, legal requirements, and the various skills

involved, this lively resource proposes ways to engage with a local community at every stage of a community network.

The book is organised in six parts that comprise 25 short chapters. The first parts address different topics, starting with general definitions of what community networks are, and why they are important in society and in the global communications ecosystem. Next come more technical parts that address different dimensions (engineering, social, legal, political) on how to kickstart a community network, how to let it grow properly, and how to make it sustainable.

After three years of work and research, we are convinced that there is no single recipe for the success of a community network. To reflect this, the book takes an "exemplify and experiment" approach. The exemplification starts with success stories which are framed within a more general and methodological process to highlight positive patterns. As for experimentation, it takes the form of questions and reasoning around them to help the readers and practitioners elaborate the right strategy for their own context: social, cultural, economic, political and geographic.

The significant emphasis on personal stories highlights the fact that the book represents the perspective of a specific group of people, gathered in a specific place in a specific moment in time. The book takes a European perspective, since all experiences documented have

taken place in various European countries. Some technical details presented in the book might be outdated today, and others will probably become outdated in a few years. But since they are presented as stories of key actors in the field of community networks, we believe that they can remain a source of inspiration to new community network pioneers around the world.

The book is completed by a seventh part with five appendices. They include the Pico Peering Agreement, a document formalising the interactions between volunteers and owners of individual network nodes; a template for terms of use (based on European law) that will make community networks who use it legally safe and robust; and guidelines for policy makers on how to foster community networks (again, they are based on the European legal environment). These appendices are completed by a glossary to navigate the complexity of technical terms that are needed to understand a community network, and finally, a list of suggested readings to strengthen knowledge on specific themes and find appropriate resources to help increase know-how and technical skills.

1

2

3

4

1-2-3-4. In October 2018, hard work and lots of writing, but also great discussions

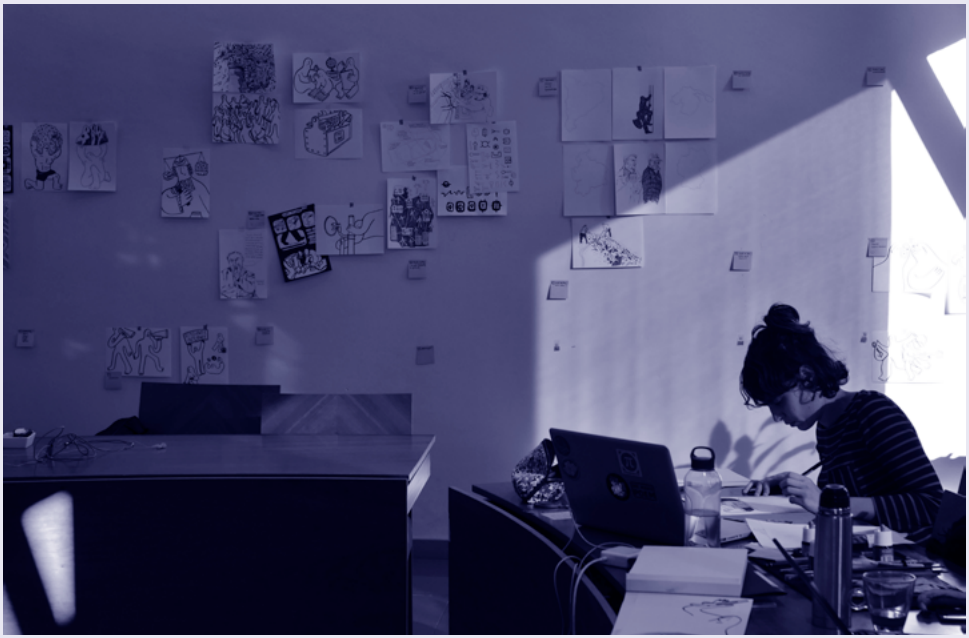
5

6

5. Guifi antenna on top of the Vic Seminary tower

6. Vic Seminari in Catalonia

7



8

7-8. Research on the illustrations

ADSL Asymmetric digital subscriber line

AP Access point

APC Association for Progressive Communications

ARCEP Autorité de Régulation des Communications Électroniques et des Postes

AS Autonomous system

AWMN Athens Wireless Metropolitan Network

B4RN Broadband for the Rural North

BSS Basic service set

CCC Chaos Computer Club

CJEU Court of Justice of the European Union

CN Community network

CPCE Code of the Post and Electronic Communications

DC3 Dynamic Coalition on Community Connectivity

DIY Do-it-yourself

DPA Data Protection Authority

DSL Digital subscriber line

ECS Electronic communication service

ETX Expected transmission count

FFDN Fédération FDN

FDN French Data Network

FLOSS Free/libre and open source software

GDPR General Data Protection Regulation

GMO Genetically modified organism

ICT Information and communication technology

IEEE International Electrical and Electronic Engineering

IGF Internet Governance Forum

IP Internet protocol

ISOC Internet Society

ISP Internet service provider

ISS Information society service

ITU International Telecommunication Union

IT Information technology

LAN Local area network

NGO Non-governmental organisation

NRA National regulatory authority

OLSR Optimised link state routing protocol

P2P Peer-to-peer

PIN Public Initiative Network

PPA Pico Peering Agreement

SNR Signal-to-noise ratio

UNESCO United Nations Educational, Scientific and Cultural Organization

VPN Virtual private network

WLAN Wireless local area network

PART 1 : WHAT ARE COMMUNITY NETWORKS?

Community networks are local telecommunications infrastructures set up by groups of people (a community) to connect to the internet and provide digital communications services.

They are built and managed as a commons, that is, a resource produced and maintained collectively, rather than held privately, as alternatives to large commercial or state networks and internet service providers.

Under this general description, we find different coordination and organisation models, from a legal entity, such as an association, to an informal group, and many different technical, economic and legal solutions respecting certain ethical values. In this part of the guide, you will learn more about community networks in Europe, what they are, their goals and some key organisational features.

1. Introduction

Thank you so much for picking up this book about community networking. As you will see, it is meant to be a step-by-step guide on how to build a local telecommunications network that you will then be able to connect to the internet to serve the needs of your neighbourhood, of your village, of your city, maybe of an entire region.

But while doing so, and as the book will make clear, you will also improve the life of those around you, make your community stronger and more resilient, promote self-empowerment and knowledge-sharing.

You will have fun, and get to know and collaborate with people from very different backgrounds!

Community networks (CNs) started appearing in the 1990s, as the internet was growing in popularity. They have been called by many names: free networks, alternative telecom providers, do-it-yourself internet service providers (ISPs), etc., but basically, it is about managing telecommunications as a commons, that is, a resource produced and maintained collectively, rather than held privately.

Community networks build on a long history of people coming together to serve their own needs with regards to communication and media infrastructure. At the end of the 19th century already, local residents in the United States or in Sweden, for instance, grew tired of waiting for large companies to serve their regions, and decided to create their own telephone networks. In the 1960s and 1970s, at a time when radio and television were still under a monopoly regime in many parts of the world, activists started to build free radios and other community media to broadcast their own voice, and foster a more democratic communication environment.

Community networks providing internet connectivity and other communications services have been developed since the 1990s. By building a community network, you will become part of this long history. In this early phase of the 21st century, many might think that we already have too much communication and connectivity, or even that the internet is a dangerous space. It is true that it is dominated by large corporations that make a lot of money by keeping us always connected, always engaged on "apps" that are designed to turn us into digital addicts, and which collaborate with both despotic and liberal governments to implement their surveillance policies.

But as the stories gathered in this book illustrate, another internet is possible, one where people and their rights are put first, where they are able to reappropriate the digital infrastructure and challenge the power structures that are turning us into digital serfs, where modern-day communication tools that are all around us come to serve trans-local communities and become tools of emancipation.

With this guide, written collectively by a group of community network pioneers in Europe, activists and academic researchers, we intend to provide a mix of practical knowledge and explanations illustrated by hands-on experiences and real-life stories. Starting with presentations of successful community networks, and an introduction to the importance and the role of community networks, we will present step-by-step guidelines and concrete information on the resources needed to start a community network, get it running, and keeping it sustainable in the long term.

From technical options to economic models, governance choices, legal requirements, and the various skills involved, we hope to provide you with a useful and lively resource to engage with your local community at every stage of a community network.

Story #1: FAQ or community networks in a nutshell

Imagine you arrive at an event organised by practitioners of community networks to learn more about them. In the hallway, you meet Rita. She is an energetic member of a community network who is eager to share her experience. Your discussion could look like this:

You: Hi Rita. Could you please explain to me what community networks are?

Rita: They are telecommunication networks designed, built, owned and maintained by a community of people.

You: They must be new. I've never heard of them.

Rita: They've been around since the 1990s.

You: So they are relatively recent.
Rita: Yes, although they built on earlier community media initiatives, such as community radio. Actually, community initiatives in relation to telecommunications have a longer history: think of community telephone networks in the USA and Sweden in the late 19th and early 20th centuries; community antenna television in the 1950s, which was designed to boost the reception of TV signals in remote and hilly areas; free radio movements of the 1960s and 1970s. All these movements and other so-called community media are part of this history.

You: Where can I find community networks?

Rita: Many countries have them, and the number is growing. You can find them both in countries of the global South, for instance in South Africa, Indonesia and Mexico, and in developed countries like Canada, and many in Europe.

You: Can you give me some examples in Europe?

Rita: Sure. Examples in Europe include Freifunk in Germany, a wireless meta-community with over 400 local communities; B4RN in Lancashire, United Kingdom, a fibre-to-the-home network; guifi.net in Catalonia, one of the largest community networks; Sarantaporo in central Greece, another example; FFDN in France, an umbrella organisation bringing together various community networks; and Ninux.org, a collection of wireless community networks in Italy.

You: I see you mentioned different technologies. Other than that, are all community networks the same?

Rita: No, no two community networks are the same. But although they come in different shapes and sizes, they share some common characteristics. They typically offer an alternative network

architecture, with independent ownership and alternative business models, and share certain values. Alternative means that these features differentiate community networks from commercial internet networks. These characteristics stem from the fact that they are networks conceived, built and operated by and for the people. In addition, differences depend on the characteristics of their geographical location and the social and economic conditions in the territory. Among the above examples there are community networks in urban settings, some that operate across a region and others in a remote valley, some that extend throughout large territories the size of an entire country, etc.

You: Why would people decide to build their own network?

Rita: There are many reasons. The most obvious one is because they have no real connectivity. It might be a community that lives in a remote, rural or in other ways hard-to-reach area, where the population might be dispersed. Commercial providers think that demand for connectivity in such areas is not high enough to justify the cost to service them. But community networks have proven that it can be done and often at a fraction of the cost for better quality.

You: So community networks are just for the unconnected?

Rita: No. For sure community networks have contributed to expanding internet access in many

rural and underserved areas, as well as informal settlements of refugees and migrants, but while the need for connectivity is a key driver, one can encounter community networks in different socioeconomic contexts, including, for instance, urban areas in developed countries (like guifi.net in Barcelona or Ninux in Rome and Florence).

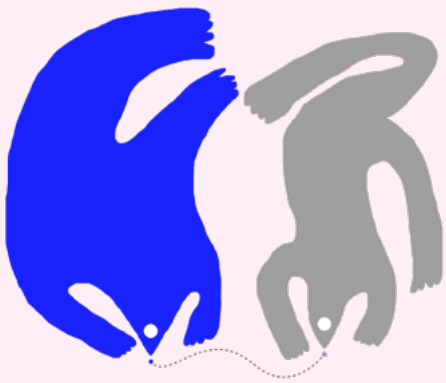
You: What are the other reasons than connectivity?

Rita: Beyond connectivity, the people involved might also be driven by political, philosophical, economic, community and personal motives and values. For example:

- The desire to have a network that differs from – that is an alternative to, as explained earlier – state-run and corporate internet networks.
- A preference for autonomy and self-organisation.
- The wish to have open and affordable networks.

- The desire for better privacy and closer control of personal data.
- Wanting to experiment and play with technology.
- The desire to educate and transfer knowledge to others, thereby empowering them.
- Helping their community to grow economically and become more cohesive.
- Gaining personal satisfaction from the above.

One can see that the benefits of community networks go beyond filling in the "gaps" (those left by large telecom providers) by providing connectivity to under-served or unserved areas. Without discounting their significant contribution through the provision of connectivity, community networks offer substantial economic and non-economic benefits as well. They typically offer more affordable and inclusive internet access; they bring competition, diversity and innovation into the market; they support open technological solutions; and they tighten community ties.



You: You mention economic aspects. Can you tell me more?

Rita: Community networks can help keep local businesses running and growing, and contribute to a thriving local economy. This in turn means that young people can find jobs and stay there rather than go to cities in search of a better future. In other words, community networks promote a circular economy (many resources stay within the community) as opposed to an extractive economy (many resources are extracted from the community and go elsewhere, often depriving the community of the means to sustain itself).

2. Meet some great community networks!

In this short chapter, we want to give you a sense of the diversity of community networks that exist across Europe. So, we will jump from one to another and give you the feel of the experience of each.

2.1. consume.net, United Kingdom

In late summer 1999, two British artist-designers – James Stevens and Julian Priest, each in their early 30s – came up with their own "crazy idea" for a citizen network.

The pair had met at Backspace, a gathering place for artists, designers and entrepreneurs that would likely be branded today as a hackerspace. Backspace had been founded in 1996 and for the three years of its existence acted as a cultural hub on Clink Street, on the banks of the Thames next to the London Bridge. Its protagonists were not trained as engineers, nor did they identify as "techies". But they had an understanding of the internet's potential for alternativeness. As James Stevens recalls, at Backspace "the spirit of free networking and collaboration spawned by its passing lives on in the flow of activity and passion for [self-publishing platform] IndyMedia and peer-oriented exchange."

At first, the project was about sharing a connection and laying out a fibre optic cable between a higher floor of Backspace and the building across the street. But they realised that old planning laws forbade the deployment of a telecom

cable in a public space to entities that were not registered as "public telecom operators" under the Telecommunications Act of 1984.

Thankfully, around the same time, a new networking technology appeared: the Wireless Local Area Network (WLAN) and International Electrical and Electronic Engineering (IEEE) protocol 802.11b – the first technology to be included by the Wi-Fi Alliance under the Wi-Fi interoperability umbrella. According to consume's founders, Wi-Fi "could be thought of as the networking equivalent of CB radio." It allowed for the building of an autonomous network where individuals, groups or organisations would relay internet traffic to one another through their antennas.

Functioning as a free, open local network, consume could relay traffic to the global internet through its members who had their own connection at mainstream ISPs and were willing to share them with others. In that way, the network would "re-distribute access" while "promoting common ownership" of the network. Armin Medosch, a hacktivist and thinker involved in these early efforts, puts it in this way:

"Node owners would set up wireless network nodes on rooftops, balconies and window sills. Each node would be owned and maintained by its owner, who would also define the rules of engagement with other nodes. The network would grow as a result of the combination of social and urban topologies."

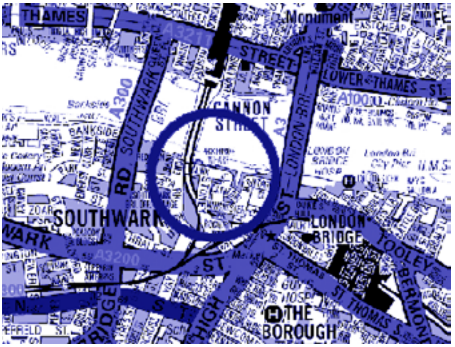
Active between 1999 and 2003, consume.net pioneered a model for wireless community networking that was taken up by Freifunk and others a few years later.

2.2. Freifunk, Germany

This text from an email written by Jurgen Neumann, co-founder of Freifunk, explains how Freifunk took inspiration from consume.net's free Wi-Fi sharing and turned it into one of the most successful community networks in Europe.

Jürgen says: **"The early initial work that me and my colleagues took [up] in the year 2002 was to set up a website and to find simple mechanisms to gather all the people out there who wanted to do the very**

1

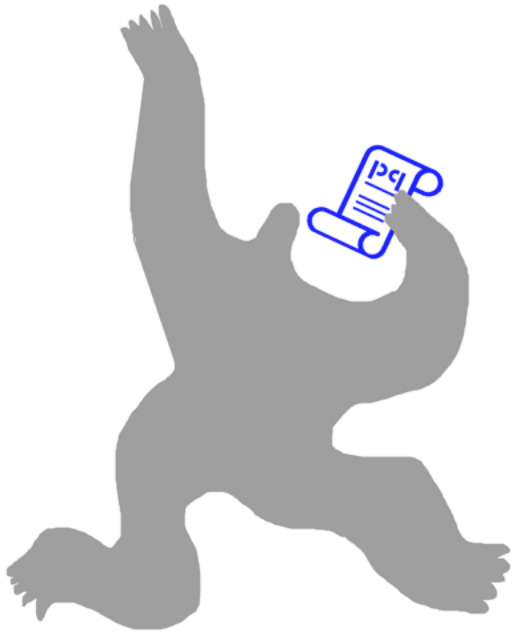


2

1. Breezecom AP10, a wireless router used by consume.net

2. consume.net birthplace: the alternative scene of Clink Street in London (July 2000)

same things. Freifunk.net was very much inspired by the British consume.net. I got to know all these people from Britain in early 2002 and one of my first plans was to simply call the German community de.consume.net. But the more we thought about it, the more we understood that this really wouldn't make much sense. This is because local activities need a localised branding. Also the German term "freifunk" means free radio, a very strong name which speaks a lot from itself in the German-speaking community."



There are a few rules that we have adopted for Freifunk.net that make it so strong:

1. It is totally non-commercial (no ads, no paid labour, no legal body, it's just a movement of equals!).

2. The technical infrastructure is based on the Pico Peering Agreement (common values allowing for the free exchange of internet traffic between Freifunk participants).

3. It is as decentralised as possible.

4. It is meant to connect and support all people who are willing to build and use the free wireless infrastructures (no exclusion).

5. It is part of an international movement for "Free Information Infrastructure".

6. It has a good design and a strong brand which works like a community franchise model. That means everyone can adopt the design and will find style-sheets and logos and presentations that they can use themselves.

7. It doesn't serve the community – it is the community. It's based on the strong idea of DIY motivation (If you want to build a boat, tell the people about the beauty of the sea!).

8. We have our own free software to be installed on small Wi-Fi routers, which can be customised to different looks and designs, extended with individual plug-ins and which is used by many other communities on the globe with different brandings.

9. Freifunk.net is also a domain name service, which delegates sub-domains for cities, regions or organisations to the local communities and their websites, for example, http://augsburg.freifunk.net, http://berlin.freifunk.net, http://leipzig.freifunk.net, etc.

10. There are several websites, blogs and services which are of relevance for all communities. These are, for example, http://global.freifunk.net, http://blogs.freifunk.net, http://freifunk.net, http://firmware.freifunk.net, etc.

11. People with different skills, social and technical engineers, web designers, coders, text writers, marketing experts, artists, lawyers, can all help to push the movement – and everyone will profit from a truly free local wireless infrastructure, to share files, contents, VoIP, and share the costs for internet access.

But as I have learned over the years, this process needs one or more individuals to push and to protect the points I have addressed earlier. The initiative needs to be protected from being overtaken by some egotistic personalities or commercial entities. And it needs people to initialise and push this process. I am very happy to see that there are a growing number of people in the world who are understanding the strength of a true non-commercial community approach. I am also very much aware of the fact that the meaning of "non-commercial" and the ability of user contribution vary a lot. But even under different conditions I think that there is a good chance to try to build a network together with the local community.

"I also want to tell you, that when we started this project, many people told us that a user-contributed network would not work at all, because someone would have to be the leader responsible for the whole network. But now, five years later, there are Freifunk.net initiatives in very many different parts of Germany and also a growing number of Freifunk-like projects out there in the world. In Berlin, we have over a thousand nodes today and in many other cities and rural areas all over Germany people have adopted our model. It truly worked and works and grows from day to day!"

2.3. guifi.net, Catalonia

guifi.net was born in the spring of 2004 in Catalonia. Several people interested in the subject gathered to share ideas and plan the first test, also getting some help from Freifunk people. The results of the tests done on 15 May were established as the first permanent and stable wireless links between the municipalities of Calldetenes, Gurb, Vic and Santa Eugenia de Berga, in the Osona county.

Since then, guifi.net has grown into what is probably the largest community network in Europe. It spans over several regions of Spain, connecting tens of thousands of people through wireless Wi-Fi links and fibre optic networks. It has created a very interesting model where volunteers, non-profit groups, local public administrations as well as small and medium-sized businesses can collaborate to grow the "commons" – in this case, the telecom infrastructure. You will learn much more about guifi.net in later chapters.

2.4. Fédération FDN, France

Fédération FDN (FFDN) was founded in 2011. At the time, the most visible community network in France was French Data Network (FDN), which was founded in 1992 when most internet access providers were non-profit entities. But around 2010, as the debate on net neutrality was raging in France, FDN's president Benjamin Bayart and other active FDN volunteers motivated people across France to join and start building their own community networks. Rather than growing a single organisation, or even the handful of other community networks already existing across France at the time, the choice was made to "swarm" in a decentralised way by creating many local non-profit organisations, all under the 1901 French law on the freedom of association.

To coordinate these developments, share expertise and organise the legal and political representation of the movement, an umbrella non-profit organisation was also created: the Fédération FDN. It now comprises 29 member organisations operating in both rural and urban areas and using both wireless and leased landline networks, whose (physical) members are automatically members of FFDN. This makes for a very diverse community of CNs in geographical, technical as well as socio-political terms – as a participant put it, "Some of us work in suits, other don't work at all."

FFDN's principles are laid out in three important texts that provide a framework for corresponding practices: its bylaws, its internal rules ("réglement intérieur") and its "Charter of Good Practices and Common Commitments". According to this document:

FDN CNs "shall not use commercial methods, such as for instance the purchase of advertising space." People sitting on the boards of FFDN's CNs must be unpaid volunteers and income must be "systematically kept on the books or reinvested."

The Charter also requires members to commit to "protecting and/or promoting the internet" and net neutrality.

To give you an even better sense of the diversity within the FFDN, here are some of the CNs who have joined the federation:

FDN (French Data Network) is the historical French CN, founded in 1992, providing ADSL connectivity at a national scale on last-mile landline infrastructures leased from incumbent operators (the network itself is private, but the connectivity is managed by the community, so it is still a community network). FDN has 502 members, about 330 of which are also subscribers.

Scani was founded in 1998, first as an association called PC Light that did not provide internet access but promoted digital literacy. In 2012, it became a full-fledged ISP. Scani is particularly interesting: not only is it the first FFDN member to include paid professionals (rather than active volunteers); it is also one of the very first FFDN members to foray into the deployment of last-mile fibre optic connectivity.

Faimaison was created in Nantes in 2011 with the help of FDN. It provides ADSL connections and is now moving to expanding its network with Wi-Fi links. Still small (about 80 members, of which 15 are subscribers), it is very active on the advocacy front, organising social events around digital rights campaigns led by French or European non-governmental organisations (NGOs).

Tetaneutral.net is a wireless community network founded in 2011. Its starting goal was to provide internet access rivalling commercial ADSL offers that, in certain parts of the city, were limited to 512K. Its coverage soon expanded to half a dozen rural areas in the surroundings of Toulouse that previously did not have access to a decent broadband connection. Tetaneutral.net now has almost 500 members, including 400 subscribers.

Rezine is based in Grenoble and was founded in early 2012. Athough it is smaller, it is similar to Tetaneutral.net. It provides a mix of ADSL and Wi-Fi internet connectivity in Grenoble. It is also interested in accessing a public radio network developed by local authorities in the district of Isère, but is still looking for interested potential subscribers to make the operation financially viable. It currently has 57 members, of which 43 are also subscribers.

1

2

1. A scene from the building of Sarantaporo.gr community network

2. A scene from the planning of Sarantaporo.gr community network

2.5. Sarantaporo.gr, Greece

At the foot of Mount Olympus in Greece, there is a relatively isolated valley where internet connectivity had not reached until recently. There are 14 villages scattered throughout this valley, belonging to the municipality of Elassona, which in total comprises 50 villages. Farming is the main occupation and economic activity, in particular almond trees and dairy products. The remaining population is ageing, as most of the youth have left for the city, in search of better jobs and more developed social infrastructure.

Regarding access to the internet, although in some of the villages the former national company (OTE) provides ADSL connections, the available lines are not enough to cover the demand of existing users. And because of low potential return on investment, cellular network providers have not invested in the area.

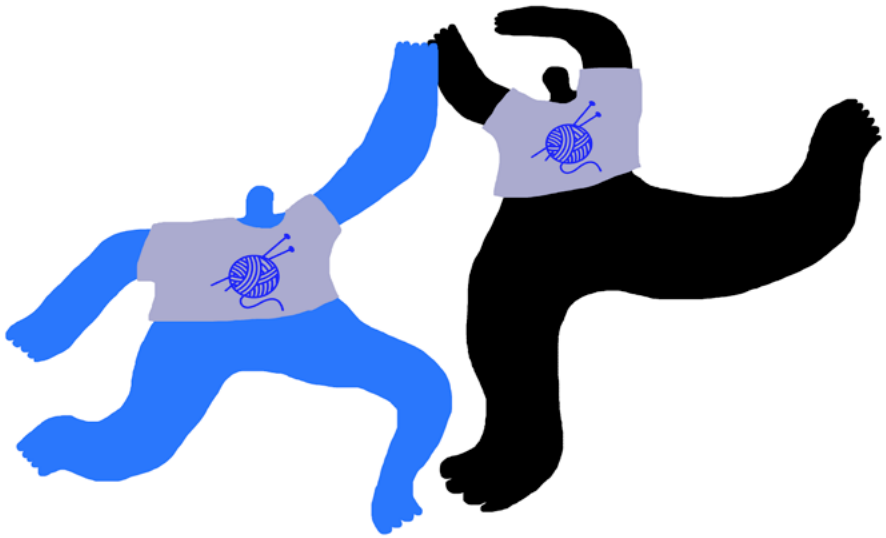
In the absence of internet connectivity, grandchildren began to shorten their vacations in their ancestors' villages, farmers could not get informed about new products that could ease or improve their farming activities, nor coordinate their work by means of specific software applications, etc. By and large, the future of the region appeared to be uncertain, as there was little hope for any significant change; the residents felt disempowered, missing their grandchildren and being unable to attract youth to the region.

After the 2010 crisis in Greece, a group of enthusiasts, some of them born in these villages or having relatives in the region, started to organise to address some of these complex regional (spatial) problems in a sustainable manner. One way out was to build a community network.

So in 2013, this group founded a non-profit organisation by the name Sarantaporo.gr to design and deploy wireless community networks in the area. More than 10 villages are currently interconnected under the same backbone network. The network operation is supported by the Sarantaporo.gr non-profit organisation in collaboration with local support groups of around 60 people involved on a voluntary basis.

The CN could potentially serve around 5,000 residents of the valley, as the infrastructure is openly accessible by all. Thus, children and grandchildren are returning to the villages during their vacation time, as they can stay in touch with their friends in the city. Farmers have begun to use apps that can provide them with information about how to improve their crops. Winters do not seem that long any more, now that internet access brings news and information to any remote village, such as new ideas on crafts, like various knitting models that spread through the valley thanks to grandmothers watching relevant YouTube videos. The villages' inhabitants can now trade their produce or handcrafts in distant locations without the need for intermediaries, and so forth. On many roofs of private houses or of local restaurants, as tavernas are among the main village nodes, one might notice the CN antennas reaching out to the world. Sarantaporo.gr has been visited several times by the netCommons project partners. The pictures in Figure 1 and 2 were taken during these visits, when planning and expansion of the network took place.

Sarantaporo.gr is so far a success story of the provision of public infrastructure by a grassroots organisation. It also generated structures for self-management in keeping the network operation sustainable. This was critical for the reinvigoration of the social fabric of this region, and for restoring a greater sense of togetherness. This initiative demonstrates how information and communication technologies (ICTs) in general are capable of transforming perceptions and influencing social behaviour, and also have a significant impact on the spatial development and economy of a territory.



2.6. ninux.org, Italy

The following text is taken from the 2018 edition of Global Information Society Watch (GISWatch), a yearly publication by the Association for Progressive Communications (APC) that in 2018 was focused on community networks, released with a Creative Commons Attribution 4.0 International (CC BY 4.0) licence. One of the chapters was dedicated to ninux and written by Leonardo Maccari and Claudio Pisa (an activist of ninux).

Ninux.org was started in Rome in the early 2000s and was the initiative of a computer science engineering student, Nino Ciurleo. Nino had grown technically in the ham (amateur) radio community as well as the Italian hacker scene and was influenced by the punk do-it-yourself attitude.

One day he read about the Seattle Wireless community network in a magazine, liked the idea, and decided to use his personal web page – http://ninux.org (a pun on "Nino" and "Linux") – which was hosted on a server in his room, to search for other enthusiasts to help him build a wireless community network in Rome. To help spread the word, stickers were printed and placed around the city. After a couple of years, the ninux network was bootstrapped, and the core of the network, composed of three nodes, was up and running.

Many people with different (but still technical) backgrounds were then joining the ninux mailing list and meetings. The motivations for joining the community ranged from socio-political reasons, helping to bridge the digital divide, a desire to learn by doing, down to pure curiosity.

Since then, many things have changed. Ninux is now a community with about 350 nodes scattered around Italy. It is an integral part of the European community network movement: it hosts services, it has participated in European research projects, it has its own "autonomous system", and it is well known among Italian hackers and geeks.

One of the key characteristics of ninux is its hacker nature. In the period 2013-2015 (when Italian legal limitations on Wi-Fi in public areas were no longer in place and Snowden's revelations were under the spotlight) ninux almost

doubled the number of its nodes and hit the news in many mainstream newspapers and websites. Mesh networks were depicted as a remedy not only for the digital divide, but also for surveillance. Besides a certain degree of journalistic hype, the truth was that around 2010, both the technical and ethical propositions of community networks were extremely advanced. The idea that a mesh network, being technically distributed, could enable the creation of a communication platform with a governance structure inspired innovation and advancements in many directions.

Today ninux has expanded into rural areas with poor connectivity. On some islands, its primary purpose is actually utilitarian: to overcome the digital divide. But the original spirit still persists.

The ninux community does not have well defined decision-making bodies or procedures, and its participants come from heterogeneous backgrounds. Until now, ninux has not had the willingness to try to become a formal community ISP, even if successful models point in this direction.

1

2

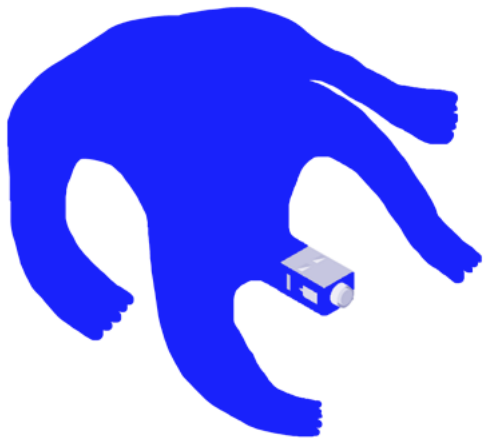
1. Installation of an ubiquity antenna

2. An installation of an antenna by Ninux CN

1

1. Parabolic grid and directional antenna

3. The "network" in community networks



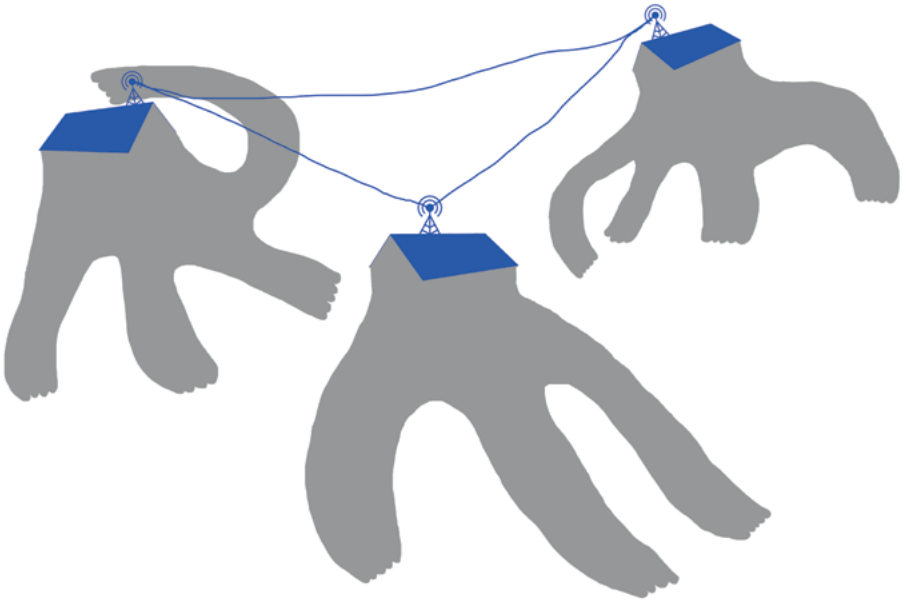
After these quick introductions to various community networks in Europe, you may still be unclear about what the network part really is. So, in this chapter, we would like to introduce basic technical notions and vocabulary that are crucial to understand these bottom-up infrastructures.

3.1. Nodes

The first structural components of your community network are its nodes. In telecommunications, a node is either a point of redistribution of communication, or its point of delivery. Going beyond the traditional network and computer science definition, a node or a peer can also designate the location where the devices comprising the network are installed, or even the person operating or hosting them.

3.1.1. Routers

A redistribution node can be a group of directional antennas on a roof establishing directional links with another node on a different roof. It can also be a single antenna expanding connectivity across a building or a given area. It can be a computer interconnecting two or more fibre optic lines. It can also be a wireless access point offering public access in a park or meeting place. In all these cases, the node can be said to be a router (its role is to redistribute and route traffic within the network).



Nodes can have various characteristics. For instance, there are optical fibre nodes (they are called "splitters") that can collect and distribute the internet traffic directly within the optical fibre without requiring electronics, or even electricity! These are called passive nodes. A splitter does not require energy and can be placed anywhere that is safe and cheap. Active nodes, on the other hand, might require rooms with some special characteristics, such as cooling during the summer. Splitters have the advantage of robustness and zero maintenance, but they also have a limited capacity, as the number of optical fibre links that can be handled by a splitter is limited, e.g. 32 or 128 or similar numbers depending on the technology. Furthermore, this number is fixed at installation and cannot be upgraded: you have to change the entire splitter and this can be complex and expensive.

An active node, instead, can scale more easily as it is possible to add "ports" terminating optical fibres to the active node as they are needed, and also the capacity can scale with the number of ports. Upgrading an active node can be easier and cheaper than changing a splitter. The two technologies can also be mixed. An active node can collect traffic from many fibres, each one of them being "splitted" to reach 32 or 128 houses, for example.

3.1.2. Clients and servers

The principal role of a communications network is to bring information and data from one endpoint to another. Endpoint nodes are where communications and data are delivered, and they can be clients or servers. To connect to the internet, retrieve emails, browse the web, we typically use a desktop computer, a laptop, or a smartphone. These machines are usually referred to as the "clients" of another device or a special-purpose computer, a server, which can offer a range of applications that we wish to use: a website, a simple storage of files, an online forum, or more sophisticated ones like tools for collaborative editing or platforms for online deliberation, and multi-player games. Even when two people communicate with each other "directly", this communication needs to be mediated by a server responsible for setting up the connection.

