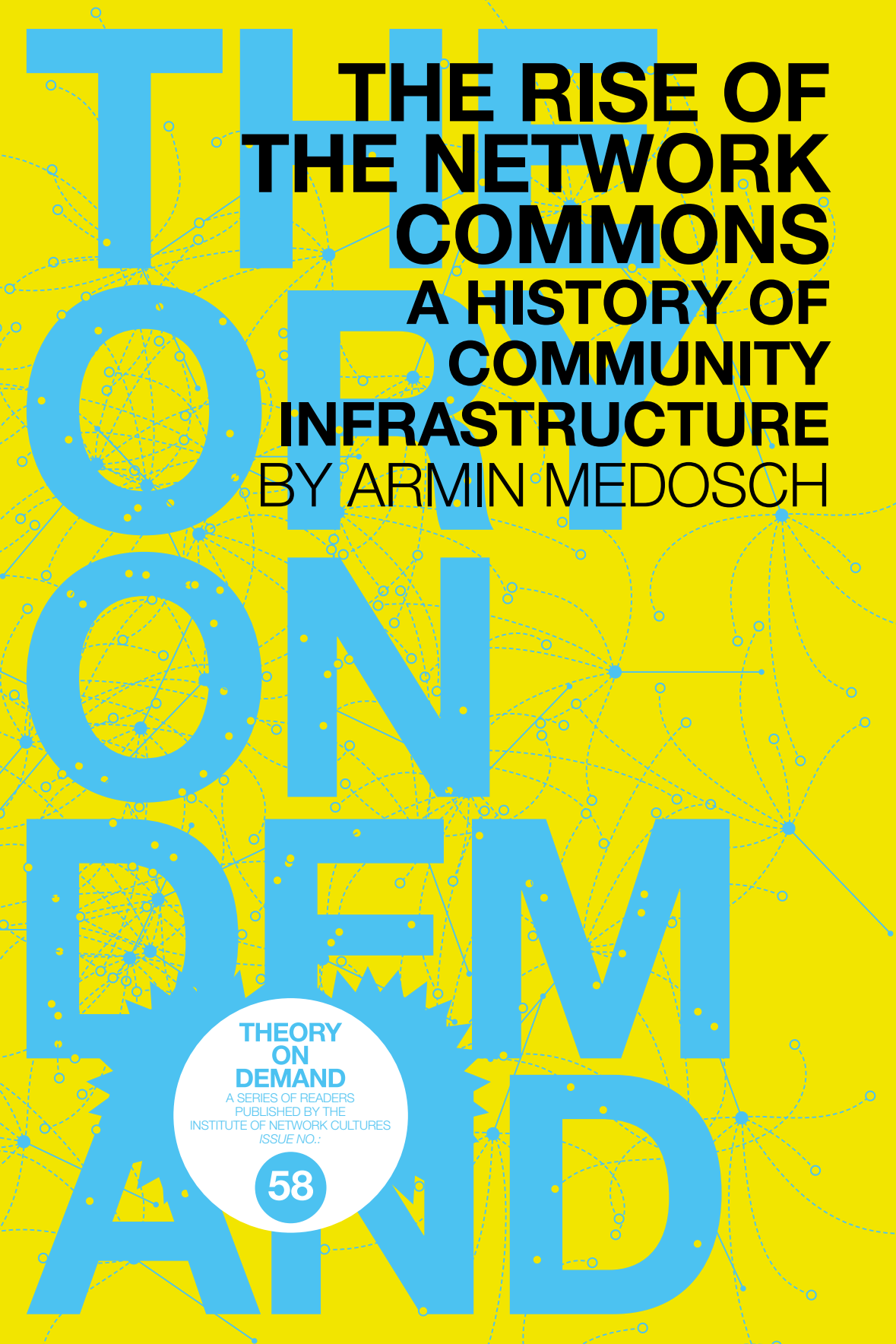

THE RISE OF THE NETWORK COMMONS

A HISTORY OF COMMUNITY INFRASTRUCTURE

BY ARMIN MEDOSCH

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THE RISE OF THE NETWORK COMMONS

A HISTORY OF COMMUNITY INFRASTRUCTURE

ARMIN MEDOSCH

COLOPHON

Theory on Demand #58
The Rise of the Network Commons: A History of Community Infrastructure

Edited by: Volker Ralf Grassmuck and Adam Burns

Special thanks to: Ina Zwerger, Elektra Aichele, Panayotis Antoniadis, Gregers Baur-Petersen, Andreas Bräu, Sebastian Büttrich, Teresa Dillon, André Gaul, Aaron Kaplan, Geert Lovink, Monic Meisel, Mauricio Román Miranda, Jürgen Neumann, Ignacio Nieto Larrain, Julian Priest, Enrique Rivera, Tim Schütz, Felix Stalder, Thomas Thaler, Ulf Treger, Sven (C-ven) Wagner, Simon Worthington, Manuel Orellana Sandoval and everyone at Señal 3, TV Piola.

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INTRODUCTION

The book in your hands is a message in a bottle that washed ashore ten years after it was sent. Armin Medosch began documenting self-managed local networking initiatives with his book *Freie Netze*[1] published in the German language in 2004. He developed *The Rise of the Network Commons* in draft chapters presented on his cooperative website, *The Next Layer,*[2] from 2013 until 2015, before his death in February 2017.

Nearly two years later, Volker Grassmuck, who with Elektra Aichele was working on freeing unused TV spectrum for WLAN, came across the manuscript. He reached out to Ina Zwerger, Adam Burns and a few other friends with the idea to collectively complete Armin's book project. We considered the main body of text finished, only in need of proofreading. He had planned an addendum with case studies of wireless networks in several countries, of which he only published Ignacio Nieto's report about two cases from Chile and his own open letter to Fidel and Raul Castro after a visit to Cuba. Our idea to invite people from networks around the world to contribute additional case studies turned out to be too ambitious. The book project went through ups and downs until it was defibrillated back to life at the PicoPeering Meeting 2024 in Berlin.[3]

Adam Burns and Volker Grassmuck took on the editing role and were supported by many of the people who this book is about, including Elektra Aichele, Panayotis Antoniadis, Gregers Baur-Petersen, Andreas Bräu, Sebastian Büttrich, Teresa Dillon, André Gaul, Aaron Kaplan, Geert Lovink, Monic Meisel, Mauricio Román Miranda, Jürgen Neumann, Ignacio Nieto Larrain, Julian Priest, Enrique Rivera, Tim Schütz, Felix Stalder, Thomas Thaler, Ulf Treger, Sven (C-ven) Wagner and Simon Worthington. His partner Ina Zwerger, as heir to the copyright of Armin's original work, kindly agreed to and supported this publication project from the start.

At the Institute of Network Cultures, who agreed to publish this work, the editors are thankful to Geert Lovink, Sepp Eckenhaussen, Ruben Stoffelen, Tommaso Campagna, and Katja Stiphout.

The phrase *Network Commons* was conceived right after Armin's previous book had been published in long conversations with his London neighbor and colleague Adam Burns together with Consume cofounder Julian Priest. It continued to evolve in Armin's thinking. He wanted to have an English-language companion and update to his 2004 book. In his own words:

> *The Rise of the Network Commons* is the working title of a new book which I am currently writing. It returns to the topos of the wireless commons on which I worked

1 Armin Medosch, *Freie Netze. Geschichte, Politik und Kultur offener WLAN-Netze*, Heise Verlag, Hannover 2004, https://ftp.heise.de/tp/buch_11.pdf.

2 Archived at https://webarchiv.servus.at/thenextlayer.org/.

3 PicoPeering 2024 held above c-base in Berlin on 17 and 18 May 2024. See sig0namectl at Picopeering 2024 Unconference, 18 May 2024, https://sig0namectl.networkcommons.org/posts/20240518-picopeering-2024-presentation/.

during the early 2000s. In this new version, combining original research from my German book *Freie Netze* (2004) and new research conducted in the context of the EU funded project Confine (2012-2015)[4], the exciting world of wireless community network projects such as Guifi.net and Freifunk, Berlin, gets interspersed with philosophical reflections on the relationship between technology, art, politics, and history.[5]

Fig. 0. BerLon Meeting, Berlin, 2002. Armin Medosch is in first row at the right in jeans and red shirt.[6]

The model of wireless community networks at the heart of this book, Consume.net, was conceived in London during the last days of the 20th century. Armin emphasizes that the two founding protagonists driving Consume were no techies but artists, web designers, internet pioneers and most importantly, endowed social networkers. The Consume model attracted a wide range of people with different backgrounds and skills, including: hacker-programmers,

4 *Confine Project* (2012-2015), archived October 2015, https://web.archive.org/web/20151003180403/https://www.confine-project.eu/. See also its successor Horizon 2020 project, *netCommons* (2016-2018, https://netcommons.eu/), a key output of which was the book Melanie Dulong de Rosnay, Félix Tréguer, Panayotis Antoniadis, Ileana Apostol, Virginie Aubrée, et al. (Dir.). *Telecommunications Reclaimed: A Hands-On Guide to Networking Communities*. ISOC, 2019, https://shs.hal.science/halshs-02414439/file/telecommunications-reclaimed-webversion-page-1.pdf.

5 Armin Medosch, The Rise of the Network Commons, Chapter 1 (draft), *The Next Layer blog*, 8 August 2014, https://webarchiv.servus.at/thenextlayer.org/node/1231.html.

6 Others include: Julian Priest (back row 2nd left), Juergen Neumann (back row 3rd left), Thomas Krag (back row 3rd right), Saul Albert (3rd row left, sitting) Adam Burns (3rd row 2nd from left), Gio D'Angelo (3rd row 3rd left), Alexei Blinov (3rd row 5th left), Simon Worthington (front row 2nd from left), Shu Lea Cheang (3rd row center, with laptop).

artist-engineers, operating systems developers, networking wizards, social entrepreneurs, technology activists, as well as artists and curators like Armin, whom you will meet on the following pages.

In the following years, Consume participants teamed up with other international groups to experiment with and share cutting-edge mesh networking technology. As each network node joins the mesh network, it senses its own network environment and interconnects to grow the local network in an organic way. Participants can share local resources with each other and communicate directly without leaving their own community infrastructure, only using the wider commercial internet when communicating with the outside world. A sense of network freedom spread fast. First we take the neighborhood, then we take the world. Armin sees the spirit as catching on:

> Our mesh network dispositif does not (yet) add up to all society, but it is something that is widely shared among techies building wireless community networks. It is a discursive behavior, but also a set of beliefs and a set of material assemblages. [...] Decentralization was at the core of the idea, politically as well as technologically.[7]

Geographically, the self-provisioning Consume spirit caught on throughout the UK and Europe. The internationalization of the Network Commons manifested itself in the BerLon meeting in Berlin in 2002. Figure 0 shows the British, German, Danish, Austrian members of that historic unconference where the German Freifunk was founded. 'The exciting world of wireless community nework projects' spreads from the urban to the rural, from the global north to global south. It spreads as an educational, emancipatory movement: by learning and exchanging knowledge and skills with our neighbors.

> Building and maintaining telecommunication networks is seen as a technical task but affects fundamental human rights and social issues. Thus, everybody should have at least some idea about how it works, as one otherwise cannot meaningfully participate in Network Society.

This is the twofold thesis that Armin develops in this book: Involving ordinary people in building a network commons has a profound emancipatory effects on them. At the same time, doing so contributes to the democratization of technology: it is not developed behind closed walls into a product to be consumed. By having community networkers participate in shaping future technologies, those technologies become less elitist and less controlled by narrow commercial or security interest:

> The original peer-to-peer spirit of the Net gets enhanced and made fit for the future in a network commons that is there to protect our democratic freedoms and rights.

7 This and the following quotes are from the present book.

Today at the beginning of Trump's second reign over the USA, the need for resilient socio-technical systems for defending democratic rights and freedoms is more evident than ever. As a history of community infrastructure, *The Rise of the Network Commons* is therefore a highly topical narrative for strengthening the resilience of our *last mile* digital infrastructures and re-enforcing regional digital self-sovereignty through direct community participation and knowledge sharing.

And indeed, we find that the spirit in Armin's text resonates in many areas today – the spirit of peer-to-peer, of decentral and federated networks – both technologically and politically. We see it in the rise of the Fediverse, whose applications such as Mastodon and Peertube offer alternatives to globally centralized social media giants, and in projects for federated European cloud and media infrastructures.

It is our hope that this posthumous publication will inform and inspire successive generations of activists to continue to build a more decentralized, networked, human-centric, and commons-oriented world.

Adam Burns & Volker Grassmuck, Berlin, March 2025

Armin Medosch (1962 – 2017) was an Austrian media artist, journalist, curator, theorist, critic, and a pioneer of internet culture in Europe.[8] As art activist, he co-initiated the transformation of the ship MS Stubnitz,[9] a former GDR deep-sea fishing vessel, into a floating art space. He is well recognized as a journalist and as the co-editor of Telepolis.[10] As an academic he earned a Master of Arts in Interactive Digital Media at the University of Sussex and a PhD at Goldsmiths, University of London and continued to his last days to publish[11], teach and research.[12] See also the obituaries collected by Monoskop.[13]

Adam Burns (1966) is a technologist & Australian internet pioneer. He was the technical manager for Australia's first national ISP assisting activists to communicate across south east Asia and Pacific Islands. He founded the first open community wireless network in Europe. He designed the software behind the Pocket FM broadcast system deployed in crisis areas & IDP camps in the Middle East and Africa. Published, interviewed, filmed and quoted in numerous publications and documentaries (including Steal This Film 2[14]), he advocates for open source, as well as equitable digital access and participation.