An end-device that is mostly used as a client can act also as a server. For example, in the peer-to-peer BitTorrent system, software allows end-user devices to directly download and upload content between each other (for example, large movie files). In this case, however, the communication still often depends on the existence of other servers dedicated to coordinate the peer-to-peer interactions.

Indeed, the client/server terminology refers to functions and software, rather than devices: a software process that "asks" for a communication is a client, while a software process that "answers" this request is a server. "Cloud" services are communication applications that run on distributed servers hosted by large telecom companies often known as "content delivery networks".

All internet services that we use daily involve a server somewhere storing, indexing and filtering data received from clients and the devices owned by the "users".

In principle, a good server needs:
1. to have a "permanent" address,
2. to have sufficient computing power and upload bandwidth for serving the requests of its clients, and
3. to be always available, up and running.

Although it does not have to be that way, such features might require the replication of functionality in multiple computers, cooling, dedicated personnel, and other expensive measures (similar to those adopted in data centres), which may be harder to replicate in a "home" environment. Due to

this, there are today numerous "web hosting" providers like Amazon that offer online "space" for organisations, companies and individuals to host their servers, from personal blogs to sophisticated platforms. And this is increasingly so as people increasingly rely on small devices like smartphones to connect to the internet.

Story #2: The trend towards (de)centralisation & how community networks can help (by Panayotis Antoniadis)

Reflecting this tendency towards centralisation, today we see more and more services moving to big data centres, often referred to as the "cloud", reducing the burden of computation and storage from the end-user devices. Even software traditionally installed on one's computer like Microsoft Office is increasingly accessed remotely through one's web browser (e.g., Google Docs).

On the one hand, this relieves people from the burden of maintaining and updating their own infrastructure, even from the need to keep backups of their files. But on the other hand, the computing and environmental costs of remote communication increase significantly. In addition, there is a loss of ownership and control of one's data, which become controlled by large, often US-based cloud firms.

Decentralise, with the help of free software

To help reverse some of these trends, and in addition to offering connectivity to the internet, a community network can offer additional services, such as hosting its own services in dedicated servers located in more or less central nodes of the network. Some of these servers are necessary for the functioning of the network itself, like monitoring, solving technical issues, etc.

Others can provide community-owned alternatives to services of global platforms like Google, Facebook, Amazon, etc.

In this context, the role of free/libre and open-source software (or FLOSS) can be instrumental, since it allows scaling to be achieved through replication, allowing for different groups or even individuals to run their own services, like a WordPress blog or an Etherpad server for group projects.

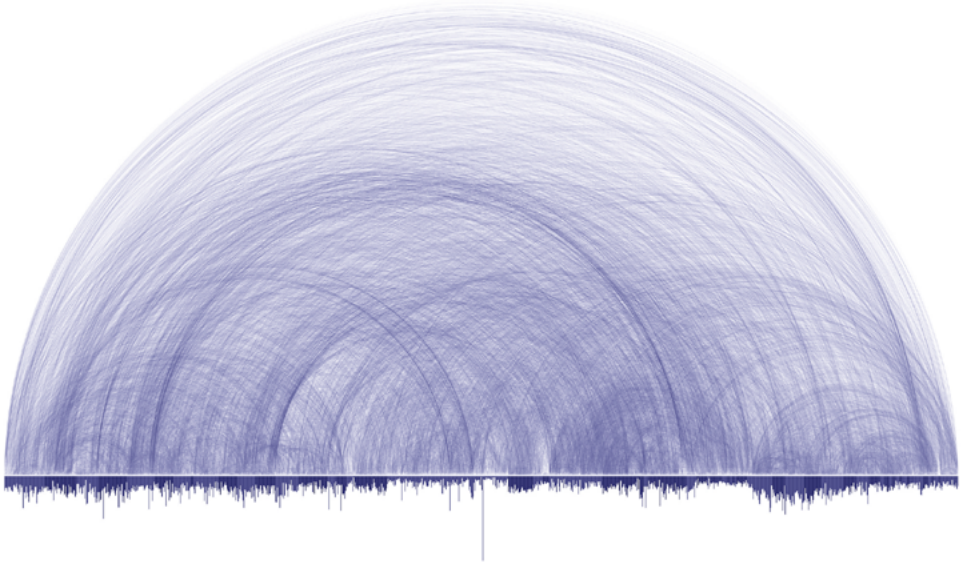
For more sophisticated services such as video calls or streaming, however, additional investments in infrastructure might be required, as well as the appropriate institutional and governance structure for deciding on important design details, data management, and more.

3.2. Links, backbone, gateway

3.2.1. Links and backbones

Nodes, whether routers, servers or clients, are interconnected through links. Links can either can be wireless, using radio signals like Wi-Fi, or wired (also called landline), when they are formed by a copper line or a fibre optic cable. These links may connect nearby elements (for instance, two routers each installed on roofs in a neighbourhood), or travel long distances. Long-distance links form a part of the network that is called the backbone. The backbone is a collection of links with a significant amount of bandwidth capacity interconnected through powerful routers. In some sense, the backbone creates a network of networks, connecting different local networks to one another, expanding their reach and finally connecting them all to the internet, typically in one (or more) of the large facilities where all internet operators exchange their traffic (these are called internet exchange points or IXPs).

1



1. Data visualisation of internet backbone

3.2.2. A gateway to the internet

You might be happy to operate just at the local level unconnected to the internet, following the model of an isolated island like ninux groups do in Italy (but ninux islands are urban community networks, where most, if not all, the participants already have an internet connection). A lot can already be done just by establishing such a local network, in terms of building a community, setting up local online services and learning about the technology. But chances are your community will also want to be able to access the global internet and its vast resources.

As a matter of fact, community-run telecommunication networks have been around for a long time, and growing beyond local connectivity has always been key to their survival. For the local and community-run telephone networks of the late 19th century in the US or in Sweden, interconnecting with national telephone networks was already an essential feature for success.

But in some cases, scaling up can also harm the community, by making its network dependent on large, corporate actors that will eventually seek to impose their own technological and economic terms.

To put it in a nutshell: interconnecting with national and global networks often has trade-offs. But many thriving community networks have learned to negotiate this issue successfully. You will learn more about internet interconnection later in this book.

3.3. Similarities with and differences from other infrastructure resources

The internet has interesting similarities with, and differences from, other resources like water, energy, food, and transport networks. Understanding these similarities and differences will help you better conceptualise the potential role(s) of a community network in relation to the internet.

The internet can be seen as a network that interconnects any two nodes in a city, a country, a continent, the world. This is achieved through a series of links, wireless or wired. Seen from this perspective, transportation networks represent a comparable infrastructure.

But internet nodes not only enable the interconnection process, like, for instance, a transportation network facilitates faster transfer of travellers or goods from one point to another. They can host "services", software programs that offer a wide variety of applications that could be seen as the main "resource" made available through the network – they are the "destination". The internet could in that sense be considered as a distribution network, like the water and energy networks.

So, the internet gives us access to Facebook, Netflix, Google and the like, but also to a local website hosted by a small provider in our city. Taking into account the variety of the "sources", and the quality of the resource or service offered, food is perhaps a closer analogy, since there are a wide variety of food "sources", both local and globally distributed, organically grown, or produced at an industrial scale. In the case of water and energy, the difference is that the variety of "sources" is rather limited and can get exhausted.

All these analogies share the concepts of a (re)source, a node and a link. In most cases, the connectivity of nodes to the resources is almost straightforward, as they give you access to all you need: water to wash and drink, energy to power your home, appliances, devices and servers, a path to any destination in the global transportation network. It is only in the case of food that specific distribution nodes, from a supermarket chain to a local store, offer access only to a subset of the food "sources" in the world. And these can differ significantly in terms of the type and quality of the source.

In the case of the internet, nodes offer access to the whole network, as in the case of water and energy, but the different information sources are of varying types and quality, as in the case of food. These sources are the servers that host different types of content or facilitate various interactions, from a simple phone call to a sophisticated collective editing process.

The properties of the links also have different characteristics. For water, energy and food distribution, which actually depends on the transportation means and networks, "links" may be diversified, yet without users' awareness. In the case of transportation networks, one may experience very different speeds and comfort levels, and the same holds for the internet links which can offer different performance levels in terms of speed, latency and resiliency.

Access to the nodes can be also private or public. Moving between different places in the world, one can find huge differences on how "close" to one's location one can have access to different resources. In some parts of the world, access to water and energy is available at home, and limited in public spaces, for example, water from public fountains or energy sources in public facilities like airports, etc. In others, water is collected directly from the natural source that is publicly accessible. In the case of the internet, there are similar disparities. There are places where internet connectivity is accessible directly at home and with cellular networks it is essentially "in your hands" (almost) anywhere you are; and there are other places where there is no or very limited internet access.

In this context, a community network is a simple term to describe a wide variety of efforts by local communities, rather than private companies or the state, to build and manage all or parts of the infrastructure required to enjoy and co-create the internet and other communication services.

Sticking to our analogies, in some cases the focus has been placed on building links to a close-by internet node or gateway, as in the case of the Sarantaporo.gr CN. In other cases, the focus has been on developing local servers accessible through a local distribution network like ninux.org or the Athens Wireless Metropolitan Network (AWMN). Others like guifi.net have successfully built a high-capacity and widely distributed infrastructure made up of both fibre and wireless links to connect to the internet. Freifunk.net gives particular importance to the public access network, making it easy for individuals to share their internet connection through their Wi-Fi router.

In the case of water, energy, food and transport, there is also a wide variety of combinations of actors responsible for different parts of the infrastructure. However, there is not always "consensus" about the appropriate mix. There are actually numerous ongoing struggles around the world against the privatisation of water and railways, or against coal or fracking for gas and oil extraction, or genetically modified organisms (GMOs) or pesticides for food.

The comparison with organic agriculture and food sovereignty is also particularly interesting and relevant. Global solutions to food security promoted by large corporations (companies like Monsanto) can appear as the most efficient and secure. But many local communities refuse to become passive consumers of food technology and claim their right to grow their own food, using traditional techniques which they own and can master, even if they may not look as "efficient".

Finally, not many people realise that creating a local network infrastructure today could be no more work than building a community garden, not so easy maybe, but very empowering and liberating. In the past, it was mostly an activity carried out by experts and technology enthusiasts. These efforts led to remarkable success stories despite the legal, social, political and economic barriers. Today, growing your own network needs fewer technical skills, as technical resources are widely available (see the educational material in Chapter 12) and easy to use, even without a specific technical education. This has empowered diverse communities around the world to get access to the internet by building their own networks and to share their knowledge. But it makes sense also for those who are already connected to a commercial or state provider.

In the same way it makes sense to also grow vegetables in your garden even if there is a lot of food in the supermarket next door ready to be put in the microwave and consumed in a few minutes.

4. The "community" in community networks

Now you know more about the technical infrastructure underlying a community network. But in addition to network infrastructures, community networks should be about a group of people, that is, the community. The community might pre-exist the creation of a self-owned and managed telecom network, and it will be strengthened by the creation of its own local telecom network. In other cases, the group will gradually become a community in the process of building that network.

The point is that community networks require people to come together, create and nurture human and social bonds, establish and negotiate forms of knowledge sharing and decision making, and while doing so, improve the lives of people affected by the network. In the same way that the complexity and challenges of building communications networks grow as they become bigger and more diverse, the same holds for communities.

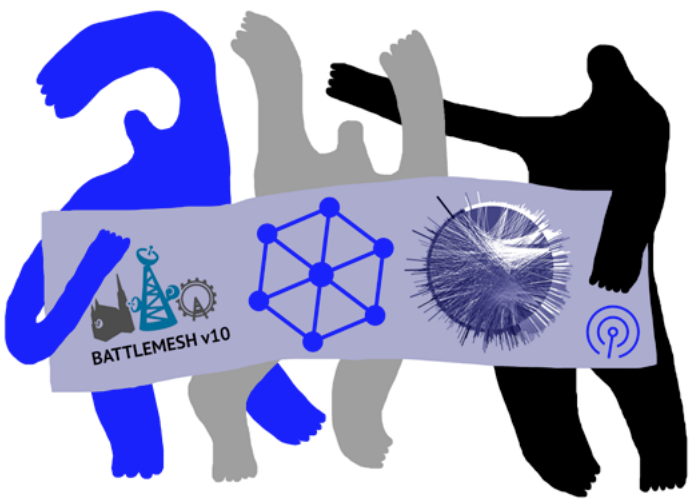
4.1. What community?

The term "community" itself can be a source of confusion, because it can mean different things: from a local reading club or a group of friends, to a global community of hackers or of Wikipedians. Let’s make things simpler: a community is built around at least one common interest, goal, attribute.

The term "community" in community networks could then refer to different communities and levels of participation:

- The community of inhabitants able to use a community network in a specific location, urban or rural, like the Sarantaporo community, enjoying the community network independently of their involvement in its maintenance.
- The community of individuals building and maintaining a specific network in a specific territory, like the Athens Wireless Metropolitan Network.
- The community of people supporting a specific community network concept, which can be replicated in different locations, like the wider Freifunk community.
- The community of experts around the world, exchanging knowledge and supporting each other in developing various CN models, like the Battlemesh community.
- The community of initiatives (local and/or global) fighting for the same cause, like sustainability, democracy, self-determination, the commons, privacy and network neutrality, for which community networks can play a key role.

Go find yours !



4.2. Community and the notion of space

By construction, community networks are located in a certain territory, though very often the very same network structure and organisational models are replicated over and over again, as in Freifunk and ninux. Their existence and characteristics are thus an integral part of the social, political and economic environment of a space. But like community, "space" is a complex term that includes many dimensions in addition to the "physical" space.

As you consider the creation of your own community network, it is very important that you also understand space in its social dimension. Today, information and communication technologies also act as mediators for interactions between people, and thus contemporary space is inherently hybrid, mixing spaces of digital and physical nature. Because they are built by a community of people grounded in a specific territory, community networks can be a great tool for the formation of a hybrid space, one with both physical and digital layers, in both urban and rural areas.

But community networks can do more than that. They turn into a metaphor for the practical and symbolic junction not only of the physical space (what is material and tangible around us) and of our social or lived space (space transformed through our emotions, filtered through our memories, the space of artistic creation), but also of our mental space (the space of reason, logic, intuition and imagination). The importance of linking these various spatial layers with one another was first suggested by French philosopher Henri Lefebvre in the 1960s. Across their short history, community networks have proved to be a very effective way of interlinking these various spatial dimensions.

The following story highlights the importance of space, of the community and of networking. It shows how strictly local community networks, meaning that they are not connected to the global internet, can serve local needs and provide applications that would be otherwise difficult to provide locally in a bottom-up fashion.

Story #3: L200, a hybrid neighbourhood node in central Zurich (by Ileana Apostol)

Currently throughout Switzerland, affordable high-speed landline and 4G internet access is available. Due to an overwhelming offer from commercial providers, it is more difficult to engage people through Wi-Fi networks. Yet community networks could contribute, nevertheless, to what might be the particular needs of locality, for instance, through customisable options of local networks.

In a central district of Zurich, Kreis 5, in recent years rental prices have been increasing dramatically, making it impossible for small businesses, art studios or other non-commercial activities to afford a central location. For instance, some of the small shops had to move out of the locations where they have been operating for decades. Powerful players at the national or global level, having a stake in this central neighbourhood, dominate the rental market and have a strong influence on urban policies and neighbourhood development.

Given this disproportionate distribution of power within the political spectrum of the neighbourhood, several grassroots initiatives and citizen associations have been active in fighting its homogenisation by preserving some of the small local shops, and a vibrant scene of alternative organisations that are active in promoting a sustainable urban life. They include initiatives on food, housing, social infrastructure, digital technology, and so forth.

All these small neighbourhood players needed a central and visible location for a shared space, where gatherings of neighbours could take place, or during earlier hours of the day, a co-working space could be run as a collective. Such a place could provide neighbourhood entrepreneurs with a space for encounters, where they could network and over time create a coalition to support their continuous presence in the neighbourhood. Moreover, they required communication and networking options suited to their specific collective activities in the neighbourhood, which could be fulfilled with software applications on a local network.

At the beginning of 2018, the association L200 was created and successfully applied to be the tenant of a ground floor space on one of the busiest streets in the centre of Zurich. The space called L200 has been conceived from the beginning as being hybrid, equipped with digital technology. At the L200 space the aim is to intensify its use. At the same time,

it is a way to provide access to the city as specific places within a political economy of cooperation, of solidarity, and of mutual benefit. From the participatory discussions and meetings with neighbourhood actors, it was clear that the location will be shaped at the convergence between individual needs (e.g. co-working space, meeting space, networking of small shops) and collective needs (e.g. place of encounters and networking in the city, of collective learning, of exposure of ideas and neighbourhood initiatives). In this complex situation, digital technology had the potential to contribute to organising the associations and coordinating the use of time and space.

The L200 hybrid neighbourhood node represents direct democracy exercised in Switzerland, a manifestation of the ongoing struggle for the right to difference, by providing the necessary openness to imagine and act for new possible spatialities. Through its spatial and temporal flexibility, due also to the local network deployed, the L200 space is likely to shape a new culture of neighbourhood conviviality.
In this complex situation, digital technology helps to organise the association, and to coordinate the use of time and space at L200. But it has been a goal since the beginning to transform L200 into a genuinely hybrid space, including a local-only digital platform accessible only to those present in the space. A website that you can literally "visit" walking into the space.

Since 2018, the local network named L200.digital is hosting a photo exhibition of the year's events, advertising the member organisations on the on-site displays, and is used also for file sharing, as a digital whiteboard, or for editing collective notes.

1

1. L200's storefront windows enable a wide variety of playful hybrid interactions with passers by, like an anonymous digital whiteboard using a screen that projects an Etherpad instance hosted on the local WiFi network

PART 2 : WHY ARE COMMUNITY NETWORKS IMPORTANT?

Community networks are an increasingly important piece of the global communications puzzle. As individual entities seen from a distance, they might seem too small to be relevant. But as this part will show, they are one of the most important assets to keep global communications, or the internet, as we normally call them today, a space of freedom and knowledge sharing.

Community networks bring diversity in the internet: they help sustain local cultures and know-hows, they reduce the digital divide, they foster economic and social welfare, they advocate for human rights, freedom of communication and privacy.

Now that we have a basic understanding of what community networks are, let's dive deeper into the underlying philosophy, values and needs of these initiatives. Here we focus on the values which are probably the most important, and to some extent, also key for other community-based initiatives: direct, decentralised ownership and self-governance; a potential to reconfigure our social relationships and foster solidarity within our local communities; the joys of learning-by-doing, exchanging knowledge and experimenting with communications technologies; and lastly, the ability to better protect human rights on the internet.

5. Introduction to the philosophy of community networks

5.1. Direct, decentralised ownership and self-governance

A good place to start exploring these questions is London, in 1999. At the time, consume.net – which we already introduced in Part I – was experimenting on what it means to be a wireless community network.

One of its main contributions to the history of community networks was to stress the political potential of local networks against the global gigantism of the internet.

Through some of its members sharing their traditional internet connections, consume.net was connected to the internet. But its participants insisted that it could also exist and be useful without these connections to the global network. Rather than interconnecting with a traditional network operator, local networks could grow in a different way, expanding organically by recruiting new neighbours and eventually, providing an alternative public network of interconnected individuals and communities. After a point, these local communities would interconnect with one another, so as to bridge local boundaries, and exchange their members' data based on ad hoc agreements and shared values.

That vision would soon materialise in a set of basic principles which came to be known as the Pico Peering Agreement, first presented in 2003. The Pico Peering Agreement aimed at interconnecting these "network islands" by providing a template document regulating the various aspects of these interconnections.

The idea was that, according to the document, the "owners of network nodes assert their right of ownership by declaring their willingness to donate the free exchange of data across their networks."

Story # 4: Appropriating the Pico Peering Agreement (by Jürgen Neumann)

Back in October 2002, I was seeking a solution to solve my disconnectivity problem that arose from the fact that I had moved into the far east of Berlin. I wanted to fight my personal digital divide, a result of the German Telekom's OPAL (Optical Access Lines) experiment.

The district where I moved to had no DSL available. So, I wanted to learn how to build a wireless link to a local internet service provider at a distance of two kilometres, which was in line of sight from our house's rooftop. Around that time, some people had organised a little open space style conference about free Wi-Fi experiments, with network activists from Berlin and London, the BerLon (Berlin, London) meeting at the Bootlab, a former Berlin hackspace.

By chance I dropped into a group of Londoners, including Adam Burns, Julian Priest, James Stevens, Saul Albert, Armin Medosch and Simon Worthington. They were intensively discussing a set of rules and a guideline for community networks.

I joined their intense conversation about the relations between the

network peers. After about two hours I had a flashing and life-changing realisation: for the first time, I grasped the huge political dimension of the whole topic. It was the starting point of my engagement with wireless community networks. We had follow-up meetings in Copenhagen and Berlin, where we included the feedback from many other network activists.

In Djursland, at the "Fresh Air Free Networks" event, we then finally published The Pico Peering Agreement (see Appendix A). Since the early 2000s, Freifunk has used the Pico Peering Agreement as a baseline to interconnect its participants and local chapters. In an exciting experiment from 2012, FunkFeuer (Austria), NEDWireless (Croatia) and Wlan Slovenija (Slovenia) also established a wireless backbone radio link spanning across national borders.

5.2. Direct interconnection and local interaction

These examples illustrate one of the core convictions underlying community networks: that local and even transnational connectivity does not always have to be mediated through large internet service providers. We can interconnect our houses, neighbours or localities, and even span out telecom networks across borders, without having to rely on these companies.

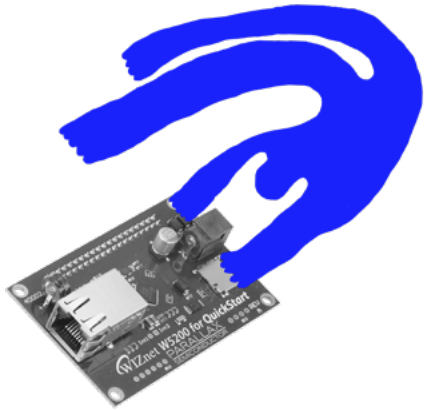
Through the community networks you build, you will also set up a basic organisational structure where it will be for the community itself to decide how the network should effectively be designed and managed, who will be able to access it and on what conditions, in other words, the governance rules. It is not like just subscribing to a commercial internet access provider, where you may choose from a range of different commercial offerings, and depend on pre-established tariffs and conditions imposed in their contracts. At the core of a network commons, there is typically a form of peer-to-peer approach to decision making, based on deliberation and consensus.

We will return to how to achieve this, as it is not always as easy as it first sounds. But a good start is to provide basic channels of communication for all community members, like mailing lists or an online forum, or to hold weekly or monthly meetings, where all willing participants and the most active volunteers can get together to socialise and debate important issues. As one guifi.net participant told us :

"Day-to-day decisions are often proposed and debated on mailing lists and social networks, while the most important decisions are usually presented and discussed in meetings."

Yet, as is often the case in internet governance and other advocacy forums, community networks tend to favour the most active members. Some define themselves as a "do-ocracy": **"We are organised in a non-hierarchical community where common decisions are made consensually through constructive debate and arguments, but where in the case of equivalent arguments, we favour arguments of those who are more actively participating in the network"** writes Mitar, a member of the Slovenian network Wlan Slovenija.

6. Learning and experimenting



For community networks, users' lack of technical skills is sometimes one of the most challenging problems. Educating users and encouraging knowledge sharing through workshops and other educational activities that can help participants understand the functioning of a network, how to install new nodes, fix a broken radio link, or use network management tools can therefore become crucial for the sustainability of the initiative.

But as illustrated by the following stories, community networks do more than just offer basic digital literacy skills. Because they are fuelled by the pleasures of learning by doing together, they foster scientific and engineering experiments, and can also act as a proxy for forms of political education.

Story #5: Learning together leads to further philosophical and political views (by Adam Burns)

free2air, established in 2001 in East London, chose to establish a CN to discover how to directly connect local people and groups to a locally run shared network: hopping from one neighbour to another neighbour. The process of meeting, planning and installing direct communication links creates a common learning and understanding not only of how the technology works, but also an understanding of the human consequences of its use.

A shared understanding leads to strengthening common community bonds beyond the technicalities of computers and networks.

After holding knowledge sharing workshops on how each of us could deploy our own part of this local network, the core group of local technologists, artists and activists continued to hold social meetings discussing the ways we were all utilising the network, inviting each other to collaborate and promote each other's projects.

Story #6: From computer research to community networks (by Leonardo Maccari)

What we call "the internet" is a mixture of components in continuous evolution. It is disorganised but follows some trends. Those that build the internet can interfere with such trends.

When I started my PhD in computer science, in 2007, mesh networks were the next frontier to expand the internet. We constantly squeezed our PCs out to simulate networks made of tens of nodes, to design and test new protocols. In 2012, I came into contact with the people from ninux.org and I remember one of my first conversations. I asked them, "How big is your network?" and they answered, "About 100 nodes, but there are larger ones." I jumped on my chair; these rookies were building real networks way larger than those that we, "computer scientists", could just simulate.

From that moment I started to look at community networks with great respect and interest. **I understood that in a community network there is a unique mix of competencies, enthusiasm and ethical values that is a fundamental complement to the scientific research needed in the technical field.**

As researchers we have the ambition to help to build a better internet: more accessible, more transparent, and more respectful of people's rights. This goal can't be reached without the participation of communities.

Communities will enjoy accessibility, transparency and respect, and therefore we can't build a better internet for them, we must do it with them. Communities reinforce the social ties through which technical innovation from researchers can percolate into the roots of society. They do so while building the internet. They produce the image of a bottom-up, community-led internet which is a powerful metaphor that people understand.

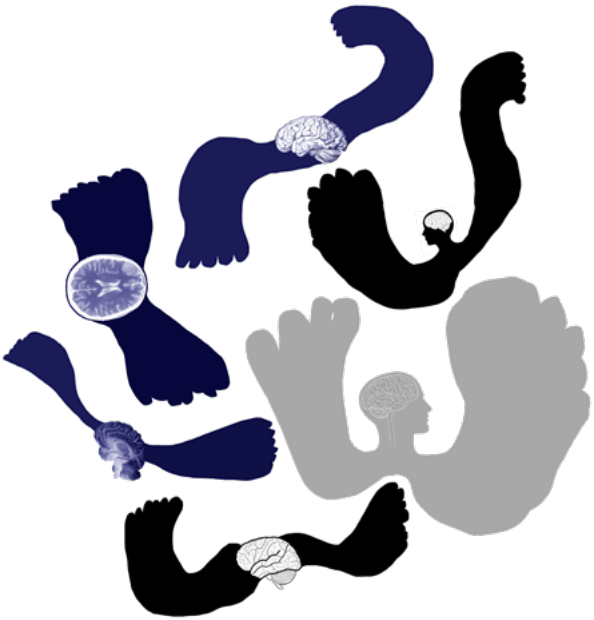
Here comes the uniqueness of a CN: it grows only if the community grows. For this reason, CNs organise activities to motivate more and more people to build their small share of the internet.

The ninux community organised several courses, skill-sharing sessions and small schools in many of the ninux islands, with the goal of making people independent when they build their part of the network, but also in general to make people understand all the problems that the internet has and that CNs can alleviate.

In Florence, in Rome, in Cosenza (just to name a few), I have seen such events organised by CNs in cooperation with local organisations. They attract people because they are organised by groups rooted into society, which makes it easier to reach those who are normally not interested in technical concepts. This process tackles the "relevance" leg of the digital divide problem: we know that the digital divide is not only about being reached by the internet, it is also about being able to understand its importance. People who do not value internet access are left out of the internet, or they passively use it as consumers, without exploiting the creative potential it offers. **CNs disseminate the value of networks, and help transform internet users into internet citizens.**

For a researcher, a community network is an incredible playground, it enables us to experiment, discover and replicate at scale the dynamics of the internet. It forces us to think outside of the box, to find new solutions to old problems with a special attention to sustainability. It teaches us that a technical solution alone is not sufficient if it is not acceptable for the community.

7. Community networks and human rights



When you decide to build a community network, you will also establish an infrastructure that protects human rights. Actually, if you read the Universal Declaration of Human Rights, you will encounter several provisions which can positively be impacted by community networks, such as freedom of opinion and expression (article 19), freedom of thought (article 18), the right to privacy (article 12), the right to equal access to public services (which can include communication services) (article 21.3) and the right to equal participation in the cultural life of the community (article 27).

Here, we focus on just a few of these rights. As you will see, community networks can achieve a great deal in protecting rights and freedoms online where they are increasingly threatened.

7.1. Censorship

As governments enter into alliances with telecom providers and large online platforms to monitor and censor online communications and people's habits, community networks can act as a shield against these new systems of control that are being put in place, often with no regard for the rule of law.

In a number of countries, community networks are usually not affected by censorship orders issued by courts against illegal online content. In France, for instance, the state has to compensate ISPs financially for the cost incurred for blocking websites. As a result, prosecutors make the choice of focusing on the few large commercial ISPs with the biggest market share.

Because they can function autonomously from traditional communication networks, some models of community network can also act as a last-resort resource to allow citizens to organise (politically or otherwise), should governments activate the "kill-switch" and shut down all public communications networks, as has occurred for instance in Egypt and Libya during the 2011 Arab Spring. In those instances, European community networks acted alongside other activists to provide people in these countries with ingenious schemes to circumvent such censorship.

7.2. Net neutrality

Besides facilitating government censorship, commercial internet access providers also have a history of blocking or slowing down certain websites or content for business reasons. When they do so, they infringe on a crucial principle known as net neutrality.

Conversely, community networks pledge to really treat all traffic equally, without any form of discrimination. In practice, in terms of traffic management, net neutrality entails several principles that community networks can explicitly refer to in their charters, value statements or terms of use.

In order to respect this principle while transmitting data over your network:
- You should not inspect the content of the transmitted data.
- You should treat data equally (no throttling, no blocking, no prioritisation), irrespective of the source, destination or protocol.
- You should not alter the data (adding or deleting content).

Net neutrality was one of the major factors leading to the flourishing of the early internet, and the ability of small non-commercial or commercial actors to develop and find their audience. Net neutrality supports innovation, because it prevents internet access providers from blocking services, applications or protocols just because they don’t know them or because they compete with

these firms' own services; it guarantees fair competition as it ensures that all actors on the network are treated equally at the technical level.

7.3. Privacy and surveillance

For privacy, too, community networks bring important protections. For one thing, you might feel more comfortable communicating through a community network operated by people you trust rather than giving away your traffic data to commercial providers. Also, the more online services are hosted on the local community network, the less users are exposed to the various forms of online commercial surveillance. In some more serious cases, especially in cases of authoritarian practices by state authorities, if a member of the community is exposed to repression, the community network can act as a proxy and even refuse to comply with illegal requirements issued by the police. They act as a proxy for human rights.

That being said, using a community network does not mean perfect protection from surveillance. As a member of Freifunk told us in an interview: "Devices operating in any wireless network – including mesh networks – use a radio transmitter that can always be located by triangulation."

Commenting on the choice not to put passwords on the shared Wi-Fi networks of the community, he also stressed that this might give a false sense of anonymity:

"We are teaching people that even though they do not have to give their identity to log into our mesh network, they are not anonymous toward the authorities or other entities due to the hardware and software profiles of their devices and other metadata which may be used to identify them."

James Stevens, co-founder of consume.net, also explains that users were warned:

"We run an open wireless network. So, no passwords for access but encrypted tunnels between network nodes and internet gateways. If this is a concern or messages need security then it's the responsibility of each individual to guard against intrusion and practise effective methods. Those who wish to communicate in secret will always find a way of achieving this goal. Once through the gateway we have no control anyway."

7.4. Enabling digital rights

Thus, in spite of their benefits, in no way can local community networks replace proper encryption techniques. But what is also great with community networks is that they are communities of people who are passionate about the relationship between computer networks and human rights. They seek to raise awareness and call on users to adopt a more proactive approach to securing their online communications. They promote the use of free software, decentralised online services and end-to-end encryption techniques, which all help build a digital environment that is more friendly to human rights. As a guifi.net participant sums up :

"We are educating users how they can protect themselves on our and any other network."

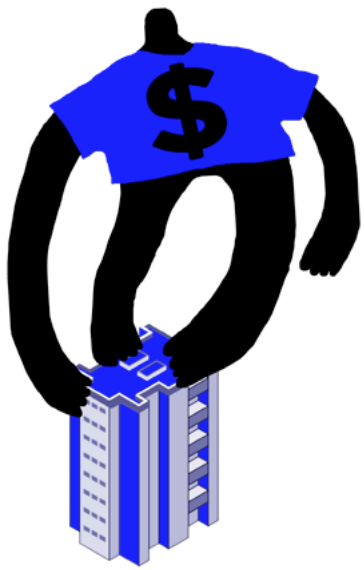
Sometimes, defending the community's rights will also entail following the evolution of legislation surrounding internet regulation, and working with other organisations focused on defending human rights at the legislative and political levels, which will be studied in Parts V and VI. In practice, that will imply following good practices in terms of computer security and remaining up to date regarding potential vulnerabilities affecting the software and hardware the network is made of.

But despite these challenges, community networks are networks built by the people for the people. And for that reason alone, they are by design much better suited to respect human rights.

1

1. Militant action against the move of Google offices into the heart of Berlin

8. Solidarity and the right to the city



The "right to the city" is a philosophical rather than a legal right that can be regulated and enforced by state power. It is strongly linked to the "right to difference" and its content is defined and redefined with every project and particular action to be taken.

But what does the "right to the city" really mean, and why is it relevant for community networks? The term the "right to the city" refers to a widespread and frequent citizen demand for the democratisation of the urbanisation process (or contemporary spatial production), which is one of the main domains of investment and productive activities of the post-industrial phase of capitalism.

By building a community network, you can start improving the lives of those who live around you, while working to alleviate the trend towards gentrification and commodification of urban spaces. It can have a huge impact on the territory, because in the last decades, the development of localities has been conceived as a top-down process, remote from the particular needs of local communities. Imagine an intimate place in a small town, like the square that gathers a diverse crowd in close proximity, where people can get easily

in touch, whether they are familiar with each other or not. Such places have been shaped over time in a DIY (do-it-yourself) manner, similar to what community networks do for digital technologies. But instead of that, the outcome of generic urbanisation is abstract space that disregards local specificities.

Most of the new projects for places take the same shape, looking and functioning the same way, just like global social networking platforms do not offer customisable solutions for communication and organisation in the digital space. Why is that important? Because what is conceived in the abstract cannot naturally produce differences, which are essential for the liveability and sustainability of any system.

So grassroots initiatives like community networks are very necessary to offer alternative options that develop organically, incorporate and reflect local differences, and generate specific solutions, in a political economy of cooperation, solidarity and mutual benefit. This is actually a form of resistance, and an ongoing struggle for the "right to difference".

For example, consume.net (Section 2.1) made an initial call for communities to organise around local networks as an alternative to the global internet. More recently, as Section 4.2 described, a hybrid urban node was built in a central location in Zurich. This initiative is a statement that the "smart city" should be created by citizens actively engaged in its civic life, who are connected both digitally and through face-to-face encounters.

It is interesting that this hybrid node was initially created as a reaction to gentrification, to the fact that in recent years rental prices have increased dramatically, making it impossible for small businesses, art studios or other non-commercial activities to afford a central location. Some of the small shops had to move out of the locations where they had been operating for decades. Powerful players at the national or global level, having a stake in this central neighbourhood, now dominate the rental market and have a strong influence on urban policies and neighbourhood development.