Volker Grassmuck (1961) is a media sociologist, free-lance author, and activist, has studied and conducted research on Free Software, copyright law and practice, Public Service Media, and the knowledge commons at Free University Berlin, Tokyo University, Humboldt University Berlin, University of São Paulo and Leuphana University of Lüneburg. Most recently he was Senior Researcher in the H2020 project European Media Platforms (EuMePlat) at the Leibniz Institute for Media Research | Hans Bredow Institute Hamburg (2021 to 2024). He was project lead of the conference series Wizards-of-OS.org and of the copyright information portal iRights.info, co-founded mikro-berlin.org, privatkopie.net and CompartilhamentoLegal.org, is member of Digitale Gesellschaft e.V., c-base.org and C3S.cc. He blogs at vgrass.de.

8 Monoskop, Armin Medosch (1962-2017), 28 February 2017, https://monoskop.org/images/c/c3/Armin_Medosch_1962-2017.pdf.

9 Started in 1992, the original project went bankrupt in 1994, yet the ship lives on as art space: https://www.stubnitz.com/.

10 The original one, co-founded in 1996 by Armin Medosch und Florian Rötzer as first online-only magazine of the Heise Group, which after Rötzer's retirement at the end of 2020, is now headed by Harald Neuber, who at the end of 2024 decided to take all pre-2021 articles offline, i.e. large parts of the early digital cultural heritage (Ludger van der Heyden, "Qualitätsoffensive." Der Heise Scheiß. Zensur des Archivs, KI-Journalismus und Mainstream: Kritiker beklagen Geschichtsfälschung bei Onlinemagazin Telepolis, Junge Welt, 13 December 2024, https://www.jungewelt.de/artikel/489833.qualit%C3%A4tsoffensive-der-heise-schei%C3%9F.html).

11 E.g. *New Tendencies: Art at the Threshold of the Information Revolution (1961–1978)*, MIT University Press, 2016.

12 At Ravensbourne College in London, at Goldsmiths, and at Singidunum University in Belgrade.

13 Monoskop, Armin Medosch (1962-2017), 28 February 2017, https://monoskop.org/images/c/c3/Armin_Medosch_1962-2017.pdf.

14 The League of Noble Peers, Steal This Film 2, 2007, https://archive.org/details/StealThisFilmII.

1. THE RISE OF THE NETWORK COMMONS

The Rise of the Network Commons returns to the topos of the wireless commons on which I worked during the early 2000s. In this new version, combining original research from my German book *Freie Netze*[1] (2004) and new research conducted in the context of the EU funded project *Confine*[2] (2012-2015), the exciting world of wireless community network projects such as Guifi.net and Freifunk, Berlin, gets interspersed with philosophical reflections on the relationship between technology, art, politics, and history.

Fig. 1. Antenna installation at Haus des Lehrers, 2003. Image courtesy Freifunk.

1 Armin Medosch, Freie Netze. Geschichte, Politik und Kultur offener WLAN-Netze, Heise Verlag, Hannover 2004, https://ftp.heise.de/tp/buch_11.pdf.

2 Confine Project (2012-2015), archived October 2015, https://web.archive.org/web/20151003180403/https://www.confine-project.eu/.

1.1 The World of Guifi.net and the Dispositif of Network Freedom

Fig. 2. Guifi antenna.

On my recent visit to Barcelona in the context of the Confine project, Guifi.net founder Ramon Roca took me to Gurb, the village he comes from. There, in 2003 Guifi.net was started when Ramon realized that he would never get good bandwidth at a fair price in this remote area in sight of the foothills of the Pyrenees. Ramon, who is an IT professional but keeps his working life and activities with Guifi.net separated, found that he could get broadband by using WLAN to connect to a public building in the outskirts of a nearby small town, Vic. Since then, Guifi.net has grown to become the largest WLAN community network in Europe, with currently more than 25,000 nodes. It is not entirely correct anymore to call it a wireless community network since a growing number of nodes are created by fibre-optic cable. Since Ramon and his cooperators have found out how relatively easy it is to work with fibre, he is on a new mission to get fibre to the curb to as many houses as possible.

Visiting Gurb and talking to Ramon for nearly a full day has revitalized my fascination for wireless (and wired) community networks. I have written a book on wireless community networks in 2003, in German, under the title *Freie Netze* (Free Networks).[3] The choice of title back then had deliberately emphasized the analogy between Free Networks and Free Software. The title had been inspired by two very different influences. On one hand there had been Volker

3 Armin Medosch, Freie Netze. Geschichte, Politik und Kultur offener WLAN-Netze, Heise Verlag, Hannover 2004, https://ftp.heise.de/tp/buch_11.pdf.

Grassmuck's early book Freie Software.[4] Volker's magisterial work provided deep insight into the history and politics of Free Software and stood out for me as an example how a book on wireless community networks should be written. The other inspiration had been provided by a sweeping lecture in Vienna in June 2003 by Eben Moglen, lawyer of the Free Software foundation and legal brain behind the licensing model of Free Software, the GNU General Public License (GPL[5]). Moglen's thunderous and captivating speech had presented the combination of Free Software, Free Hardware and Free Networks like a kind of holy trinity of the everything-free-and-open movement. Moglen's conclusion was that while Free Software was already an accomplished fact and free hardware was the hardest bit, free networks were a viable possibility, yet there was still a long way to go to attain critical mass.

My book had come maybe a few years too early. When it appeared, some of the most important wireless community networks of today, such as Freifunk, Berlin, Funkfeuer, Austria, or Guif.net, were either non existent or existed in embryonic form only. The model of wireless community networks on which my book had been based had been created by Consume.net in the UK. Consume.net was the outcome of an improvised workshop in December 1999 in Clink Street, near London's creative net art hub Backspace. I will describe the history of Consume in more detail below, but one key aspect of that initiative was that it was launched by non-techies. James Stevens, founder of Backspace, and Julian Priest, artist-designer-entrepreneur, provided the impetus for DIY wireless networking by sketching plans for a *Model 1* of WLAN-based community networking on a napkin during a tempestuous train journey in late summer 1999. Their *Model 1* – a name chosen for its association with Henry Ford's first mass-produced car, the Ford Model 1 or Tin Lizzy – was a techno-social network utopia.

The relatively young discipline of science studies teaches us that the technical and the social cannot or should not be considered as categorically separated. 'Technologies are socially produced' is one of the key phrases in the discourse of science studies. They do not exist outside the human world but are the product of specific societies which exist under specific conditions and circumstances. Technologies are hybrids between nature and society, as science studies author Bruno Latour puts it. Moreover, a specific school of science studies, the Social Construction of Technological Systems (SCTS) has studied the co-evolution of large technological systems and social structures. SCTS pioneer Thomas P. Hughes, who studied the building of the first nationwide electrical grid, has found that there are strong co-dependencies between technological and social systems. While there is undeniably a strong influence on the shaping of technologies exerted by business interests, Hughes' work emphasizes co-dependencies between technologies and the people who build and maintain them, the technologists or techies – a term I will use from now on because it allows to refer to both academic computer scientists and researchers and autodidactic hackers, whereby I hope my use of the term is not seen as derisive in any way.

4 Volker Grassmuck, Freie Software. Zwischen Privat- und Gemeineigentum, Bundeszentrale für politische Bildung, 2. Auflage 2004, https://freie-software.bpb.de/Grassmuck.pdf.

5 GNU General Public License (GPL), https://www.gnu.org/licenses/licenses.html.

Engineers and skilled workers involved in large technological projects bring certain predispositions to projects. As projects evolve, the communities of techies develop certain habits and ways of working. The technological and social system build a unity which determines the ways how those technologies evolve in the future. What we can learn from science studies is that neither is science objective (in the strict sense of the word), nor is technology neutral. To believe the opposite would either constitute scientific objectivism – a rather outdated form of scientific positivism – or technological determinism, which is the belief that technology alone is the main factor shaping social developments.

James Stevens and Julian Priest, founders of Consume, are neither scientific positivists nor technological determinists. They conceived Model 1 as a techno-social system from the very start. Their ideas combined aspects of social and technological self-organization. In techspeak, the network they aimed at instigating was supposed to become a Wide Area Network (WAN). But while such large infrastructural projects are usually either built by the state or by large corporations, James and Julian thought that this could be achieved by bottom-up forms of organic growth.

Individual 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. The properties of the technology – well, strictly speaking, there is no such thing as property of technology, as I just explained, but lets reduce complexity for a moment – impose certain restrictions. WLAN (Wireless Local Area Networking), later called Wi-Fi by the trademark of the Wi-Fi Alliance, operates in a part of the electromagnetic spectrum that does not pass through obstacles such as walls. Therefore, from one node to the next there needs to be an uninterrupted line-of-sight. Node-owners need a way of identifying each other in order to create a link. According to the properties of internetworking protocols each of those links is a two-way connection, which means that data can travel as easily in one direction as in the other. Furthermore, node owners would agree to allow data to pass through their nodes. There would not only be point-to-point connections from one node to the other, but larger networks, where data can be sent and received via several nodes. Such a wide area community network would also have gateways to the internet in order to allow exchange of information between the local wireless community network and the wider networked world.

Those desired characteristics of Model 1 were not actually invented by Julian and James. Those properties already existed, deep inside the technologies we use to connect, but working for most parts unnoticed by those who use them. The key term has already been introduced above, without further explanation, it is the *protocols* that govern the flow of information in networked communication structures. Protocols are conventions worked out between techies to decide how the flow of data in communication networks should best be organized. The basic protocols on which the Net is running, such as the Internet Protocol (IP) and the Transport Control Protocol (TCP) have been defined decades ago by engineers and computer scientists working on the precursors of the Net, Arpanet and NSF-net. Some people would go as far as saying that the internet is neither the actual physical structure of cables and satellites used to connect, nor the content that travels via such structures but it is embodied in the suite of

protocols, commonly referred to as TCP/IP (those two are usually mentioned but there are many more). The protocols are the essence of the Net because they give it its key characteristics. I am not sure if this is not a very refined form of technological determinism, but I would like to leave this question open for a moment.

The reason for this hesitation is that the protocols are not identical with the technology that uses them. The protocols are conventions that can be described in textual form. The way how this is done is through so called Requests for Comments (RFCs). Since the dawn of the Net, RFCs have been defined in a way that runs counter to common understandings of how technologies are created. RFCs are approved by techies who congregate under the umbrella of the Internet Engineering Task Force (IETF). The arcane decision making mechanisms of the IETF have since the very start been governed by maxims such as 'rough consensus and running code'. People who develop new internet technologies present them to their peers who then react by making noises such as humming or whistling. Criteria for approval are not theoretical consistency but whether they actually do something or not. The robustness and the freedom of the Net is guaranteed, despite the lack of central coordination, by the self-organized decision making power of those techies who meet at the IETF. While a lot of those people may have jobs with large corporations, when they meet at IETF conferences they still decide as technicians who adhere to their own codes of human responsibility.

It is amazing because, despite the commercialization of the Net, this has not fundamentally changed. Corporations and governments may seek to wrest more and more control over the net, and while they are actually quite successful in doing so in some areas, the social protocols of decision making enshrined in the mores of the techno-social communities have so far been able to withstand all such assaults. On the layer of the protocols the Net was and is still *free*.

Thus, when James and Julian wrote out the formula of growth for Model 1, they referred to a freedom to connect that is inherent to the way in which the internet was originally conceived and still functions now, on the layer of the protocols. The knowledge and awareness of that fact had become buried by new layers built on top of older layers in the course of technological improvement but also the commercialization of the Net in the 1990s. Consume.net was started at the cusp of what was then called the New Economy, a stock exchange boom fueled by the rise of information and communication technologies in general and PCs and the internet in particular. The 1990s had been a very exciting decade which saw the rise from obscurity of the Net from a communication technology used by scientists and a small number of civil society organizations, artists and freaks in the late 1980s, early 1990s, to a widely used medium driving and being driven by a gigantic economic machinery. In the process, a lot of the properties that had been dear to the early inhabitants of the Net, the digital natives, had become either sidelined or overshadowed by commercially driven interest and the secret workings of the deep state.

Model 1 was thus both a new techno-social invention but also a recurse to the original Internet Arcadia. Against the tide of rising commercialization and the inequalities and distortions that came with it, wireless community networks were supposed to bring back a golden age of networked communication, of equality and freedom. Technical and social properties were

conflated into a model of self-organization. The possibility for that was provided by a small and often overlooked feature of the technology. 802.11b was the technical name of the wireless network protocol as used at about 1999. It allowed two different operating modes, one where each wireless network node knew its neighbors and could receive and send data based on fixed routing tables, and another one, the ad-hoc mode, where nodes would spontaneously connect with each other. The ad-hoc mode was supported by routing protocols that are best suited for the wireless medium. In a fixed network with cables, it is of advantage to work with fixed routing protocols. When data arrives, the network node decides where to send it, based on its knowledge of the topology of the network. But in wireless networks that topology constantly changes. Nodes can break down due to atmospheric or environmental influences. The quality of connection can change dramatically because of disturbances in the electromagnetic medium. Or a truck parks in front of your house and the line-of-sight is suddenly gone.