It became clear that the only chance for these smaller players to survive in the neighbourhood was to network and organise themselves as an association, which needed of course a central and visible location for a shared space. At the beginning of 2018, the association applied successfully to become the tenant of a very central location owned by the city of Zurich, previously used as a commercial space.

The application to the city of Zurich, the owner of the space, included in its argumentation the need for an alternative to the "smart city" narrative – a space that can become a hub for citizens, small shops and organisations to claim their right to the city and the right to the internet, at the same time.

However, the "right to the city" is not only relevant for city centres, but also for rural areas, like the wider area of the Sarantaporo.gr CN (see Section 2.5).

Story #7: Sarantaporo: bringing mountainous communities closer together (by Ileana Apostol)

In March 2017 we were in a toy store in Athens, buying "illustrative elements" that could explain to local farmers the main components of their community network, Sarantaporo.gr. Some chess pieces were to become the towers for antennas, thin ropes were to explain the cables between the backbone nodes, small wooden cubes were the individual houses that had colourful circles around them to show the range of their network nodes, etc.

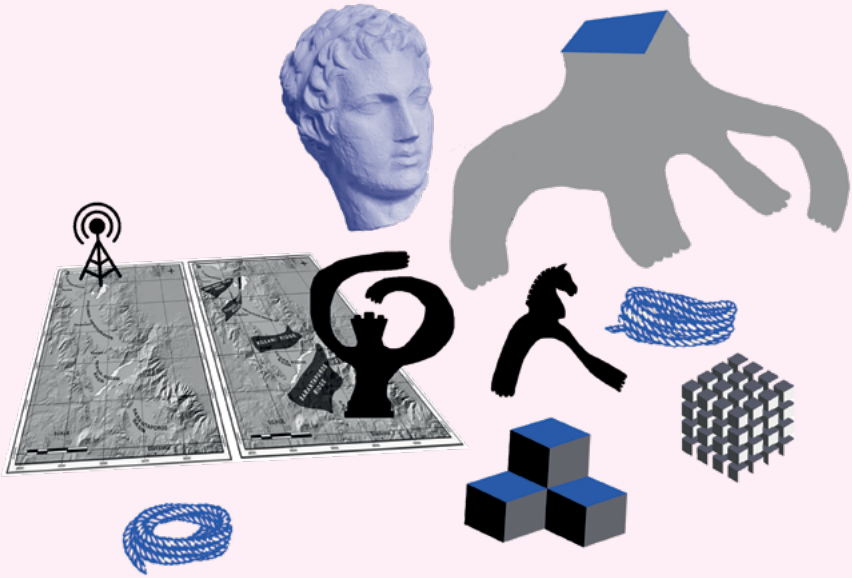
The next day, the netCommons project co-organised a workshop in a taverna in the village of Pythio, where a map of the region was placed in the middle of a large table, on which these toys were being used to explain the network three-dimensionally.

Around the table the discussions were intense and animated, and a few decorations meant to make the model more vivid were highly appreciated: some cars, people, a group of chickens, a small lamb, and even a cow talking on a mobile phone. And at the end of the day, all the participants seemed to have a clear idea of how the internet connection arrived at their home. In the following months the toy kit has been used in more workshops, some of them hands-on, on how to make the network on your own.

In a recent conversation with one of the CN founders, Achilleas Vaitsis, an urban planner working with the city of Larissa, he told me that **an initial intention of the CN was to complement the structures and funding that were lacking at a time of austerity measures for rural spatial planning**. In other words, in addition to information, communication and networking structures, coordination of activities that could engage residents in participatory practices.

One hope was also to strengthen the cooperative spirit that has atrophied over the last years. The 14 scattered villages that have been isolated from other locations, and whose inhabitants have had less and less opportunities for cooperation between them, have become more and more interconnected since the deployment of the Sarantaporo.gr CN. And somewhat more "central".

The installation and operation of the community network requires all sorts of knowledge sharing and mutual help, addressed through related workshops, ad hoc gatherings, etc. Residents of the valley are "shaping" together their social space that is now also digital. One may say that the rest of the



world has come closer to them, not only online but also offline through visitors or researchers working on community networks.

Even more spectacular is that the valley is sort of "shrinking" as the distances between its villages are reduced through more frequent exchanges and intense social ties between the permanent residents.

PART 3 : WHAT DO I NEED TO START A COMMUNITY NETWORK?

So far, we have explained what community networks are, and why they are important. In this part, moving to the preparatory phase of setting up a community network, we survey some of the fundamental resources that you will need to start one.

As you will see, a community network is mostly about people, and the skills, energy and support that they can bring to the initiative. It is also about successfully combining their know-how to start and grow the network.

You remember in the first chapter when we presented you with a fictional dialogue you were having with Rita, our community network practitioner, during an event focused on community networking? Well, imagine that you were to go back to a similar event a few months later. You've learned about community networks and their importance. And Rita is now getting into practical guidance, starting with the importance of gathering a group with diverse skills.

9. Things you should consider when starting a community network

Story #8: Kickstarting a community network

You: Hey Rita! Now I understood what a community network is and why it is great. So, I also want to start my own one. What would I need?

Rita: Well, being a community network, you will need a community! Do you already know some interested people? For example, among your friends could be some of the future network initiators, your neighbours could be interested to form one, people whom you haven't met yet but they will show up once you'll announce your project, and, of course, people with a similar interest or values, some of them who are already engaged in related projects, etc. Go find the group with whom you will start your community!

You: We are just a few people, is that enough?

Rita: Of course. There are community networks that started with a small group of enthusiasts, even a single person. Later on, you will be able to choose to stay a small community or cover more people, even an entire region! For this, carefully deciding on the institutional structure that will be responsible for important

activities taking place in the name of the network (e.g. a foundation, a cooperative or an association), and agreeing on a set of values that will guide the expansion of the network, are really important tasks to consider in the early stages.

You: It's encouraging to hear! But me and my friends know nothing about it, we have no specific knowledge... Can we still do it?

Rita: Absolutely! Starting a community network will be an opportunity for all of you to gain some skills, make something together, and discover new areas of knowledge as a team. At the beginning, you will need at least one person with an understanding or experience in each of the crucial topics. Later on, at your own pace, you will be able to share knowledge so that each member of the community feels confident and literate about participating in their community network.

You: OK! Nice! But what skills should we develop exactly? What do I have to do for that?

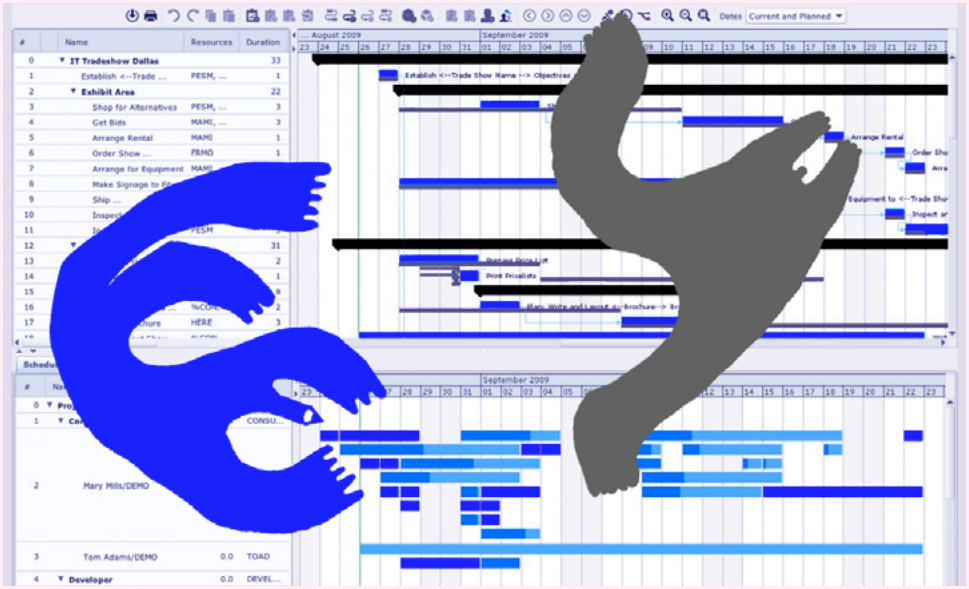
Rita: First, since you will work as a group, you will need organisational skills. The initiative involves various roles, either leadership or supportive roles, and there is always a core group that initiates the project. These choices always depend on the local culture and on the aspirations of the group. Then making a plan for the budget and setting up costs is another important part of the organisation. Access to a physical location is very useful, where you can meet and exchange information, discuss goals, plan network deployments, work together and strengthen relationships in your group.

Maintaining a functioning communication flow within the group is critical, and there are simple ways to train for that, for instance, by organising frequent get-togethers in addition to online communication channels, and most importantly, actively listening to each other. Of course, keep in mind that disagreements are likely to occur and you could learn about the perspectives of the others or even get support.

Anyway, no big deal, any community is shaped through conflicts and contradictions that are transformed creatively. Your vision and goals will be keeping the project going, mostly if you believe that the organisation should serve the community.
You could always consult other supportive organisations, and attend training sessions for starting small collectives.

You: Understood. Anything else I should know?

Rita: Yes! You will also need to get familiar with the technical features of your network. It is important to understand that you can start simple, with what you know and the resources you have at hand. Start to familiarise yourself with basic networking, including an understanding of access network



types such as Wi-Fi. Also start to get to know your environment, like climate conditions (temperature, humidity) but also the availability of physical features (a common space, roofs, towers or a playground, etc.), in order to have an idea of how to plan the deployment of your network. Does this all work? You might want to start with a simple experiment in a sandbox or on your kitchen table.

You: Very well. Is that all?

Rita: One last thing: you will need to be aware of some legal basics. But you don't have to be an academic or have actual experience in law, just like you don't have to be trained as an engineer. At first, you would only need an overall grasp of the legal system and some key concepts.

1

1. Stock remains of hardware, computer equipment, furniture in donalo.org

10. Keep in mind various aspects of sustainability

As the previous chapter suggests, it is never too early to start thinking about the sustainability of your community network. We will go into more details in Part VI.

For now, we would like to continue with a general overview of what this concept entails for a community network, and of the various aspects it encompasses and that need to be considered even at the early, planning stage of your project.

The concept of sustainability has expanded from its original environmental policy meaning to include various aspects. We see five key dimensions of sustainability that are relevant to community networks: natural/environmental, economic, political/organisational, cultural and legal sustainability. This brief introduction covers key points of these dimensions as understood by key actors from seven community networks, based on our research.

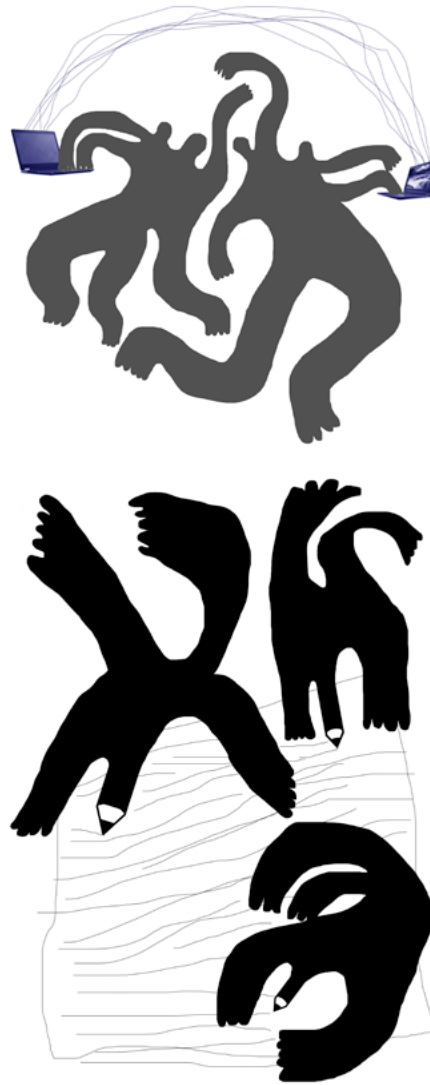
Environmental sustainability is about the potential impact of community networks on the environment. This includes, for instance, energy consumption, e-waste, recycling of hardware, etc. This is very important as digital technologies are made up of highly hazardous substances, including rare metals extracted in unfair conditions in conflict and/or exploited zones, and represent around 10% of humans' total electricity consumption.

Economic sustainability relates primarily to the characteristics of the market and resources, in particular people and money. For some community networks, sustainability has to do with the alternative character of the network and the bypassing of commercial interests (big telecom providers). For other community networks, sustainability has to do with the provision of a good service, which might be more effectively realised with the help of (typically small) commercial partners. Beyond their own resources, community organisations can be supported by external stakeholders, private organisations, or public institutions (local, regional, national or European funds) interested in promoting their activities. The resources provided by external actors should be managed in coherence with a vision defined collectively, by means of horizontal negotiations among members, in order to avoid organisational disagreements. In fact, access to external sources of financing may create new constraints and/or open new opportunities for organisational growth, thus pushing for change in the specific objectives of the network or the nature of its general mission.

Political and organisational sustainability relates to empowerment, active ownership of resources and data, control of one's own communication needs, how to be ethical and respect the values you agreed upon, and the rights of the network's users (which can be expressed in terms of use – see the draft in Appendix B). Members can also try to influence policy makers towards more favourable laws (see Chapter 24), build partnerships to enhance the legitimacy and the scale of the community, and make physical spaces available for meetings and for other public initiatives. Organisational and governance aspects, and in particular the access of community members to decision-making processes, are central to this dimension of sustainability. They are examined in more detail elsewhere in this book (Ch. 15, 16 and 22).

Cultural sustainability is understood as social cohesion and a common identity, or at least a spirit of sharing common resources. Communitarian practices and philosophical concerns for the commons in general have resulted in strong practical efforts to reflect the communities' values and culture, but also to re-use existing networking and other equipment as much as possible. This concern also contributes to environmental sustainability.

Legal sustainability means respecting the various legal obligations (Chapter 19), and deciding whether to incorporate and under which status (Chapter 16). To improve legal sustainability, you may try to influence the legal framework through advocacy (Chapter 24) to change rules that may threaten the network's activities or, to the contrary , to promote new measures that can facilitate its development.



Story #9: A few hints from guifi.net on making a good start (by Ramon Roca)

Organisation: Making the community sustainable

Even if you're still at an early stage, you should remember that scaling up your community network will prove difficult.

Actually, the main weaknesses of the community network will be the community itself: the community leaders and principal volunteers are typically a small number of persons, and if these persons leave the community for whatever reason, that might put the continuity of the whole project at risk. In the long run, scaling up and ensuring sustainability may require:

1. The recruitment of professionals as a complement to the voluntary activity, and

2. The development of a set of tools to monitor and document the contributions, resource appropriation (such as instances of capacity over-consumption), and ensure the reinvestment of a fraction of the revenues obtained from professional or for-profit activity.

Without addressing those questions, it will usually prove difficult to sustain and later scale the network.

Economic sustainability: Funding community networks

Having a good knowledge of the economic aspects of running a community network will reduce uncertainty of investments, expansion plans, and overall operations.

In terms of economic models, a sustainability framework should develop compensation settlements between all participants aimed at ensuring:

1. A fair distribution of the network operation costs based on use of the resources, and

2. The generation of the required resources to recover the investments made or to enable future ones.

Access to funding is crucial. Some communities have tried to access external funding at local, national or European level but found the process too complex, demanding and often not tailored to their needs. In addition, (heavy) dependence on external funding can lead to uncertainties. For example, what happens if the funding, for whatever reason, doesn't materialise, or comes to an end? Our research suggests that the funding of the network from the community's own resources is the most reliable. It

develops feelings of ownership and promotes long-term sustainability.

Communities should value inclusiveness and fairness more than profitability. For instance, many have a strategy to provide connection to members who cannot afford it. Some community networks also have differential pricing schemes for different groups of users, such as households, small companies, larger companies, and public institutions such as schools and hospitals. Consider the values of your community in working out the best funding model for your initiative.

Political sustainability: Agreeing on a basic set of values

While still at the volunteering stage, it might be the case that the community is still based on verbal agreements or a network of friendship relations.

When going further however, there will be a need for formalising agreements between all participants (see the Pico Peering Agreement and the Draft Terms of Use in Appendices A and B respectively) and developing a governance framework. A good start could be to develop the ecosystem based on the following principles:

1. Sharing network infrastructure increases the efficiency (i.e. better performance, efficient use of the spectrum or wider coverage for the same investment) of the network infrastructure because it stimulates cooperation, prevents duplication of efforts and facilitates economies of scale. This is particularly true in the case of optical fibre because, once in place and operational, it becomes a non-rivalrous asset (zero marginal production costs) due to its virtually unlimited capacity.

2. The contribution of local economic activities is essential for the project's sustainability because it creates a positive dependency: it generates the required resources to maintain and expand it.

3. The professionals (i.e. individuals or enterprises that deliver services to the community in return for an economic remuneration) deserve a fair reward for their work, but speculation on the network infrastructure is not allowed.

4. Network participants have the right to satisfy their connectivity needs through their own efforts as well as through the procurement of professional services in a fair and competitive market. **The network must remain open, free (as in freedom), and neutral.**

Story #10: Minimising the ecological cost of community networks (by Mireira Roura)

Although I live under capitalism, where "everything is possible" but nothing can change, I believe that the circular economy can act as a new paradigm. Actually, it is not a new concept – 2,500 years ago, Aristotle already pointed to this principle with this sentence: wealth is not in the ownership of things, but in their use. I think a lot about this concept. In this, and in taking care of my things as if it was my teddy bear. That's why I try to keep my environmental footprint as small as possible.

My brother's phone was mine, my laptop was donated by the innovation office of the city council (Barcelona Activa) and prepared by Miquel from Solidan, a local social enterprise.

Part of my internet access in the eReuse.org office comes from a second-hand router that used to be part of the guifi.net backbone in Barcelona – it became too slow for that but works wonderfully for our office. I try to reduce waste, reuse and recycle. I don't want to shred electronics if they can be reused, it would be harmful for the environment that me and my daughter will be living in.

I don't think having the best and fastest computer or router makes me a better person, quite the contrary. In fact, I think this planet is overloaded with consumers. We have surpassed the limits of the planet, eating plastic, contaminated by heavy metals from everything we dump into the atmosphere, the land and the sea. Climate change is already very visible and that's very alarming. Our "digital world" needs a lot of hardware, cables, antennas, electricity, and these are made with exotic and toxic components so it has a huge social and environmental impact.

I work part time in donalo.org, a digital meeting point where companies donate their surpluses (stock remains, computer equipment, furniture...) in good condition and NGOs receive it free of charge. It is a project based on the circular economy: we turn waste into resources. **But we had a problem with the computers that we were giving to NGOs, because we couldn't certify or guarantee them. That's why I started to collaborate with eReuse.org, a federation which tries to extend the lifetime of electronic products through repair, refurbishing and reuse, ensuring traceability.**

Our challenge is to prevent products from being prematurely recycled. To do that, we trace the devices at the component level and each of them

has an identifier in our database. We have restored hundreds of computers for reuse in NGOs, fostering digital inclusion, avoiding the manufacture of new devices, ensuring recycling and creating jobs and contributing to the local economy. Now, we are working on a few routers donated by the Barcelona Council and trying to find them a second life.

I can see we are not only contributing to minimising the ecological impact of our own personal computing life, but also helping many other people to do so. **We can tell the person who bought a computer long ago about the social impact of that particular device: how many people used it and for how many hours after they gave it to someone interested.**

We can also show them the environmental impact of its usage: what parts and materials were used to build it, the savings from extended use, where and when it was recycled (and now the same can be done with routers).

What motivates me is that it's not just abstract statistics like tons of saved CO2 that I never see. It's personal: **when I visit, for example, Alencop, one social partner, I see migrants who used to pick up scrap in the streets and now work on the collection, preparation and sale of these electronic devices as their paid job**, and that makes me feel good as I am helping these particular guys in my community. I wish there were more girls in this field, by the way.

11. Finding support

Now that you have a general idea of what skills are needed to start and grow a community network, it is important to also know where to find support. That could be practical, hands-on support as well as related knowledge, either from complementary local initiatives or from other community networks.

As we have already pointed out, a big part of the success of community networks has been due to the collaborative spirit between the pioneers of that time.

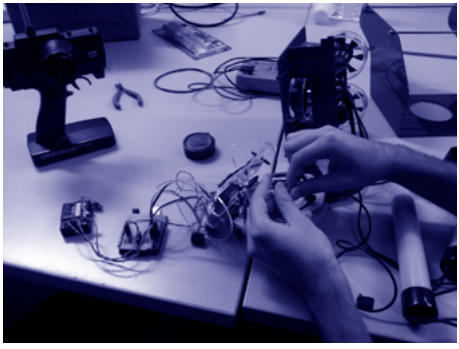
Today there are still many venues where community network practitioners meet and exchange knowledge and experience like the Wireless Battle Mesh, the Radical Networks conference as well as various mailing lists you can freely subscribe to (the Dynamic Coalition of Community Connectivity – or DC3 – discussion spaces, including a mailing list; the Battlemesh mailing list, and many others) – more resources are covered in Chapter 12 and listed in Appendix E. You will probably want to engage in these various spaces to get feedback and advice on your project.

If your project becomes ambitious, it might require the engagement of network technologists to deploy and maintain the network, of designers to create a visual identity, of software developers to implement sophisticated local services, of managers to work toward the economic sustainability of the network, of legal and policy experts to ensure the legality, and of other facilitators, initiators and community leaders to develop or enhance different local initiatives that would benefit from being linked to a community network.

People with these skills may already be engaging in other local community initiatives, and they could prove to be interested in your community network project. An urban garden can offer a public access point to the network and a physical space for community gatherings or for organising network-related events. A community currency project can create links to other actors in the local economy towards a complementary market of resources and services. A local design firm could provide support in framing and passing on the concept through visual communication. A hack lab or fablab can contribute with technical expertise. An academic institution can engage students and potential interns for documenting and analysing the communications, social, legal, business and political dimension of the project.

Together, all of these actors form an entire ecosystem that you should engage with when planning for your project. You can, for instance, invite them to work jointly in educational activities on the politics of digital technology, or participatory practices in planning and decision-making processes, social and political activities at the neighbourhood level such as urban gardens, cooperative housing, community currency initiatives, etc.

1



2

1. The Neighborhood Academy in Prinzessinnengarten is a self-organized open platform for urban and rural knowledge sharing, cultural practice and activism

2. Projects that take place in hackerspace.gr, a place for creativity, collaboration, research, development and education

Story # 11: Joining forces in hybrid spaces: the Battlemesh encounter (by Panayotis Antoniadis)

On 13 May 2018 in Berlin, an encounter took place between digital and urban activists in the context of the "Battle of the Mesh", a major event in the community networks scene returning in 2018 to the famous C-base, one of the birthplaces of the community networks scene back in the early 2000s.

The Prinzessinnengarten is a 10-minute walk from C-base. It is a key location for the right to the city movement in Berlin and, in a very central location of the city, it hosts a wide variety of activities and organisations. Its wooden arcade structure "die Laube" is both a symbol and a visible functional space for hosting events and workshops on various topics related to the right to the city movement. Interestingly, many of the local actors in these two activist hubs have not visited the other one.

The encounter was introduced with two provocations, one for each side: **urban activists will not be able to defend our rights to the city if they don't include in their claims the right to the digital infrastructures, and the ability to communicate free of corporate or government controls.**

Digital activists will end up offering just cheap labour for providing affordable access to the internet, and more specifically to Facebook, Google, and the like. A circle was formed in the centre of the room, which was joined only by a few of the "locals", the rest staying outside the circle observing the round of introductions (see Figure 3).

Many interesting urban initiatives were represented, like the neighbours academy Nachbarschafts Akademie, Stadt von Unten or the city from underneath, MetroZones, the rental union Mietshaeuser Syndikat, Tesserae, INURA Berlin, Bizim Kiez, Tempelhof Vision, and more.

In the beginning, it felt like a foreign body entered the C-base and started talking among themselves, including statements by all participants allowing them to get to know each other better (e.g. What is the Battle of the Mesh? What is the Prinzessinnengarten? What are the current challenges/tactics of urban and digital activists?).

After the end of the "inner" circle in which only a few digital networking projects were introduced, like Freifunk community network, the digital rights advocacy association La Quadrature du Net, and the hackerspace Athens, the debate

started quickly with many people questioning the dichotomy created by the description of the event, separating the digital space from the physical space, and indeed the digital activists from the urban activists.

Johannes from MetroZones gave as an example collaborations already from the 1990s. Botschaft, Bar + Disco and Katrin proposed that looking at past experiences would help to understand how the movement could be strengthened.

I defended this framing, stressing that the only reason for making a distinction between these inseparable contemporary spaces is that in reality, many people actually don't reflect upon their close interrelation, and most importantly, upon the many inspiring analogies and potential complementarities and synergies.

This clarifying intervention broke the ice and people out of the circle started participating and sharing their experiences and possible tactics to defend our rights to the hybrid city. For example, the rental union Mietshaeuser Syndikat is an interesting case study of using existing institutions and laws to create alternatives like various forms of non-speculative, affordable housing, and more specifically to take housing stock out of the "market". On the technology side, the important role of a "playing" attitude was highlighted by Adam Burns, a founder of Free2Air, netCommons Advisory Board member, and co-author of this book. Adam also highlighted that community is a tricky word and thus it is critical to keep experimenting.

From a policy perspective, Virginie Aubrée from the netCommons team and La Quadrature du Net (also a co-author of this book) highlighted the need to participate in policy and regulatory activities at the EU level but also at the national and global levels.

There are many important constraints or openings that could be created by bad or good legislation, respectively. European programmes like URBACT and netCommons can also play a positive role bringing together different actors.

Then the project Genuino Clandestino in Bologna was given as an example of synergies between different forms of self-determination, including mesh networking, and also between content, organisation and communication within the movement. And the situation in Greece was discussed as an example of how the economic and other crises could also become drivers for resistance and offer opportunities, like the abundance of empty spaces in the city of Athens.

At this point the key role of infrastructure as an important common aspect of both domains of action (digital and urban) was identified. Interestingly, **the idea of the "infinite" digital or virtual space was contested as artificial,**

since the energy limitations are an important constraint for the digital space that shouldn't be underestimated.

Actually, many of the urban activists have recently been involved in actions against the moving of Google offices into Berlin's Kreuzberg neighbourhood, consuming the neighbourhood "collective product" as someone noted. A very telling manifestation of how digital and urban rights become more and more interrelated. But what is the alternative to Google?, someone asked. How can one compete in terms of usability and economies of scale?

Monic Meisel, co-founder of Freifunk and an advocate for local applications in CNs since the early days, admitted that engaging people in using such local applications has proved extremely hard.

The examples of Autistici/Inventati and Framasoft, the French approach of "degooglisation" (un-googleing) of the internet, creating server cooperatives that are collectively (self-)managed, but also the MAZI toolkit to develop a local network, were brought as good examples on how technology can help to reduce the barriers to entry. Thiago from Brazil brought the experience from the Amazon, explaining how communities manage to build their own networks with very few resources, and highlighting the fact that it is the process that it is the most important and not the final outcome, the infrastructure in itself.

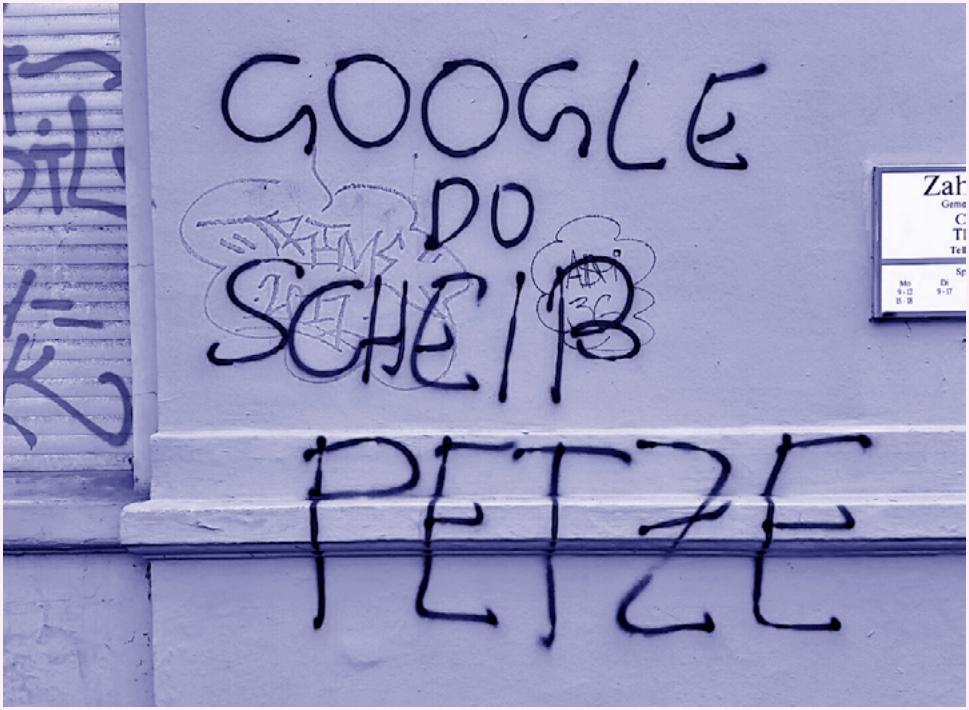
3

3. Meeting between urban and digital activists at the Battlemesh 2018 in Berlin


Shutdown google


GOOGLE, DU Scheiße


FUCK OFF


GOOGLE
DO
SCHEIß
PETZE

This part of the discussion was concluded by Ileana from NetHood, also a co-author of this book, proposing to collectively develop and promote a broader perspective on sustainability, through various initiatives and projects, affirming differences and creating a diversity of choices for the liveability of the urban system.

The discussion then moved to some ethical dilemmas that activists might face in their effort to engage people in their actions. For example, the use of aggressive advertisement tactics was discussed, with some being in favour, seeing it as one of the only ways to compete for attention with the big corporations, and others against, considering that such tactics are not compatible with the values and principles of the movements.

Even more controversial was the proposal to use local networks as a means to block access to Facebook and Google. This seemed to be a very sensitive topic for digital activists, who were mostly reluctant to the idea. It led to a heated discussion about the meaning of internet freedom, and whether those who jeopardise this freedom should be actively excluded from alternative infrastructures.

After this introductory round, we all walked together toward the Prinzessinnengarten in small groups, some of them already "mixed", engaging in more informal discussions.

For most of the digital activists it was the first time they had visited the Prinzessinnengarten and they were offered a guided tour when we arrived. It was interesting to know that one of the principles of the garden is to allow easy access to experimentation by making it easy to make mistakes and thus learn, which is one of the main principles of hacking.

The need for compromises was also brought to the fore, with the description of the necessary commercial activities developed in the garden that subsidise non-profit projects like the Neighbourhood Academy.

During the "apéro" that followed at the wooden construction Die Laube, more mixed groups were formed and interesting discussions took place. For example, some urban activists were impressed by the resistance of digital activists to the temptation of blocking Google from their local networks, something not so obvious in political movements in which the exclusion of "racism", "violence", etc. is typically tolerated as a defence mechanism.

Someone also mentioned the pervasiveness of the internet and the reaction of friends living in the rainforest area in Brazil being informed about our discussion, saying "Don’t come here, leave us alone, disconnected." But others commented that "they" will go there anyway, so it is better if connecting the unconnected comes with some values, principles and awareness

of important issues like privacy, digital coloniality and the risk of algorithmic manipulation.

12. Self-teaching resources: a short collection

In planning the early stages of developing your community networks, you will probably want to look beyond this book to get more detailed information. Fortunately, there are many resources out there you can use to that effect.

The book "Wireless Networking in the Developing World" has been a precious reference for creating new community networks since 2005. It was written by community network practitioners and it compiled long experience on the technical aspects of wireless communications, sustainability, and more.

The MAZI toolkit, cited in Chapter 11, provides applications, software and guidelines to develop a local network. Yunohost and Framasoft, mentioned in Chapter 14, also provide free software. Freifunk.net and LibreMesh.org provide free software, and LibreRouter, under development, open hardware.

There are various organisations that produce up-to-date documentation on CNs, organise events and provide funding:

The Internet Society (ISOC) is more focused on policy and regulation issues, with a special focus on spectrum and education, running a very successful funding programme for supporting community networks all over the world called "Beyond the Net". ISOC also maintains a page fully dedicated to community networks resources.

The Association for Progressive Communications (APC) is a global organisation as well as a network of organisations that has produced and supported relevant publications such as the 2018 edition of its annual **Global Information Society Watch (GISWatch)** report, which focused on community networks and featured an important contribution from our research project netCommons. APC also produces a very informative monthly newsletter on community networks and other local access initiatives.

DC3 is the Dynamic Coalition on Community Connectivity of the Internet Governance Forum (IGF), in which ISOC, APC and other organisations also participate, and has published three books on community networks, the latest being **The community network manual: How to build the Internet yourself.** It also maintains a list of resources, including books, documents, a list of community networks and much more.

There are also several community networks that produce documentation in their local languages, such as **Freifunk, guifi.net, AlterMundi, ninux.org**, and many others. These European communities meet annually at the Battle of the Mesh conference, and have recently formed an ISOC Community Networks Special Interest Group, which has a global scope.

Several mailing lists and newsletters exist that regularly discuss community networks-related topics and where you can find answers to your doubts and questions: DC3 maintains one, the Battlemesh organisation another, one from Radical Networks, and the Telecommons mailing list for policy advocacy in Europe, just to name a few.

From an academic perspective, two recent issues of the **Journal of Peer Production: "Alternative Internets" and "CITY"**. They cover a diverse range of topics related to community networks. At the crossroads of academia, activism and art, a good reading can be the upcoming book by the late Armin Medosch, with a focus on history and the political dimension. Unfortunately, he didn't manage to conclude this book, but his friends are committed to finishing it and publishing it soon.

NetHood maintains a collection of links with a special focus on the local dimension of CNs and do-it-yourself (DIY) networking, a dedicated term for this specific dimension of a CN, at **http://nethood.org/links**. The **netCommons website (netcommons.eu)** is probably the major source of information and resources from a research and innovation point of view. Finally, more concrete resources and suggestions for further reading are provided in Appendix E.

1

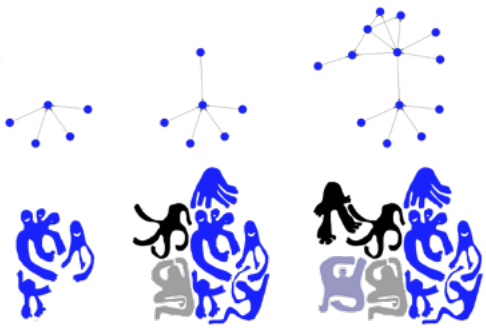
1. A scene from the APC project "Connecting the Unconnected: Supporting community networks and other community-based connectivity initiatives"

PART 4 : HOW TO START A COMMUNITY NETWORK?

You have now teamed up with people of different backgrounds who have all learned about community networks and seen the potential of a shared local telecom infrastructure. They are ready to work together, and have reached out to other organisations, people with experience in community networking, or even local businesses and public authorities who might be willing to provide support. Now that you are moving to the hands-on part of the project, you have also gathered educational material and resources to assist you in your endeavour.

So, in this part of the book, we will share inspiring stories about the first wonders of setting up network nodes, and then move on to explore various technical options you might want to consider for setting up your infrastructure.

13. Seeding nodes in a community network



We begin this part with hands-on accounts about how to install the first nodes of your network.

In the following three stories, vortex, Jürgen Neumann and Ramon Roca share the joys and wonders of seeding the first antennas of a wireless community network!

Community networks, as you now know, are normally not planned and built in a single engineering effort. Rather, they grow around a small group of early enthusiasts who decide to seed nodes. Obviously, there are exceptions, like Broadband for the Rural North (B4RN) in the United Kingdom, which follows a more structured growth model, probably also due to their technical choice of using only optical fibre to build a very high-capacity infrastructure.

Story #12: The story of groundzero (by vortex)

This message was posted online by vortex on 10 February 2002. Since late December 2000, groundzero has been offering open wireless access to the local area around Bethnal Green in the East End of London.

To the best of our knowledge, groundzero is the oldest, most stable and reliable public wireless access point in London, if not the UK. Actually we think it may be the longest running such gateway in Europe.

The host
The host is a PII (Pentium II) laptop running Red Hat Linux 7.2 with patches. Its primary function is to act as a wireless gateway and support ancillary services such as IP forwarding and tunnelling, firewalling, and experimental dynamic routing. It is currently also running various applications:

- Apache
- mod_perl
- mysql
- scoop
- BIND 9
- DHCPD 3
- Net SNMPD
- PoPToP, L2TPD and
- FreeSWAN (for peering with other wireless and wired connections).

The wireless card
An Orinoco Silver 802.11b PCMCIA card (Figure 1) is used to provide the wireless gateway. This brand and model of card was chosen for a number of reasons including the ability to connect it to an external antenna as well as the wide driver support at the time for all Linux, *BSD's, and MS OS's.

Connectors, cabling and antenna
The Orinoco Silver card has a connector for an external antenna, which connects to a pigtail connector, which in turn is connected to a lightning protector, followed by 50 feet of LMR400 coaxial cable. At the far end of the coaxial cable is a Hyperlink Technologies Omnidirectional 16dBi antenna used to serve the local area.

Initially this antenna was mounted on a heavyweight industrial tripod that was free-standing but ballasted on a street-facing balcony (above a shop). If you are considering a similar set-up, you should pay attention to potential very strong wind and ballast the tripod used to mount the antenna accordingly. After positioning and testing, the antenna was moved to a rooftop chimney mount on a two-metre mast rising above a very firmly mounted TV mast. The work to mount the antenna and the final mounting is shown in Figure 1 and 2.

Client connections
The first permanent connection was to the host "newsfilter", where a publicly accessible web server was run from the far end of a 500-metre wireless link. **This initial link was so inspiring! It worked reliably**

1

2

1. The original Orinoco 802.11b network card serving groundzero

2. Final mounting of the antenna (right) of the groundzero.free2air.net host and access point (not reachable anymore)

despite the distance and despite the fact that heavy passing traffic could affect the network link quality and speed! Zoo was then connected permanently to groundzero in February 2001. Other current connected friends include the crew from "Ambient TV" via the host "gastower", as well as the Mute magazine-supported "youarehere" project.

1

2

1. The initial topology with access points and their IP addresses

2. One of the first Freifunk nodes set up with a white patch sector antenna for remote connection and a black omnidirectional antenna on top of it to offer local service

Story #13: Seeding the first Freifunk nodes (by Jürgen Neumann)

Berlin, some time in 2002. I used two different types of antennas: a white square sector antenna and a black thin omnidirectional antenna on top of it. The sector antenna connected the house to an internet service provider about 2 km away.

Figure 2 shows the mounting on the flat roof; the ISP antenna providing service can be guessed from the white sector antenna pointing. The omni antenna offered access to this internet uplink for my neighbours. My housemates and I used a wired connection to the Wi-Fi router, as we all had Ethernet cables in each of our rooms.

Before the installation, the 35 house residents shared one asymmetric telephone line modem connection with 56 kbits/s, because German Telekom did not provide DSL in our district by that time. After the installation of the Wi-Fi link, we had 1 Mbit/s symmetric. A fantastic DIY upgrade back in 2002! All my housemates and neighbours were really happy about it. :-)

From there, it only took us a few more months, until my house became part of the so-called BerlinBackBone, an early experiment for a Freifunk-based wireless backhaul whose topology is shown in Figure 1.

Starting from the c-base, our hackerspace and regular meeting point in the centre of the town, it interconnected the local wireless networks in the outer districts of the city.

I will never forget the moment when for the first time I was able to ping my own access point on the rooftop of my house, while sitting in c-base, at one of our regular Wednesday meetings. I then felt certain that we could build our very own city-wide information infrastructure.

Story #14: Kickstarting guifi.net (by Ramon Roca)

At that time, there were several initiatives already existing in Catalonia, like Mataro Sense Fils, Barcelona Wireless, and many others. Also, some people, like me, living in very small villages or dispersed farmhouses in the countryside were looking for solutions for themselves.

At some point, we started to get in touch and realised that, apart from getting connectivity for each of us, it would make sense to cooperate at all levels, and even for those who already had access, to share the gateways. We were convinced that this would contribute a lot to the cohesion of the community for the benefit of all. That launched guifi.net in 2004.

The very first initiative was to create a backbone connecting all the already existing but individual infrastructure in the region of Osona. For achieving this, a "Supernode" was installed in one of the towers at the Seminari de Vic (where, by the way, this book was written – Figure 9 shows a moment of relaxation in this process), which is at the top of a small hill and from there we had views to all of us. Everything was set up in a few days and worked, so we realised that with small efforts, it was possible to connect people at very long distances in various remote villages and rural areas; Figure 10 shows how many links departed from this "Supernode" a few months after installation.

We felt that we were doing something very big, something which the large companies were saying was not possible at that time, and for which the political administration was claiming to have programmes, but which was actually never implemented here. Instead, we found out it was something we could do as citizens!

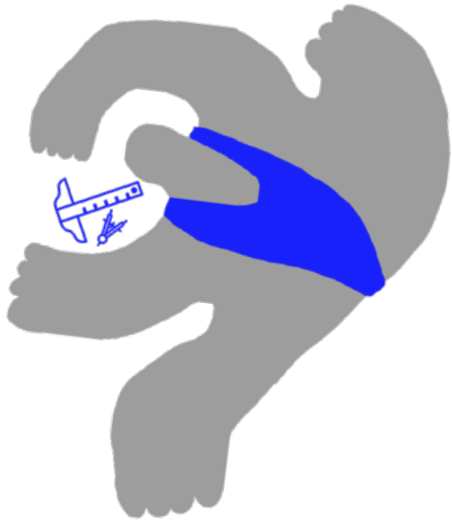
1

2

1. Seminari de Vic, the venue of the netCommons booksprint, where the first "Supernode" of the guifi.net network was installed

2. Links from the "Supernode" at Seminari de Vic at some time during guifi.net's evolution

14. Explore your technical options



A community network is a multi-dimensional project, which includes many different complementary technical components. For each component, there is a large variety of choices which will depend on the specific context and available resources. Examples of such choices are given below just to provide a better understanding of these different components and a rough idea of the trade-offs involved.

So, in this part of the book, we will share inspiring stories about the first wonders of setting up network nodes, and then move on to explore various technical options you might want to consider for setting up your infrastructure.

14.1. Gateway to the internet

If you decide to connect your community network to the public internet, you'll have two basic options to reach out beyond the local boundaries of your community, which can be used in parallel to create redundancy.

Using a commercial internet subscription: That's probably the easiest. Any traditional ADSL or, better, fibre-optic subscription from a mainstream internet access provider will do the trick. The only requirement is to have one person in your community who has subscribed to such a service and is willing to make it available to the community. A drawback is that if traffic gets too

voluminous, the connection might be slowed as the bandwidth might not be able to absorb all the community's traffic.

Finding a transit operator to the global internet: The most basic answer is to interconnect with existing networks nearby, which will then be able to relay the traffic of your community and thereby connect your local network to the global internet. These can be owned by public authorities or private corporations. You will have to contract with them and pay them a fee which will vary depending on the amount of traffic you send to their network. It is possible that they will offer you direct connection to the global internet (transit), or just collect your traffic and bring it to another network operator who will be able to provide you with transit services. In Toulouse, France, Tetaneutral was lucky enough to realise that a data centre run by an independent, for-profit company had been built just next to the squat where most of their infrastructure was based (it's the main hub for their mostly wireless network where the community's servers are hosted). They thus simply rolled out a fibre-optic cable to the data centre and directly reached that data centre where a transit operator could then connect their network to the global internet. No need for another intermediary to collect the network and bring it to the transit operator.

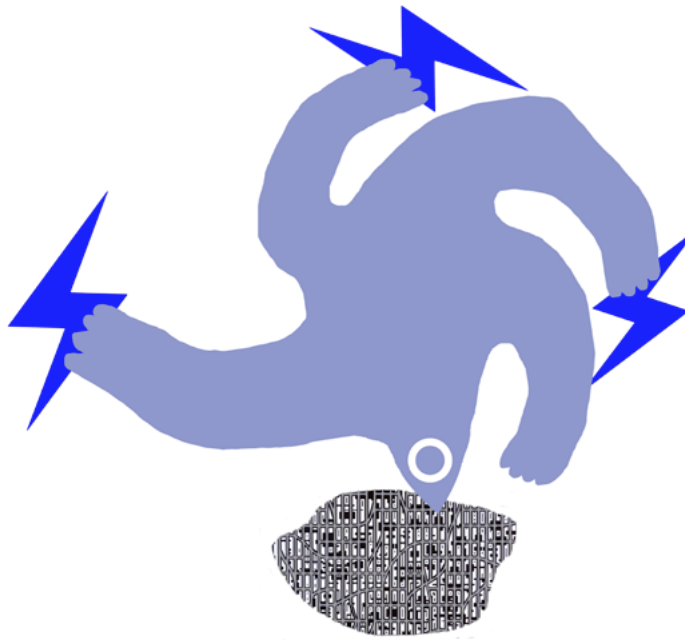
14.2. Nodes and links

The establishment of links between nodes of a CN, through a wired or wireless connection, serves a very concrete objective: to extend the coverage of the services offered by different nodes of the network to a larger geographic area. Some of the nodes host certain services like internet connectivity or local applications, others serve only as "forwarders" or as access points. The placement of network nodes and the chosen links between them can significantly influence the performance, stability and evolution of a CN. But even the biggest CNs started from somewhere, so don't hesitate to create a node where the need is.

14.3. Wireless

In the case of wireless, the installation of a network "node" entails the following elements:

- A suitable location, typically roofs of high buildings since wireless links require "Line of sight"
- One or more antennas and 802.11 devices
- A router
- An energy source.



There are many proprietary solutions for antennas, routers or both in the same device, and it is rather easy to establish a wireless link by just mounting such gear on two roofs that can "see" each other. However, there are many good reasons why free software and open hardware solutions should be preferred. The Freifunk.net and LibreMesh.org communities are maintaining the appropriate software, and a new open hardware router, the LibreRouter, is also under development and almost out.

In practice, many community networks are advocates of free software and open hardware, but they often make compromises, especially when the "community" is also constituted by non-experts for whom the usability of the proprietary solutions can make a big difference.

14.4. Fibre

At the beginning, when most community networks ran on wireless, the nodes were typically placed on tall buildings like bell towers of churches, agriculture silos, or also at the top of hills and mountains. The requirement was to have good views (in order to have a good line of sight everywhere and thus provide better coverage) as well as electricity to power the equipment. If electricity was not present, then solar power and a battery to operate 24 hours a day were also an option, considering that the power consumption of such equipment is not too high. But at the end of the 2000s, some communities like guifi.net moved

to fibre-optic last-mile networks. When you deploy fibre, you can choose between two kind of architectures:

- Passive nodes (boxes with connections) than can be placed anywhere (in a wall, in a post or on the street).
- Active nodes (those requiring power), which are typically placed in racks, whether outdoors or indoors (there are racks suitable for every type of placement).

Usually, deploying fibre will require you to have access to lamp posts, ducts and other facilities through which your fibre cables will be deployed. It does not matter if it is public or private space, as long as it is easily accessible for those who have to maintain the network. Legal aspects are highlighted later (in Chapter 19).

Laying out a fibre network will also require some special tools and expertise, for instance to solder fibre-optic cables. But after some basic training, it is generally quite easy to do! And of course, using fibre will increase by tenfold or more the speed of people's connection. We advise you to choose a place with a clean atmosphere and not many chemicals: Ramon Roca told us that once, guifi.net participants had placed an active node in the engine room of a sewage treatment plant of a public school, but there were so many corrosive chemicals in the air that they started destroying guifi.net's equipment!

14.5. Servers

Practice has shown that, from the moment that a community network offers access to the internet, local services – those hosted on servers within the network – either degrade or, even when successful, usually address a narrower audience that their mainstream alternatives.

One of the reasons is that the capabilities of local services are not well communicated, neither to the public nor to application designers. Part of the misunderstanding is due to the difficulty to imagine a more intimate digital space, a local application accessible only to those connected to a community network, in the "let's connect everything" mentality promoted today.

Open and free software applications required in this setting have not yet reached the usability levels of global platforms, but software like NextCloud and Etherpad are making significant progress and are changing this perception that free software is only for geeks.

Various toolkits and platforms for local services like yunohost, Framasoft and the MAZI toolkit exist, which you will be able to replicate on your network to start servicing your community with great, decentralised and free software!

15. Start organising your community

As a community network grows and takes form, it gives shape to one or more communities related to it, the community of its users, its maintainers, its allies.

There are many choices during the first steps of the network development that can influence this evolution. So, depending on how concrete your vision is at the early stages, you might need to make appropriate decisions for these choices. In any case, it is good to start organising early, to think about the objectives and the goals, the dimension you have in mind, and discuss all this with friends and other participants.

First of all, as we have already stressed, it is important to select people with the appropriate skills who share similar values and objectives.

Second, a physical space acting as a meeting place, an info point, a library, a hub for your community network will help a lot to engage more people along the way.

But beware that it will also frame the character of the community you are building. Depending on your environment and locality, you can seek help

from the local authorities (municipality, county, etc.) or from local cultural associations, sometimes even local religious organisations, or sport clubs. They often have social spaces, or high buildings like churches, and may be willing to share and may end up getting involved in the community network too.

The same holds with the online forum that you will choose for online discussions, coordination, decision making, etc. Clearly, a Facebook group can be more inclusive if you would wish to address a more mainstream audience, while a self-hosted Mattermost or Discourse.org platform might raise the barrier to entry a little, but would make clear what the political values of the project are. Clearly you can choose to have more than one platform addressing different needs, and probably at some point you will want to have your own domain and set up a "traditional" web portal, like guifi.net, ninux.org and other community networks have done.

Finally, the name and overall branding of your network is also very important in this respect, so the naming and domain selection is a strategic choice. But don’t wait to be fully confident about all your decisions before you start, you can change and add, and this is one of the beauties of building your own network, placing it into your community and into the world. Those that will join later will also have an opinion, and it is important they can participate in the formation of the identity.

16. Decide on your legal status

It may seem strange that the issue of your community network's legal status is only coming up now. But from our experience, these questions are only raised once your community has come together and started its network. However, the question of whether or not you should have a legal status is actually a crucial one, one which you will make based on your ethical values and the legal constraints you are subject to.

16.1. Why should you consider incorporating your community network?

To start your community network, you will have to make a choice on whether or not to get a legal status. You might prefer sticking to an informal and flexible structure relying on self-management. Or you might want a more structured organisation, where all roles are clearly defined and distributed. You may also find a middle ground, something in between.

Whatever you choose, your community's decision in this regard should be based on its goals and preferred mode of governance. But it is also one that you'll need to make with legal considerations in mind. The fact is that, overall, we found out during our research that having a legal entity (a legal form like an association or a cooperative) for all the members and participants of your community network will reduce legal risk for individual participants. Take data protection law for instance. When you are providing access to a network for your community, the law applicable in Europe says that those who manage the network engage in the processing of personal data – the data of the network's users. From a legal point of view, that means you are a "data controller". This legal qualification implies legal liability. You have to respect specific requirements (that are explained in the next section). If you fail to comply, you may be prosecuted and might have to pay a financial penalty. Other forms of more legal liability may also apply.

When a community network has no specific legal form, it is more difficult to understand who the "data controller" is, or who is more generally responsible if something goes wrong. Liability might only bear on private individuals participating in running the network.

Having a legal form is a way to share liability and distribute it among the members of the community, and make the organisation liable rather than individual persons. But even then, it does not necessarily mean having a strict organisation.

16.2. What are the different legal statuses that you may consider?

There are several forms of legal status provided by your national law that you will be able to choose from when considering what legal status to take. These range from non-profit status such as associations or foundations, to forms of for-profit legal status that put the interest of the community first, such as cooperatives. Here we have collected some informative stories from different community networks in different countries, illustrating some of the reasons why they chose to incorporate and what legal status they found best for their needs. Each of them found a different, valid path. Many other solutions exist and many other paths have been explored, with or without success. Find yours! And remember that these decisions can also be changed as the network evolves and grows.

Story #15: guifi.net becoming a foundation (by Ramon Roca)

guifi.net started in an informal way in 2004 as a group of citizens connecting to each other and getting access to the internet in small villages in the countryside of Catalonia. That was done without a legal entity or formal "bylaws", but from the very beginning there were written principles of the community as a commons ("Comuns per la Xarxa Oberta, Lliure i Neutral") inspired by the Pico Peering Agreement.

Because these principles were documented and well understood among our members, this was at first enough to successfully address the problems that arose in the first stage of our growth. Over the first years, we grew and built a significant amount of new infrastructure. When we started considering rolling out a fibre-optic network, we had a debate and decided to establish a legal entity. We felt like the status of a foundation was best to grow and coordinate many different participants, while remaining loyal to the original principles in terms of keeping the infrastructure neutral and safe from any speculation.

During that internal debate, several aspects convinced us that the status of a foundation was right for us, and coherent with our priority to ensure the protection of our infrastructure as a commons:

1. Declaring the network to be a public good and handing over its management to public administrations was not considered safe enough: there were already many cases of public assets being privatised or appropriated by the public sector.

2. Taking the form of a cooperative or association, with one vote per person, would have potentially created the risk of unfair representation of our community. For example, by growing guifi.net in urban areas, votes coming from urban participants could become a majority and relegate those living in rural areas, undermining our original priority of connecting everyone.

3. Foundations are protected against threats such as a hostile takeover. They cannot be sold. They adopt long-lasting objectives through their bylaws. A drawback with the status of a foundation is that it does not necessarily entail democratic governance. So, we had to include additional specific mechanisms to establish open and participative governance. We also adopted a declaration and related measures to ensure that it would remain neutral from partisan, government or economic interests.

Story #16: When a community network becomes a cooperative (by Spyou)

The project of the SCANI cooperative started in 2012 out of a non-profit internet access provider that had been around since 1998. We didn't plan anything at first. No business plan. No grandiose speech of great endeavours. We just seeded a few radio antennas here and there to build a tiny network. We only had two ethical principles:

- **No public subsidies.**
- **No conflict of interest, by separating decision making and the money that we might make as a non-profit.**

But being a traditional non-profit association was at least for some, especially local elected representatives, hindering the development and professionalisation of our operations. As we were told, we were the nice little computer club of Cheny, our village.

We could give courses to teach people how to use a computer or even inform about the politics of digital technologies.

However, the "heavy lifting" of planning and rolling out radio and fibre-optic networks was not for us. Too tiny. Too not credible.

Our reaction was to become a "cooperative for digital planning", a way to scale up and say "hey, we are here, and we are going to digitally network this territory". With, on top of that, two overarching principles:

- To avoid mobilising public money without being able to reimburse them, we now have social capital which local governments can acquire (capped at 50%). We can now use public money, and we can give it back when we don't want it anymore or when we no longer need it.

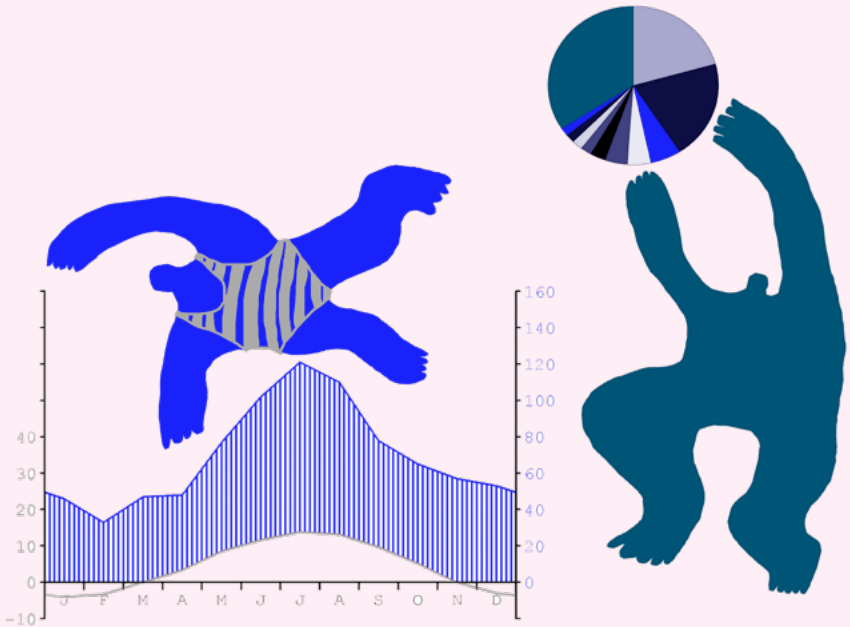
- To solve the issue of remuneration and direction of the whole cooperative, we opted for a system with an executive board ("conseil d'administration") that includes two members that might be paid for their participation in the technical operation of SCANI (because those who spend the most time on the cooperative are ideally positioned to decide, but they need to eat at some point and need to be compensated), and an oversight board (whose only role is to oversee, so it's typically not as time-consuming) which comes into play if there is a problem (for instance, a conflict of interest).

Quite pragmatically, the status of a cooperative is not necessarily useful to reach these goals, but it makes it easier: **people are sympathetic to our work, we are not exposed to being sued by fiscal**

authorities for unfair competition, we have written rules that are more stringent than those of a non-profit organisation, so our structure is easier to pass on to potential followers.

In the end, I remain convinced that it all comes down to people and timing. I'm not sure we can turn into a model that would be better or more adapted than a non-profit association. I'm not even sure that an official entity is necessary, but it sure can help to be considered and to work with other organisations.

I did not talk too much about problems. They are basically the same as in any other human group: lack of communication between people, lack of time to come to grips with our issues and actions, and so a lack of a clear vision of the larger picture leading to arguments, irritations, departure, return, nervousness and waste of time... Add to that some disagreements over the whole purpose (some of those who were there from the beginning realised a little late that they actually wanted a small internet access provider to be managed by a couple of friends, not a cooperative open to all; they eventually left the deck to return to the bottom of the ship's hold...).



Story #17: Freifunk getting a legal status (by Jürgen Neumann)

Today Freifunk is a meta-community of hundreds of local communities. As such, Freifunk has no legal entity. But to interact with the rest of the world, you sometimes need a legal entity. To solve this problem, there are several registered not-for-profit organisations related to Freifunk in various regions of Germany. One of them is the Foerderverein Freie Netzwerke e.V. aka FFN. This was also the first registered legal club in the context of Freifunk.

The initial need to set up the entity was to facilitate the organisation of the first international get-together of free network activists in Berlin in 2003, the "Freifunk Summer Convention". We needed to rent a large venue, get insurance for it, and rent some expensive video equipment. We did not want a private person to take the risk. Another reason to register a legal entity was to comply with German publishing laws to provide on our website the name and contact information of those responsible for the content published.

We had a lot of discussion about the name of this new organisation. Many people just wanted to call it Freifunk. But I argued for a clear separation of the community of activists and the legal entity. The reason for that was that everybody should be able to become a "Freifunka", as we call Freifunk activists, without having to be a member in the legal entity.

My feeling was also that the community should not be governed by a hierarchically structured organisation, but that the not-for-profit organisation should remain at the service of the community. Finally we agreed on that idea.

Today, some of these associated not-for-profit entities in the Freifunk ecosystem are also formally registered as internet service providers. Besides other services already mentioned, they do offer internet gateways for the community and maintenance services for backhaul infrastructures.

16.3. Should I formally register as an internet access provider?

If your community has decided to incorporate itself – be it as a foundation, an association or a cooperative – you might wonder if there are any further steps you can take so that your wonderful project can get the recognition it deserves from public authorities.

From a legal point of view, your community network provides an "electronic communications network or service" (legally an Electronic Communication Service or ECS – see the Glossary). As such, you may have to register before a specific authority. The actual procedure and terms depend on the country in which you are based. Most of the time, you will have to provide specific information to your telecommunication national regulatory authority (NRA). Its job is to monitor the telecom market, implement EU telecommunication and competition law, and ensure the rights of users of telecom devices. There is one in each EU member state.

In any case, this authority can give you the information you need regarding paperwork obligations. In Germany, Spain and France, this registration is free of charge. However, in other countries it can still be costly. Fortunately, a forthcoming EU law is about to change this. It encourages national authorities to avoid requesting these administrative fees from "commons-based" and non-profit networks (see our policy guidelines in Appendix C, also freely available for anyone as a stand-alone document, Enabling the Telecommons: Guidelines for Policy-Makers).

For now, this paperwork might seem like a burden to you. However, it often gives you rights, such as access to resources (e.g. radio frequencies allocation, interconnectivity with other networks, legal protections, etc.). Plus, depending on your national law, you may be fined if you decline to do it. So, it’s probably a good idea to consult with the NRA first.

Story #18: Registering with telecom authorities: an easy way to become a legitimate stakeholder (by Pierre)

Let me tell you about how we managed this issue at Franciliens.net, a French community network that is a member of the Fédération FDN. **One of the first steps for the creation of an internet access provider in France is for it to declare itself to the telecommunications regulator, the Autorité de Régulation des Communications Électroniques et des Postes (ARCEP)**, based on article L.33-1 of the Code of the Post and Electronic Communications (CPCE). Even if this formality is mandatory, it has only a declarative value. There is no actual control, unlike an authorisation system.

Beyond the legal obligation, this formality allows us to be considered and treated by the authorities as an operator, whatever our size. **It is the formality that makes our activist telecom operator a legitimate interlocutor, which has the right to speak on all matters related to the regulation of electronic communications.** It is therefore an important tool for an activist organisation that wishes to be heard within an existing legal framework.

Regarding Franciliens.net, of which I was head of the board at the time of our declaration, the latter was one of the very first formalities that we accomplished, as soon as the "non-profit association" had been created (through a declaration to administrative authorities). We didn't even have a bank account yet. The declaration itself was quite simple: the form is available online on the ARCEP's website, and it only requires straightforward information, including a letter from the heads of the organisation, the proof of creation of the organisation and a descriptive summary of the network you want to operate. One of the first concrete effects that the L.33-1 declaration had for Franciliens.net was the possibility to receive notification of all the calls for co-investment from fibre optics operators, and consequently to better grasp the state of fibre-to-the-home deployments in France. This topic is a big issue for us, as we would like to operate fibre-optic networks. Another effect, probably the most long-lasting considering the rapidly growing number of declared non-profit internet access providers in France, was to boost the credibility of the spokespersons of the Fédération FDN when they speak with the ARCEP. **The fact of acting as representatives of many declared operators gives them more weight, paving the way for our upcoming policy actions!**

17. Consider your revenue models

When you want to start a community network, you will need to spend time and money for labour, equipment and services, such as websites or an uplink to the internet. You are planning to set up an information technology (IT) infrastructure and to operate it for several years.

To do so, you will need to find out the amount of money needed to start your project and also how much money you will need to keep it up and running. In other words: at some point you need to know all your initial and recurring costs. Initial costs include everything you have to purchase to start – the one-off starting costs. Recurring costs are things like loans, electricity or rental fees, which you'll face on a regular basis.

Keeping in mind that any hardware will be outdated or break down at some point, you will also need to save some money to replace it from time to time. An advisable and very common method to deal with this is to calculate the price of the device and simply divide it by the period of time you expect it to last. This is called depreciation. Here is an example: an average computer device like an access-point is supposed to last for three to five years. If the initial

costs are 500€ and you plan to use it for five years, your annual depreciation will then be 100€. So, to make sure your project survives after this period, it is of fundamental importance that you collect these 100€ every year and keep these savings to replace your device later on.

In an early stage, most communities are self-funded, meaning that the community members will spend their own time and money to set up a first nucleus of the network infrastructure. This is of course the easiest and most practical way to actually get going. But for further expansion of the network infrastructure, you will have to discuss with the members of the community and agree on a suitable revenue model. Depending on your local environment and your community, there is a choice of various alternatives to generate revenue. For example, it could be self-funded, sponsored, or financed by member fees or paid services. It can also of course be a mix of all these options. For now, you should just start thinking about revenue models and discuss them in your community. You will find more detailed information on these issues later on in this book, in Chapters 20 and 23.

Story #19: An example of a small-scale ad hoc economic model for community networking: free2air (by Adam Burns)

At free2air initial economic resources were provided by a small group of people who donated their time, expertise and equipment. In addition, people providing value-added services on top of the local network (video streaming, professional printing, digital telephony, etc). Regular participants often worked together, assisting each other through sharing expertise in technical network routing, planning and other tasks.

The economic model of the free2air community network was based on offering free connectivity and local services to light or occasional personal users. As usage of the network increased and became heavier or more frequent, **users would be asked to help underwrite the running costs of the resources on the basis of "pay what you can and think it is worth"**. People would also be encouraged to join regular meetings and workshops should they wish to. Local businesses such as internet cafés were charged a monthly subscription.
At peak, 30 to 50 subscribers on that basis proved to be sufficient to cover labour and equipment costs of network maintenance and upgrades, as well as contributing to further workshops and meetings.

Story #20: The cost structure of Freifunk (by Jürgen Neumann)

Let's have a closer look at cost structures at first:
1. Hardware (computers, router, cables, antennas)
2. Education
3. Roll-out (set-up costs)
4. Electricity
5. Maintenance and support services.

I'm leaving out costs for internet access, as in Freifunk's model of a free network, this is an extra service that can be run on top of a free network (e.g. via a virtual private network).

Here in Germany, all of the costs listed above are truly user-contributed. Users buy their own hardware and pay for electricity themselves. We as individuals offer free trainings to educate them how to connect the routers to the network. So, the roll-out is done by every single user himself/herself. This is very important, because only this makes it possible to grow the network almost endlessly without the need of having a huge administrative team to manage the network.

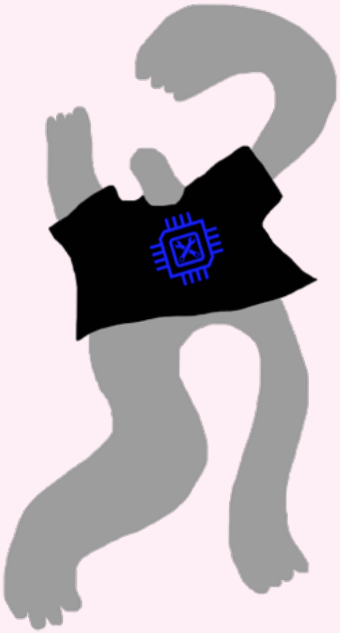
Users in other places can start a network themselves once they know how to do this. Our meshing technology is a very important key issue to these kinds of organically growing infrastructures.

Maintenance and support services are also user-contributed. We do organise this like in a Linux User Group. We offer regular meetings very locally. For example, in Berlin we offer regular meetings once a week in the evenings in almost every district. These meetings work like a typical user group. People who have questions or problems can go there. They can ask their questions, and the person with the minimum skills needed to answer the questions is pleased to do so. If the question is more complicated, a more educated person is asked to answer. And only if it is even more complicated are the true experts needed. This is a very important methodology to deal with local resources. Also people learn from the very beginning to teach and help each other. It also helps to educate the "experts" not to get involved in every issue, but also to give other people a chance to help others and to learn more and more over time, so that they can become experts themselves one day.

There is another important issue I would like to address at this point. I know that many of the costs addressed above can not always be covered by the users in the local community themselves. But I think it is a good way to try to help the others to get to own their own nodes (access points). Because in the end it is all about the ownership of the network. Our networks are owned by the users! So it will be very

hard to sell them to a commercial entity for the good of only a few people who might have established some superpower within the local community. This is to protect the wealth that over time the community has built into the network. It also protects us from the laws which are addressed to network providers. As there is no single entity that runs the network, there is no legal body other than all the single users who are offering this service. At least here in Europe these people therefore are not service providers. As mentioned before, a service like e.g. internet can be run as a different model on top of the network! This is a very important issue that I cannot stress often enough!

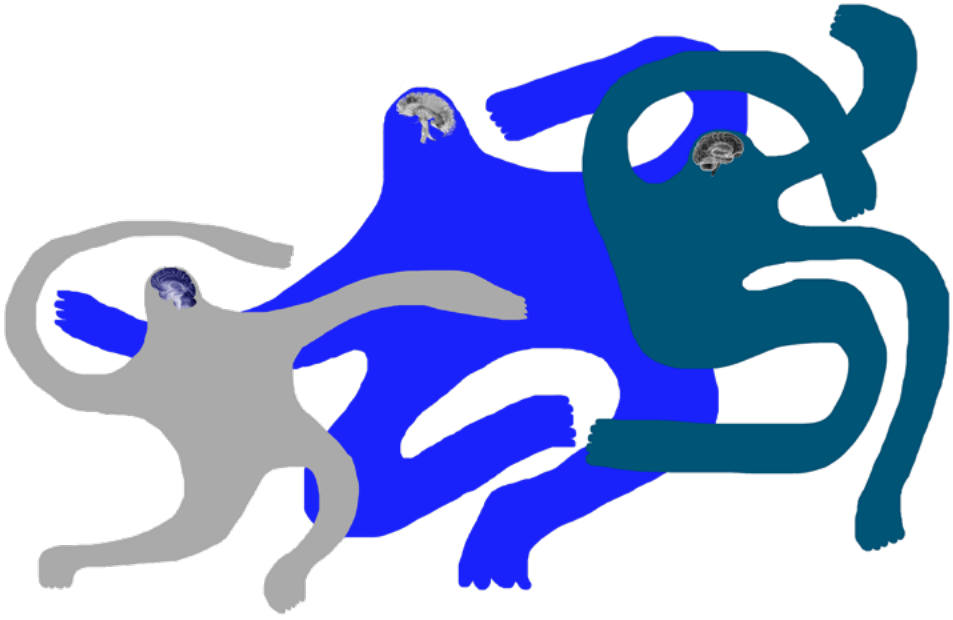
So as I know that this model might not be adoptable so easily, you should find ways of how to realise this. One could be that the routers and other equipment are sold to the users with micro-credits. There might be other ways to solve this issue, but I am sure that you as local people will know much better than me how to deal with this.



PART 5 : HOW TO GET A COMMUNITY NETWORK REALLY RUNNING?

Congratulations! You have gathered a great team of people to start your community network and get it running. Now that you are ready to experiment with your network, you can consider expanding it, launching new services like hosting the community's emails, or testing local online applications that the community wants to use to improve their lives.

In this chapter, we go one step further in considering various aspects of running the network. It might look tedious at first, but after the early phase of development of your community network, you will need to adopt basic practices that will ensure that your friends and neighbours are happy with the common resource you have established together.



18. Monitoring and managing your network

In this part, we will guide you through basic notions on how to manage communications on your network. This is called "monitoring" your network.

Monitoring is the process of collecting data that is relevant to the operation and availability of network resources, like capacity, packet losses, routes that fail, signal-to-noise ratio on links, and so on. It might sound technical, but as you will see there are also political and administrative implications to this. In a nutshell, we could put it this way: with (distributed) ownership comes responsibility.