For this reason, Consume.net started to get interested in a technology called mesh networking. In the year 2000 mesh network protocols were still very much in their infancy. There was a working group called Mobile Ad-hoc Networking (Manet), supported by the US military. In Germany, a small company was building something called MeshCube.[6] It was a working technology but it was not really open source and only the developer knew how to run it. When Consume.net started to work with mesh network technology, this seemed to be a utopian technology. While neither James nor Julian were techies, they had the support of some very skilled hackers, but neither of them was capable of significantly developing mesh network protocols. Mesh networking was a dream, something that was already on the horizon but not yet there.

This was a pattern established in 2000 and still very much in place in the year 2014: when the problems of mesh networking would be solved, wireless community networks would flourish and become unstoppable. Social qualities, such as self-organization without centralized forms of control, were mapped onto technological properties, such as the ability of machines to automatically recognize each other and connect to build a larger cloud of networked nodes. The idea of network freedom – the ability to connect without having to apply to a central point of governance and without having to go through a company such as a telecommunications operator (telco) – was supposed to further communication freedom and thus the rights and ability of people to express themselves and communicate freely without top-down hierarchical control. The convergence of those ideas I call the dispositif of mesh networks and network freedom.

I am appropriating the term *dispositif* from Michel Foucault who used it to 'refer to the various institutional, physical, as well as administrative mechanisms and knowledge structures which enhance and maintain the exercise of power within the social body.'[7]

6 OpenWrt: 4G Systems MTX-1 MeshCube / AccessCube, https://openwrt.org/toh/4g.systems/access.cube.

7 Wikipedia: http://en.wikipedia.org/wiki/Dispositif. The same Wikipedia page further defines the dispositif as 'the interaction of discursive behavior (i. e. speech and thoughts based upon a shared knowledge pool), non-discursive behavior (i. e. acts based upon knowledge), and manifestations of knowledge by means of acts or behaviors [...]. Dispositifs can thus be imagined as a kind of Gesamtkunstwerk, the complexly interwoven and integrated dispositifs add up in their entirety to a dispositif of all society.'

Our mesh network dispositif does not (yet) add up to all society, but it is something that is widely shared among techies building wireless community networks. It is a discursive behavior, but also a set of beliefs and a set of material assemblages. *Assemblage* is another term that I appropriate freely from a French philosopher, Gilles Deleuze. While the dispositif does not exist outside time, it is somehow hovering above the concrete historical moment. In this way, the dispositif of mesh networks has influenced wireless community networks since the year 2000. The assemblage, while also consisting of material and non-material components, is concretely manifest in the historical moment. The mesh network dispositif promises to bring about an era of unrestricted and seamless communication, free from technological and social constraints. This dispositif historically legitimates itself by the way the internet was originally conceived. At the same time it contains the promise of a future when the Net will be again what it once had been.

When I came to Barcelona in July 2014, I was thrilled to see that as part of the EU funded research project Confine a project was under way to develop the Quick Mesh Project (QMP). QMP is a so called free firmware, a GNU/Linux based operating system for network devices. Many people now have wireless routers at home. When you buy internet access from a provider, you often also get a box that allows to wirelessly connect to the Net. QMP would replace the operating system of such a device with a much improved version, one that speaks the language of mesh network protocols. To give a simple example, if in a street of apartment blocks everybody who owns a wireless router replaces the firmware with QMP and puts the router on the window sill, all those machines would automatically connect and build a network without using any cables or other hardware from commercial providers. It would make it easy and simple to connect without having to go deep into system settings. This has now changed from being a faraway utopian goal to something that is literally around the corner.

It may or may not succeed. One problem with that is that it resembles what Saskia Sassen described as an engineer's utopia. Techies, whether they are academically trained computer scientists, telecommunications engineers or self-taught hackers, tend to believe in the unlimited potential of technology. They see the potential of a technology. There is nothing that speaks against it, on the contrary. It needs such people who are capable of dreaming a different future based on creative bending and twisting of technologies. The problem, however, is that far-sighted techies tend towards a linear extrapolation of technologies into the future without considering other factors, such as politics, the economy, the fundamental differences between people in class-based societies and so on and so forth. In this way, the highly productive mesh network dispositif gets turned into the dreamworld of the internet cornucopia. The technology gets imbued with characteristics that are actually outside of it and depend on factors beyond the influence of creative technologists. It becomes a messianic technology in the way the great philosopher of culture and technology Walter Benjamin theorized it in the 1930s.

(quoted from Siegfried Jäger: Theoretische und methodische Aspekte einer Kritischen Diskurs- und Dispositivanalyse http://www.diss-duisburg.de/Internetbibliothek/Artikel/Aspekte_einer_Kritischen_Diskursanalyse.htm).

1.2 Dawn of an Idea

Fig. 3. James Stevens with projection of network topologies.

Good ideas often pop up at the same time at various points on the Earth, they just seem to be in the air. And so it came that around the year 2000 at different points on the globe wireless free community networks were started: Consume.net in London, New York Wireless, Seattle Wireless, and Personal Telco, in Portland Oregon, were among the first wireless community networks based on Wireless LAN, or WLAN. Nobody really can say which one came first. I have been lucky to experience the development of Consume and free2air.org in London from a close encounter. Therefore, in this chapter I will tell the story of those networks.

But before I go into the details of this story, it is worth remembering a bit how things were back then. Today, when the debate shifts to a topic such as so called digital natives, many young people seem incapable of comprehending that there are middle-aged people like me who have spent a large part of their adult life on-line. I had my first computer in 1985, whereby I should say *we*, because it was a shared computer between my then girlfriend and myself. In 1989 it was followed by two new computers. She got an Amiga 2000, and I got a pre-Windows PC. So I spent a good time learning key commands for the DOS version of Word, while my partner could do wonderful graphical stuff on her Amiga. We could even digitize video, change every single image and turn it into a loop that could be played out and recorded to tape. While I was envious of the slick graphical interface of the Amiga, my PC soon learned a new skill, communication with other computers. That was when the whole on-line fun started.

Actually, we had to overcome a few obstacles first. In Europe, computer modems at the time – around the late 1980s to the early 1990s – had to be licensed by the national postal, telegraph and telephone service (PTT). This made the stuff prohibitively expensive for many. But we found a workaround. We traveled to West-Berlin and there, in a store called A-Z Electronics, we could buy a 2400 baud modem on the cheap. This modem could be legally sold because it had one cable missing – a loophole in German law according to which it was legal to sell unlicensed equipment if it was not in a state to be used. After we smuggled it back to Vienna, we soldered in the cable and connected the modem to the phone line. Franz Xaver, a friend and artist-engineer, had to help to solve issues with the arcane Austrian telephone system. Another friend brought a pack of diskettes and we installed Telix, a programme for communicating with bulletin board systems (BBS).

The BBS world was like a testing ground for virtual communities where certain types of behavior could form. This could be elements of a netiquette, but also an understanding of what it means to be on-line in the first place. Stories about early on-line communities by authors such as Sandy Stone[8] and Howard Rheingold[9] describe how these communities, some of which go back to the early 1970s, foster social (or anti-social ;-) behaviour.

First artistic experiments with *Art and Telecommunication*[10] began in the late 1970s. The Canadian artist Robert Adrian X, who by then was living in Vienna, started an artist's conference board called Artex on a proprietary network in 1980. Fellow artist Roy Ascott described in vivid terms how it felt to be on-line and engage in real-time synchronous communication.

> Over the past three years I have been interacting through my terminal with artists in Australia, Europe, and North America, once or twice a week through I.P. Sharp's ARTBOX. I have not come down from that high yet and frankly I don't expect to. Logging in to the network, sharing the exchange of ideas, propositions, visions and sheer gossip is exhilarating. In fact it becomes totally compelling and addictive.[11]

Similar feelings have been shared by almost everyone who experienced an always-on network connection. But let us return to the BBS world, which could be quite wild at times. Artists-hackers such as Toek from radio art and performance group DFM circumvented the fact that those systems did not really have graphical interfaces by creating a log-on page with flashing and blinking ASCII animations. Communications in those systems were uncensored – apart from the curiosity of the maintainer of the system – and sometimes one could encounter, without looking for it, cracked software or literature such as the *Hackerfibel* by the Chaos Computer Club, or the Anarchist Hackers Cookbook, or The Temporary Autonomous Zone by Hakim Bey; one could also find software for war-dialing and similar things bordering on what was legally permissible. This BBS content led to promote the myth that the internet

8 Allucquère Rosanne Stone, The War of Desire and Technology at the Close of the Mechanical Age. MIT Press, 1996.
9 Howard Rheingold, The Virtual Community: Homesteading on the Electronic Frontier. MIT Press, 1993.
10 Heidi Grundmann, Art + Telecommunication. Vancouver, B.C.: Western Front Publication, 1984.
11 Roy Ascot 1984, quoted in Grundmann 1984, p. 28.

itself is a haven for radical illegal content with dark corners of countless publicly available DIY bomb-building manuals.

This is a pretty persistent myth by the way, but has maybe more to do with the criminalization of hacking by the US secret services who seemed to be intent on demonizing an activity that many of those involved understood primarily as curiosity, research, interest, gaining new knowledge. When the internet was opened up for public usage, it seemed to get populated very quickly by all kinds of creative spirits. In 1995, when I had, through work, my first always on *broadband* internet, the web seemed to consist primarily of artists, anarchists, trade unionists, multinational and non governmental organizations, campaigners for the environment, workers' rights and indigenous groups, as well as the occasional commercial web page of a forward looking company and the standard setting physics department homepage which has been immortalized by artist Olia Lialina with this work *Some Universe*[12]. Olia Lialina has also collected *Under Construction* signs such as this one, another charming aspect of the early web:

Fig. 4. Animated GIF of computer user banging head on keyboard.

While the on-line world was colorful and intellectually stimulating, internet access was not that cheap at all at the time. We looked with envy at the US, where local calls were almost free. In Europe you had not only to pay the cost of a provider, but also the cost of the call for every minute you spent on-line. As the 1990s progressed, the modems got faster and maybe telephone provider rates a bit cheaper, but the situation remained fundamentally the same, except in those rare instances, where people came up with inventive solutions.

1.3 Cheap Broadband for the Masses: Vienna Backbone Service

In Vienna, Austria, the media artist Oskar Obereder started an internet service provider almost by accident. With some art school friends, Obereder had launched *A Thousand Master Works*, a project where artists produced multiples which were sold via a poster. Soon, the poster proved an inefficient method of keeping the offerings up to date. Obereder created a data base and together with some other artists, hackers, and the editors of music magazine Skug

12 Olia Lialina, *Some Universe*, http://art.teleportacia.org/exhibition/stellastar/.

brought the server on-line, as a web based ordering system. The same technology also supported Skug's data base of independent music. This machine had to be online 24/7, so Obereder and Skug had to get a leased line. In order to share the cost, they distributed internet access throughout the loft-spaces in a former furniture factory where lots of other artists and creative people worked. Everyone who connected to this cable-bound ad-hoc net got the buzz of an always-on internet and Obereder inadvertently became a provider.

Working together with a small ISP, AT.net, Obereder and colleagues found out about a technology that was coming from California, brand new, and allowed normal copper telephone lines to be used for broadband internet connections. This was called DSL, and when they first contacted the manufacturer they told them to get lost, because they only sold to telecom providers. Finally, the Austrians got hold of a few modems and started laying the groundwork for what would become Vienna Backbone Service (VBS). This network was offered by three small ISPs as a cooperative effort, but it was also *provided* by many of its first customers who were hosting network exchange services in their cupboards.

Because of the *creative milieu*[13] in which Obereder existed, he knew many artists and techies or combinations of those, who had high bandwidth needs and some technical skills. As he by now had founded a company, called Silverserver – later shortened to Sil – they had found out that there was a special type of telephone line that you could rent quite cheaply from the incumbent and over which you could run DSL. Moreover, the cost was dependent on the distance from the next exchange. Silverserver started finding friends, who were also customers, who lived next to an exchange. In this way, they found a foothold in many Viennese districts, from where they could spread out organically, offering always-on broadband, initially at a tenth of the price of the incumbent.

In 1998 the workshop and conference *Art Servers Unlimited* brought together about 40 artists, hackers, and activists of all kinds at London's Backspace and the ICA. Obereder was presenting the model of VBS and James Stevens caught an earful of it. What he mainly got out of it was that you could grow a rather large network in a decentralized way, by a cooperative method that involved people taking over responsibility for a node.

13 I have written more extensively about this in Medosch, Armin. *Kreative Milieus*. In *Vergessene Zukunft: Radikale Netzkulturen in Europa*, 1. Aufl., pp. 19–26. Bielefeld: Transcript, 2012.

1.4 Consume – the Culture of Free Networks

Fig. 5. Free Networking as social mechanism: Consume workshop with Manu Luksch, Ilze Black and Alexei Blinov, circa 2003. Photo: Chris Helgren.

James Stevens and Julian Priest found another inspiration for their *Model 1* (see chapter 1.1) through the way in which in a particular neighborhood and social environment WLAN was used to share a leased line internet connection. At the turn of the millennium, James Stevens and Julian Priest had 'worked for a decade almost in multimedia, making CD ROMs and websites, running around… then we decided to give it a try and concentrate on doing more altruistic work.'[14]

Both had their offices in a special corner of Southwark, the London borough just south of the Thames, in Clink Street, in a small warehouse, directly on the riverside, called Winchester Wharf. Today, oh irony, the ground floor is occupied by a Starbucks. Adjacent to it there were other warehouses, converted into offices and studios for various creative outfits, from record labels to web and multimedia companies. In Winchester Wharf, the web company Obsolete and the internet cafe Backspace enjoyed a few years of happy coexistence. Obsolete had become successful quickly by making web-pages for Ninja Tune and other record labels located in the same building. After record companies followed some blue chip companies such as Levi's who were intent on having a cool, young image. But James Stevens had already opted out at that time.