18.1. Why monitor?

Visualisation of the resources and connectivity that each member contributes to a community network is an invaluable tool to show the impact of participation on the collective achievements brought by the community network itself.

Monitoring is also useful for a number of aspects of ownership responsibilities. Monitoring helps the owner visualise and understand how the resources are used and where to plan any future upgrades or changes.
Two basic reasons for monitoring should be considered. Problem management concentrates on issues of the present: things that need to be addressed immediately or in the near-term future. Network and capacity planning are issues that need to be addressed according to the rate of change of network usage growth. **A key component is to use historical data to visualise this rate of growth**. We will give an overview of both approaches.

Troubleshooting
The main goal of troubleshooting is to keep the common resources of the network available to the community. Monitoring helps those who manage the network to identify (and hopefully fix) any issue before members of the community notice that there is a problem at all.

Problems facing members of the community network usually come in two varieties:

- A fault or change in a network resource that impacts access to, or availability of, this or another resource. Such a fault will impact access to resources for many or even all members of the community. These problems may come at a high cost to an owner in terms of many people needing assistance at once (all trying to ask for help or support at the same time). The goal of monitoring for these types of problems is to notify owners of a resource of the problem as soon as possible, sometimes even before it really happens. Usually, monitoring a network will prevent major problems, for instance, identifying a single point of failure in the network, so that resources in that point can be added, increasing the network's resilience.

- A lack of knowledge on how to access a resource. Such a problem is usually experienced by a single member of a community and can be resolved by providing clear channels of help and support such as a community help wiki or forum pages or FAQ (Frequently Asked Questions). Where to find such resources should be clearly communicated to the community.

Encouragement of a friendly, lively, experienced community helps keep this advice fresh and current.

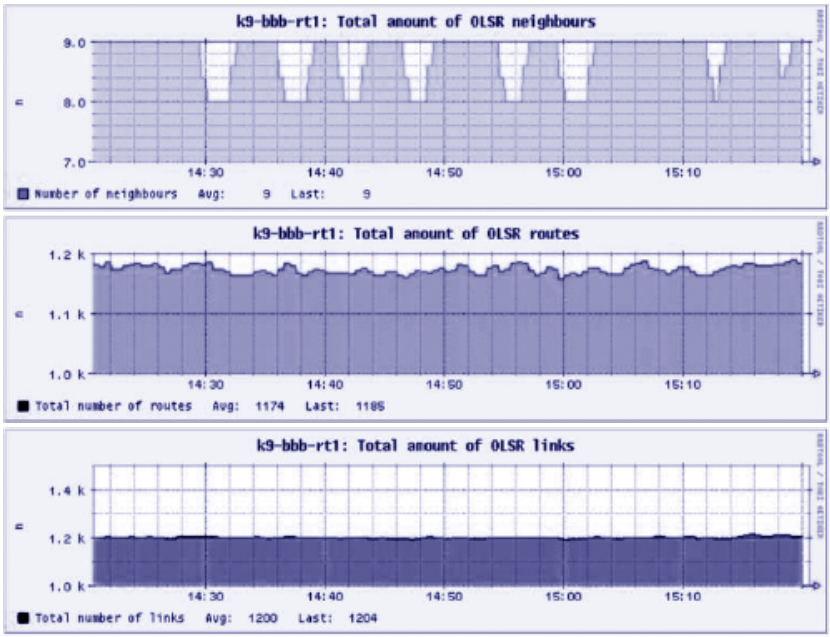
The goal of problem management is to reduce repetitive strain on owners who support the network resources, as well as on people with specific knowledge who answer the questions of other community members.

1

2

1. Freifunk mesh radio links in a portion of the network; clicking on the link shows its length and quality measured as the inverse of the estimated loss rate (known as ETX); 1 means top quality

2. Freifunk single node map showing location and characteristics of the node together with the number of connected users (clients).



3

3. The OLSR statistics over time reported by one of the Freifunk nodes. OLSR is the routing protocol used by the network; the statistics include the number of neighbour nodes, the number of routes (end-to-end logical connections between nodes) seen by the specific node, and the number of links in the entire network as communicated through OLSR

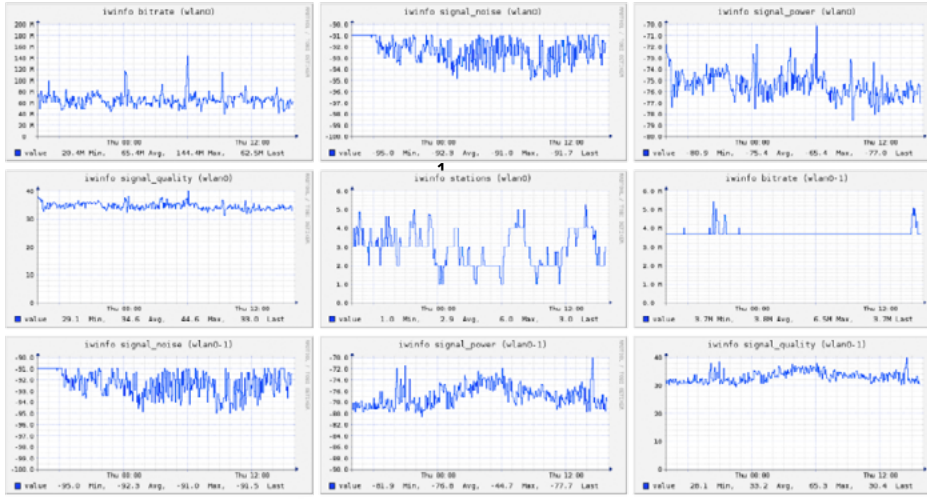
OLSR-Verbindungen

Übersicht über aktuell bestehende OLSR-Verbindungen

Nachbar-IP	Hostname	Schnittstelle	Lokale Interface-IP	LQ	NLQ	ETX	SNR
10.31.9.254	k9-ff-gw.olsr	wan	10.31.9.241	1.000	1.000	1.000	
10.31.9.252	mid2.liberacion.olsr	wan	10.31.9.241	1.000	1.000	1.000	
10.31.7.157	mid10.f2a-bbb-rt1.olsr	vlan25	10.31.9.25	1.000	1.000	1.000	
10.31.9.231	mid1.k9-bbb-31.olsr	vlan30	10.31.9.225	1.000	1.000	1.000	
10.31.9.233	mid1.k9-bbb-33.olsr	vlan30	10.31.9.225	1.000	1.000	1.000	
10.31.9.232	mid1.k9-bbb-32.olsr	vlan30	10.31.9.225	1.000	1.000	1.000	
10.230.228.5	v36-core.olsr	vlan23	10.31.9.23	1.000	1.000	1.000	
10.31.10.17	mid6.Zwingli-Core.olsr	vlan20	10.31.9.20	0.944	1.000	1.058	
10.31.4.81	mid8.sama-core.olsr	vlan21	10.31.9.21	0.086	1.000		

Legende:

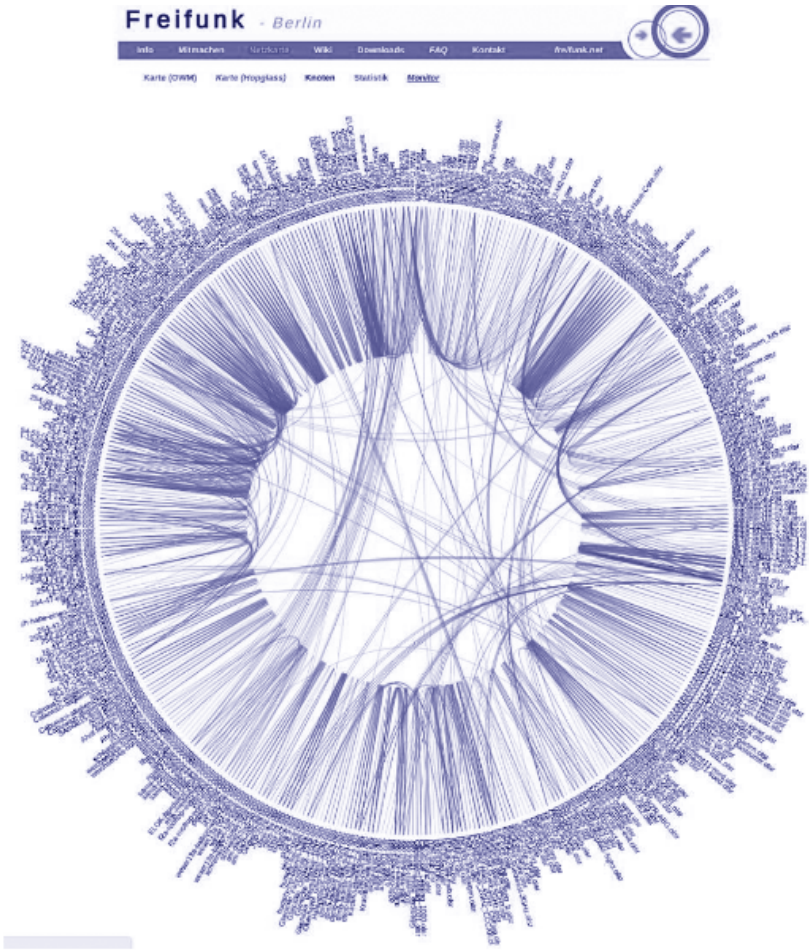
- **LQ:** Erfolgsquote vom Nachbarn empfangener Pakete
- **NLQ:** Erfolgsquote zum Nachbarn gesendeter Pakete
- **ETX:** Zu erwartende Sendeversuche pro Paket
  - **Green**:Very good (ETX < 2)
  - **Yellow**:Good (2 < ETX < 4)
  - **Orange**:Still usable (4 < ETX < 10)
  - **Red**:Bad (ETX > 10)
- **SNR:** Signal Noise Ratio in dB
  - **Green**:Very good (SNR > 30)
  - **Yellow**:Good (30 > SNR > 20)
  - **Orange**:Still usable (20 > SNR > 5)
  - **Red**:Bad (SNR < 5)



4. Detailed link quality measures from a specific node toward its direct neighbours, measured both as ETX and as SNR (two different metrics, essentially monitoring signal quality and interfering signals)

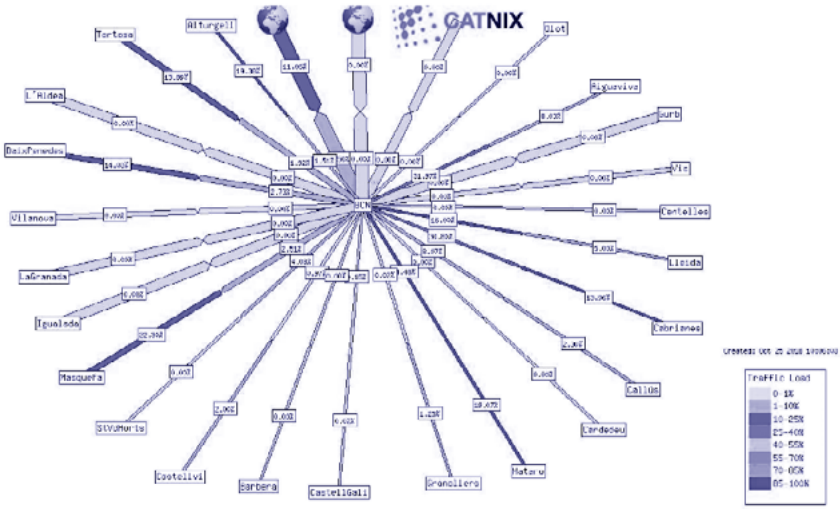
5. A detailed technical breakdown of wireless interface characteristics of a node; the nine plots give information as a function of time for about one day on parameters like the physical layer, bit rate available, signal power and quality

6



6. Chord diagram representing the logical connectivity between a large number of nodes in Freifunk Berlin. Although "unreadable" at first sight, these graphs are useful to highlight anomalies (e.g. the red interconnections) and empower intervention to solve them; details can sometimes be embedded in the links

7



7. Visualisation of guifi.net internet exchange and territorial fibre bandwidth utilisation encoded as colour code; the width of the connection indicates its capacity

Network planning
The goal of network planning is to deploy resources in the most efficient way to properly sustain the needs of each and every user. You need to plan the capacity of the links, i.e. to "right-size" transmission resources, balancing the capability of a resource to grow with the community's needs against the costs of upgrading resources to fit and scale with predicted future needs. Collection of monitoring data is an essential part of network planning and capacity planning in particular, as visualising growth of resource usage can help predict when upgrade investments may be necessary before they impact the everyday usage of the growing community.

You will also need to properly replicate key resources so that the network is not blocked by trivial problems. For instance, you should avoid having a single "authenticator" if your network has an access control mechanism.

18.2. What to monitor?

Some technical components are essential to smoothen availability of commonly used network resources. Typical initial resources of a community network include:

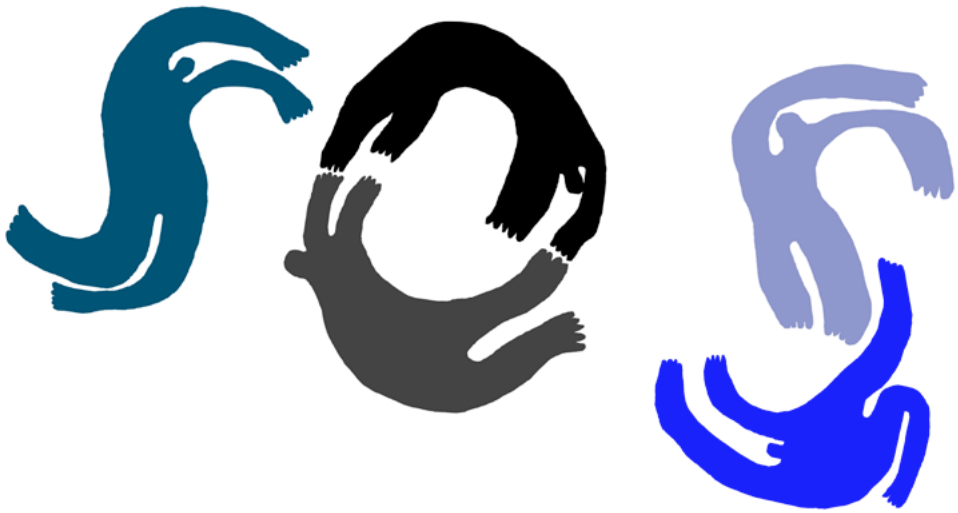
- Internet connectivity
- Capacity availability
- Local access availability
- Number of users connected
- Number of network nodes connected
- Link quality of radio connections
- Traffic load on network links and routers.

There are many different tools that can assist with monitoring, and many well-established community networks offer online resources to help with monitoring and visualising the birth, growth and current status of a community network. The examples of visualisation shown in Figures 1 to 7 are taken from Freifunk and guifi.net monitoring tools.

Most of these monitoring examples are visualisations that are available not only to the owner of the resources, but are also open to all users of the network. There is a practical advantage to this approach: the more people are interested in the status and growth of the network, the more healthy it is likely to remain.

The visual representation of the network can become a symbol of collective achievement and pride of involvement in a common endeavour, and incentivise people to keep all information up to date.

But be careful: before opening up such information to the community, you should ensure that the privacy expectations of the network's users will be respected when showing this information.



Story #21: Tools, knowledge and self-management: with great powers come great responsibility (by Adam Burns)

Around 2000, in London, the free2air community network was already making available traditional network measurement and management tools to reflect this data back to the entire local community. This gave visibility of common network resources, which in turn helped the community empower themselves in terms of providing feedback mechanisms useful in collective self-management of common resources. These tools were also used as a visual aid to understanding and resolving issues and problems within the local network.

One such tool, accessible only within the community network, visualised the status of the community network resources and allowed all participants and users of the network to understand quickly the status of the resources. In one case, **by visualising the reason behind why the network was very slow, the local tool showed that most of the network bandwidth was used by one computer, and that the network bandwidth was mostly being used by a file transfer application called "bittorrent"**.

This tool also shows that this computer was also being used to connect to a Hotmail chat system by the username hey_treacle.
The combination of this data allowed the regular network user (whose pseudonym was vortex) to contact the new user (hey_treacle) and engage in an introduction to the community network and politely raise the issue that their computer was using all the resources and this was affecting other people's use of the common resource.

The following conversation took place:

(14:48:16) hey_treacle: hello?

(14:48:21) vortex: hi.

(14:48:27) hey_treacle: whos this?

(14:49:00) vortex: adam. i run the free2air-ap wireless network.

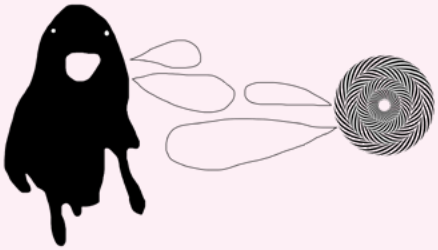
(14:49:05) hey_treacle: ah cool

(14:49:15) vortex: just thought i'd say hi.

(14:49:21) hey_treacle: nice one

(14:49:24) hey_treacle: i live next door

(14:49:45) vortex: you can see details of the network at http://media.free2air.net:3000



(14:49:49) hey_treacle: how fast is the network then

(14:49:52) hey_treacle: as thanks

(14:50:06) hey_treacle: i had a hell of a time connecting, i think its xp

(14:50:22) vortex: the only thing i would ask

(14:50:49) vortex: is that i get volume charged on the downloading during the day.

(14:50:58) hey_treacle: ah ok no problem

(14:51:14) vortex: so if you use it heavily, contributing to costs would help.

(14:51:18) hey_treacle: is it ok at night, i don't download much just the deadwood series via torrent

(14:51:36) hey_treacle: i am happy to contribute

(14:51:43) vortex: cool. you can browse through the web link i gave to see who's doing what.

(14:52:07) hey_treacle: is it ok to leave it on to download torrents at night?

(14:52:31) hey_treacle: i am getting another connection switched over but it take a week or so

(14:52:39) vortex: should be. if you can set a throttle on your bittorrent client, it might help.

(14:53:00) vortex: it's a 2m line until shoreditch exchange upgrade occurs.

(14:53:17) hey_treacle: ah right ok

(14:53:30) hey_treacle: i was hoping orange could get me 8m

(14:53:59) hey_treacle: any idea when they upgrade

(14:54:20) vortex: both my phone lines go thru shoreditch. not sure why it's taking so long for an inner exchange.

(14:55:27) hey_treacle: well thanks, i'll look into putting a limit on it at night and i'll check the link you sent. wont download anything in the day.

(14:55:41) hey_treacle: any idea what the throttle should be by the way?

(14:56:34) vortex: 2m link maybe limit torrent to say 1m leaving headroom overnight?

(14:56:59) vortex: some maybe most clients support doing that now.

(14:57:13) vortex: anyway, just thought i'd say hi.

(14:58:13) hey_treacle: i have utorrent i think that would do it. I

only download deadwood. anyway really. thanks for the service. have a good day.

While initially shocking the new user (hey_treacle) in an unsolicited chat request, the discussion ended with a respectful understanding of the community network principle and philosophy. hey_treacle became an active local user of the network for several months, until they moved away from the area.

This story highlights positive methods of self-management that enable learning and direct problem resolution among participants of the community network.

It also highlights and enables an understanding of what information can be discovered in a network. **The issue further highlights the necessary use of encryption to keep communication private, both from other people and from tools that share the network.** Care should be taken in the selection and use of such tools so that the usage of the tools is in alignment with EU and local laws and regulations, particularly those concerning data protection and privacy.

It may be required to not store or log this information beyond the immediate display use for network management, and this may need explicit agreement and consent before use.

This particular tool was used in the UK before data privacy and data protection regulations (e.g. the General Data Protection Regulation) were formalised and the story serves as an illustrative example of feedback mechanisms that may be useful in collective self-management of a common community network resource.

19. Respect the law, protect privacy

The story that concludes the previous chapter provides a good illustration of the fact that, when you are running a network, you actually process very precious content: your community's communications. Each member of the community uses this network to share their thoughts, express their feelings, search for information, and many other personal and professional activities. This network can be a new tool expanding the freedom of the community. It can also restrain it, depending on how it is managed.

Once you are aware of this, a lot of questions and doubts might arise about how to preserve your community member's fundamental rights. So, in this chapter, we go over important tips on how to treat your community's data with care

19.1. Are all data bits equal?

When we talk about net neutrality, which you will need to respect (it's EU law!), we are used to saying that "all bits are created equal." Hence, **you should not block, throttle or prioritise content** based on political or commercial motives. But when you are processing your users' data, all data packets might look all the same to you. However, from a legal point a view, some have specific

implications. Having a general grasp of the two distinctions explained below will help you understand your obligations.

Personal data vs. anonymous data

Personal data is any information relating to an individual and which may be attributed to this individual. The scope is very wide and often underestimated by communities. Concretely, data such as name, surname, dynamic and static IP addresses, email addresses and phone numbers, for instance, should be regarded as personal data. Such data has a strong link to a person and is part of his or her private life.

As such, specific rules exist to ensure a higher level of protection of personal data and protect the privacy of users. Below, we will help you understand and follow these rules. Anonymous data relates to any information relating to an individual, but which cannot be attributed to this individual by anyone, in any circumstance. No legal requirement is attached to such data. Truly anonymous data is rare. More often than not, data can, in the end, be re-attributed to a specific individual and therefore is likely to be personal data.

Metadata vs. content

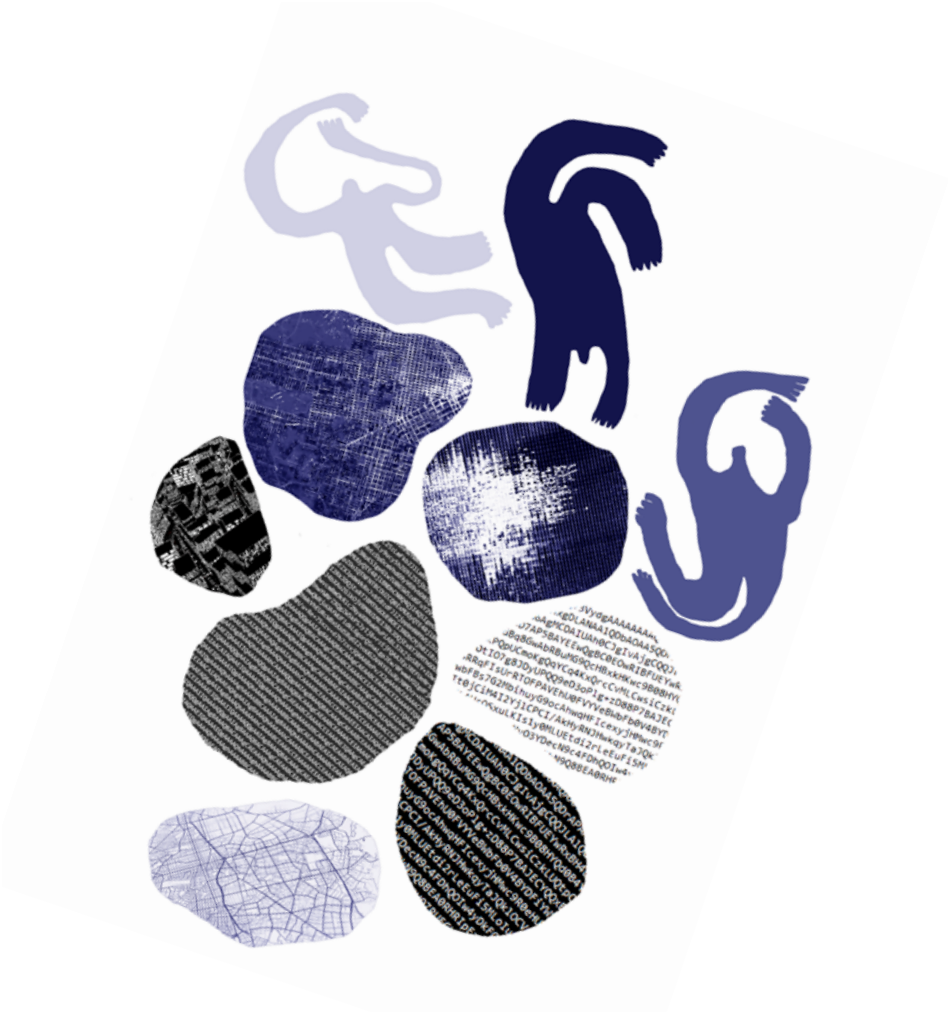
The content of a communication refers to the information that users send or receive and which does not need to be processed, manipulated or stored in order for the information to be transferred. Community networks, like any other entity, should regard all contents as personal data in all circumstances, since they are attributed to the sender or receiver of a communication, or both.

Metadata is a technical word that you will not read in the law, but it refers to all the data that is either needed to transfer the content, or in general characterises or describes the content transfer in some way.

Within the broader category of metadata, the law makes a distinction between the words "traffic data" and "location data". Traffic data are data processed for the transmission of a communication on a telecommunication network (or for billing purposes, when the service is not free). The data identifying the user of a service (e.g. IP address), the receiver of a message, as well as the date, time and duration of a communication are regarded as traffic data. On the internet, "cookies" can be regarded as traffic data, but they normally embed much more information than what is strictly necessary to transmit the content of communications. Location data are data processed on telecommunication networks or by Electronic Commerce Service providers, indicating the geographic position of the terminal equipment of a user.

With regard to community networks' activities, the processing of traffic and location data may be related, for instance, to the management of their network (such as the listing or the mapping of the nodes, access points and users of the network), or to research purposes. These traffic and location data may be related to the users of a community network, as well as to its participants who are running nodes and access points.

Processing metadata properly should not be underestimated. They may give away very specific and personal information regarding the daily life of the members of your community.



This distinction between content and metadata is crucial regarding specific data processing, especially data retention obligations, which we will discuss in Sections 19.2 and 19.3.

19.2. Inform your community about data processing

All members of the community will be linked to each other through your network. Creating and maintaining this link implies processing data, and very often personal data. **To protect your community's rights, you must clearly inform users, and as precisely as possible, about the data processing needed to provide**

them with connectivity and give them access to online services. This is a legal obligation. To fulfil it concretely, you can provide users with a legal document called "terms of use", which sums up how you process their data (a template is provided in Appendix B).

In addition to specific information, you also need a legal basis to process personal data – see article 6(1)(b) of the General Data Protection Regulation (GDPR) for more information. One such legal basis is simply the fact of having signed a contract or an agreement with each user. As long as there is a contract describing the service offered (e.g. electronic communication service to a member of the community), all data processing necessary to perform this contract is lawful. You could also use this agreement to establish a transparent relationship with members of the community. Terms of use therefore allow you to inform your community members, but they also give you a legal basis allowing you to process users' data for the purpose of your using the network.

However, on a philosophical level, your community might prefer having an informal and trust-based relationship. There are positive aspects as well as drawbacks to this solution.

Below, in Story 22, you can read how some community networks have dealt with this issue.

19.3. Do you have to log your community's communication?

This is a very heated question. Groups defending human rights and privacy have been working on this issue for almost 20 years, and it is still an unresolved matter.

France, the UK and Italy were the first countries to require telecom providers to retain all of their users' metadata for up to one year after the terrorist attacks of 2001, and soon these rules were expanded to all EU countries. The rationale was that it would allow the police to identify suspects. But with the increasing use of digital technologies, the range of metadata available to law enforcement has exploded, which means that metadata can let the police know about virtually all of your location and social interactions of the past year.

So after litigation and campaigning by human rights groups, the Court of Justice of the EU ruled in 2014 that these obligations for telecom providers to retain all the metadata of all the population came down to indiscriminate and

general surveillance of the whole population. It is, the Court ruled, a bad sci-fi movie, a gross overreach of the state's surveillance power. Five years later, however, a lot of countries still refuse to comply and change their laws.

That means that **you will be faced with a contradictory legal environment: the supreme court of the EU (which is supposed to have precedence on national laws) says that blanket data retention is illegal, but national law may force you to disregard that ruling and threaten you with jail if you refuse to comply.**

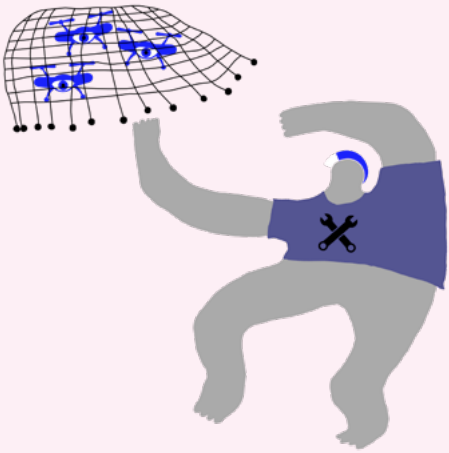
On this issue, your community will need to debate the best course of action. You will probably reach the conclusion that there are three main possibilities:

Option 1: Comply with national law, retain all data listed in national law and therefore disrespect the EU court's ruling; overcomply at the expense of your users' fundamental rights. It will also be costly because you will need a lot of storage space to retain all that data (which might never be used by anybody but hey, "it's the law").

Option 2: Just retain basic identification subscriber information (name, postal address, and what IP address was used over the past year – or whatever duration is mandated in your national law). In their investigations, the police are often left with an IP address tied to a suspicious activity and want to find the people to whom that IP address can be traced back. You might help them move one step forward by giving authorities the identity of the subscriber using that IP address. That is what many existing community networks do, and from our experience, the police will be satisfied (they seem to understand that the law, when interpreted literally in the context of internet communications, is problematic, and it also entails dubious ethical consequences).

Option 3: Disobey national law and abide by EU law! After a thorough debate and exchange of arguments, your community might be shocked by their government's unwillingness to review national legislation to better respect privacy and freedom of expression online. Existing national law clashes with your values and you want to make a point. You will hence only retain the metadata needed for the smooth technical operation of the network, for as short a time as possible. You might be taking a slight legal risk if you are served with a warrant. But you have European law on your side, you know that there will be allies to support you should that risk materialise, and you feel good about being as protective of your community's rights as one can be.

Story #22: La Quadrature du Net stops obeying French data retention laws (by Arthur Messaud)

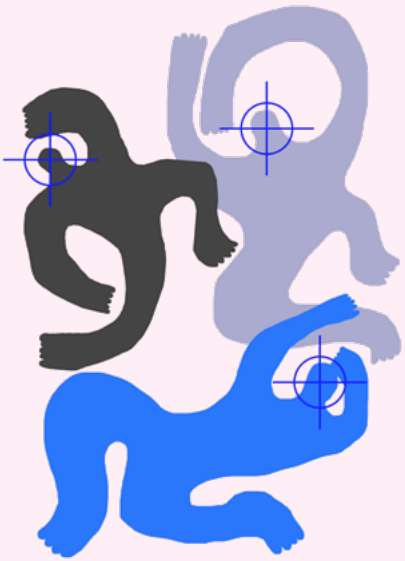


In late 2017, the French advocacy group La Quadrature du Net was subject to a legal request: a police officer acting under the authority of a judge asked us to transmit all data in our possession to identify a user of an account hosted on Mamot, the instance of Mastodon we are hosting on our servers.

However, La Quadrature has chosen to respect European Union law by refraining from keeping the login data of all its users (so-called "data retention" obligations).

The data we retain is only kept for technical reasons. In this case, the user targeted by the request had not used the service for at least 14 days, and La Quadrature therefore had no information about them, except an email address used for registration (required to connect to Mamot.fr). We gave this email address to judiciary authorities.

The choice of La Quadrature du Net is opposed to an ongoing practice which, inherited from a French law that today stands contrary to the law of the European Union, forces hosting providers (and internet access providers) to keep for one year all information concerning the users (the IP address from which the content was published, in particular). We call on all hosting providers and internet access providers to reject this illegal practice and to comply with European Union law: Do not retain any connection data concerning your users for more than 14 days!



20. Balance your accounting sheet

Let's go back to financial issues. At the end of the day, the long-term sustainability of the community network will be achieved by reaching a balance sheet where all the costs – initial expenditures required to set up the infrastructure (capital expenses or CAPEX), as well as recurrent expenses for maintaining and upgrading the network (operational expenses or OPEX) – are reconciled.

At the beginning, it is common to seed this by initial crowdfunding of small donations, followed by extraordinary contributions when needed. That is a simple way to get seed funding, and it may be enough for small cohesive communities.

But if the community grows and becomes diverse in terms of both participants and territories, it might be necessary to address this in a more

systematic way. **So, when a new expense has to be paid, there will be an answer to the unpleasant question: "Why should I contribute now if there are others that use it more?"**

A more systematic way would consist of implementing a very basic accounting system, expressed in whatever currency, measuring on one side all the contributions and costs, and on the other side a measure of the usage of the resources available as a commons (which is the network itself). What usage metrics are used within a given specific scenario could vary for each community network.

By comparing those two aspects on a periodic basis, it is then easy to achieve settlement between costs and use, and implement corrections and redistributions on a fair basis that is satisfactory to everyone. What's more, by balancing the accounts with this type of accounting, another important aspect in community networks can be solved: the coexistence of volunteers and professionals (for instance, small companies providing internet access services on top of the guifi.net network, or deploying fibre to grow the network) on the same infrastructure as a commons. Guifi.net's experience shows that such coexistence is key for constantly scaling the community network.

One thing you should remember in establishing accounting mechanisms is to make sure these rules are agreed by the whole community and that the rules and the way they are implemented remain transparent. Transparency is an important precondition to open governance.

Whether related to expenses or equipment costs, fees or other revenue streams, most community networks choose to make all of this data publicly available.

Story #23: guifi.net's large-scale compensation system: how volunteers and professionals can work together to build a network commons (by Ramon Roca)

The community resources must be properly managed to avoid over-usage by particular users. The governance tools and procedures take into account those participants who use a significant amount of resources to compensate the imbalance between investment in the common infrastructure and network usage among professionals. Expenditures declared by the professionals are periodically cleared according to the network usage. The calculations are done by the Foundation and are made available to the professionals.

For those engaging in economic activities around the community network (for instance, those working on laying out fibre, or for-profit internet access providers), it is required to sign an agreement.

This agreement provides that the participants should take part in the "compensation table" according to the scope at which they operate. For instance, there might be several compensation scopes: global exchange of internet traffic, territorial transport, local access to facilities and equipment in cities or villages, etc.

The "compensation tables" are regular meetings aimed at establishing the criteria for periodic compensation settlements.

So the agreement for economic activities and participation in the compensation system agreement is a legally enforceable contract that establishes the rules for participation of cases such as installers, operators, investors, public administrations, etc. It formally defines the foreseen roles and activities that entail the obligation to sign a compensation agreement.

Note that this is only enforced for those who are carrying out economic activities or making some kind of economic profit. Normal individuals or volunteers are not required to sign this agreement, although they are able to do so if they wish.

The compensation settlements are aimed at ensuring both the fair distribution of the network operation costs based on use of the resources, and the generation of the required resources to recover the investments made or to enable future ones.

The compensations are implemented by balancing between the contributions or the expenses of each participant and their use of resources. The balances are calculated by periodically applying the current compensation criteria. The resulting amounts are settled between the Foundation and each participant, either in cash or materials.

In order to ensure that the operators charge the reinvestment quantities agreed in the corresponding compensation tables to their customers and to increase the overall transparency, the operators must provide to the guifi.net Foundation the list of the amounts per customer they have collected in each billing cycle (on a monthly basis).

The Foundation uses this data to:

1. Calculate the compensation settlements of the next compensation cycle.

2. Ensure that the operators are properly reinvesting these funds by cross-comparing these lists with the expenses they have declared through the expenditures declaration system and other sources of information.

3. Issue the donation certificates to the end-users, where appropriate (according to Spanish regulations, a contribution to the commons infrastructure is a donation; thus, the donors, i.e. the customers of the operators, may benefit from a tax deduction).

PART 6 : HOW TO MAKE A COMMUNITY NETWORK SUSTAINABLE?

Scaling up is always a challenge for local, bottom-up initiatives. You start with your group of friends, and for some time, informality, excitement and the fun of working together is enough to sustain the magic. You achieve a lot with very little resources and time. It feels just great.

Chances are that after some time, some people in the group might get tired. Tensions can grow. Newcomers with not-so-good intentions may join the band, and since you are not really the suspicious type, you do not really pay attention until problems start appearing. Or, it is just that you are too successful and too many people from beyond your community want to join, putting existing governance features or resources under strain. Or some people – for instance the "geeks" who are key to the technical operation of the network – just happen to centralise power. Or you run into legal questions after the first stages of growth of your network.

In this part, we consider various approaches through which you can avoid or mitigate these risks. We start by addressing how to boost your governance mechanisms to clarify roles, avoid power cliques, and promote inclusiveness. We then move to economic

and technological sustainability, exploring how you can plan to upgrade network equipment. We end up with legal considerations on how you can use other people's infrastructure to expand your network, and how to organise to enact positive changes in telecom policy, if the latter becomes a hindrance for the development of your initiative.

21. Organise your governance

When trying to solve governance issues, remember that you are not the first to do this, that others have succeeded beyond expectations, and so you don't have to reinvent the wheel. There are practitioners in your region or country that will be able and glad to help.

Even in your community, you can gather very useful information from some of your friends or seniors, parents, grandparents or neighbours. You will find people who have been involved in bottom-up initiatives in the past and who have run into similar problems as the ones you'll face in building a community network.

We provide two examples as stories – participating in a community garden, and setting up a community radio – which can help you start thinking about governance issues. We then move to another story and think about how to solve these issues, and more generally questions that you should address when thinking about improving the governance of your community network.

Story #24: How to foster inclusive participation for all? Example from a community garden

Aurélie is a member of a shared garden. She buys a basket of fruits and vegetables every week and has to spend at least three weekends every year doing communal work.

She enjoys meeting new people, being in nature and having access to organic local food all year long. She sometimes participates in the general assembly of the association, but she does not really like the way decisions are taken. **It is mostly the same active persons talking and new voices are not heard. She is not inclined to participate more in the management of the garden.** But she sees that some improvements could be made.

For instance, when there is an excess of fruits and vegetables, or during the holidays when they are not picked up, liaising with a food bank could be done on the same day. Her neighbour is a volunteer in a food bank. But each new project has to be presented to the general assembly and approved by the managing board, and Aurélie does not want to prepare a presentation. **There is a very masculine culture.**

She feels discouraged and intimidated.

Story #25: How to take decisions about funding and independence? Example from a community radio station

Tristan is the manager of an indie music label. His uncle, with whom he discovered music, participated in a free radio station in Lyon, Radio Canut. From 1977, he shared his passion for independent music and broadcast punk rock for one hour every Tuesday night. Some other shows, hosted by trade unionists or activists, were political, with an assumed subjectivity.

Free radio stations were not legal. The station's material was seized in 1978 and three radio hosts were taken to court in 1980 for breaking the law on radio broadcasting monopoly.

Self-management was the rule. Decisions were taken collectively by all participants. He remembers fights among the radio hosts. One was to decide if the radio should start accepting advertisements in order to have steady revenues. **Some wanted to hire a few core staff. But some wanted to stay independent, and purely volunteer-based.** They needed to find some sources of funding.
In the end, it was decided to organise concerts and parties for fundraising.

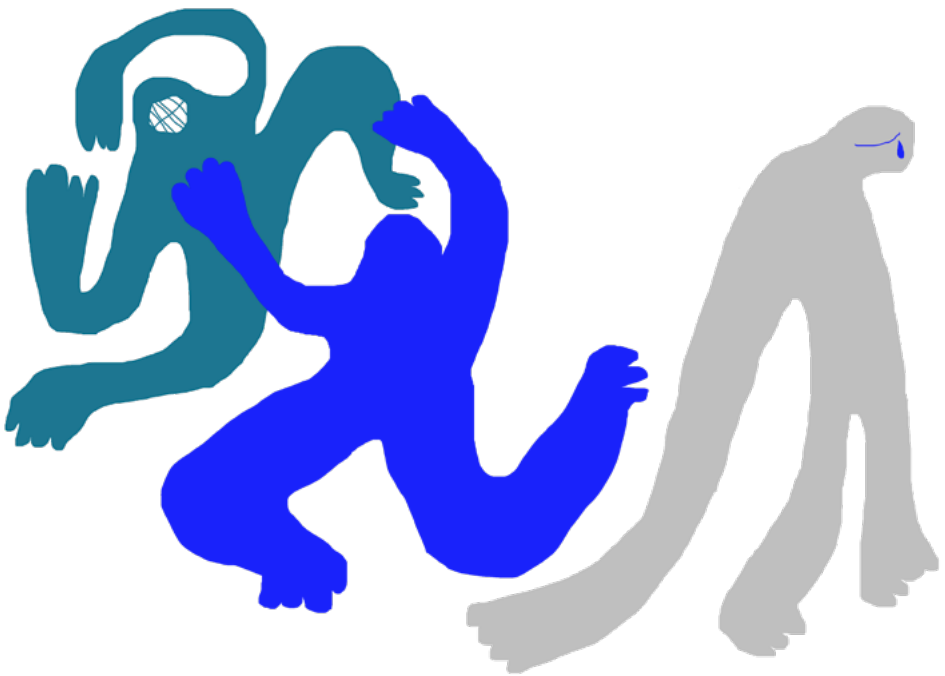
Nowadays, the radio station still exists under a non-profit association status, and every 1st of May, a community meal is held to gather together former and current radio hosts, joined by inhabitants of the studio's neighbourhood and by demonstrators.

21.1. An architecture of the governance

The issues that both Aurélie and Tristan's uncle were trying to solve were indeed similar and can be summed up in this way: **both collective projects were trying to address market failure, which means the absence of an equivalent good-quality public or private service**. The shared garden is a response to the lack of organic locally grown produce. Supermarkets offer organic products coming from far-away countries, and small organic shops are very expensive. The free radio station provides access to alternative culture, since only commercial music was being broadcast on public and market-based radio stations.

The problems they faced tackling these issues were similar, and are similar to problems community networks face: the organisation of the work, motivations, inclusion principles, power and authority relations, gender balance, discussion procedures, and decision-making processes. Choices to be made with regard to the nature of the product or service, the source of funding, the relation with the state, from illegality to co-optation, possible partnerships, etc.

The two stories emphasise problems in decision making due to strong personalities with divergent political views. In the garden, a dominant, confrontational style makes it hard for new persons to be heard and to propose new ideas. Formal processes had become institutionalised,



which can create security, but can also be discouraging. The radio station saw tensions between those who wanted to compromise with commercial partners and those who wanted to remain purely non-commercial.

The self-management of communities and collective projects can be challenging and is hard work. But none of the organisational questions you face are completely new. Experiences from the past may help to anticipate which aspects should be taken care of. **Of particular relevance are economist and Nobel Prize winner Elinor Ostrom's eight design principles affecting the success of self-managed groups**, which can be applied to collective projects developing shared resources that are meant to be governed as commons, and serve as guidance to ask the right questions adapted to your local community and the network's features.

21.2 Design principles for commons

1. Define clear boundaries for the group

- What is the purpose of the infrastructure?
- What resources or services are produced?
- What community does it serve, how are they identified?
- Who is entitled to access to what, and under which conditions or rules?

2. Adapt rules to local needs and conditions

- How is the resource or service distributed?
- What social norms apply to use of the resources?
- What are the guidelines that apply to contributions from the community?
- How are new contributors guided towards becoming productive members of the community?
- What are the means by which people can access and reuse the data?

3. Participatory decision making is vital: Ensure that those affected by the rules can participate in writing and modifying the rules. People will be more likely to follow the rules if they had a hand in writing them.

- How does the community share ideas about how the infrastructure should evolve?
- What are the decision-making processes and the tools used to support them?
- How are differences of opinion, or innovative ideas relating to e.g. new design, new services, improvements, or organisation issues, discussed within the community?

4. Assessing activity and monitoring rules

Once rules have been set, communities need a way of checking that people are following them. Commons don't run on good will, but on accountability.

- Is there a monitoring process?
- Who is accountable?
- How are moderators identified and promoted? How might their privileges be removed?
- How are contributions managed or reviewed?
- How does the community measure its progress and activity?
- What metrics are available to measure quality, coverage, etc.?
- How are good uses of the infrastructure showcased?

5. Sanctions for those who abuse the resources or the community rules should be graduated

- What behaviours or misuse are harmful?
- How does the community document and share its norms?
- What are the means by which contributors gain or lose privileges?
- You should develop a system of warnings, fines, or informal reputation consequences in the community. Just banning those who break the rules can create resentment.

6. Debate and conflict resolution should be easily accessible

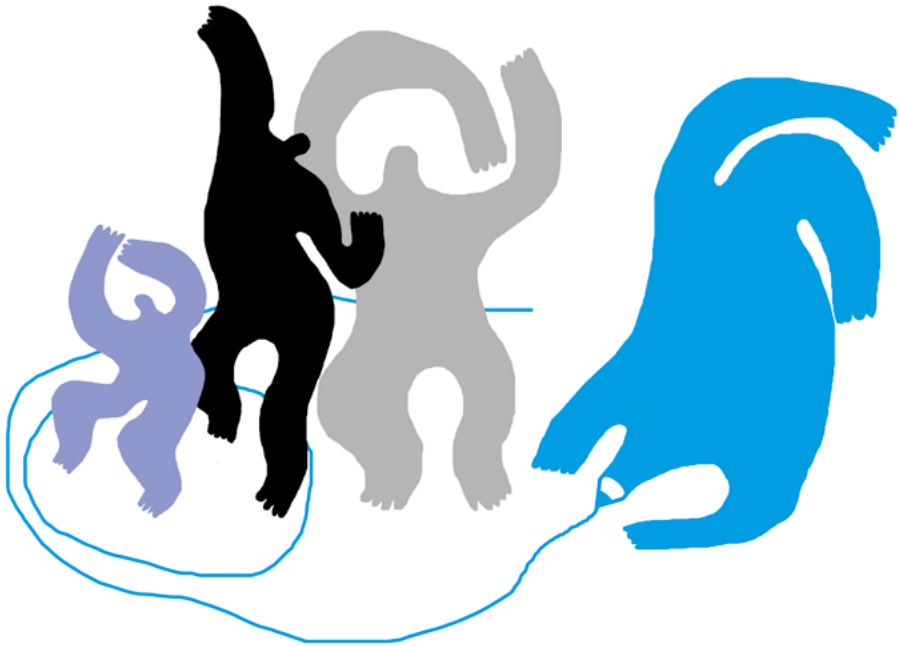
- How can quality or any issues be flagged and addressed?
- What processes are used to resolve debates and make decisions?
- What are the mechanisms by which community members can share their opinions, or have their voice heard?
- How are the results of debate and key decisions recorded?
- When issues come up, resolving them should be informal, cheap and straightforward. That means that anyone can take their problems for mediation, and nobody is shut out.

7. Recognition by higher-level authorities

- Your rules won't count if they are not legitimated.
- What type of organisation is used to manage the community resources?
- What is the process by which other organisations engage with the community and/or its representatives?

8. Small local communities work best when nested within larger networks, which can have layers of interconnection and responsibility

- How does the community interact with other similar initiatives, e.g. in a sector or broader community?
- Some things can be managed locally, but some might need wider regional cooperation – for example, an irrigation network might depend on a river that others also draw on upstream or downstream.



Story #26: Freifunk Memorandum of Understanding (by Jürgen Neumann)

A first central aspect for building an effective internal government concerns the elaboration of a specific and clearly articulated mission, usually in the form of a written charter of principles, that reflects the foundational values of the community.

The process through which a community organisation translates its mission into specific goals can vary considerably, depending on the leadership styles, forms of participation, power distribution, and surrounding environment. This process may follow a dynamic model of negotiations and bargaining both among the members of the community and with third parties that support the community. Moreover, both the specific goals and the general mission may be consistent and, to a certain extent, customised, with the characteristics and expectations of the participants. **Shaping the mission and goals to encompass the expectations, values and motivations of community members is crucial to enhance the likelihood that participants remain active and support the organisation over time.** This aspect seems to be extremely relevant to achieving a good degree of internal consensus, so as to facilitate the processes of coordination between the members.

In this sense, **it is important that the objectives to be pursued, even if they change in order to meet the transformation occurring in the surrounding context, remain compatible with the main motivations that have driven individuals to participate actively in the community**. Therefore, it is important to emphasise how the intensity of the memberships, the opportunity to feel like active and integral members of the community, is closely linked to the process of building and formalising a common vision concerning how to intervene in the public sphere to address a specific set of problems:

Key partnerships: The network of surrounding organisations (suppliers, authorities, partners, supporters) that enable and make the commons work.

Key activities: The most important things that need to be done to make the commons work and deliver value.

Clear roles/bodies: Clear relationship and responsibilities / clear channels for participation (for everyone).

After 10 years of existence, Freifunk established a document to reflect the goals and principles of the project. They are related to core values, technical choices, social norms, the process of production and learning, and forms of

organisations. This text can serve as a basis for other CNs to develop their own set of shared values and vision. It can help to define them early on, to build a sense of community, and later on, to rely on them to take decisions or solve conflict.

Freifunk Memorandum of Understanding

After 10 years Freifunk is quite successful, well known, and widespread. However, we don't see that the original ideas and goals of Freifunk are still taken into consideration by all communities or all community members.

It is not our intention to exclude communities which don't identify with this self-understanding. But we are interested in a basic discourse about what we are doing here jointly under the label Freifunk. This draft was written by a group associated with the Förderverein Freie Netzwerke e.V. It is meant to be a basic understanding and intends to encourage all communities to reflect on the stated topics:

Why do we engage in Freifunk? Which ideas are behind it? Which goals do we pursue? According to which principles do we make decisions and take action?

It is the goal of this text to develop an understanding which connects all individuals and groups who act under the label Freifunk.

Preamble
Free (wireless) networks are

built and provided by many local initiatives. The users are simultaneously operators of the computer networks. They create "do it yourself" networks by self-reliantly connecting apartments, houses, streets of houses, districts, villages, or whole cities.

A Freifunk network is built in a decentralised way and is operated by many individuals. This decentralised structure of organisation deliberately promotes local activities instead of wanting to be governed by a higher entity. "Frei" (free) stands for making these networks open and anonymously accessible, they are to be operated in a non-commercial way, are not analysed and the information passing through them is not to be inspected, modified, or censored. Although Freifunk refers primarily to WLAN networks, the term "freie Netzwerke" (free networks) should be seen in a broader context. Among other things, it follows the spirit of the freenetworks.org definition. Despite all decentralisation we think it is reasonable and important to

come to a common understanding on the basic principles of the undertaking Freifunk, in order to act jointly and support each other in our activities.

Goals of Freifunk
The use of technical networks has become an everyday occurrence long ago, nevertheless the underlying power and action mechanism are often not being reflected sufficiently. Freifunk has declared its goals to be (among other things) the creation of an awareness of these contexts in the broader society, the promotion of free and open access to public networks, and encouraging self-determined actions.

In this process we would like to include the needs of various societal groups. We consider diversity and a broad spectrum of ideas to be an important foundation to reach these goals. We would like to encourage all participants to take matters into their own hands, and would like to support them in getting familiarized with the subject matter.

We are aware that this is an elaborate learning process. However, we would like to avoid hierarchies (of knowledge) caused by the desire of participants to merely "consume" the service.

According to our view this leads to the erosion of the basic idea of a "do it yourself" network.

Being Freifunkers we participate in the political process in order to achieve the legal preconditions for free networks. The Freifunk movement is non-partisan in this respect and works across party lines.

Principles of Freifunk
It is our wish to have the social community building and the technical implementation of free networks in the communities according to common principles: decentralised, with as few and as shallow hierarchies as possible, yet with a common agreement.
Many of our principles have already been formulated elsewhere. As Freifunkers we commit to the following existing documents:

- Pico Peering Agreement
- Our Vision
- Free Culture definition
- Community Wireless definition
- Principle of Datensparsamkeit (minimising data collection) and Datenvermeidung (data avoidance) (BDSG 3a)
- The hacker ethics of the Chaos Computer Club (CCC), which is transferable to free networks
- The CCC's declaration of non-acceptance of discrimination and fascism, "Farbe erklären gegen Rechts", in particular the section "Die Erklärung".

Technical principles
The Pico Peering Agreement is the basis of our networks. For us the following pillars constitute a free network.

- Our nodes form a mesh network by connecting to each other.
- The term Freifunk network refers to this mesh network.
- It ends where the internet begins (i.e. where a router routes the data traffic into the internet) and

it ends where the private home network begins.
- We design our networks to be open and public: everybody can operate a node and thereby extend the network.
- Our network is anonymously accessible, neither users nor node operators should register to participate.
- Our network is non-commercial.
- Our network is uncensored.
- We abide by the secrecy of telecommunications law.
- Privacy protection and minimisation of data collection: We log neither connection nor inventory data.
- We do not save personally identifiable data.
- The disclosure of contact information as well as coordinates on the map are optional.
- Users are responsible for end-to-end encryption and anonymising their traffic.

When designing our networks we pay attention to avoid any type of centralisation. Therefore, a small admin group or individual persons having control over a whole (sub) network does not reflect our thinking.

Node operators have the choice to allow remote maintenance. Interventions on the nodes, for example firmware upgrades or other remote administration work, must be done with explicit agreement of the respective operators.

Node operators can furthermore decide whether they would like to provide internet access, be it for the participants of the mesh network or for the public.

When doing so, **it is important that Freifunk should not be perceived as a provider of "free-of-charge internet access".** Decisions about releases in the local communities are made jointly. The firmware for our nodes is based on free software. We publish further developments likewise as free and libre open source software (FLOSS). We aim at providing very good documentation that enables the operator to extend the firmware or suggest improvements. Openness creates confidence in the software.

Social principles
A pleasant social climate is important for our communities. Freifunk should be a place that allows individuals to freely participate and feel comfortable regardless of their gender, sexual orientation, origin, beliefs, looks, age, and further (factual or attributed) traits. Social interaction should be respectful; newcomers are always welcome. We do not tolerate any form of discrimination. This means for us: there is no space for Nazis, nor racism, sexism or other forms of dehumanising behaviour.

According to our understanding, "participation" can include at least the following: using free networks and operating nodes, socialising in local communities, being active in the local or cross-regional Freifunk community by applying their own abilities.

Participation is not limited to technical skills.

Every form of contribution is explicitly welcome and is seen as an enrichment of the community. We are aware that questions of power arise in our communities: power, attribution of power, and exercise of power are promoted by centralised structures of both social and technological nature.

This is one of the reasons why we operate according to the principle of de-centrality. Also, questions of power can be related to unequally distributed technical expertise.

It is important for us to deal responsibly with this matter and to address and where it is possible reduce imbalance of power. We would like to achieve this through maximum knowledge transfer and decentralised structures.

Proper handling of information and knowledge
We want to learn to build and operate networks instead of having them set up and maintained by "experts". We call that "do it yourself network". We would like to empower and encourage people to actively engage in the creation of infrastructure and to research and design the impact of technology on society.

We promote the understanding of networks and network technology ("network/code literacy"), therefore we pass on knowledge at any time and make the code publicly available.

We research and experiment with infrastructure, therefore we do not have aspirations for permanent availability.

Creation of "do it yourself" networks is a process. We are aware that we may not fully attain every goal in this process. Therefore, we regularly reflect critically, without hostility. We give priority to learning and improvement of social and technological structures.

Forms of organisation
A Freifunk community is, simply put, a loose affiliation of several individuals.

Local associations may support the group when such a registered legal entity is beneficial, e.g. for collecting donations or signing contracts; however, founding your own association is no precondition for Freifunk.

Changes are jointly decided by all active participants, not only by members of an association or supporting organisation.

For the few community-overlapping decisions we establish a "Freifunk Advisory Council", a representation of community members of the different (German) federal states. This council can be called in when there are conflicts between communities.

22. Fund your upgrades

The development of sustainable business models for community networks, particularly in remote areas, can be a great challenge. A community network may provide communication and digital services for personal, social and business needs for the people who use them. Both equipment and expertise are required during the entire life cycle of the project, from the very beginning of planning stages, to the potential wind-up of the infrastructure, should it be recognised that it no longer is fit for purpose.

To gain sustainability, it is generally a good idea to keep your expenses as low as possible. Before installing an expensive device, ensure there is a sufficient number of individuals and organisations in your community willing and able to pay for using it. At the same point, it is usually better to over-budget for expenses than to under-budget. You might face unforeseen costs, especially during the first years of operations, while you learn how to better manage your network.

Keeping your costs down should not be at the cost of quality, because low-quality equipment is more likely to malfunction. You could be spending more on maintenance in the long run. The larger and more complicated your infrastructure becomes, the more financial and labour resources you should allocate. Often this relation is not linear but exponential. If you have a quality problem with your equipment once it is rolled out, it can cost you an enormous amount of money to fix it. Concurrently, your income will decrease while the service is unavailable.

Keep in mind the rapid advancement and changes in technology and think about how and when it may be time for you to reinvest in newer and cheaper or better devices to keep your infrastructure up to date. As mentioned before, it is highly important that you save enough to be able to do so, when necessary.
To fund the ongoing maintenance and improvements, the costs for equipment, and the human labour in setting up and running the services, various models can be considered. In the following story, you will learn about the basics of the more complex model set up by the guifi.net foundation.

Story #27: Good practices for funding and upgrades at a large scale implemented at guifi.net (by Ramon Roca)

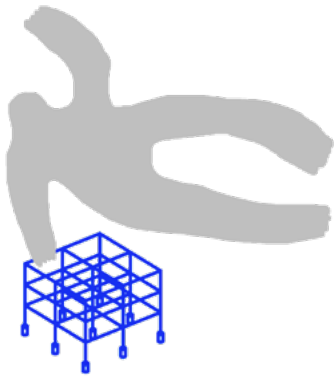
At guifi.net, there are just a few but very fundamental principles, embedded within the governance we have developed over the years.

The network usage is monitored to ensure that the network is never congested at peak times, and can indicate when an upgrade is going to be needed. For example, once the user capacity usage starts to consistently exceed 50% or more of the available capacity, that must trigger a plan for an appropriate capacity upgrade, e.g. by updating the technology.

Since the monitoring over time allows us to identify clear trends of when 50% will be exceeded, the timing for the expense of the upgrade becomes predictable.

Once the budget for the upgrade is finalised, it can be charged upfront, or partial regular amounts can be offset against credit in guifi.net's compensation system (see Story #23). Thus, by adhering to simple processes, the network never gets congested, and the funding is always available through the guifi.net compensation system to perform the required upgrades to network resources.

23. Know the law regarding access to infrastructures



When you are building a network, you are actually building your own infrastructure. But at some point, you might want to access other infrastructures to expand the reach of this infrastructure. Now, they might be run by people who are not directly part of the community. Let's see a little bit how the law might regulate this.

23.1. Free Wi-Fi hotspots: Do I have to password-protect our connection?

Now that you have your piece of network up and running, and you are about to give access to your network to your community, you might be wondering how you can do it. If you provide access to the network and the wider internet through wired lines, chances are that users will be known community members who subscribe to the network. Except for specific regulations like

so-called "data retention" regimes, which we already discussed in Chapter 19, nothing specific is required.

But if you choose to do like Freifunk and other similar community networks – or even if one of your members chooses to open its private Wi-Fi network to share it with its neighbours – offering public access through free and open Wi-Fi hotspots, things can get more tricky. One of the first questions will be:

Is it possible to let users access the network freely or do we need some kind of access control, authentication and similar security means?

EU law provides that telecom operators and intermediaries cannot be held liable if a third party uses their services or connection to commit an unlawful act. This may vary depending on national laws but, in principle, as a community network, you do not have to password-protect it on your own initiative.

However, recently, there was a case where a member of the Freifunk community had opened the Wi-Fi network of the music store he owned. Some people in the vicinity used the network to share copyrighted content on a peer-to-peer network, and the store's owner was then taken to court by Sony Entertainment for being liable for copyright infringement.

The Court of Justice of the European Union (CJEU) said that he could not be held liable. In these cases, the court said, all a national judge can do in this regard is to ask you to take measures in order to stop an unlawful act committed thanks to the access to free Wi-Fi hotspots. That means, for instance, putting in place password protection and giving that password only to a number of identified people. So, basically, until you are taken to court and until a judge asks you to password-protect a Wi-Fi hotspot, you do not have to worry. When you receive such an order, you should comply with it, keeping in mind that only a judge or a public authority can ask you to take such measures (CJEU, Tobias McFadden, C-484/14, 15/09/2016, § 80).

So, from a practical point of view, you are free to decide whether you prefer to password-protect it or not. Your decision will mostly be based on who you want to have access to the community's network. The lack of password protection is a more inclusive approach, one favoured by most community networks. However, your community might have specific reasons to control or reduce the access to the network. It is up to you to decide.

Story #28: Freifunk's dealings with the police: don't password protect unless required by a judge (by Jürgen Neumann)

Since the foundation of the "Förderverein Freie Netzwerke e.V." (FFN), the first registered legal club in the context of Freifunk, we have had several enquiries by the police. The police contact the FFN, because the wireless networks are all called Freifunk or have something with Freifunk in their network name.

When you search the internet for Freifunk, you will find our website. On the website you find the FFN as responsible body. Also many of the internet gateways in the Freifunk infrastructure use an IP address registered with the FFN.

The usual police enquiry looks like this: a police officer contacts the FFN via email and asks for the name and address of a person that used a certain IP address in a certain area of Germany at a certain time. They also send us a court document or a reference to it.

Freifunk is a completely open public wireless network. It is accessible by everyone and does not require any authentication. The same is true for all other networks where people access the internet, be it in a library, cafe, etc. where you might have to enter a shared Wi-Fi password but not provide your identity. So, we immediately inform the police officer that we are providing an open public wireless network without registration and logging, and that we just cannot give that kind of information. And that is it. They are always satisfied with these explanations.

You may think that this is a door open for all kinds of criminal activity. But statistics show that there is only a very little percentage of abuse, compared to the total number of users. To give you some numbers: Freifunk operates more than 45,000 access points all over Germany with hundreds of thousands of users all together. At the same time, Freifunk communities receive less than 10 police enquiries per year.

23.2. How can the community access other infrastructures?

After having seeded your first nodes, or even at the launch of your community network, if you want to interconnect your network with other people and services than your own, or simply make new network deployments, you may need access to existing infrastructure.

In some cases, this will be very easy. If you want to connect your local network to the internet, you might find that there is a telecom company (often called a transit operator) operating in the area with which you can contract so that they can collect your traffic and carry it to and from the global internet.
In others cases, you will want to expand your network to reach out to new members of the community. You can expand your network by using the networks of other entities. It can be another telecom infrastructure which you would like to use by renting some capacity from the telecom provider managing it. It can also be a water supply system, an electrical grid, railways, or any other physical network that can be used to deploy your own cables much more cheaply than would have otherwise been possible.

In any case, such infrastructures will likely be owned by a larger private company, or in some cases by local governments. This is a bit more tricky. The good news is that the law is on your side. **In 2014, the European Union adopted a Directive to encourage the development of high-speed digital networks. EU legislation requires that national and local administrations facilitate as much as possible the deployment of high-speed networks.** The goal is precisely to make your life easier.

- When you ask for a permit to deploy network components on existing physical networks, those operating these networks have to give you an answer within four months.

- **National and local administrations should provide information about existing physical infrastructure.**
  If they do not, you can directly ask network operators to give you information regarding their own facilities, so you can have a better idea of what is possible and needed for your own deployments. The entities running such infrastructure can only refuse you access for "objective reasons".

- Access to existing infrastructure should be given to you on "fair and reasonable terms" (including technical or operational conditions and of course, the price charged to let you access the facilities). These conditions cannot be disproportionate or discriminatory.

- If for one reason or another you have a conflict with another network operator, there is a specific, fast and accessible procedure available in your country. Your national regulatory authority can give you further information if needed. You can find your national authority on the "Telecommunications national regulatory authorities" list maintained by the EU Commission.

Unfortunately, more often than not, these favourable requirements are not actually enforced either by states or regular telecom operators.

In Spain and France, as the following stories illustrate, community networks have decided to stand up for their rights and protest against unfair and discriminatory policies.

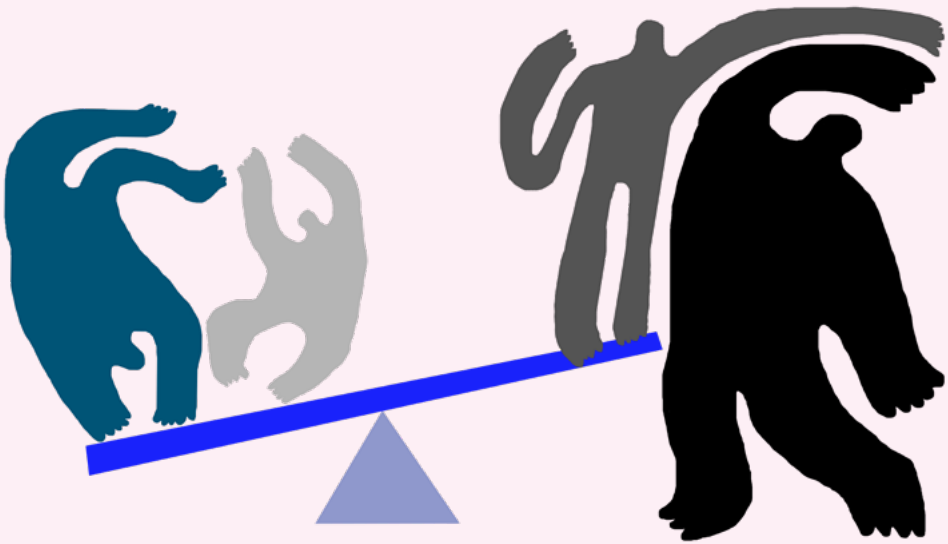
Story #29: guifi.net denounces the non-application of the European telecommunication and competition regulation (October 2018)

Today (26 October 2018), the guifi.net Foundation lodges a complaint before the European Ombudsman. It urges the European Commission to act against the bad practices happening within member states and to ensure compliance with the EU telecommunications and competition law.

The complaint describes actions in conflict with economic interest, bad practices and barriers to entry that exist in all areas of the Spanish state.

The decision to file the claim is based on the continuous and systematic breach of the European regulations regarding telecommunications and competition, and very specifically of Delegated Regulation 330/2016, of 9 September 2016, relative to the measures to reduce the cost of the deployment of high speed electronic telecommunications networks (this law transposes Directive 2014/61/EU of the European Parliament, which allows the access of public communications networks providers to existing physical infrastructures, regardless of their location).

The wrongful actions, or the lack of action, are caused by private



companies but also at all levels of the administration and in different jurisdictional areas. It provokes a deadlock situation (mutual blockade) that ends up making network management projects of guifi.net unfeasible, when their goal is only to create an infrastructure that reaches the entire territory to connect all households in order to end the digital divide.

Story #30: FFDN's open letter to incumbent operator Orange and Arcep, the national telecommunication authority in France (October 2018)

Gentlemen,

The deployment of optic fibre is ongoing in France. As the EU Commission noted in its Brief C(2017) 8038 sent to Arcep, a network between a few operators sharing a local loop is currently being established. This network is not accessible for a lot of operators.

Particularly, the absence of active offers (where little equipment from third-party operators is necessary to reach subscribers connected to these networks) leads to a lack of diversity of offers, and therefore an important delay in several markets. (See the market analysis of the French telecom regulator, Arcep, about the fixed-line market. The Commission replied, in the note mentioned above, to this specific analysis.)

The French Competition Authority has called for caution regarding wholesale markets, which are necessary to spur competition in the fibre market. The Authority especially emphasised the need for active, or bitstream, offers. Such offers allow tiny operators to be part of some markets which can be deemed to be niche markets since they are very different from mainstream offers. These demanding markets exist both for professional and private subscribers. However, the offers of integrated big telecom operators do not cover them.

In December 2015, the national telecom regulator had already established guidelines about active offer pricing on the shared optic local loop in Public Initiative Networks (PINs) (networks built by local public authorities). Article L. 1425-1 of the General Local Authorities Code obliges Public Initiative Networks to be accessible without discrimination between operators. The lack of reasonable active offers goes against the effectiveness of this right.

The market power of Orange (the incumbent telecommunication operator) is peculiar. Orange operates in all areas where a call for intention of investment is organised and was contracted to operate a lot of PINs. Moreover, technology used by Orange in fibre-to-the-home networks is entirely compatible with an active offer delivered according to widespread professional standards.

Recent techniques are also compatible with the delivery method of active offers. The obligation weighing on PINs to provide a reasonable offer, including active offers for small operators in line with the regulator's guidelines, is easy to achieve for Orange from a technical point of view.

The lack of availability of such an offer in reasonable terms clearly shows a shrinking of the market and the lasting worsening of competition. As such, it should worry regulators. Indeed, the French coverage of optic fibre is directly leading to this shrinking, and the recovery of the dominant position of Orange, both on the infrastructure and on the retail market. If it wanted to, Orange could help the regulator to enhance the smooth operation of the broadband market for companies, as well as the wholesale market of private individuals for niche markets.

The opening of active offers does not imply modification of infrastructure, nor investment in network equipment, which are already here. It does not imply anything new in terms of network engineering, and the investment in marketing tools is very reasonable. This effort is probably the easiest to carry out right now, before any action of the regulator forced by authorities.

This choice, which would be a sign of Orange's goodwill, would prove that the closing of the market does not stem from a mischievous purpose which could be regarded as a dominant position abuse, but an inadvertent by-product of the sequencing of current deployments and the commercialisation of useful offers. This choice would also be a powerful incentive for other operators of PINs as well as for other shared optic local loop operators.

It should therefore play a strong role to enhance the whole market and make it healthier. Finally, for Orange to propose such offers in a consistent way between all geographical areas where Orange operates the optic local loop, would help diversify the base of users of these local loops. Many markets are currently miscovered, meaning that the area is covered by fibre network, but the latter is used by very few people. Thus, developing active offers would be a choice able to enhance the rate of use of these networks.

It appears to us that this choice, quite easy for Orange, is favourable for all involved parties. For our community networks, as for every other operator concerned, this would avoid litigation and delay in the use of fibre optic.

For Orange, this is a way to show its good will and increase the use of the optic local loop. For the telecom regulator, this is a way to clean markets that are being blocked by lack of competition.
Remaining at your disposal to discuss this if needed,

For the Fédération FDN, the French federation of community networks, Oriane Piquer-Louis, president of the Fédération, Benjamin Bayart, president of the Fédération

24. Engage in political advocacy

As you might have understood by now, not only can telecom policy be at odds with the needs of community networks, but it also often stands in their way. Over the years, community networks across Europe have faced similar issues in this regard.

These range from seeing the agencies in charge of telecom regulation fail to assist community networks, to having to deal with lawsuits. Such legal and policy obstacles can really put the community under stress, create tensions, discourage participation and threaten the network's sustainability.