So he founded Backspace,[15] a place at the ground floor, with one window almost on water-level when the tide was high. Fittingly, the homepage of Backspace showed (and still does show) a graphical animation of the river Thames with the web-sites hosted by Backspace floating like

14 James Stevens, interview with the author, June 2003, private notes.
15 Backspace, http://bak.spc.org/.

half submerged buoys in the river. Descriptions of Backspace as an internet cafe or gallery just show the ineptitude of common language to describe what it was. It was a hub where people with all kinds of ideas – whether they were related to the internet or not – came together to talk, organize, share. Backspace was a crucible of London's net art and digerati, where events such as the legendary *Anti with E*[16] conferences and lectures took place. Backspace also became quickly known for its regular live-streaming sessions, at first mainly radio, later also videos, with Captain Gio D'Angelo often in command.[17]

That was only made possible, because Backspace shared a leased line with Obsolete, who were just upstairs. The other small outfits in the area, on the same street but not in the same building, also wanted a share in the bandwidth bonanza. At first some sort of grey-area solution was considered, like finding a way of connecting buildings via Ethernet, but that turned out to be impossible, unless one dug up the street, legally, as a provider company or one broke the law. At some point, someone must have stumbled over Wi-Fi or AirPort, as the version promoted by Apple was called. A lot of people in Clink Street were designers and thus Apple users. Apple at the time was the first major consumer computer company which supported Wi-Fi through their so-called *Airport* access point together with early integration of Wi-Fi interfaces into their consumer computer products.[18]

The creative cluster of artists, designers, musicians, and entrepreneurs experienced the benefits of broadband and also the laws of network distribution. As Stevens and Priest noted, the maximum bandwidth available is only relevant at peak times, when everybody was on-line, checking into the system, or after work, when people played games or watched videos. Otherwise, the 512K connection, which today would not be considered broadband anymore, was giving everyone enough space to live, listen to music, build web-pages or even play on-line games. But the bandwidth paradise on the Southern shore of the Thames was not to last.

Winchester Wharf was sold as part of a general regeneration drive of the Southern river bank, at a time when Tate Modern was opened and the whole area underwent a wider transformation. 'Between us, we both had an axe to grind when Backspace was closed, we sat together and talked about it and thought it was a good moment to put into practice some of the ideas that we have hatched and some of the things that we have experimented with', remembered James in 2003. In late 1999, they organized a first workshop to start building Consume, in the offices of I/O/D, one of a web of companies and art groups in the area. For James Stevens, it was from the beginning a *social thing*. 'The idea that came out was much more straight forward than it looks now, but it was interlinking locations where people work and live using this wireless stuff. We did it already across the street, so that sort of scale where we had a grasp.' (James Stevens, interview with the author, 2003).

16 *Anti with E* conferences and lectures, http://www.irational.org/cybercafe/backspace/.

17 See article by Josephine Berry, Captain's Mate D'Angelo In Interview with intergalactic hack Josephine Berry aboard Starship Backspace, 07 August1998, archived July 2003, https://web.archive.org/web/20030704110709/http://www.medialounge.net/lounge/workspace/crashhtml/cc/23.htm.

18 See History of Wi-Fi: Wolter Lemstra, Vic Hayes and John Groenewegen, The Innovation Journey of Wi-Fi: The Road to Global Success. Cambridge University Press, 2010.

Fig. 6. Consume workshop at the studio of AmbientTV.NET, London, circa 2003. Photo: Chris Helgren.

I received an invitation to this workshop and remember that I was electrified (although it turned out that I could not participate in that first meeting). I knew that James Stevens was on to something. As he later put it in his own words, 'it was on the cusp of a wave of awareness that was sweeping around, also economically we were in a funny state, in a kind of decline of the swell after all of that gluttony of that Dotcom shit.' Within the space of a few years the Net had been completely transformed from a colorful space dominated by various leftist and creative types to a place apparently ruled and defined by multinational corporations.

The early WWW had generated a lot of enthusiasm about free speech and possibilities of political self-organization. It was seen as an electronic Agora, a place where democracy could be reinvented through participatory processes, electronically mediated. Yet in the eyes of the media, all attention was devoted to internet startups such as Netscape and Amazon who made billions with their IPOs. Ideas about freedom of speech and creative expression, held dear at places such as Backspace, were completely omitted in public discourse. But in late 1999 the stock market boom had started to flounder and in April 2000 the Nasdaq collapsed. Suddenly, the pendulum swung back and ideas about freedom of speech and political self-organization came back. The call for the first Consume workshop was met with *a phenomenal response* according to Stevens. The question they asked themselves was: the technology had shown to work in a relatively confined area. Could it be made to work over a mile or two? Could different areas be connected into a Wide Area Community Network? Stevens:

> There was a momentum there, in that way, because it grasped people's attention and got them to come out, literally, just physically to turn up, gather at a meeting, and really, the second meeting that we had, we built nodes. It was really just like as direct as that: physically turn up and do it; those who could handle the Unix side of it, which is not everybody, obviously.[19]

19 James Stevens, interview with the author, June 2003, private notes.

A subsequent workshop was held sometime in the first half of 2000. What they were out to do, 'was to provide ownership of network segments to self-provide those services and in addition to that do all sorts of node-to-node kind of benefits', explained Stevens. But the dynamic IP packet routing required (or meshing) was soon confirmed as a core issue remaining to be solved. The nodes deployed in such a network had to mesh, and this had to be automatic.

This was a grave problem in 2000, since the internet by then had been thoroughly commodified and chunks of it handed over to companies, who could define it as their *country* or Autonomous System, controlling the entry points of their network. This is called Border Gateway Routing Protocol and on such a technical level there is nothing to be said against it. However, it introduces a more distributed hierarchical structure, which helped accommodate rapid connectivity growth of internet networks. A downside of this growth appeared soon after with increasing scarcity for assignment of remaining globally routable IP network numbers. Due to the cascaded nature of networks, with many layers, users in internal networks are often linked via a protocol called NAT (Network Address Translation). That means, that the router controls the global connection to the world, while any node behind it is visible to the world through this gateway alone. In other words, there is no publicly visible route to one's machine. If a lot of people who share their network connectivity via wireless have such a provider, the routing in the network becomes a problem. There are workarounds for that problem, but this is just one aspect of a protracted sequence of issues regarding wireless routing.[20]

At that point, in the year 2000, mesh networking technology was really in its infancy. Through the launch of Consume, a lot of gifted people started to get interested in mesh networking and similar ideas. It is fair to say that community networks took mesh technology out of the military closet and turned it into a working technology (a story which continues today with great intensity and to which I will return later in this book).

The way Consume grew, initially, owed much more to the special *genius* of James Stevens than to any technology. *Genius*, a term usually reserved for artists or sometimes also scientists, in this context refers to a social skill. James Stevens has a special way of *growing* projects, of initiating them, bringing them into existence but then letting them go their own way. Rather than becoming the leader and figurehead, he tries to initiate a self-perpetuating idea. Maybe this has also something to do with his past in the underground music and squatter scene in the 1980s. Politically, those social scenes were, if not explicitly anarchist, connected with a deep-seated social and artistic liberalism that I found to be much more entrenched in England than in any other country of which I know.

For Stevens and Priest it was a long term goal to 'find an opportunity, within the legislation of radio spectrum, to use these domestic computer devices to interlink in a way that it was deemed possible to bypass the local loop', argued Stevens. For him, what became a priority was advocacy, 'promotion of systems that create a mesh over the topography. [. . .] You just

20 Corinna *Elektra* Aichele, a free networker from Berlin, has summed up those problems and possible solutions much better than I ever could in her book *Mesh – Drahtlose Ad-hoc Netze*, Open Source Verlag, 2007, https://download-master.berlin.freifunk.net/ebooks/mesh_kapitel4_leseprobe.pdf.

have to propagate the idea or possibility or potential across the landscape.' And that is what happened in the years 2000 to 2002. While Julian Priest had to take a step back for a little while for private reasons and because of moving to Denmark, James Stevens and a small but fast growing group of volunteers was building Consume, a self-propagating net. A Consume mailing list and a website were launched. But the main mechanism for propagating the idea were workshops. There were a number of workshops in spring and summer of 2002, one at the studio of Manu Luksch and Ilze Black, another one at Limehouse Town Hall, which I remember vividly.

The workshops offered something for everyone. First and foremost, they gave people in a particular area the opportunity to meet and discuss the possibilities of creating a local wireless community network. This involved the social side of getting to know other people in the area. This may not sound like much, but in London talking to neighbors is seen as something quite radical. The only apparently banal thing of *talking to neighbors* went together with exploring the city-scape for suitable locations for antennas and repeaters.

Those who were inclined to do so were building antennas, an activity that showed to be quite attractive for a diverse range of people. It is also something that turns the rather abstract idea of the network into something that can be literally grasped. Antenna building also involves learning about basic physics and the electromagnetic spectrum, which is something very useful in a world pervaded by electronic devices.

Other workshop participants turned to the software side of things. At the time, old computers were used as wireless routers. They were taken apart, reassembled, equipped with network cards, turned into GNU/Linux machines and then configured by usage of some bespoke experimental routing software. The issues that posed themselves with regard to routing and networking were publicly and hotly debated which, in my case, triggered a steep learning curve. This was a time when I started to gain knowledge of IP numbers, address spaces, NATing, and port forwarding, and, last not least, routing protocols.

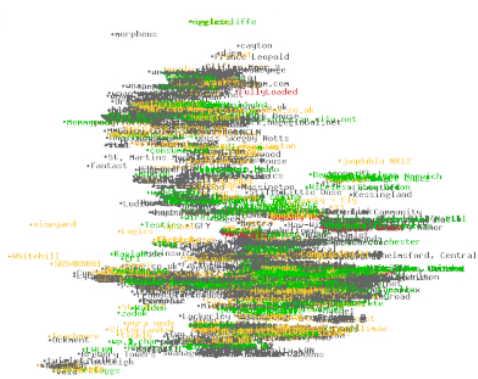

Fig. 7. Screenshot of Consume Node Data Base of UK in text mode.

As Stevens and a core group of supporters traveled up and down the country, workshopping, talking, advocating, Consume quickly developed a national dimension. Networks and nodes popped up all over the country. The vibrancy of Consume was based on the support it found by a wide range of people across the UK. Stevens advocated a model of decentralized person to person communication, realized via self-managed nodes. Decentralization was at the core of the idea, politically as well as technologically. The network was not centrally owned and managed but came together as a result of the activities of many independent and self-motivated actors. James Stevens at the time argued:

> Creating any sort of infrastructural layer on the landscape, in an environment or the community, that's something that has always been left to the councils or commercial entities, but this is something that can be pulled out from the ground at any level almost really. A school can just decide to put up an access point: utilize, redistribute, in order to legitimately pass the network that it has got from its council network and say its available throughout the school without any wires.[21]

Stevens wanted to demonstrate that large, infrastructural projects could be realized in a bottom-up manner, through processes of self-organization and through the mobilization of social capital (rather than financial capital). This was only possible because Consume attracted some very gifted people, such as the Russian artist-engineer Alexei Blinov, founder of Raylab, later Hive Networks; hacker-programmer-techies such as Jasper, who programmed the Consume Node data base, and BSD core developer Bruce Simpson; and network admin wizards such as Ten Yen and Ian Morrison. Other people who participated, such as Saul Albert and Simon Worthington, co-founder of Mute Magazine, could be described as non-commercial social entrepreneurs; their strength was also advocacy, creating ideas of their own and pulling in people and resources; the same can be said of artists and curators such as Manu Luksch, Ilze Black and myself who, for a while, also belonged to the core of the London free network scene.[22] Another core participant was Adam Burns, who can claim to have had the same idea, more or less, by himself, and had set up the first wireless free network node in Europe, free2air.org.

21 James Stevens, interview with the author, June 2003, private notes.

22 Here, the original text said: "(I will dedicate a special chapter to art and wireless community networks later in this book)", which might have been a note of the author to himself that ended up unrealized.

1.5 You are Free 2 Air Your Opinion

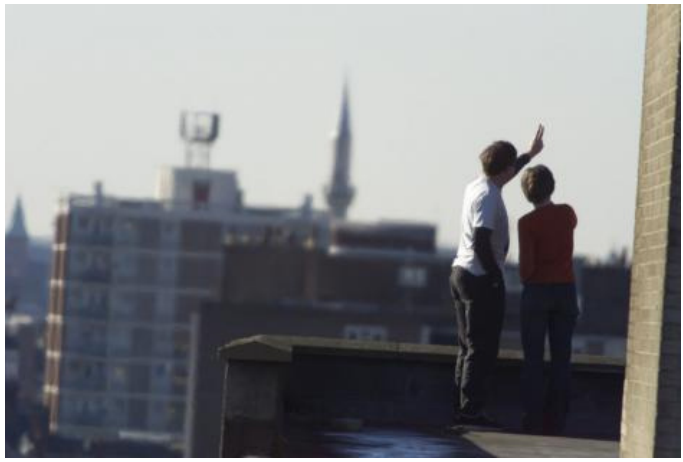

Fig. 8. Adam Burns and Manu Luksch explore skies over East London. Photo: Chris Helgren.