It should not be this way. In 2016, netCommons reached out to several European CNs and started listing some of the most frequent policy and legal obstacles faced by community networks across Europe. Among the most urgent and common issues were topics tied to legal threats looming on people openly sharing their Wi-Fi networks, or the fact that access to publicly funded networks was overly expensive for community networks. An overarching issue was the fact that telecom policy makers in national capitals or in Brussels

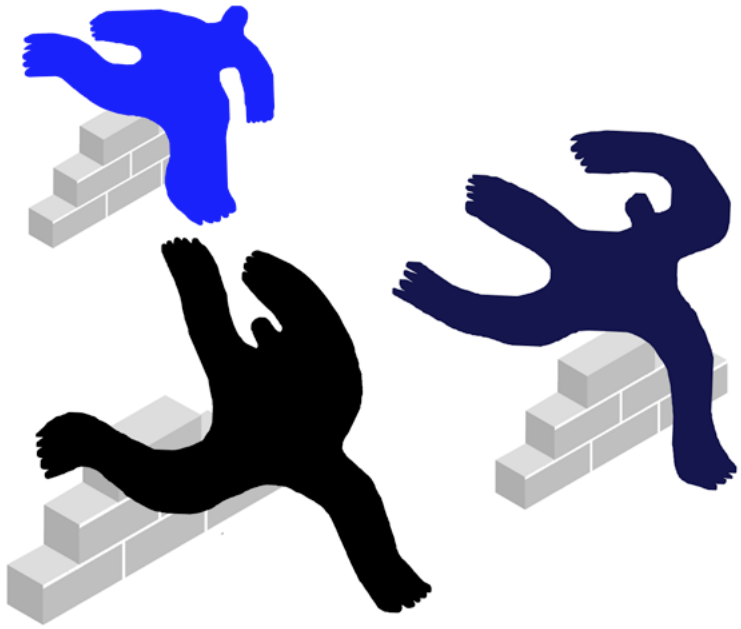
completely disregard community networks and fail to involve them in the policy-making process.

This netCommons effort came at a particular moment. The European Union was in the process of revising its telecom laws, applicable across all EU member states. So, we seized this opportunity and engaged in what was likely the first pan-European effort of community networks in "political advocacy" – or what is often referred to as lobbying. Simply put, we wanted to address lawmakers, present our demands and ensure that new legal provisions would be adopted to address our needs. **To do so, in March 2016, netCommons researchers drafted an open letter that was signed by more than 30 European community networks. We then sent it to the EU Commission, national governments, and members of the EU Parliament to make the demands of community networks known.**

Over the course of the following months, as the EU Parliament worked to reform EU-wide telecom policies, several community networks partnered with netCommons researchers and digital rights activists to follow and influence the legislative process, and turn these demands into actual policy. Ahead of crucial votes, we identified some of the most influential people in the Parliament. We sent them a short analysis explaining to them what was at stake. We drafted and translated press releases. Not everything was perfect but we did our best.

You might have discovered by now that telecom policy is often not very effective. It is prone to what economists call "regulatory capture". It can take many forms, from conflict of interest to outright bribery. A 2014 report by the EU Commission listed telecommunications as the second business sector most prone to corruption, right behind the construction sector. The thing is, it is a policy field where, for the most part, only experts, lawyers and big industrial players have a say. It is generally too technical for "average" citizens to get interested and invest resources in it, as it is demanding in terms of time, money and knowledge and skills. Yet, community networks have both the expertise and legitimacy to intervene. And when they do, they bring a dissenting view and help ensure that telecom policy is developed with the interests of actual citizens in mind, not just those of large corporations. For this reason, their contribution is generally valued by telecom regulators, and sometimes a very constructive dialogue can take place (the problem is that it often is hard to translate that dialogue into actual policies that support community networks).

Now that community networks across Europe and the world are turning into some kind of a movement, a key objective for the years to come is to ensure that telecom policy allows their development. At your level and when you see fit, you should take part in this collective effort by engaging in policy



advocacy: you will realise how some small changes in regulation can make your life and those of your fellow community members much easier. They can help you expand your network much faster and allow your community to reach its objectives more easily. **The good news is that our pan-European effort paid off! European law – which all member states must respect – now clearly says that policy makers should pay special attention to community networks and take into consideration their regulatory needs. This creates an avenue for you to reach out to policy makers in your locality, your country or even at the EU level to address your needs, so as to overcome policy and legal obstacles.**

In the same way, netCommons efforts led to community networks being included in the United Nations Educational, Scientific and Cultural Organization (UNESCO) Internet Universality Indicators, a tool to evaluate internet policies in force in each country. The avenues are there, but achieving change won't be easy. It will require dedication and good strategies. However, as our story and other examples suggest, it can be extremely rewarding and even fun! So let us now turn to some practical steps you might want to consider in this process. Here, we assume that in your community, you already have people with a background in law or policy skills. If not yet, don't worry. Community networks at the beginning often reach out to like-minded organisations, such as digital rights groups. In other words, if you don't have policy and legal capacities in-house yet, it can still be done.

Start by defining your policy objective

Is there a public network you would like to interconnect to? A radio frequency that would make for a highly effective long-distance link between two villages? Great! But why is law or regulation getting in your way? Is it that it explicitly prevents you from doing what you would like? Is it just silent on the situation? Or is it favourable to you, but simply not respected?

Identify key policy makers

Identify key policy makers who are somehow responsible or competent with regard to your situation and ask for a meeting. The goal here is to establish contact and present your case. Making them know that you exist is a first step. Often, these people are just completely unaware of the fact that a local community can self-organise to meet their connectivity needs. They only focus on the few large telecom providers, and might even tend to disregard small telecom businesses. Once you have raised their awareness and exposed your problems, they might be able to help and quickly remedy the situation.

Consider various advocacy and campaign strategies

If and when you feel that just reaching out to policy makers is not enough, you will need to find leverage to exert pressure. That is, you will need to switch to activist mode. **Do you need to go on a fact-finding mission to gather data that you can present to regulators and make your case more convincing? Should you organise a public protest in your town to pressure local politicians? Is litigation the best course of action?**

If you are unsure, try to reach out to experienced activists in your community who might be able to help you devise the best plan. Ask existing community networks for their advice and opinions. For instance, you can use a mailing list called Telecommons, set up by netCommons and La Quadrature du Net to gather community networks and digital rights activists in Europe. Others might have faced similar issues and can also offer extremely useful information based on their experience.

Gather support and make your case known to a wider audience

Regardless of the mode of action that you think is best, you will need to make the ongoing dispute known to your community and other interested people, and gather support from them and other organisations (other community organisations, local businesses, etc.). **The more people know about the ongoing dispute, the more costly it becomes for regulators and politicians to ignore or block your demands.**

You will also need to think about how they can best assist or work with you. That means you will need to be able to clearly articulate the problem and the favoured solution, find the right slogans, and the right analogies to explain complex technical and legal issues. You can use mainstream media and social media. Document each step of your advocacy action by putting out a press release; seek and respond to media interviews. Regularly broadcast news on your social media accounts.

Once you have obtained a favourable decision, make sure it is implemented

It is likely that at some point, your efforts will pay off. Yes: that radio frequency you longed for will be made available. Yes: the judge agreed that the tariffs charged by a network owner to access its infrastructure were outrageously high. But then what? What you are interested in is seeing actual changes on the ground. After a well-deserved celebration and as soon as you see that things might linger, go back and establish a good strategy that can ensure that this good decision is implemented so that your community network can flourish.

Story #31: guifi's tractor protest (by Ramon Roca)

In 2009, in a small rural village located between Barcelona and the Pyrenees, I worked with a group of friends and started interconnecting pig and cow farms with fibre-optic cables.

After setting up this local autonomous network, we sought for a gateway to connect them to the regional and global networks. A telecommunications backbone network owned by the public company managing railway infrastructures across Spain passed through the village, and it could be used for that purpose. When we asked the entity managing that network, guifi volunteers were told that they would have to pay a fee of 500,000 euros to rent access to it.

In the process, we discovered that another public network passing through the village could be used. That one was owned by the Catalan government. So, we got in touch with the Catalan authorities, which first denied that they even had a backbone in that location. Confronted with the fact that they did own the cable, the officials in charge were now open to the idea of helping us interconnect on fair conditions, but the discussions dragged on for years. The officials claimed that existing regulation prevented them from offering access to citizen-driven initiatives.

In 2012, three years after the beginning of the project, we were still waiting. We lost patience and decided to increase the pressure on the Catalan authorities to test their goodwill.

In early spring 2012, we announced we would hold a "tractor protest": we warned that on the following Sunday, we and other farmers in the area would drive our tractors on public roads to slow down traffic and delay people driving from Barcelona to ski resorts in the Pyrenees. Our call to protest came as a surprise to the authorities. Wanting to avoid the bad publicity, they pledged to speed up the process, and a few months later, our local network was finally interconnected with the Catalan public network, thus benefiting from an affordable gateway to the rest of the guifi networks and the broader internet.

Story #32: "Freifunk instead of fear" campaign on secondary liability in Germany (by Jürgen Neumann)

Freifunk's model of public Wi-Fi networks depends on the participation of people willing to share their traditional Wi-Fi network within their vicinity. But for a long time, rules regarding "secondary liability" discouraged our users from doing so.

These legal rules effectively meant that people openly sharing their connection could be sued for possible offences committed by other users. **The recording industry developed a tactic whereby it would send letters to Freifunk participants claiming that their Wi-Fi hotspot had been used to exchange copyrighted content on peer-to-peer networks, and asking them to pay huge sums of money or else face a lawsuit.** As a result of this legal regime, people were scared to share their connections, and this hampered the growth of Freifunk while putting a lot of stress on our members.

To remedy that situation, in 2010, we started a campaign called "Freifunk statt Angst" ("Freifunk instead of fear"). **We set up a campaign website, and partnered with NGO Digitale Gesellschaft and others to start a coalition of activist organisations calling for new legal protection for people sharing their Wi-Fi networks.** We documented and intervened in several lawsuits involving some of our participants, and assisted in developing a tool to automatically generate answers to the threatening (and illegal) letters sent by copyright-holders.

In 2012, we also offered to protect our users by developing a small device called the Freedom Fighter Box. Plugged into your Wi-Fi router, the box channelled the Freifunk traffic through routers and virtual private network (VPN) tunnels to Sweden, thereby anonymising the origin of the connections, and thus making it impossible to trace a particular communication to the owner of a Wi-Fi hotspot.

During this campaign, Freifunkers were also asked for help at a crucial

moment in the lawmaking process in 2015. To influence lawmakers, we asked them to sign a relay petition, while sending letters to Members of Parliament based on a template we provided, and here again a website was set up to help participants identify their elected representative. Some of us also met with policy makers in person and debated with them. The campaign eventually succeeded in amending the law in May 2016. It is not perfect but it is a huge step forward.

1

1. A Freedomfighter Box of the freifunk project

25. Assess your sustainability

Here is a final "sustainability" checklist, specially designed for community networks. The aim of the list is to generate discussion and thinking around the issues it raises with the ultimate aim of helping the formulation of solutions which promote sustainability. The answers to these questions should be read as indicative, as opposed to definitive, of the sustainability potential of a community network initiative.

25.1. Economy

(Un-)sustainability issue: Monopoly power and corporate concentration

- To what extent is the community network supported by non-profit/commons-based network access and services provision?
- To what extent does the community network rely on a commercial provider?
- What is the nature of this provider (e.g., for-profit vs. not-for-profit/self-managed/social enterprise, or local vs. non-local)?
- To what extent does the model of network provision of the community network face competition from commercial for-profit telcos on the basis of quality of signal/provision, lower cost and/or better network maintenance?

(Un-)sustainability issue: Survival, skills and resources

- To what extent does the community network manage to survive economically, i.e. to afford the necessary hardware and labour-power necessary for running the network? How does it do that?
- To what extent can the community network ensure that it has enough resources, supporters, workers, volunteers and users?
- To what extent does the community network rely on internal funding sources?
- To what extent does the community network rely on external funding sources? How regular are they?
- Are there possibilities for the community network to obtain public or municipal funding or to cooperate with municipalities, public institutions or the state in providing access and services?
- To what extent are there people to provide the technological skills for running/maintenance/upgrade of the community network?
- To what extent are there people to provide skills in accounting, law and advocacy?
- To what extent does the community network rely on a single individual or a small group of actors for providing the necessary resources (time, skills, money)?
- Can the risk be avoided that the community network becomes a "secondary internet" that is marginal, slower and less attractive than other services? How? What strategies can be used for avoiding marginalisation and resource precarity?

(Un-)sustainability issue: Governance and democracy

- To what extent is the community network controlled by the community? Is the community network collectively controlled by its members as a commons?
- How can the community network best ensure that it is a not-for-profit project?
- To what extent is the community network controlled by the local/municipal authorities?
- To what extent is the community network controlled by private corporate interests?
- What are potential dangers of collaboration with or inclusion of private for-profit companies? How can they be avoided?
- Are those who work professionally for the maintenance of the network fairly remunerated for their labour so they can lead decent lives?

(Un-)sustainability issue: Network wealth for all

- Is the network large enough to attract significant numbers of users so that this community can have mutual benefits from network effects?

- How can possible congestion and slowing down of the network best be avoided if it is very popular?
- To what extent does the community network provide free-of-charge/cheap/affordable network and internet access for all?
- If subscriptions are used, are they affordable?
- To what extent are there different pricing schemes such as for residential users, small enterprises, bigger firms, and public institutions (e.g. schools)?
- How can the community avoid or lower the digital divide?
- How can the community network help network neutrality, to avoid differentiated internet services with slower internet for some and faster for others?
- How can the community network avoid the commodification of access (i.e. using access fees) and users (i.e. using advertisements) that bring about inequality of access and the exploitation of users' digital labour?

(Un-)sustainability issue: Community needs

- To what extent are the community needs served by the community network?
- To what extent are the needs of diverse individuals (e.g. by gender, age, nationality) and groups in the community served by the community network?
- To what extent are the needs of local businesses served by the community network?

25.2. Nature and environment

(Un-)sustainability issue: Energy use

- To what extent does the community network rely on relatively environmentally friendly energy sources (wind, solar, tidal, wave, geothermal, biomass and waste energy)?
- To what extent does the network rely on suppliers of such energy forms? How is the source of energy checked?
- What is the share of the total energy consumed per year by the network that is based on relatively clean power sources?

(Un-)sustainability issue: E-waste

- What is the average lifespan of different types of hardware used in the community network?
- Can measures be taken for ensuring the long-term re-use and update of hardware?
- If hardware devices have to be replaced, is it possible to recycle the old ones? How?

- If hardware devices have to be trashed, is it possible to do so in a way that does not threaten humans and nature? How?
- If hardware devices have to be trashed, is it possible to do so in a way that avoids the creation of e-waste that is shipped to developing countries where it poses threats to e-waste workers, other humans and nature? How?
- If old hardware devices that a network no longer uses are donated to other networks, can it be ensured that this does not result in a two-tier internet access structure, in which poorer communities have slower internet access than others?

25.3. Politics and organisation

(Un-)sustainability issue: Participation/governance

- How is the community network governed? How does it decide on which rules, standards, licences, etc. are adopted?
- To what extent does the community network allow and encourage the participation of community members in governance processes?
- To what extent are there mechanisms in place for conflict resolution and for proceedings in the case of the violation of community rules?

(Un-)sustainability issue: Privacy enhancement and protection from surveillance

- To what extent does the community network enhance the protection of privacy of user data?
- To what extent does the community network provide opportunities for active user involvement in the management of their data? What are the skills required and how are they provided?
- To what extent and for how long are user data kept in servers controlled centrally (e.g. by the network administrators)?
- How do you guarantee that data storage is done in line with data protection regulation and is privacy friendly?

25.4. Culture

(Un-)sustainability issue: Conviviality, learning and community engagement

- How closely knit is the community? To what extent are trust and solidarity present and how are they manifested?
- To what degree is the community network able to foster a culture of

togetherness and conviviality that brings people together? In what ways?
- To what extent does the community network provide mechanisms for learning, education, training, communication, conversations, community engagement, strong democracy, participation, cooperation and well-being? In what ways?

(Un-)sustainability issue: Unity in diversity

- To what degree is the community network a "geek public" that has an elitist, exclusionary culture or a "community public" that is based on a culture of unity in diversity?
- How can a culture of unity in diversity best be achieved?

PART 7 : APPENDICES

Appendix A. The Pico Peering Agreement v1.0

Preamble

There are now many community networks, but they are separated geographically and socially and do not form a coherent network. This document is an attempt to connect those network "islands" by providing a minimum baseline template for a peering agreement between owners of individual network nodes: the Pico Peering Agreement.

The Pico Peering Agreement (PPA) is a way of formalising the interaction between two peers. Owners of network nodes assert their right of ownership by declaring their willingness to donate the free exchange of data across their networks.

The PPA is maintained at http://picopeer.net by a group of volunteers from around the world. It is intended to be used as a template for other small-scale peering documents and licences.

Agreement

1. Free Transit:
The owner agrees to provide free transit across their free network.
The owner agrees not to modify or interfere with data as it passes through their free network.

2. Open Communication:
The owner agrees to publish the information necessary for peering to take place.
This information shall be published under a free licence.
The owner agrees to be contactable and will provide at least an email address.

3. No Warranty:
There is no guaranteed level of service.

The service is provided "as is", with no warranty or liability of whatsoever kind.
The service can be scaled back or withdrawn at any time with no notice.

4. Terms of use:
The owner is entitled to formulate an "acceptable use policy".
This may or may not contain information about additional services provided (apart from basic access).
The owner is free to formulate this policy as long as it does not contradict points 1 to 3 of this agreement (see point 5).

5. Local Amendments:
(to be filled in ad-hoc by the node owner as this document is implemented).

Definition of terms

Owner: The owner of the node has the right to operate their network equipment and to donate any part of its functionality to the FreeNetwork.
Transit: Transit is the exchange of data into, out of or across a network.
Free Transit: Free transit means that the owner will neither charge for the transit of data nor modify the data.
Free Network: The Free Network is the sum of interconnected hardware and software resources, whose FreeTransit has been donated by the owners of those resources.
The Service: The Service is made up of Free transit and Additional Services.
Additional Services: In terms of the PPA, an additional service is anything over and above Free Transit. For example, provision of a DHCP server, a web server or a mail server.

The PPA in practice

The PPA shall be implemented in data readable form following agreed standards in community network node databases to facilitate automatic interconnection of nodes.

Terms of Use for Community Networks (netCommons template)

Version 1 December 2018
These Terms of Use, otherwise named Terms of Service, or Terms and Conditions, are meant to be a template licensing or a contractual agreement between a community network and its new members. Such a text aims at explaining how the service – that is, "electronic communication service" – is run, and the relationships between the users and the service, including each party's rights and obligations. They reflect how you intend to protect the fundamental rights of your users while providing this service.

We provide this template to give you an overview of mandatory provisions, which you can adapt and tailor to your local situation. We drafted it in a way that would make it compatible with the Pico Peering Agreement (Appendix A). This template focuses on internet access, as a core activity of community networks (CNs). For additional services such as hosting services, you may want to add more specific clauses. The following references provide additional model clauses:

https://tosdr.org
https://tldrlegal.com

"Alternative policies for alternative Internets", by Melanie Dulong de Rosnay, Journal of Peer Production, Issue 9 on Alternative Internets, September 2016.

B.1. Introduction

Dear future member of the community,
You will find below our Terms of Use. These provisions give you an overview

of our service, how our community network works, how this may impact your rights, and what are our respective obligations.

Any reference to community, "our", "we", "us" refers to [name of your community network], established in [geographical address]. Conversely, "you" refers to the user of the service provided by the community, or, as we prefer to put it, "you" refers to the member of the community that you will become by agreeing to these terms and joining the community.

We describe the relationship we intend to develop with you (B.2).
Then, we focus on how you can have access to the network (B.3).
Finally, we explain how we try to preserve your privacy while processing your personal data to the extent requested by the law (B.3).
You are free to accept or to refuse these Terms. Make sure to think about it and please feel free to contact us at [contact email address] if you need any further information.

In addition, to make sure all electronic communication services respect the European and national regulatory framework, as well as your fundamental rights, there is a specific independent authority in every EU member state. In [your country], this regulator is [put your authority here]. You can find it on these official lists maintained by the EU:
Telecommunications national regulatory authorities
Data protection authorities

B.2. Creating a trust-based relationship

Article 1: Description of the service and quality

Comments: Here you should describe the service you offer to each member of the community. You should specify the kind of technology that you are using (Wi-Fi, fibre, xDSL). It could be along the lines of the following examples. Moreover, if you want to guarantee a certain level of service, and want to join the Pico Peering Agreement (Appendix A), make sure your provision is compatible.

1. Service provided
Our community network provides access to an electronic communication network through [you can specify here which technology you are using]. This service gives access to the internet [if this is the case for your community].

2. Quality of the service
There is no guaranteed level of service. However, the community network will do its best to provide a suitable service for each of its members.

Article 2: How to join the community

By signing or otherwise accepting this agreement, you will become a member of our community network. This implies that we will provide you the service described in Article 1, according to the terms of this document. This also gives you the right to participate in the governance of the community network according to our internal rules defined in another document [link to the governance rules, if they exist elsewhere].

Article 3: Modification of terms of use

You will be notified of any modification of terms of service through the contact information you have provided. We will give you a reasonable time of [reasonable delay of a few weeks] to take notice of these changes, which you can of course refuse (but that would mean we might stop providing you with some of our services).

Article 4: Price of the service [optional]

Comments: You can specify here whether the service is free or not.
The service is provided for free.
Or
The service is not provided free of charge. We will ask you to pay a fee corresponding to [amount] by [means of payment] per [month/year].

Article 5: Duration and termination

1. Termination at the user's initiative

You can leave the community whenever you want. Just send us a message to the contact address given. You do not need to give us a reason.

2. Termination at the community network management's initiative

Although we do our best to thrive and remain sustainable, it may be that we are forced to stop our activity for some reason. Should that be the case, we will do our best to inform you beforehand, as soon as we know that we will be ending the service that we provide. Also, you no longer have the right to participate in the governance of the community if you do not respect our internal rules defined in another document [link to the governance rules, if they exist elsewhere].

B.3. Ensuring access to our infrastructure

Article 6: What the community is accountable for

Our community network is what we can call a "mere conduit". This means that we do not initiate the transmission of information nor select its receiver. Users like you do. We only transmit the information and do not select or modify it as it passes through our network (see Article 7). As such, we cannot be held liable

for any wrongdoing committed by users of our network and services. Every user is therefore responsible for their own activities on the network and may be legally liable for any wrongdoing.

A judge, or a specific public authority, has the power to require us to take measures aimed at stopping a wrongdoing committed through our network. In this case, we will have to comply. If this happens, you will be informed beforehand.

Comments: In concrete terms, with the current legal framework, this might imply adopting authentication procedures for those using the network and the services of the community. For instance, a CN may have to password-protect access to its Wi-Fi hotspots.

Article 7: Open communication and net neutrality

1. Authentication

Comments: There are two options.
Our general rule is that
We do not ask you for personal information or identification to access the service. There is no authentication system or password [optional: except in the scenario described in Article 6].
Or
We ask you for information in order to access the service. This information includes: [add information requested from users such as first name, surname, email address, etc.]. We collect, process and store this information in accordance with Articles 8, 9 and 10 of this Agreement.

2. Network neutrality

We do not modify or interfere with data as it passes through the network.

B.4. Protecting your privacy

In this section, you will find our privacy policy. It is written in compliance with the General Data Protection Regulation (GDPR), the main European legislation dealing with privacy and the protection of personal data.

It is in force and directly enforceable in EU member states since 25 May 2018. For inquiries regarding data protection, you can contact [put here the name of the person running the network and able to reply to users, which can be different from the previous contact information given. It can also be the same].

Article 8: What data do we collect?

We collect the following information about you in order to run the service or to comply with legal obligations (see Article 10): [add what data your CN collects, such as:

- first name
- surname
- postal address
- email address
- IP address

Optional: We may also collect some technical data attached to your connection (amount of data used, duration time of your connections to the network, etc.) for internal use, such as statistical analysis and the technical management of the network. We will do our best to anonymise this data to the extent possible.

Article 9: How do we process collected data?

1. Processing for internal use

We process your data in order to provide you with the service described in Article 1 of this Agreement. Otherwise, we will ask your specific consent to process your personal data.

2. Disclosure to third parties and data transfer outside the EU

We do not normally disclose your information to third parties. If we need to disclose information to third parties, we will inform you about the person and the safeguards attached and ask your specific consent. Likewise, if we need to transfer your data outside of the EU we will inform you of the terms and existing safeguards before asking your specific consent.

Article 10: Retention of data

Comments: For this specific issue you have several choices, depending on the legal provisions applicable in your country of operation as well as your political beliefs. For now, the legal framework is complicated and so is most community networks' position on the matter. This is because national laws are likely to be incompatible with European standards of users' rights (which have precedence over national law). Thus, you have three main options, and you should inform the members of the community which one you pick:

1. To avoid legal risks at the national level you can comply with your national laws.
2. To respect EU law (which is supposed to override national law) and protect your users' fundamental rights, you can decide to disobey your national laws.
3. This is a compromise in the face of the legal contradictions between national and European law. You could choose to retain less data, i.e.

only the data actually requested during criminal investigations. For more details about this tricky choice, see Chapter 19, and you can also consult netCommons Deliverable 4.3, Version 1.2, pp. 76-78

First option:
We retain data in compliance with national laws. We collect all traffic and location data and store it during [put here your the legal duration required in your country; for instance, for Greece, France and Spain it is one year].

Second option:
We do not retain your data, except for the short time needed to run the service and ensure its smooth functioning (statistical analysis, traffic management, cyber attack prevention, etc.), that is [state a specific duration in days, weeks or months. This duration cannot be longer than what your national obligations require, if these exist in your country. For instance, in Greece, France and Spain, you cannot retain data for more than a year.].

Third option:
We collect and store your IP address and identity for the legal duration required by national law. This data only allows investigative authorities to ask us to identify the subscriber corresponding to a given IP address. No more.

Article 11: Your rights

1. Right of access
You have the right of access to information relating to how and why we process your personal data. You can ask us, for each processing, the purpose, the category of data concerned, the duration of retention and the persons who have access to this data (besides the community network). We do our best to provide you with such information through Article 8, 9 and 10. Should you need further information, we will reply to your request as soon as we can. You can ask us for a copy of your personal data (to the extent that we are processing data in one way or another). We will deliver it to you as long as it does not violate the rights of another person.

2. Right to rectification
You have the right to ask us to modify personal data that we process if this information is inaccurate or incomplete.

3. Right to erasure
You have the right to demand that we delete your personal data when:

- This information is no longer necessary for the purpose of its original processing.
- You withdraw your consent for its processing and there is no other legal basis allowing the processing.
- You object to the processing.

- The processing of this personal data is unlawful.
- This erasure is necessary to respect a legal obligation weighing on the community network.
- In such cases, we will erase your personal data as soon as possible.

4. Right to restriction of processing
You may have the right to ask us to limit future processing of your personal data. As a general rule, when processing is restricted, we are still permitted to store personal data that has already been collected, but not use it. Beyond storage, when you use your right to restriction, any processing is only allowed if such processing is necessary to provide you with the service, comply with legal obligations, or if you have explicitly consented to that processing. You may think of this right to restriction as an alternative to requesting the erasure of your data.

This right to restriction of processing is only applicable when:
You contest the accuracy of your personal data that we process and we still need to store your data while verifying your claim.
Our processing of your personal data is unlawful, but for some reason you oppose erasure and request restriction instead.
We no longer need the personal data but you need it in order to establish, exercise or defend a legal claim.
You use your right to object (see point six 6 below), but we are considering whether our legitimate grounds override your interests in erasing the data.

5. Right to data portability
You have the right to ask us for your personal data in a readable format. You can transmit this data to any other person (such as another provider of service). We will give you this information as long as it does not violate the rights of another person. When it is technically possible, we will directly transmit this data to the person you have selected.

6. Right to object
You have a right to object to any processing of your personal data when the legal basis of this processing is our "legitimate interest" as data processors or when that processing is "carried out in the public interest" (See Article 21 of the GDPR). If anything is unclear to you, do not hesitate to contact us. We will be there to listen and explain. To join our community, sign/click here: [sign in].

Appendix C. Guidelines for policy makers

This Appendix is also published as an autonomous document on netCommons web site Enabling the Telecommons: Guidelines for Policy-Makers and part of Deliverable 4.4

Across Europe, community networks (CNs) represent a growing movement of organisations that operate local communication infrastructures, sometimes federated at the regional or national levels. These networks, most of which also provide access to the global Internet, are operated as a commons. That is, rather than being driven by for-profit motives, their key focus is on providing connectivity while striving for democratic governance, social inclusion, education, and human rights with respect to communication technologies.

These organisations vary considerably in terms of sizes, types of network infrastructures and political cultures. Yet, despite their diversity, they are united by the common objective of building networks that meet the communication needs of humans (rather than those of objects and machines), through networks that are built and run by communities, for communities, focused on local empowerment, affordability and resiliency. Today, they collectively provide broadband connectivity not only to tens of thousands of individual European citizens and residents in rural or urban settings, but also to organizations including small and medium sized companies, schools, healthcare centers, social projects and many more. In many cases, they have complemented or out-competed mainstream operators, by providing cheaper and faster Internet connectivity than incumbent players. Thanks to their infrastructures and through their various activities, they foster scientific and engineering experiments, help local hosting and service providers come together to mutualise investments and share costs, they support digital literacy and technological sovereignty through workshops and other educational activities.

Yet, despite these achievements, policy-makers at the national and European levels have so far mostly neglected the existence of community networks and specific regulatory needs. Worse, regulation is often hampering these initiatives, making the work of their participants and volunteers harder than it should be. This time is now over: Once it is adopted by EU lawmakers, the European Code of Electronic Communications (ECEC)[1] will offer new provisions requiring all policy-makers in the telecom field to take into account the special policy needs of community networks. The UNESCO "Internet Universality Indicators" released in 2018[2] also assess country performance based on the existence of an appropriate legal framework for establishment of community networks. In other words, it is no longer enough to "let CNs be". They should be actively supported by dedicated policies.

In accordance with these recent developments at the European and international levels, this policy brief offers an overview of approaches that policy-makers, and in particular National Regulatory Authorities (NRA), should explore to foster the growth of community networks.

C.1. Inviting community networks to the policy table

Although CNs have often partnered with municipalities and local public authorities, national and European regulators need to pay more attention to their activities when drafting regulation. community networks have both the expertise and legitimacy to take an integral part in technical and legal debates over broadband policy in which traditional, commercial ISPs are over-represented. community networks can bring an informed view to these debates, allowing for a policy-making process more attuned to the public interest.

This is all the more important considering that article 3.3.e) of the forthcoming European Code of Electronic Communications provides that: *"Member States, BEREC and the EU Commission, in fulfilling their missions pursuant to the code, should take due account of the variety of conditions relating to infrastructure, competition, end-user and consumers circumstances that exist in the various geographic areas within a Member State including local infrastructure managed by individuals on a not-for-profit basis."*

1 Proposal for a directive establishing the European Electronic Communications Code. COM/2016/0590 final – 2016/0288 (COD). Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=comnat:COM 2016 0590 FIN

2 UNESCO's Internet Universality Indicators: A Framework for Assessing Internet Development (2018). Available at: http://unesdoc.unesco.org/images/0026/002658/265830e.pdf (visited on 08/13/2018).

This language covers most, if not all, of CN models and suggests that regulators should actively mobilize the knowledge of community networks. CNs have both the expertise and legitimacy to participate in technical and legal debates over broadband policy, to make the underlying political issues more salient, and to bring an informed view of the effect of existing policies on the ground.

In sum, they bring a dissenting view that can only open up new policy paths, and stimulate a debate to ensure that telecom policy stays in tune with the public interest. Of course, for enabling real participation, there is a need for policy-makers to provide remote participation schemes and design consultation processes in a way that makes them available [accessible] to volunteer-based initiatives.

C.2. Lifting unnecessary regulatory and financial burdens

Many CNs are Internet access providers, offering access to the Internet to many users. But considering their small market size and special governance features, regulators should get rid of unnecessary regulatory burdens, such as fees or red-tape that are unnecessary or illegitimate when imposed on small and/or non-profit entities.

In Belgium for instance, the registration fee that telecom operators must pay to the National Regulatory Authorities (NRA) is at 676C for the first registration, plus 557C every following year (for those whose revenues are below 1MC, which is the case for many community networks). Even such small fees can hinder the growth of small networks that efficiently serve tens of households. In France, Spain and Germany, it is free, which might explain why the community network movement is much more dynamic in these countries. Likewise, taxes intended for large corporate firms in the telecom sectors should not apply to smaller, non-profit operators.

Fortunately, the new European Code of Electronic Communication contains recitals to that effect. Recital 48 for instance provides that:

"competent authorities should duly take into account, when attaching conditions to the general authorization and applying administrative charges, situations where electronic communications networks or services are provided by individuals on a not-for-profit basis. In the case of electronic communications networks and services not provided to the public it is appropriate to impose fewer and lighter conditions, if any at all, than are justified for electronic communications networks and services provided to the public."
In the same spirit, recital 52 states that:

"to the extent that the general authorisation system extends to undertakings with very small market shares, such as community-based network providers, or to service providers whose business model generates very limited revenues even in case of significant market penetration in terms of volumes, Member States should assess the possibility to establish an appropriate threshold for the imposition of administrative charges."

We therefore call on policy-makers to make the most of these new provisions and systematically explore what administrative charges, procedures or conditions should be revised to accommodate the special needs and capacities of community networks.

C.3. Limiting civil and criminal liability for people sharing Internet access

Several laws seek to prevent the sharing of Internet connections among several users by making people responsible (and potentially liable) for all communication made through their Wi-Fi connection, and create legal risks for people sharing their connection.

In Germany, rights-holders have used a "secondary liability" doctrine to dissuade people from sharing their Internet connection with other users in their vicinity, thereby chilling the growth of the community networks movement. In France too, copyright law imposes a form of secondary liability regime, hereby creating significant legal uncertainty for people sharing their network connections with other users. In 2017, two German courts have also made controversial application of the McFadden ruling to the European Court of Justice, holding individuals who had shared their Wi-Fi connection liable for copyright infringements committed by other users.

Here again, the new European Code of Electronic Communications brings useful developments in this regard, stressing in article 55.3 that:

"[policy-makers and telecom providers should not] restrict or prevent end-users from allowing reciprocally or more generally accessing to the networks of such providers by other end-users through radio local area networks, including on the basis of third-party initiatives which aggregate and make publicly accessible the radio local area networks of different end-users."

The same article also reaffirms that "in any event", the liability exemptions provided by "Article 12 of Directive 2000/31/EC shall apply"[3].

Open WiFi sharing – and it particular the model pioneered by CNs like the Germany-based Freifunk – is now acknowledged and encouraged by this new provision. It should be used to ensure that the right to share one's connection if effectively guaranteed. In the same spirit, where they exist like in Italy, telecom operators' contract clauses that forbid subscribers to share their connections with others should be prohibited.

C.4. Expanding the spectrum commons

It is not just Internet wireless access points that can be shared, but also the intangible infrastructure on which radio signals travel. Wi-Fi, as an unlicensed portion of the spectrum and therefore a commons open to all, is a key asset for community networks willing to set up affordable and flexible last-mile infrastructure.

Unfortunately, these Wi-Fi frequency bands are currently very limited. Not only are they getting increasingly subject to congestion in densely populated areas, they are also exposed to new technical standards that use the so-called ISM frequency band (like LTE-U) that hamper the reliability of Wi-Fi communications. Last but not least, existing frequency bands for Wi-Fi (5,6 Ghz and 2,4 Ghz) have physical constraints that prevent them for being used for longer radio links. In the face of such challenges, a new approach to spectrum policy is needed whereby policy-makers expand unlicensed Wi-Fi bands.

Other types of frequencies should also be made available either on an unlicensed (preferred scenario), or on an affordable and flexible authorization schemes. Such frequency bands for instance include so-called TV white spaces in lower frequencies (which allow for cheap and resilient long-distance links, for instance in rural areas), as well as the 12Ghz and the 60Ghz bands (for which radio equipment is affordable and which can help us build high-bandwidth point-to-point radio links). Once made accessible to community

3 Article 12.1 of the directive on the information society establishes the so-called "mere conduit" principle: "Where an information society service is provided that consists of the transmission in a communication network of information provided by a recipient of the service, or the provision of access to a communication network, Member States shall ensure that the service provider is not liable for the information transmitted, on condition that the provider: (a) does not initiate the transmission; (b) does not select the receiver of the transmission; and (c) does not select or modify the information contained in the transmission."

networks, they can help roll-out and expand cheap and resilient wireless infrastructures.

Shared and unlicensed access to the radio spectrum embodies the core principle of general authorization mechanism enshrined since 2002 at the EU level. In 2012, the European Radio Spectrum Policy Programme further called on policy-makers to assess the "need for and feasibility of extending the allocations of unlicensed spectrum" in the Wi-Fi bands[4]. That same year, a EU Commission study also called for a new 100 MHz of license-exempt bands as well as for higher power output limits in rural areas to reduce the cost of broadband Internet access deployment[5]. But unfortunately, no concrete action has since been implemented.

In the upcoming European Code of Electronic Communications, new provisions also encourage shared and unlicensed use of spectrum (see article 4.4, 45.2, 46.1). Policy-makers must understand the need and urgency of implementing a reform of spectrum policy favouring unlicensed and shared access to this vital resource, and more generally innovative licensing schemes that could benefit community networks[6]. For instance, in 2015, the Mexican NRA amended its frequency plan to set aside part of the 800 MHz band for "social purpose" licensing. To qualify for a social-use license, applicants must demonstrate that the spectrum would be used to service communities of 2,500 people or less, or communities located in a designated indigenous region or so-called "priority zone." community networks like Rhizomatica have relied on this social purpose licensing to develop networks in areas not served by traditional telecom providers.

C.5. Updating open-access rules on private and public telecom infrastructures

As our societies transition to last-mile fiber-optic networks, there is a risk that community networks will be left behind. To promote competition, diversity, resilience and local empowerment in telecom markets, regulators should urgently update open access rules that once were the cornerstone of European telecom policy to make them fit for Fiber-to-the-Home (FTTH) networks.

4 See recital 25 of the decision 243/2012/EU of 14 March 2012 establishing a multiannual radio spectrum policy programme.
5 Simon Forge et al. (2012). Perspectives on the value of shared spectrum access. Support for the preparation of an impact assessment to accompany the Commission's Initiative on the Shared Use of Spectrum, SMART 2011/0017. SCF Associates Ltd.
6 Unleashing community networks: Innovative Licensing Approaches (2018). Tech. rep. ISOC. URL: https://www.internetsociety. org/resources/2018/unleashing-community-networks-innovative-licensing-approaches/ (visited on 12/04/2017).

To do so, different strategies can be identified depending on whether existing infrastructure is privately owned or public.

In France, the first publicly available ISP was a non-profit organization called French Data Network (FDN). Created in 1992, FDN it still in operation today. But like many alternative landline ISPs, FDN does not have enough funding to deploy its own cables. It has to rent those of larger players.

Two kinds of access can be rented: either passive or active access. Passive access means that a provider actually rents access to the physical cables of another operator, installs its own equipment in key part of the network and manages every technical aspect of the access provided to users. Renting passive access is expensive and suited to providers who are able to reach out to large number of users in a given area, or to companies with very specific needs. The alternative is active access (also called "bitstream"), which amounts to simply renting part of a network already managed by another operator. It does not require to install equipment and is much cheaper. Even though it does not give as much technical control as passive access, it still allows ISPs such as FDN to provide the tailored services that its members and subscribers are looking for.

The problem is that whereas active access is now readily available in most ADSL markets, it is still a far-fetched dream for fiber networks. In France, only the four largest telecom firms are able to invest in fiber optic last-mile networks. Worse, these telecom companies are often alone in a specific area, which leads to a monopolistic situation from the perspective of end-users. The root cause is that there is currently no bitstream offers allowing smaller operators or community networks (CNs) to use the infrastructure rolled-out by these dominant players to provide their services to end-users.

Despite fears that it would reinforce monopolistic trends when it was first proposed, the Code of Electronic Communications was amended to safeguard regulatory room for manoeuvre. NRA will still be able to engage in asymmetric regulation (i.e. more stringent regulation of dominant market players). Most crucially for alternative providers like CNs, who do not have the financial power to join the so-called "co-investment agreements" (whereby large telecom companies come together as a cartel to deploy a joint FTTH network in a given area),

"NRA should also safeguard the rights of access seekers who do not participate in a given co-investment." Recital 165 also makes clear that access to NRA will retain the ability to impose active access obligations on network owners, when "access to passive [network] elements would be economically inefficient or physically impracticable." Policy-makers should therefore use their powers to ensure that active access offers are available for community

networks across local markets, especially when they review (and attach conditions to) co-investment agreements adopted by large telecom providers. Another pressing issue is that of public networks. Like the radio spectrum, networks built with taxpayers money should be treated as a commons and, as such, remain free from corporate capture. Today, their management and exploitation is often delegated by public authorities to large network operators. These entities usually adopt aggressive and untransparent pricing schemes designed for incumbent players that make it extremely costly for small access providers to interconnect with these networks. It is unacceptable that citizen initiatives designed to serve the needs of populations whose connectivity needs are badly served by traditional telecom providers be kept away from public networks. Access to these networks for non-profit entities like community networks as well as small businesses should be guaranteed, at a reasonable and proportionate cost. To do so, policy-makers should also mandate that all public networks come with active access offers and pricing schemes that makes it possible for small players, in particular community networks, to offer services on these networks.

C.6. Protecting free software and user freedom in radio equipment

In 2014, the European Union adopted Directive 2014/53 on radio equipment[7]. Although the Directive pursues sound policy goals, it might actually impair the development of community networks. Indeed, community networks usually need to replace the software included by the manufacturer in radio hardware with free and open source software especially designed to suit their needs, a collective process that improves security and encourages the recycling of hardware, among other benefits. Article 3.3(i) of the said Directive creates legal pressure for manufacturers of radio devices to ensure the compliance of the software loaded on these devices with the European regulatory framework. As a result, there is a strong incentive for manufacturers to lock down their devices and prevent third-party modifications of the hardware.

Policy-makers should provide a general exception for all free software installed on radio devices by end-users and operators (the latter being liable if their software lead to violations of the regulatory framework), so that users' rights are safeguarded. An alternative approach would be to exempt all WiFi routers from Article 3.3(i). Further, they should require router manufacturers to open their devices for installation of third-party, open source software. As an example of this, the FCC explicitly refers to free and open source software

7 Directive 2014/53/EU on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

when stating that third-party software should not be prohibited. Manufacturers should also be required to enable the free and open source development communities with sufficient information of possible consequences that firmware changes may have.

C.7. Exploring other measures supporting the development of community networks

Beyond the most urgent measures listed above, there is a wide range of policies that can foster the growth of community networks. They could for instance explore how Universal Service funds could be used to bring targeted support to community networks as a way of tapping into their experience in building cheap and resilient networks serving the needs of underserved populations. There is a great deal that can be done to boost transparency, for instance by providing clear guidance on regulatory requirements and exemptions applicable to CNs, by compiling up-to-date databases on already existing infrastructure (passive/active offers available, licensing regime, spectrum availability etc.) or on programmed civil engineering work so as to reduce the cost of fiber deployment. By opening to the world of community networks, policy-makers, and NRA in particular, will be able to think of many creative measures to better fulfil their tasks and duties, and eventually better serve the public interest. community networks have long faced a hostile regulatory framework. But since their various models have achieved considerable results, they are nevertheless an increasingly popular way for serving the connectivity needs of people and are starting to get the recognition they deserve. Much still needs to be done to lift the obstacles that hinders their development and allow community networks to unleash all their potential. Building on new European and international policy orientations, now is the time for policy-makers to work with these initiatives to ensure the sustainable development of telecom infrastructures.

Appendix D. Glossary of legal and technical terms

Access network

An access network (also known as the "last mile") is a technical infrastructure that offers any host the ability to join or leave the global network at any time. The access part of the network, frequently called its "last mile" or a local area network (LAN) in campuses or enterprises, enables a person with a device to connect to the core, or backbone, network through which it can then access all available services, hosted on servers spread around the globe. Examples of access networks include the copper wire subscriber lines connecting landline telephones to the local telephone exchange or cell towers linking local cell phones to the cellular network that is often referred to as 3G/4G. In most cases, wireless is also the access to the "wired" last mile. This is thanks to the unlicensed spectrum that is free for use by radio devices, and the corresponding cheap wireless Wi-Fi devices that make it easier to connect from a short distance to wired internet connections in homes, public spaces, airports and cafes, without the need for wires, and in a way that is much less expensive than 3G/4G data contracts.

Access point

Access point (AP) is a technical term used in Wi-Fi (more precisely in the IEEE 802.11 standards) to identify the device to which hosts connects to access a wireless local area network (WLAN), either at home or in any Hotspot.

Advocacy

The legal framework may not reflect your values and include your needs, or even worse, it may hamper your activity. Various advocacy or lobbying strategies are available and documented in this guide: protests, online public campaigns, coordination with allies, drafting of Amendments, discussions with local, national and EU policy makers, and Litigation.

Amendment

Legal texts can be laws (in specific countries), directives (at the EU level, which should be transposed into national laws), or EU regulations (which are directly enforceable). In the process of writing them, and of reforming them, members of parliament, as well as activists, draft so-called amendments, small propositions to change the existing draft. Such amendments will be negotiated, discussed and voted on. They are key battles for Advocacy for the inclusion of community networks and their needs in the legal framework.

Antenna

Technically, an antenna is a device that couples your communication device with the "wireless medium". In other words, it transfers the communication signal from your device to electromagnetic waves (in transmission) and from these waves to your device (in reception). There are three types of antennas that can be used for wireless Wi-Fi communications. First, directional antennas can establish a wireless link between distant locations, possibly many kilometres away. This link could be imagined as a very long "cable", and usually requires a "line of sight" along the imaginary line connecting two locations, which needs to be clear of obstacles (walls, trees, etc.). Such links are often called "backbone" links since they establish the wider coverage area of the network and are not accessible by end-users. Second, an omnidirectional antenna, attached to an access point (AP), can spread "cables", radio signals, in all directions around it and makes it easy for many devices to connect at the same time and independently from their relative location. In the case of common household devices with omnidirectional antennas, the distance between the AP and the small omnidirectional antennas inside the hosts must be much smaller, at most a few hundred metres, and usually less, depending on the environmental conditions. Third, sector antennas lie between these two extremes, restricting the signal within a certain angle. Omnidirectional and sector antennas can also be used to create direct links between devices, which are easier to set up (the antennas find each other automatically if more easily when they fall in each other's range) and thus the corresponding networks are easier to expand, but they are more costly in terms of noise and interference. A cellular base station use a set of three or more sector antennas operating in licensed frequencies (unlike the 2.4GHz and 5GHz frequencies often used for Wi-Fi, licences for these frequencies are bought very expensively by the corresponding operators). Due to the configuration, size and power of their antennas and the relatively lower frequencies they use, mobile phone base stations often have much larger areas of coverage than routers that use Wi-Fi to connect with mobile devices.

Autonomous system

An autonomous system (AS) is a TCP/IP-based network managed by the same

administration with the same routing protocol. Internet service providers (ISPs) are normally ASs. Your community network is by definition an AS unless it is composed by more than one "island" using different routing protocols.

Beacon

A broadcast frame (packet) transmitted every 100 metres by 802.11 access points (APs). It contains the BSSID and many other parameters used to manage the Wi-Fi connection in the specific BSS.

BSS

A basic service set (BSS) defines a Wi-Fi (802.11) wireless local area network (WLAN), in other words, all the stations that communicate with the same access point and the AP itself.

BSSID

The identifier of a BSS, i.e. the "name" of the Wi-Fi network as announced by your laptop or smartphone. It is broadcast by the access point (AP) in beacons.

Client

A client is a host that wishes to consume a service from a host over the network.

Client/server

The client/server service model is the classic service architecture of internet services, inspired by traditional business models. The service resides in a host, the server, that is constantly listening for requests coming from the clients. Clients always initiate the communication procedure to obtain the service.

Community network

An access network set up by a community of people organised into a legal entity or not. Community networks are normally managed as commons.

Data centre

A large facility hosting a large number of servers and other computing devices that provide services either to a large company or offer computing and hosting services for rent to the general public.

Data controller

The person who determines the purposes and means of the processing of personal data. See Article 4(7) of GDPR.

Data retention
Data retention refers to the collection and storage of traffic and location data, without further analysis, for an extended period of time. This allows future access by a competent authority which can request specific information from the telecom operator retaining the data.

Domain name system (DNS)
The DNS identifies the distributed database and the protocol to use it that translates domain names (e.g. "www.guifi.net") into IP addresses used by the IP protocol to deliver packets.

DSL
Digital subscriber line (DSL) is a family of technologies that are used to transmit digital data over the standard twisted pair "last mile" carving three separate channels, one for voice and two for data (uplink and downlink), on this transmission medium. In telecommunications marketing, the term DSL is widely understood to mean asymmetric digital subscriber line (ADSL), the most commonly installed DSL technology, normally used for internet access.

Electronic communication service (ECS)
Legal term used in European law (Directive 2002/21/EC) for services provided by means of electronic signals. It could be, for instance, a service offered through telecommunications or broadcasting networks. It excludes services which do not imply the transmission of signals.

European Electronic Communications Code (EECC)
The EECC is the forthcoming framework for telecommunication law within the European Union. The current content of the Code is described in netCommons Deliverable 4.3, version 1.2, "European Legal Framework for CNs", Section 2.4.5. "Development and perspectives of the EECC for CNs", p. 56.
Ethernet (IEEE 802.3)

A protocol to share the same communication medium, originally a coaxial cable. The term today identifies all the protocols that were derived from this initial standard, often using switching techniques to increase the capacity of the network. Ethernet technology today allows communications from 10 Mbit/s to 100 Gbit/s and more.

Gateway
A Router (or Node) that interconnects an access network to the global internet.
General Data Protection Regulation (GDPR)
This is the new major regulation framing movement and processing of personal data in Europe. It replaces Directive 95/46/EC. It establishes a

specific framework for data processing in communication networks and in digital services in general. For a clear introduction and overview, see: 2018 reform of EU data protection rules.

Host
A host is a computer that behaves as a communication endpoint over the internet. Hosts use the network to consume or provide services, and are normally differentiated between clients and servers, based on the main role they play in the Client/server model.

Hosting
Hosting is the process of providing a facility where a server is made available on a network (usually by a provider that makes servers available for rent in a Data centre with reliable and available network connectivity to the internet).

Hotspot
A hotspot is a physical location where people may obtain internet access using Wi-Fi technology, via a wireless local area network (WLAN). The term is normally reserved to places where several access points (APs) are coordinated to offer service over an entire building or campus, always identifying the network with the same BSSID.

Hybrid space
Used here to refer to its social dimension and hybrid (digital and physical) nature, as information and communication technologies mediate interactions between people.

IEEE
The Institute of Electrical and Electronics Engineers (IEEE) is a private association incorporated in the USA providing industrial standards in all the engineering fields that include electrical or electronic technologies, including computer science and telecommunications. In particular, the 802 project defined the de-facto standards for all technologies related to local area networks (LANs) and short-range communications, including Ethernet (IEEE 802.3), Wi-Fi (IEEE 802.11), and Bluetooth and Zigbee (IEEE 802.15).

Information society service (ISS)
Information society service (ISS) is a legal term that refers to a wide range of economic activities taking place online. ISSs are not solely restricted to services giving rise to online contracting but also extend to services which are not remunerated by those who receive them (as long as they are an economic

activity). In this way, ISSs include services offering online information or commercial communications, or those providing tools allowing for search, access and retrieval of data, but also services consisting of providing access to a communication network (for details regarding information society services, see CJEU, Sony v. McFadden, September, 15, 2016 and Directive 2000/31/EC), but you can also refer to netCommons Deliverable 4.3.

Interconnection

In telecommunications, interconnection is the physical linking of an operator's network with equipment or facilities not belonging to that network. Once a machine or a network is connected to another network, they can exchange traffic directly.

(Intermediary) liability

Liability is a duty to compensate a wrongdoing. It can arise from a breach of an obligation imposed by the law. Depending on the breach, it can be criminal or civil liability. Intermediaries and CNs will mostly face civil liability issues as they may cause damages to someone as a consequence of a privacy breach or defamation, or in cases of intellectual property rights' damages.

Internet service provider

An internet service provider (ISP) can offer both an electronic communications service, such as access to the internet, and other services, such as providing web-based content (see Directive 2002/21/EC). In legal documentation, the term used more often is Information society service (ISS), but the two terms are not strictly synonymous – for instance, an ISS may not refer to the internet at all.

ITU

The International Telecommunication Union (ITU) is a technical branch of the United Nations dedicated to defining global standards for telecommunications, including the overall management of the spectrum and its assignment to different telecommunication services and technologies.

LAN

A local area network (LAN) is an access network with a local scope. Hosts connected to a LAN communicate with one another directly, without a gateway or router in between them (for example, hosts connected to the same Wi-Fi access point or to an Ethernet switch). Sometimes LANs are not interconnected to the global internet – contrary to public access networks offered by internet service providers (ISPs) – and are called "intranets", meaning that they offer services only to a specific company or to a group of people.

Often intranets are "extended" LANs, meaning that they comprise several LANs interconnected by routers or Ethernet switches with large capacity.

Last mile

The last mile is a term used by communications companies to refer to an Access network that reaches into the residential homes and offices of their customers (or to their phones in the case of mobile service providers).

Litigation

Litigation is an Advocacy strategy which consists of starting a case in court against a specific law or measure, which can impact more broadly on other community networks, open Wi-Fi or human rights.

Line of sight (LoS)

Line of sight refers to the existence of an unobstructed pathway between two antennas exchanging traffic. This is normally the only condition that makes it possible to sustain a high-capacity link at high frequencies (greater than 2 GHz).

Metadata

Metadata is a technical word referring to all the data and information necessary to provide a telecommunication service, i.e. the transfer of user data across a network. You will not find this term in the law. Laws use the terms "traffic data" and "location data". Traffic data are data processed for the transmission of a communication on a telecommunication network (or for billing purposes, where the service is not free). The data identifying the user of a service, the receiver of a message as well as the date, time and duration of a communication are regarded as traffic data. Location data are data processed on telecommunication networks or by electronic communication services providers, indicating the geographic position of the terminal equipment of a user.

Network

A telecommunication network is the ensemble of transmission means, switching devices and other means that allow computers and other terminals and hosts to communicate. Terminals are often also considered part of the network, even if technically they use the network to communicate and are not strictly part of it. The term is rather generic and is used with different meanings in different contexts, from the global internet in some cases to a single LAN in others.

Node
See Router.

Non-line of sight (NLoS)
A radio connection that is obtained without line of sight. It is the normal condition in cellular networks and Wi-Fi access with omnidirectional antennas that exploit multipath propagation due to reflections and refractions of the electromagnetic waves.

National regulatory authority (NRA)
National Regulatory Authorities (NRAs) are national independent bodies ensuring the implementation of a specific branch of European and national law. They overview a part of a market and are often able to sanction operators if they fail to comply with their obligations. There is one for data protection law (national data protection authority) and one for telecommunication law in every country of the European Union.

Peer-to-peer (P2P)
A peer-to-peer (P2P) service is a service that is provided by many hosts that each simultaneously act as both a client and server (i.e. they hold an equal peer relationship to each other).

Peering
In computer networking, peering is a direct interconnection of administratively separate networks normally based on the TCP/IP protocol stack (the protocols of the internet) for the purpose of exchanging traffic between the two networks. To have a peering contract the networks need to be directly interconnected. Peering contracts are very often based on a free exchange of traffic without fees for the traffic exchanged.

Personal data
Personal data covers a very wide range of information: any information relating to an individual and which may be attributed to this individual. Concretely, data such as first name, surname, dynamic and static IP addresses, email addresses and phone numbers, for instance, should be regarded as personal data. These kind of data have a strong connection to a person and are part of his or her private life. As such, specific rules exist to ensure a higher level of protection of personal data and the privacy of users.

Ping
Ping is a Unix command that allows a computer connected to a network to test the reachability of other computers anywhere on the internet, as log as

connectivity exists and the remote host responds to the query. On a Linux terminal, by typing "ping <IP address>" or "ping <host-name>", you are informed on the reachability of the IP interface to which the address has been assigned and on the "round-trip time" and packet loss rate between your host and the one with the given IP address (or host name). In other operating systems there may be commands with different names, or the "ping utility" may be accessed only through Apps or graphical interfaces.

Redundancy

In engineering, redundancy is the practice of replicating critical parts of the infrastructure, e.g. the Gateway between a LAN and the internet, or a specific link in a network that, if broken, would split the network into two unreachable parts. In networks, critical services such as the Domain name system (DNS) are also very often replicated.

Right to the city

The term "right to the city" was introduced by Henri Lefebvre in his 1968 book Le droit a la ville to express the fight for the democratisation of urban space. It is still popular today among urban movements and social scientists who use it as a reference for the ongoing struggles in this respect.

Radio spectrum

The radio spectrum is the part of the electromagnetic spectrum with frequencies from 3 kHz to 300 GHz. Above 300 GHz, infrared and optical frequencies are approached. Electromagnetic waves in this frequency range – generically called radio waves, but including microwaves, mmWaves and other more specific terms – are widely used in telecommunications due to their generally good propagation characteristics. In general, the higher the frequency, the higher the capacity of the transmission technology that can be achieved; however, as the frequency increases, the propagation becomes less efficient and it is more difficult to transmit at long distances, especially above 3-5 GHz, where line of sight is definitely needed.

Router (or Node)

A router or node is a network device that switches data packets (carrying communication content) between different network links, enabling distant hosts to provide and consume services. A Wi-Fi access point is often improperly called a router because it usually passes communication between Wi-Fi hosts and an Ethernet (IEEE 802.3) connection that provides further access to a router behind it, which is normally "invisible" to the user.

Server
A server is a software process that provides services to clients running on other hosts. The term server is also used to identify the computers that provide such services.

Server farm
A coordinated groups of computers (servers) that host services and provide them with high performance.

Service
A service is the result of appropriate manipulation (normally by several software programs and processes) of information that generates a useful outcome, i.e. an outcome that is useful to someone. It can be other information (e.g. web services, database access, etc.) or the stream of a video or music for pleasure.

Spectrum
See Radio spectrum.

TCP/IP
TCP/IP is the name of the protocol architecture of the internet, which takes its name from the two main protocols: the transmission control protocol at the transport layer, taking care of end-to-end transmissions including retransmissions when packets are lost and congestion control, and the internet protocol at the network layer, which takes care of routing and delivery of the data packets from the source host to the destination host.

Terms of use
Terms of use can also be called an agreement, charter, declaration or memorandum of understanding. They are texts which contain legal obligations, such as contracts or licences, but also, in the case of CNs, the common goals, philosophical and political principles and values underlying the relations between peers. Examples are the Network Commons Declaration, the Pico Peering Agreement, the Freifunk Memo of Understanding, and the netCommons Terms of Use template in Appendix B that we propose for you to develop and adapt.

Transit
Internet transit is the service of allowing network traffic to cross or "transit" an autonomous system (AS). Transit services are normally paid for and are used, for instance, to connect a small internet service provider (ISP) to the internet, or your community network to an ISP.

Tunnel

In telecommunications and in relation to the internet in particular, "tunnel" refers to technologies that allow embedding a direct "logical" connection between two hosts within an entire network. Tunnels are often encrypted if they refer to specific applications, or if they are meant to protect privacy. Tunnelling is widely used at all levels in the internet, and also allows creating peering agreements between networks that do not have a direct physical connection exploiting a transit service.

Virtual private network (VPN)

A virtual private network (VPN) is a network technology that creates an encrypted tunnel through which a computer or host can access a single server or an entire private network that would otherwise be unreachable from the host location.

xDSL

xDSL identifies all the different versions of digital subscriber line (DSL) technology. As there are several variants of DSL connections (for instance ADSL and HDSL, which stand for asymmetric and high-bit-rate DSL, respectively), the umbrella term xDSL is used to collectively refer to this family of technologies.

Appendix E. Suggested readings

We offer here a list of books, documents and online resources that you may be interested in reading to improve some of your skills and knowledge on community networks. They are divided by topic and are accompanied by a few lines explaining what they are about and why we suggest reading them. These go beyond, in number and depth of discussion, the short list of self-teaching materials we already presented in Chapter 12. Some of them, mostly the documents produced by netCommons, have already been pointed to in the text as sources of information, and indeed they are part of the complete documentation of the work we did to be able to produce this compendium.

E.1. Legal, policy, history

European Legal Framework for CNs, by Virginie Aubrée, Mélanie Dulong de Rosnay, Federica Giovanella, Arthur Messaud and Felix Tréguer, netCommons Deliverable 4.3, August 2018.
Why you should read it: Community networks are based on democratic governance, infrastructure managed as commons, and promotion of digital human rights. Their existence and the non-mainstream way in which they conduct their activities fall within the scope of several areas of law, all over the European Union. This document presents the status of EU legislation referring to CNs and establishes formal guidelines to respect the applicable law, as well as describing various advocacy activities aimed at influencing the current legal framework.

Community Networks and Political Advocacy by Felix Tréguer and Mélanie Dulong de Rosnay, netCommons Deliverable 1.5, February 2018.
Why read it: If you ever had questions like:

- What are the appropriate organisational modes to engage in political advocacy in order to foster the growth of community networks as

cooperative platforms?
• How have advances been achieved by community networks through their interactions with other actors in the telecom sector and the local, national and European policy environments?
• In short, how can a CN build political advocacy capacities?

The Rise of the Network Commons, by Armin Medosch, unfinished book available on The Next Layer
Why you should read it: The late Armin Medosch was not able to finish this book, but the draft that he published on his blog is a great way to understand the beginnings of European community networks as well as their importance. A great activist and theorist of free networks, Medosch offers hands-on accounts in a vivid style that will take you back to the early days of community networks and their seminal importance for sustaining an organic and democratic internet.

Alternative Communications Networks Throughout History, by Felix Tréguer and Dominique Trudel, netCommons Deliverable 5.1, November 2016.
Why you should read it: This netCommons deliverable will take you on a journey across the history of community-owned telecom infrastructures, starting with the first telephone networks at the turn of the 19th century, continuing with the free radio movement of the 1960s and 1970s, and ending with the first IP-based community networks in the 1990s. This will help you understand recurring themes in that history, and give you a sense of the political importance of community networks.

E.2. Ethics, social, economic

netCommons Political and Ethical Guidelines for an Alternative Internet, by Dimitris Boucas, Christian Fuchs, Maria Michalis, Virginie Aubree and Félix Tréguer, netCommons Deliverable 4.4, December 2018.
Why you should read it: This deliverable frames the phenomenon of community networks within a broader vision on the human rights to communicate and to have unrestricted access to digital communications and resources in general. It is divided into a more theoretical part dealing with ethics and a more practical part dealing with the implementation of such ethical principles and how community networks fit into these principles.

Incentives for Participation and Active Collaboration in CNs, by Merkouris Karaliopoulos, Panagiota Micholia and Iordanis Koutsopoulos, netCommons Deliverable 2.8, October 2018.
Why you should read it: Economic sustainability is always a key issue in any non-profit endeavour, all the more in commons-based ones. In view of

this, finding the proper socio-economic incentives for active participation is fundamental. This report suggests various and novel pricing schemes for community networks, starting from the analysis of existing community networks. In addition, a clear theoretical framework is offered that can be used to further research and innovation on incentives and proper balances in the economy of a community network. The mathematical part may result difficult to access for non-technical readers, but the rest of the document is easily accessible for everyone.

Community Networks and the Right to the City, by Ileana Apostol, Panayotis Antoniadis and Alexandros Papageorgiou, netCommons Deliverable 5.5, November 2018.
Why you should read it: Digital and physical spaces are increasingly intertwined and the concept of the "right to the city" can provide important guidance to community network activists who claim our rights to the internet, but also a framework that will allow collaborations with other actors in both urban and rural areas. This netCommons report provides introductory theoretical material and examples of concrete steps toward bringing digital and urban activists closer together.

Multi-Disciplinary Methodology for Applications Design for CNs*, including Design Guidelines and Adoption Facilitation*, by Panayotis Antoniadis, Ileana Apostol, et al., netCommons Deliverable 3.3, April 2018.
Why you should read it: Community networks go beyond internet access infrastructures and can become the hosts of a variety of local services and applications. But for their design and successful deployment, collaboration between actors from different disciplines and with different skill sets is required. This extensive report proposes a methodology for facilitating such collaborations and, most importantly, describes how this methodology was developed over time through a real case study of the Sarantaporo CN in Greece. The complementary booklet titled "Community Servers: Bringing Community Networks to the Ground", provides easier access to this approach and will be subject to a constant co-creation process at http://nethood.org/studio/

The Organic Internet: Building Communications Networks from the Grassroots, by Panayotis Antoniadis, published by Palgrave Macmillan, November 2018.
Why you should read it: This is an open access article that establishes a useful analogy between the internet and agriculture. It provides a lot of introductory material on the building blocks of the internet and useful arguments on why community networks could be seen as a more sustainable and organic solution for building networking infrastructures. It also brings the question of sustainability to the fore and discusses how both internet consumption and production should be re-conceptualised in an energy-limited world.

The Community Network Manual: How to Build the Internet Yourself, edited by Luca Belli, 2018 DC3 Outcome, November 2018.
Why you should read it: This book launched at the 2018 Internet Governance Forum (IGF), soon after the netCommons booksprint, is a collection of very useful and complementary material to this book, including five chapters contributed by netCommons partners on scalability, the FFDN case study, legal issues, and the potential of community currencies and blockchain technology for the sustainability of community networks. There are also chapters on interesting technical aspects ranging from open hardware to open source software for local applications.

Global Information Society Watch 2018: Community Networks, edited by Alan Finlay, Association for Progressive Communications (APC), November 2018.
Why you should read it: The 2018 edition of APC's annual Global Information Society Watch (GISWatch) report focuses on community networks, and provides a very wide-reaching perspective on these initiatives around the world. The 43 country reports included in this book capture the different experiences and approaches in setting up community networks across the globe. This material is complemented by more technical or general thematic chapters. netCommons researchers contributed several chapters.

Technological Sovereignty Vol. 2, edited by Alex Hache, Descontrol, 2017.
Why you should read it: This book will help you understand how to build alternative digital technologies, and what initiatives besides community networks can help maintain freedom, autonomy and social justice when it comes to mobile telephony, translation services, online whistleblowing platforms, and ethical servers. You will draw inspiration from these narratives, and beef up your political understanding of what alternative communications are about.

E.3. Technical

Report on Existing Community Networks and their Organization, by Leandro Navarro, Roger Baig, Felix Freitag, Emmanouil Dimogerontakis, Felix Tréguer, Mélanie Dulong de Rosnay, Leonardo Maccari, Panagiota Micholia and Panayotis Antoniadis, netCommons Deliverable 1.2, September 2016.
Why you should read it: This is a comprehensive report surveying existing community networks across Europe and beyond, describing their organisation and also offering a classification (or taxonomy if you prefer) and interpretation of their organisation.

Report on the Governance Instruments and their Application to CNs, by Leandro Navarro, Roger Baig and Felix Freitag, netCommons Deliverable 1.4, December 2017.
Why you should read it: Albeit quite technical and theoretical, this report offers a

concise overview of good practices and bad practices for community network governance. The analysis carried out covers many different community networks in very different locations and settings, thus providing an ample perspective where everyone can find useful information for their specific case. Suggestions are given on how to improve existing governance methods and tools.

Commotion Construction Kit, by Commotion Wireless (CCK).
Why you should read it: The CCK is a set of documentation tools that the Open Technology Institute produced to help people set up and configure their own networks, in a "do it ourselves" way. While it primarily refers to the software developed by Commotion, it contains generic information for non-tech-savvy people on wireless mesh networks.

RFC 3626, 7181: The Optimized Links State Protocol (v1 and v2), by various authors, published as IETF Request for Comments: v1, v2.
Why you should read it: OLSR is one of the better documented and supported routing protocols used for wireless mesh networks. It is used in several community networks and has two open source implementations. The RFCs explain in detail its behaviour and can be used as a reference to understand the behaviour of link state routing protocols.

RFC 6126: The Babel Routing Protocol, by Juliusz Chroboczek, published as an IETF Request for Comments.
Why you should read it: Babel is another routing protocol for mesh and distributed networks in general. It has an open source implementation and it is used in some community networks. The RFC can be used as a reference to understand the behaviour of distance vector routing protocols.

LibreMesh documentation, by various authors, published on the LibreMesh website.
Why you should read it: LibreMesh is an easy-to-use Linux distribution targeted to wireless routers, which automatically configures the routers to create a mesh network. It is used in several community networks and its documentation is well realised.

Wireless Battle Mesh website, at battlemesh.org.
Why you should read it: Every year, the European (and not only) community of mesh networks meets at the "Wireless Battle of the Mesh", a self-organised event where developers and activists of community networks gather. For a week all the participants present their networks and their technical advances. The website contains dozens of presentations made by community networks around the world, describing their solutions and organisations.

A Crash Course in Mesh Networking, by Victor Bahl, Microsoft Research, 2007, available here.
Why you should read it: Victor Bahl was the head of a group at Microsoft Research (MSR) in the early early 2000s, when MSR was actively looking into wireless multi-hop networks. The 257 slides summarise many of the technical and other issues that are relevant to the set-up and operation of wireless multi-hop networks as well as solutions that the MSR team had come up with by that time. Many of these issues, such as types of interference and countermeasures, are discovered/realised/anticipated by practitioners of CNs much later in the course of CN growth.

Multi-Channel Wireless Networks: Theory to Practice, Distinguished Lecture at KTH-Stockholm, 2010, by Prof. Nitin Vaidya, University of Illinois at Urbana Champaign, video available here.
Why you should watch it: Prof. Vaidya is an established figure in wireless multi-hop networking research, and has conducted considerable research on various layers of these networks. His talk focuses on multi-channel wireless networks and could serve as an accessible tutorial for CN practitioners who want to understand more about the way wireless networks operate.

A Week in the Life of Three Large Wireless Community Networks, by Leonardo Maccari and Renato Lo Cigno, Ad-Hoc Networks, 2015, open access version from the University of Trento
Why you should read it: An easy-to-read scientific paper analysing characteristics and pitfalls of the topology of ninux in Rome and Funkfeuer in Graz and Vienna. These three networks were selected because of the availability of detailed topology information as well as the fact that they use OLSR, so that the analysis is homogeneous and highlights the behaviour of this protocol. It is an interesting reading showing how the topology of the network influences performance and reliability, and thus affects users. In conclusion, the better the network is planned, the better it will work, but network planning is not as easy as it may look.