While Consume had been an early project, as a really existing free network in London it had been preceded by free2air.org. Free2air.org was the virtual flag flown by Adam Burns, of Australian descent. In his daytime job he managed firewalls of financial groups, in his spare time he had set up an omni-directional antenna on a building on Hackney Road, just above the Bus stop and a Halal Chicken shop. From there, everybody could pick up a signal who was within range.

> To my knowledge I am not aware of any other facility in Europe offering totally open network access like this. I do not want to know the name, the address, the credit card number, the color of the eyes or hair of anyone who connects through to this network. That's unimportant to me, and I don't feel that this is a necessary requirement.[23]

At the time of the interview, in autumn 2002, Adam Burns claimed that free2air had been active for 18 months. Thus, from late 1999 or early 2000, free2air.org, hosted on a machine called Ground Zero, offered free wireless internet access to everyone passing through. Adam Burns had been involved with early ISPs in Australia in the early 1990s, providing internet access more out of ethical conviction than business sense. This background has inspired his keen sense of networking as a social project.

> free2air is a contentious name, but one that I have chosen to use. Basically it has a dual meaning: once you establish such a network the cost of information travel is free. It's not a totally free service to establish, you need to buy hardware, you need computer expertise and so on. But the whole idea of ongoing costs are minimal. Secondly, what I liked about it is the plans for a distributed open public access network. It gets rid of the idea of a central ISP, in other words, globally around the world, when we are

23 Adam Burns, Interview with Armin Medosch, Autumn 2002.

talking about the internet rather than censorship or pedophiles hanging out, or bomb makers, there is a lot of concentration on what really goes on in networks. When you have got a lot of people passing information directly to each other its very hard to track down what information has and has not passed and how it got aired. So there is a double meaning to free2air, it also means you are free to air your expressions without concern or problems in getting that message through.[24]

1.6 East End Net

Fig. 9. Free2air's node groundzero gets an antenna upgrade circa 2002.

Adam Burns became a central person in the London wireless scene around Consume and what came to be known as East End Net. The idea was launched to connect Limehouse Town Hall with the area around the office of Mute magazine at lower Brick Lane, and somehow to connect also Bethnal Green and central Hackney. That bit was also the place where I lived at the time. While the large version of East End Net never materialized, we had our local version of it, with a connection from free2air.org to the *compound*, a large workspace building for small industries at the bottom of Broadway Market in E8.

24 Adam Burns, Interview with Armin Medosch, Autumn 2002.

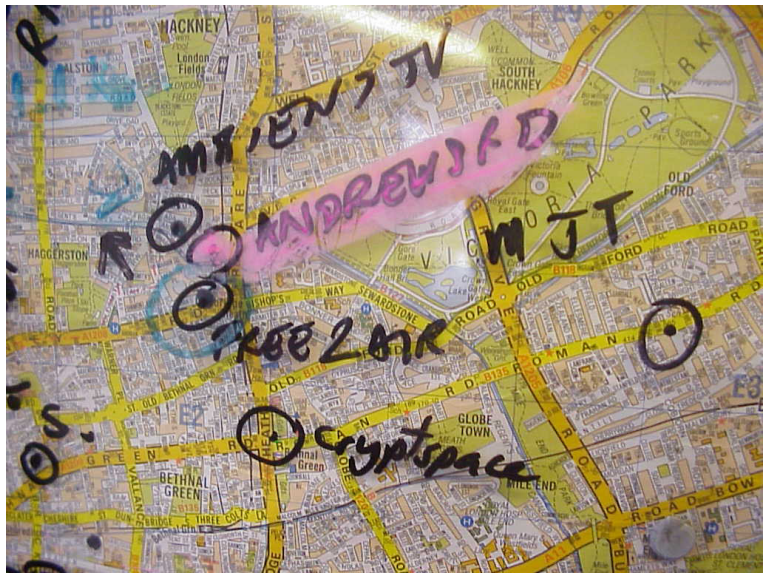

Fig. 10. East End Net: The Original Map.

With AmbientTV.net's help, the connection was spread by wireless and wirebound throughout the building. For several years a community of changing size, from between 20 to 40 or 60 people, inhabited a chunk of the net. Due to the social composition of this area, a number of art projects using the free WLAN took place. I will turn to those projects at a later stage.

While East End Net was never built in the way it was supposed to, the discussions and the focus that it generated were highly productive in a number of areas. Several lines of flight are taking off from this point, which all will have to be followed separately – so I will just hint at some of those ideas in overview form. The hand drawn original map of East End Net was the starting point for a lot of ideas about mapping of wireless networks, but also ideas about communal map making as such. It was the time when the Open Street Map project began, as it was recognized that also something as complex as a map could be built in a decentralized way by unpaid volunteers.

Consume's NodeDB, as already mentioned, was a quite early and successful attempt at building a website that facilitates registering a free network node through a wiki-like functionality. The idea was that the database would not only contain technical information about nodes, but also additional information about services offered. In this way, the NOdeDB would become the focus of community development and of micro-ecologies of small business, art, culture, activism.

The communal building of a wireless mesh network over a large part of a metropolitan area also raised issues about ownership and responsibility. While, as we shall see, in Germany the discussion from the very start was dominated by anxiety about legal repercussions of sharing an internet connection, in London the discussion was about the notion of the commons. It was

through Julian Priest that I became introduced to the work of Elinor Ostrom who successfully contested the hegemony of the thesis of the Tragedy of the Commons – work for which she later received the Nobel price in economics. We started to discuss the implications of what it means to treat the network as a commons and sought to find ways of affirming this status of the network commons.

For me, personally, two fundamental insights emerged from my involvement at the time. Through participating in workshops and talking to techies, I started to understand a bit more what happened behind the surface of the screen when one clicks on a webpage or sends an email. As I gained insight into how networks function technically, I experienced this as a form of empowerment. In my view, everyone should understand at least a little bit how networks work. Why? Because networking is not just about moving around bits and bytes, it is about communication, freedom of speech, about democratic participation, the freedom to learn things. One big problem that we have in societies such as ours is that the division of labor imposed on us creates categorical separations between things that should be seen and understood as belonging together. Building and maintaining telecommunication networks is seen as a technical task but affects fundamental human rights and social issues. Thus, everybody should have at least some idea about how it works, as one otherwise cannot meaningfully participate in Network Society.

Thus, as a grand thesis I would like to introduce here, I propose that the involvement of ordinary people in building a network commons has a profound emancipatory effect. In particular, as the process allows people to learn more about the structure and the functioning of the internet, they gain a better understanding of what they can potentially achieve in societies and, no less important, how to protect themselves from the harmful effects of information abuse by corporations and government. As people learn how networks work they can become teachers of the free network spirit. They will understand that they can become part of the network (and not only be users of a service provided by a corporation or the state) and can bring to it their own specializations and ideas. Through that, the idea of the network also gets enriched.

Thus, the second part of the thesis is that free networks contribute to the democratization of technology. Conventionally, technology is considered to be developed behind the closed walls of research labs. There, gods in white (or jeans and black polo-neck sweater) develop the technologies of the futures, which the thankful people then consume as a commodity. The way in which wireless community networks function, that is, the development of cutting edge technology, is opened up to wider mechanisms of participation. This second part of the thesis is almost confirmed already through the existence of projects such as the EU project Confine. Through the involvement of community networkers in shaping future technologies, those technologies become less elitist, less controlled by narrow commercial or security interest. The original peer-to-peer spirit of the Net gets enhanced and made fit for the future in a network commons that is there to protect our democratic freedoms and rights.[25]

25 Related links:
Guifi: https://guifi.net/
Freifunk: https://freifunk.net/

2. CONSUME THE NET: THE INTERNATIONALIZATION OF AN IDEA

Fig. 11. The Sky Above Berlin: Freifunk in action.

This chapter starts out with a summary of the achievements of Consume.net, London, and then traces the development of this idea, how it was spread, picked up, transformed by communities in Germany, Denmark and Austria. The internationalization of the free network project also saw significant innovations and contributions, developing a richer and more sustainable version of the network commons through groups such as Freifunk.

In London, Consume had developed a model for wireless community networks. According to this idea, a wireless community network could be built by linking individual nodes which would together create a mesh network. Each node would be owned and maintained locally, in a decentralized manner, by either a person, family, group or small organization. They would configure their nodes in such a way that they would link up with other nodes and carry data indiscriminately from where it came and where it goes. Some of those nodes would also have an internet connection and share it with everybody else on the wireless network. Technically, this would be achieved by using ad-hoc mesh network routing protocols, but those were not yet a very mature technology. Socially, the growth of the network would be organized through workshops, supported by tools such as mailinglists, wikis and a node database, a website where node owners could enter their node together with some additional information, which was then shown on a map. Within the space of two years, this proposition had become a remarkable success.

Consume nodes and networks popped up all over the UK. Consume had made it into mainstream media such as the newspaper The Guardian.[1] The project also successfully tied into the discourse on furthering access to broadband in Britain. The New Labour government of Tony Blair was, rhetorically at least, promising to roll out broadband to all as quickly as possible. This was encountering problems, especially in the countryside. The incumbent, British Telecom, claimed that in smaller villages it needed evidence that there was enough demand before it made the local telecom exchange ADSL-ready. ADSL is a technology that allows using standard copper telephone wire to achieve higher transmission rates. The Access to Broadband Campaign ABC occasionally joined forces with Consume. The government could not dismiss this as anarchist hackers from the big city. These are *good* business people from rural areas who needed internet to run their businesses and BT was not helping them. Consume initiator James Stevens and supporters traveled up and down the country, doing workshops, advocating, talking to the media and local initiatives.

2.1 BerLon

In 2002 the opportunity arose to bring Consume to Berlin. Although living in London, I had been working as co-editor in chief for the online magazine Telepolis for many years, so I knew the German scene quite well. After quitting Telepolis in spring 2002, I traveled to Berlin to renew my contacts. The curator of the conference Urban Drift, Francesca Ferguson, asked me to organize a panel on DIY wireless and the city. This gave me the opportunity to bring James Stevens and Simon Worthington to Berlin, as well as nomadic net artist Shu Lea Cheang.

The idea emerged, to combine our appearance at Urban Drift with a workshop that should bring together wireless free network enthusiasts from London and Berlin. Taking inspiration from Robert Adrian X's early art and telecommunication projects, we called this workshop BerLon, uniting the names Berlin and London. Robert Adrian X had connected Wien (Vienna, Austria) and Vancouver, Canada through four projects between 1979 and 1983, calling them WienCouver.[2]

Our organizational partner in Berlin was Bootlab, a shared workspace in Berlin Mitte, where a lot of people had a desk who were interested in unconventional ideas using new technologies. Some Bootlab'ers were running small commercial businesses but most of them constituted the critical backbone of Berlin's network culture scene. Bootlab was a greenhouse for new ideas, a little bit like Backspace had been in the late 1990s in London. Our hosts at Bootlab were Diana McCarthy, who did the bulk of organizational work, and Pit Schultz, who had, together with Dutch network philosopher Geert Lovink, invented the notion of net-critique and initiated the influential mailinglist nettime.

A little bit of additional money for travel support from Heinrich Böll Foundation, the research and culture foundation of the German Green Party, enabled us to fly over some more networkers from London, such as electronics wizard Alexei Blinov and free2air.org pioneer Adam Burns. And as

1 Jack Schofield, 'Wi-Fi can bring broadband for all', The Guardian, 20 June 2002, http://www.theguardian.com/technology/2002/jun/20/news.onlinesupplement.

2 WienCouver, http://kunstradio.at/HISTORY/TCOM/WC/wc-index.html.

is often the case with such projects, it developed a dynamics of its own. Julian Priest came from Denmark, where he lived at the time, and brought along Thomas Krag and Sebastian Büttrich from Wire.less.dk. Last not least, there were people from Berlin who had already experimented with wireless networking technology, among them Jürgen Neumann, Corinna *Elektra* Aichele and Sven Wagner, aka cven (c-base Sven).

The rest is history, so to speak. I would be hard pressed to recall in detail what happened. Luckily, the Austrian radio journalist Thomas Thaler was there. His report for Matrix, the network culture magazine of Austrian public radio ORF Ö1 gives the impression that it was a bit chaotic, really. There was no agenda, no time-table, no speakers list. Sometimes somebody grabbed the microphone and said a few words. As Thaler wrote, 'London was clearly in the leading role' in what will have to be accounted for under *informal exchange*. Most things happened in working groups.

One group was discussing the networking situation in Berlin. There had already been initiatives to create community networks in Berlin, one called Prenzelnet, another one Wlanfhain (Wlan Friedrichshain). As an after effect of re-unification of Germany, there were areas in the eastern side of Berlin that had OPLAN, an optical fibre network, which made it impossible to use ADSL. What also needs to be accounted for is the special housing structure of Berlin.

As an after effect of Berlin having been an enclave of Western *freedom* first, then having a wild East right in its center of occupied houses and culture centers in Berlin Mitte and neighboring areas, a relatively large number of people live in collective housing projects. These are not small individual houses but large apartment blocks, collectively owned. Freifunk initiator Jürgen Neumann lives in such a housing project which was affected by the OPLAN problem, so that 35 people shared an expensive ISDN connection. After learning about WLAN, he built a wireless bridge to an ISP for his housing association and spread it around the block. Other people who were already experimenting with wireless networks before BerLon were cven and Elektra.

Another working group dealt with the question of how to define the wireless networking equivalent to the licensing model of Free Software, the GNU General Public License (GPL). From Berlin, Florian Cramer, an expert on Free Software topics, joined this discussion. This issue about a licensing model for Free Networks caused us quite some headache at BerLon, and we did not really finalize a solution there, but managed to circle in on the subject enough to finish the draft Pico Peering Agreement at the next meeting in Copenhagen.

At BerLon, Krag and Büttrich also reported about their engagements in Africa. There, well-meaning initiatives trying to work with Free and Open Source technology often meet socially difficult and geographically rugged environments.

I cannot claim to know in detail what happened in the other working group, the one on networking in Berlin, but the result is there for everyone to see. This was the moment of the inception of Freifunk, the German version of wireless community networking. Freifunk (which, in a word-by-word translation means simply *free radio transmission*) is today one of the most active wireless community networking initiatives in the world. Ironically, while today Consume is defunct, Freifunk became a fantastic success story. With German *Vorsprung durch Technik*, Freifunk

volunteers managed to contribute significantly to the praxis of wireless community networks. In particular, the Freifunk Distribution and the adoption and improvement of mesh networking technology contributed significantly to inter-networking technology. Freifunk's existence, vibrant and fast growing in the year 2014, is testimony also to the social viability of the Consume idea.

However, I am not claiming that Freifunk simply carried out what Consume had conceived. This would be a much too passive transmission model. Freifunk, just like Guifi, contributed significant innovations of its own. I am also not claiming that Freifunk jumped out of the BerLon meeting like the genie out of the bottle. A number of significant steps were necessary. However, it is also undeniably the case that BerLon provided the contact zone between Berlin and London. This set into motion a process which would eventually lead to a large and successful community network movement.

Jürgen Neumann and a few other people from Berlin decided to hold a weekly meeting, WaveLöten (wave soldering), every Wednesday at c-base starting at 23 October 2002, which was very soon after BerLon. WaveLöten was an important ignition for Freifunk in Berlin. As Neumann said, the lucky situation was that there was a group of people who understood the technical and social complexity of this and each started to contribute to the shared project of the network commons – Bruno Randolf, Elektra, cven (c-base Sven), Sven Ola Tücke, and others on the technical side, Monic Meisel, Jürgen Neumann, Ingo Rau, and Iris Rabener on the organizational and communicative side.

What are the reasons that Freifunk could thrive in Berlin and Germany, while Consume lost its dynamic in the UK? The answer is not simple, so I am just pointing at this question here. Which will pop up throughout this book. What makes a wireless community network sustainable? Why do some communities thrive and grow while others fall asleep?

2.2 Copenhagen Interpolation and the Pico Peering Agreement

BerLon was followed, on March 1st and 2nd 2003, by the Copenhagen Interpolation. On this occasion the Pico Peering Agreement was brought to a satisfactory level. I am happy, because I contributed to writing it, and as this story has developed since, it has found some implementation. The Denmark meeting was also quite small. There were people from Locustworld, the Wire.Danes, Malcolm Matson, and Jürgen Neumann, Ingo Rau, and Iris Rabener from Berlin. They decided in Copenhagen to hold the first Freifunk Summer Convention in Berlin in September 2003.

At BerLon we had discussed the social dimensions of free networking. What were the *social protocols* of free networking? The answer was to be given by the Pico Peering Agreement, a kind of Bill of Rights for wireless community networking.

It had all begun with discussions on how to improve the NodeDB. James Stevens expressed his desire that a node owner could choose a freely configurable license – to create a bespoke legal agreement on the fly for his network on the basis of a kind of licensing kit. The node owner should be able to choose from a set of templates to make it known to the public what their node

offered at which conditions. This work should be done with the help of lawyers so that node owners could protect themselves. This seemed a good idea but was way to complicated for what our group was able to fathom at the time. We needed something much simpler, something that expressed the Free Network idea in a nutshell.

The success of Free Software is often attributed to the *legal hack*, the GPL. This is a software license which explicitly allows to run, copy, use, and modify the software, as long as the modified version is again put under the GPL. This *viral model* is understood to have underpinned the success of Free Software. Today, I am not so sure anymore if this is really the main reason why Free Software succeeded.

Maybe there were many other reasons, such as that there was a need for it, that people supported it with voluntary labor, or that the development model behind Free Software, the co-operative method, simply resulted in better software than the closed model of proprietary software with its top-down hierarchical command system. Anyway, we thought that Free Networks needed an equivalent to the GPL in order to grow. But how to define such an equivalent?

With software, there is one definitive advantage: once the first copy exists, the cost of making additional copies and disseminating them through the Net is very low. Free Networks are an entirely different affair: they need hardware which costs money. This hardware is not just used indoors but also outdoors and is exposed to weather and other environmental influences. Free Networks can not really be free as in gratis. They need constant maintenance and they incur not inconsiderable cost.

The crib to get there was the sailing boat analogy. If there are too many sailing boats at a marina, so that not all of them can berth at the pier, boats are berthed next to each other. If you want to get to a boat that is further away from the pier, you necessarily have to step over other boats. It has become customary that it is allowed to walk over other boats in front of the mast. You do not pass at the back, where the more private areas of the boat are – with the entrance to the cabins and the steering wheel – but in front of the mast. In networking terms that would be the public, non-guarded area of a local network, also known as the demilitarized zone (DMZ).

We agreed that it was conditional for participation in a free network that every node owner should accept to pass on data destined for other nodes without filtering or discriminating. We can claim that we defined what today is called network neutrality as centerpiece of the Copenhagen Interpolation of the Pico Peering Agreement.[3]

While it is important, and I am happy to have contributed to it, I see things slightly differently today. I think the real key to Free Networks is the understanding of the network as commons. The freedom in a network cannot be guaranteed by any license but only by the shared understanding of the network commons. The license, however, is an important additional device.

3 Pico Peering Agreement, http://www.picopeer.net/.

3. FLY FREIFUNK FLY!

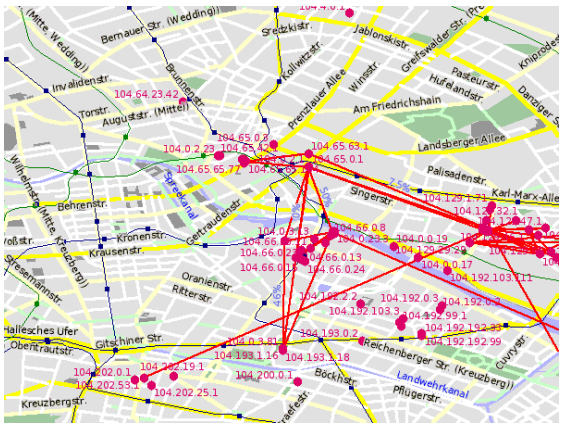

Fig. 12. Early Map of Berlin Backbone, courtesy Freifunk.

The Copenhagen Interpolation had induced confidence into the very small number of participants, including a delegation of three from Berlin. In Berlin, the domain freifunk.net was registered in January 2003. The name was coined by Monic Meisel and Ingo Rau over a glass of red wine. Their initial impulse, according to Monic Meisel, was to create a website to spread the idea and make the diverse communities that already existed visible to each other. They wanted a domain name that should be easily understood, a catchy phrase that transported the idea.

Freifunk is a good name. It carries the idea of freedom and the German word *Funk* has more emotional pull than *radio*. *Funk* is funky. The German word *Funke* means spark. The reason is that early radios actually created sparks to make electromagnetic waves. *Funken* thus means both, to create sparks and make a wireless transmission. Meisel, who at the time worked for a German web agency, also created the famous Freifunk Logo and the visual identity of the website.

Fig. 13. Freifunk logo by Monic Meisel. Image courtesy Freifunk.

It seems that Freifunk took off because of a combination of reasons. It quickly found support among activists all over Germany, not just in Berlin. It had people, who had a good understanding of technology and made the right decisions. And Freifunk did very good PR from the start. Jürgen Neumann quickly emerged as a spokesperson for the fledgling movement. However, he could always rely on other people around him to communicate the idea through a range of different means. Freifunk from the start was more like a network of people than Consume has ever been. When James Stevens decided to stop promoting Consume, it ceased to exist as a nationwide UK network of networks.

In spring and summer 2003, the Freifunk germ was sprouting in Berlin. I was writing my German book[1] and started to put draft chapters into the Freifunk Wiki.[2] Freifunk initially grew quickly in Berlin, in particular in areas that had the OPAL problem and thus could not get broadband via ADSL.

In June 2003 the Open Culture conference, curated by Felix Stalder in Vienna, brought together a number of wireless community network enthusiasts. There, Eben Moglen, the lawyer who had helped write the GPL, gave a rousing speech. His notes consisted of a small piece of paper on which he had written:

> 'free software – free networks – free hardware.'

Fig. 14. Eben Moglen at OpenCultures conference 2003. Image courtesy t0 / WorldInformation.org.

1 Armin Medosch, Freie Netze. Geschichte, Politik und Kultur offener WLAN-Netze, Heise Verlag, Hannover 2004, https://ftp.heise.de/tp/buch_11.pdf.

2 Manuscript of Armin Medosch, Freie Netze in the Freifunk Wiki, archived March 2004, https://web.archive.org/web/20040301060127/http://www.freifunk.net/wiki/FreieNetze.

The holy trinity of freedom of speech and participatory democracy in the early 21st century. His speech was based on the dotCommunist Manifesto[3] which he had published earlier that year. Moglen skillfully paraphrased the communist manifesto by Marx and Engels, writing 'A Specter is haunting multinational capitalism – the specter of free information. All the powers of *globalism* have entered into an unholy alliance to exorcize this specter: Microsoft and Disney, the World Trade Organization, the United States Congress, and the European Commission.' Moglen argued that advocates of freedom in the new digital society were inevitably denounced as anarchists and communists, while actually they should be considered role models for a new social model, based on ubiquitous networks and cheap computing power. His political manifesto posited the digital creative workers against those who merely accumulate and hoard the products of their creative labor.

While sharply polemical and as such maybe sometimes a bit black and white in its argumentation, Moglen's dotCommunist Manifesto is correct insofar as it outlays a social conflict which characterizes our time and is still unresolved. The new cooperative culture of the Net would in principle enable a utopian social project, where people can come together to communicate and create cultural artifacts and new knowledge freely. This world of producers he juxtaposes with another world which is still steeped in the thinking of the past, which clings on to the notion of the production of commodities and which seeks to turn into commodities things that simply are not. This is the world of governments, of corporations and lobbyists who make laws in their own interest which curtail the freedom and creative potential of the Net.

There is no reason why a network should be treated as a commodity. The notion of access to the internet is, as the free network community argues, a false one. The internet is not a thing to which one gets sold access by a corporation. As a network of networks, everybody who connects to it can become part of it. Every receiver of information can also become a producer and sender of information. This is realized on the technical infrastructural layer of the Net, but it has not yet transpired to mainstream society.

3.1 Freifunk Summer Convention 2003

In September 2003, the first Freifunk Summer Convention FC03 happened in Berlin at c-base. This self-organized memorable event, from September 12 to 14, brought together a range of people and skills which gave some key impulses to the movement to build the network commons. Among the participants were activists who funded their own travel from Djurslands to join the gathering. This is a district in the north east of Denmark, a rural area with economic and demographic problems. Djurslands.net[4] demonstrated for the first time that you could have a durable large scale outdoor net with a large number of nodes. The guys from Djurslands.net brought a fresh craftsman approach to free networking, with solidly welded *cantennas* (antenna made from empty food can). At the Freifunk convention, it was decided to have the

3 Eben Moglen, *dotCommunist Manifesto*, January 2003, https://moglen.law.columbia.edu/publications/dcm.html.

4 Djurslands.net, archived January 2014, https://web.archive.org/web/20140102104641/djurslands.net/.

next community network meeting in Djursland in 2004, which turned out to become a major international meeting of community networkers in Europe.

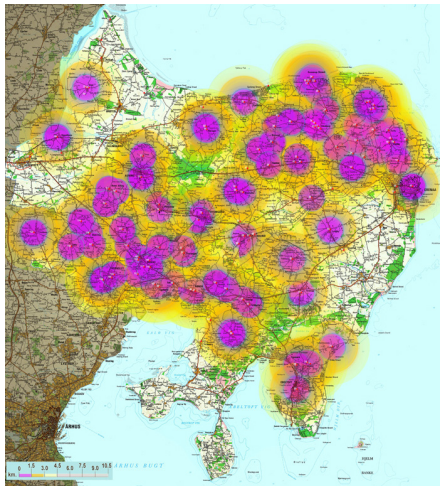

Fig. 15. Map of Djurslands.net.

According to conflicting reports at FC03 Bruno Randolf showed the MeshCube, a technology he developed for a company in Hamburg. However, according to a recent entry on the timeline it was only after FC03 that the development of the MeshCube began in serious. At the time, Julian Priest wrote in the Informal Wiki[5]:

> Bruno Randolf ran mesh routing workshop. After a good discussion covering the main mesh protocols and solutions, AODV (an early dynamic routing protocol), mobile mesh, scrouter, and meshap, around 10 – 15 linux laptops were pressed into service as mesh nodes using the mobile mesh toolset. Tomas Krag crammed a couple of wireless cards into his laptop (which only just had space to fit) and ran the border router and others stretched the network around the buildings. Many discussions about how to assign IP addresses in the mesh followed, maybe IPv6, mobile IP or Zeroconf could be ways forward here. Bruno demoed the jaw dropping 4G mesh cube. 4 cm cube sporting up to 4 radios, smc type antenna connectors, a 400 Mhz mips 32Mb flash 64M ram, with power over ethernet and usb, currently running Debian. A space to watch for sure.

The MeshCube made use of industrial small chips optimized for running an embedded GNU/Linux distribution. Initially it was configured with the early AODV dynamic routing protocol and later included early versions of the OLSR protocol, developed by Andreas Tønnesen as a master thesis project at the university graduate center in Oslo. However, it seems at FC03,

5 Freifunk Report on the Freifunk Summer Convention, Informal Wiki, Last edited on 19 September 2003, archived December 2003, https://web.archive.org/web/20031207152025/http://informal.org.uk/wiki/index.php/FreifunkReview.

a further dynamic network stack developed by MITRE called 'Mobile Mesh'[6] was discussed and tested. (See this entry on Mobile Mesh[7], by Elektra, on the early Freifunk Wiki.)

Thus it is confirmed that on a mild day in September 2003 in Berlin, a couple of dozen of geeks could be seen walking around the streets with laptops making, to the ordinary passers-by, incomprehensible remarks about pings and packets. This was the beginning of a long and fruitful engagement of free network communities with mesh routing protocols (see also this report from 2003[8]).

Shortly after FC03, the Förderverein Freie Netzwerke was founded, a not-for-profit organization whose aim was the furthering of wireless community networks. The convention had also mobilized a television crew, who made a short film (in German).[9]

It shows a number of free network advocates including this author at a slightly more youthful age.

As the video makes evident, Freifunk from the start advertised itself as a social project which is about communication and community. Freifunk created an efficient set of tools to be picked up as a kind of community franchise model, as Jürgen Neumann calls it. There is the Freifunk Website with a strong visual identity and the domain name, which also works as an ESSID of the actual networks. Everybody can pick up a Freifunk sub-domain and start a project in a different locality. Freifunk initially grew out of Berlin's creative new media scene, so that from the very start interesting videos and other new media content was produced.

Another decision that should proof beneficial was that early on Freifunk started to build a Berlin Backbone, long-distance connections between high-rise buildings with reliable radio links. Freifunk was really good at choosing buildings – and getting access to them – with suitable roofs where weather-proof installations could be made. This idea of the Berlin Backbone was a good one from the start, it gave the community something to experiment with. In an interview with radio journalist Thomas Thaler, Sven Wagner advocated the Berlin Backbone as a network linking Berlin's big alternative culture centers such as 'Tacheles, CCCB, Bootlab, Lehrter Kulturfabrik, and c-base and a few other projects'.[10]

6 MITRE Corporation, Providing Solutions For Mobile Adhoc Networking, last update 8 October 2003, archived February 2004, https://web.archive.org/web/20040202044948/http://www.mitre.org/work/tech_transfer/mobilemesh/index.html.

7 Elektra, Mobile Mesh, Freifunk Wiki, archived March 2004, https://web.archive.org/web/20040313124958/http://freifunk.net/wiki/MeshingUndMeshAPs.

8 Martin Röll, live from freifunk.net summer convention, Das E-Business Weblog, 13 September 2003, archived October 2006, https://web.archive.org/web/20061003173018/http://www.roell.net/weblog/archiv/2003/09/13/live_from_freifunknet_summer_convention.shtml.

9 *On Polylux*, a TV show (1997–2008) by Tita von Hardenberg broadcast on RBB that unfortunately we could not locate in any archive.

10 Thomas Thaler, ORF Matrix 19 November 2003, transcript, archived December 2003, https://web.archive.org/web/20031205010408/http://freifunk.net/artikel/magazin/0000_BBB_Thomas_Thaler.

I believe that for those early long distance connections MeshCubes were used. Those links however, did not mesh, as they were set up on fixed routes. But from those points then bandwidth was redistributed. Thus, from early on a Berlin Backbone grew, such as shown in this image which appears to be from July 2003. (Meanwhile, Berlin Backbone receives financial support from the regional government – more about that in a future installment of this story).

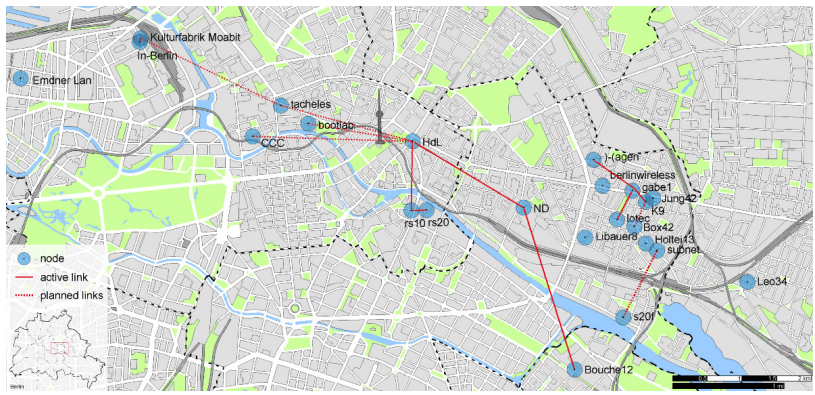

Fig. 16. Berlin Backbone, Summer 2003.

In London, if you look at an early map of East End Net, the dots are there but they are not connected. Between Cremer street and Free2air.org and Limehouse there was never a connection. This has partly to do with the urban topology of London, partly with the social structure. Everyone is much more commercially minded, even the church.

In May 2002, there was a Consume workshop in Limehouse Town Hall, where networkers discovered the spire of the adjacent church as an ideal antenna mounting point for a long distance connection. The Vicar, however, had already sold access to the spire of his church to a mobile telephone company.

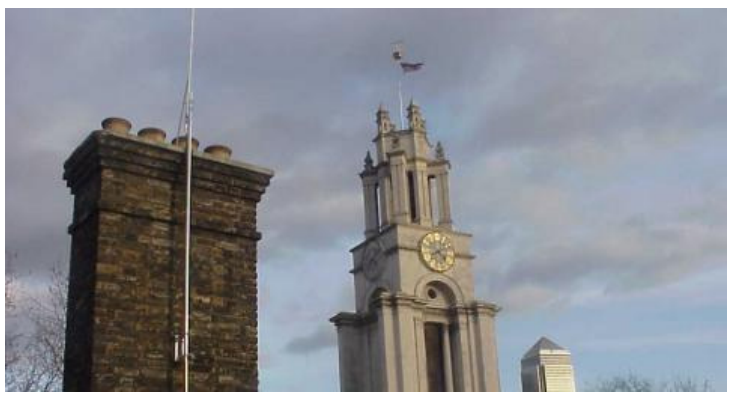

Fig. 17. An omni-directional antenna by Consume, a spire and the towers of the financial center, East London, 2002.

It seems significant that today's Berlin Backbone uses quite a few churches. Another aspect of the social side is that in Berlin it is easier to find people who have time to engage in voluntary labor. The combination of lower costs of living and the remainder of a welfare state make it easier for socially motivated techies to devote unpaid labor time to such projects. In London, that capitalist behemoth, everybody is under permanent pressure to make money, unless one is very privileged or young enough to live in insecure squats. Such comparisons, however, should not make us conduct false comparisons. At around 2003-04, Consume was still very innovative and dynamical, while Freifunk was also developing rapidly.

If we follow this list of links from the Wayback Machine,[11] then we can see that in autumn 2003 there were already quite many initiatives. The timeline which has recently begun as a cooperative work, shows similar results.[12]

In spring 2003 also the early beginnings of Funkfeuer in Austria were made. Funkfeuer, which means radio beacon, was initially built by the artist Franz Xaver for Silverserver. When the provider decided that this was commercially not viable, the network was taken over by a group of volunteers, among whom was Aaron Kaplan. He had already, together with Austrian digital civil rights initiative Quintessenz, made an open WLAN hotspot in Vienna's Museum District (Museumsquartier). Funkfeuer has since successfully branched out to Graz and a number of rural locations.

In above mentioned interview, Elektra also made a strong statement in support of meshing technology, expressing confidence that the Free Software community would solve this. The confidence should proof to have been justified. In autumn 2003 Elektra spoke about joining together a GNU/Linux distribution such as Knoppix with everything a wireless community node should be capable of, especially meshing. The protocol under deliberation was still mobile mesh, but this would change soon.

11 Frontpage Freifunk Wiki, archived July 2003, https://web.archive.org/web/20030723203256/http://freifunk.net/wiki/FrontPage.

12 Timeline Freifunk in a Freifunk EtherPad, http://pad.freifunk.net/p/ff-timeline.

4. THE SOCIAL TECHNOLOGIES OF THE NETWORK COMMONS (FREIFUNK 2)

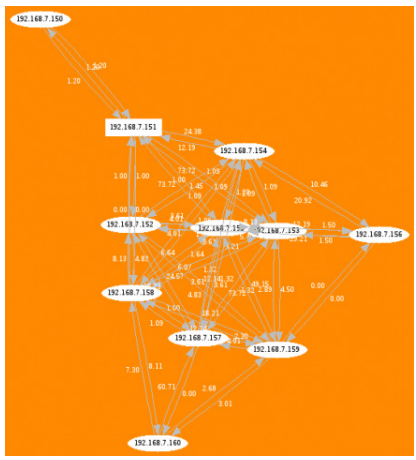

Fig. 18. Topology and metrics of a local mesh test network.

The social technologies of the wireless community network are technologies specifically developed to support social goals, such as community networking. Typically, new technologies are developed by large firms or the state. The achievements of wireless community networks demonstrate that there is an alternative: community based innovations. This chapter presents the genealogy of some of the key technologies needed for wireless community networking and discusses their social content.

A happy accident in June 2003 opened the gates to wireless cornucopia. Developers on the Linux Kernel mailing list started making comments about a product of the company Linksys. In March 2003, Cisco Systems had bought Linksys for US$500 million. The firmware of the wireless access point WRT54G included both the Linux kernel and other code released under the GNU General Public License (GPL). The company had published the firmware as binary, but not the source code, which was against the terms of the GPL. As the developer who revealed the GPL violations quite happily added, this meant that a whole family of chips by one wireless provider, Broadcom 802.11b/g, supported Linux. 'Complaints appeared on discussion boards such as LKML and Slashdot claiming that Linksys was violating the GPL by not providing source code for certain code used in its WRT54G wireless access point.'[1]

The Free Software Foundation stepped in, leading the campaign for enforcement of the GPL. Cisco was brought to comply by publishing the source code. This enabled a revolution, albeit one that most people have never heard of before: the revolution of firmware flashing.

1 Heather J. Meeker, *Open Source and the Legend of Linksys*, Linux Insider, 28.06.2005, http://www.linuxinsider.com/story/43996.html.

Based on the source code for the Linksys product, a new initiative called OpenWRT came into existence and began making an increasingly stable GNU/Linux distribution specifically for small wireless devices.

The WRT54G became the most popular router for community networks, and this is where OpenWRT has its name from. Meanwhile, OpenWRT works on many embedded devices such as WLAN routers but also wireless hard-drives and basically everything that networks.[2]

Firmware replacement had been the battle-cry of East London artist-engineers such as Alexei Blinov and Adam Burns in 2003-4. It was possible, in principle, even before OpenWRT, but it was very hard. At the time, early ideas for Hive networks were being flouted around. This project, which went through many instantiations, initially was quite Utopian.

It was a boldfaced claim that you could make multi-hop networks using mesh network protocols that use every available snippet of network connectivity, be it Bluetooth, Wireless, LAN or you have it; furthermore, those devices should also be self-announcing, if they carry any services. Taking inspiration from the Zeroconf protocol, the meshing devices would tell if they offer services such as streams, voice chat, podcasts, skype, jabber, and others.

With OpenWRT, this utopia came that bit closer, but as this interview with Sven Ola-Tücke[3] also attests to, it needed great skill and tenacity, even with OpenWRT. You needed to create a directory on a Linux machine for compiling the firmware. To compile one Linux kernel on a machine for another machine is very difficult, especially if the other machine is so different. *Cross-compilation toolchain* it was called by my London friends Alexei and Adam. Once you had built a customized Linux image for your device, you needed to transfer it to the device and *flash* it, replace its existing firmware with the new one.

If anything went wrong, you had not flashed it but *bricked* it. The device's electronics were as dead as a brick. As Alexei Blinov pointed out, that is quite unfair against bricks because they can actually be still useful. A dead WRT54G is really only electronic toxic trash. Once you have successfully replaced the firmware, you still need to configure it, all via ssh and shell. Last not least, you had to make the OLSR work with the firewall. If then everything worked well, you could indeed mesh using cheap, nearly ubiquitous devices in autumn 2004. The liberation of hardware to build the network commons through OpenWRT was undoubtedly a great step, hence now software experimentation could begin.

Another important step was the release of OLSR 0.48. In this announcement by Elektra,[4] the advances of this protocol are explained. The Open Link State Routing protocol was developed initially as a master thesis by Andreas Tønnesen at UniK – University Graduate Centre. In the

2 Here is a long list of devices on which it is possibly running: OpenWrt: Table of Hardware, http://wiki.openwrt.org/toh/start.

3 Fab, 'Interview mit Sven-Ola Tuecke', Wireless-Forum, 15 March 2006, archived October 2007, https://web.archive.org/web/20071029082121/http://www.wireless-forum.ch/forum/viewtopic.php?t=16140.

4 Elektra, 'OLSR 0.48 zum Download freigegeben', Indymedia, 7 December 2004, archived February 2005, http://de.indymedia.org/2004/12/101054.shtml.

context of Wizards of OS he was invited to give a presentation at c-base. The conference series Wizards of Operating Systems was initiated by Volker Grassmuck and ran from 1999 to 2006. In 2004 we made a panel on free networks[5] and a workshop.[6] The latter was organized by the community, that is largely by Elektra and Sven Wagner. At the main conference Dewayne Hendricks talked about a 2 Gigabit network for California, constantly referring to the *holodeck*.[7]

The workshop was dedicated to mesh networking and was to have lasting repercussions. The Freifunk community started using OLSR, which gave decisive impulses for its further development. As Elektra writes, as soon as communities started using mesh networks, the technology started to flourish. The community networks have the decisive advantage of having real test conditions. This underpins also project Confine which has developed a community testbed. Many problems of routing stem from the wireless medium, which is unpredictable.

At WOS3 a number of MeshCubes from 4G systems were used to create the network at the conference venue. It was running OLSR and the quality of service was horrible, according to an online posting.[8] But within the space of a few months the metrics used were significantly improved. OLSR started to use routes according to the actual quality of transmission, the so called ETX metrics (Expected Transmission Count).

This was the start of a long story of community development of mesh networking. Who wants to get more into the technology should read *Mesh – Drahtlose Ad-hoc Netze* by Corinna *Elektra* Aichele.[9] According to her, the release of OLSR 0.48 in December 2004 was a major step in mesh routing. We could say that mesh routing is the paradigmatic technology, the one which is most expressive of this dispositif, because it brings together technological and social goals and advantages. It expresses the ideal that everyone could connect to everyone in a decentralized way.

I will return to the topic of mesh routing but stick to the timeline. Some of the *technologies* which communities have developed are rather more like techniques, social technologies in a more direct sense, ways of doing things. At around 2004-5, Cornelius Keller put the website OLSR-Experiment online.[10] This was a website which according to a logic following Berlin's postcodes, handed out IP addresses for people who wanted their wireless router to be part of Freifunk. The visual logic of this method you can follow here:

5 rc.fn runcommand reality check freenetworks, panel at WOS3, 10 June 2004, http://www.wizards-of-os.org/index.php?id=926.

6 Armin Medosch, 'run command free networks – a reality check', Workshop at WOS3, 10 June 2004, http://www.wizards-of-os.org/index.php?id=719.

7 Dewayne Hendricks, 'One Gigabit or Bust™ Initiative – A Broadband Vision for California', at WOS3, 10 June 2004, Abstract: http://www.wizards-of-os.org/index.php?1659; Video: https://archive.org/details/3_do_t1_13h_2-Hendricks/3_do_t1_13h_2-Hendricks_hi.mp4.

8 Berlin OLSR Wireless Mesh Testbed at Wizards of OS 3, free2air.org, 16.06.2004, http://www.free2air.org/story/2004/6/16/103734/486/.

9 Corinna Elektra Aichele, 'Mesh – Drahtlose Ad-hoc Netze', Open Source Press, München, 2007. Extract available at: https://download-master.berlin.freifunk.net/ebooks/mesh_kapitel4_leseprobe.pdf.

10 Cornelius Keller, OLSR-Experiment, archived December 2005, https://web.archive.org/web/20051211030128/http://olsrexperiment.de/.

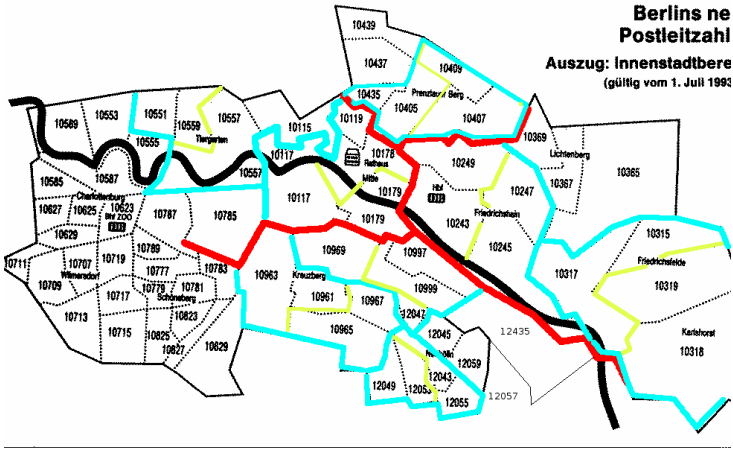

Fig. 19. Berlin map by postal codes.

As another snapshot shows, in a series of core meetings, the Berlin community decided how to use the IP addresses for a Class B Net.[11]

Last not least, in autumn 2004 Sven-Ola Tücke had started developing Freifunk Firmware. Initially it was developed for the Berlin Backbone, but then became the foundation for the whole Freifunk community. The Freifunk Firmware (FFW) brought together OpenWRT and all software components you needed to run a Freifunk node, in an easy to use, web-based installation process.

This is how it works more or less still today. You can buy a device from a recommended list of compatible devices. Then you go to the Freifunk webpage and request an IP address. Then you get the automatically compiled correct installation package for your device. You install the firmware via the web-interface, enter the IP address and here you go.

In 2005, OpenWRT released the so called White Russian version, which was the first stable release. The Freifunk Firmware still relies on a follow-up version of that.

There is no doubt that the Freifunk firmware contributed massively to the take off of Freifunk in Germany and Funkfeuer in Austria, who made a customized version, based on the same foundations. As Jürgen Neumann said in an interview, when he saw Sven-Ola's Freifunk Firmware for the first time, he knew that Freifunk was becoming a reality.

The coming together of this assemblage of artifacts – the liberation of hardware to build the network commons, mesh routing and the Freifunk Firmware – stimulated a rapid growth of free networks. Other regional flavors of firmwares were made for Funkfeuer, Guifi, Wireless

11 Freifunk, Ergebnisprotokoll CoreMeeting 2004-10-20, Freifunk Wiki, archived February 2005, https://web.archive.org/web/20050219235855/http://www.freifunk.net/wiki/CoreMeeting20041020.

London. In the mid-2000s, Freifunk communities mushroomed, many also in former GDR territory. The availability of small and cheap hardware for Open Source experimentalism was a great breakthrough. Potentially, you could network everything with everything, make alternative ad-hoc infrastructures.

Those breakthroughs in peer based innovation fell into a climate that was thick with promises. The early 2000s were full of techno-political hopes. The tone had been set by Wizards of OS in 1999, which was the first significant attempt (to my knowledge) to think through Free and Open Source Software also as a political project.

Political means in this case, it has a social significance beyond that usually granted to software. The success of GNU/Linux and the things that could be done with it arrived in the art scene – but also the intellectuals of social sciences, etc. – to ask questions about what that freedom or openness was and if and how you could harness that for other things than software.

Looking back at this period, a number of things happened in close proximity: Creative Commons was making a breakthrough with having one million of its licenses used in 2003. Wikipedia was started in 2001 and was gaining critical mass. Many GNU/Linux distributions appeared for creative tasks, such as Dyne.org, Puredyne, Knoppix. The protocol Netsukuku[12] was developed, a really explicitly political technology, a peer based routing protocol. It has changed a lot since its first release in 2005 and now seems to take on a very interesting direction.[13]

In 2003 together with FACT, commissioned by Michael Connor, we made a brochure and DVD, with Kingdom of Piracy.[14] It was like a toolbox for free culture, in software, intellectually, in art.

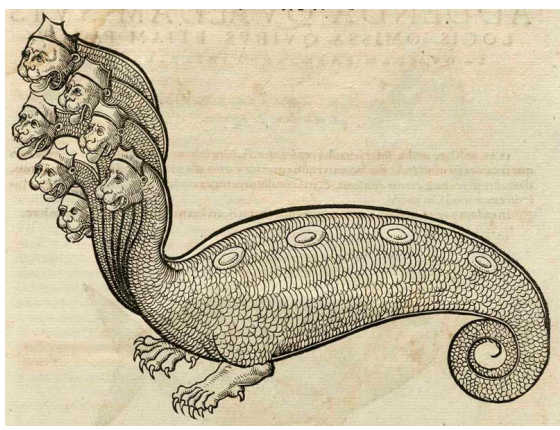

Fig. 20. The many-headed hydra of community mesh.

12 Wikipedia: Netsukuku, http://en.wikipedia.org/wiki/Netsukuku.

13 Ibid. Netsukuku development and mailing list traffic appear to have ceased circa 2009.

14 Kingdom of Piracy (KOP), online workshop, 22 February 2003 – 26 March 2003, archived March 2016, https://web.archive.org/web/20160303075302/http://www.fact.co.uk/projects/kingdom-of-piracy.aspx.

The early 2000s were an era of rapid growth of the digital commons. The network commons in practice enabled a range of other creative practices. At the time, do-it-yourself map making and the larger framework of locative media was an exciting new topic, debated at the Cartographic Congress in London 2003 and two workshops organized by RIXC in Latvia. WLAN technology opened the possibility of so called war-driving, of driving or cycling or walking through an area with a laptop or similar device, scanning for networks. Depending on the ethical stance taken by those doing the scanning, no intrusion happens, but the information gathered can be used for location based tasks.

Fig. 21. Warwalk.

One thing that can be done is simply measuring the signal strength of WLAN networks. You can also use the IP addresses for WLAN triangulation – establishing your own location in relation to geolocative database information. This enabled art driven, non-commercial projects to experiment with locative media art, at a time when commercial applications were still lagging behind. The network commons and locative media art seemed like a perfect marriage, but it was a short spring. While OpenStreetmap may have made rapid gains in 2003, Google Street Maps was also released at around the time. Mapping became part of this sprawling data monopoly. Many of the ideas that were hatched around the early to mid 2000s by independents and small groups ended up getting recuperated by the info-oligarchy.

Around that time the moniker *Web 2.0* was introduced. A lot of the things that were the product of community based innovations and were created in a decentralized way, were reunited in a new centrality, the soon to rise monster of *social media*. As Evgeny Morozov explains, the capacity to coin those terms gives a lot of interpretative power to Silicon Valley.[15]

15 Evgeny Morozov: 'The Meme Hustler', The Baffler, April 2013, http://www.thebaffler.com/salvos/the-meme-hustler.

In my view, you could say that the early 2000s were a time when a peer-to-peer view of the world was formulated on many layers. Michel Bauwens and the P2P foundation's Wiki[16] may also give testimony to that. But these were still ideas by a relatively small elite. The majority of the world was busy with *the war on terror*. As we now know, it was used as a pretext to build a gigantic surveillance machinery.

Web 2.0 turned out to be the slogan of commodification of community-based innovation, while under the surface massive data harvesting is going on. As an economic model, it was not to last.

The banking crash of 2008 reveals a systemic crisis. The informational paradigm does not see effective demand in the rich countries, there is a downward pressure on the cost of labor, and all those conditions have not significantly improved since the crash. The former West is in crisis and community-based innovation could be a way out of it.

Wireless community networks should not be considered in isolation but as part of this larger movement for the commons as the last great liberal utopia. Already before, but now intensified, people start getting involved in food coops, urban gardening, time sharing economies of all kinds. Peer based commons production makes sense when capitalist ways of organization break down. A project to bring wireless community networks to deprived areas in Detroit, the Digital Stewards project, has received mainstream media attention recently.

The former motor city is still in a process of de-urbanization. Inner city communities have appallingly low broadband connection rates, a digital divide reminiscent of a developing country in the heart of industrial America.[17] A project to bring WLAN to a community on the outskirts of Valparaiso, Chile, has started and gets documented on these pages here.[18]

16 P2P Foundation Wiki, https://wiki.p2pfoundation.net/.

17 Detroit Digital Stewards, https://detroitdigitalstewards.tumblr.com/.

18 Ignacio Nieto, 'Free Mesh Networks. Two Cases from Chile', The Next Layer, 31 May 2015 https://webarchiv.servus.at/thenextlayer.org/node/1325.html. See also section 12.1 of this book.

5. FREE NETWORKS: WE ARE ONLY JUST BEGINNING

Fig. 22 Gio and Alexi in the Wireless Spring.

We are only just beginning, is the message I have picked up from the two biggest communities in Europe, from Guifi.net and from Freifunk. Since the publication of the first chapter and this one, Guifi.net has grown from approximately 25,000 to 26,500 nodes. Similarly, the political implications of the free network movement have become more easily visible today. As Jürgen Neumann and Monic Meisel report, Freifunk has *unfortunately* benefited massively from the Snowden allegations. Since it has become known how massive the surveillance machinery is, self-managed networks suddenly make much more sense again. While many things have been coming together to make Freifunk possible, one thing was less in their favor, the German legal climate. Freifunk finds itself at the center of a prolonged battle about *Störerhaftung*.

In Germany, from the very start I was asked by potential node owners, if they would not get themselves into trouble by offering an unprotected WLAN access. In Germany, there was and is a big worry about so called Störerhaftung – liability for violations of laws by users of an open WLAN access point. In Germany, cases of legal precedence have been created, where owners of WLAN routers were held responsible for violations of law by people who had logged on to their access point and used it, for instance, for file sharing of copyright-protected music and films. Such cases, however, have been relatively rare. The real problem is that in Germany, there exist specialized law firms who have made it their business model to send threatening letters to people whom they accuse of a violation. While often there is hardly any evidence, and the intention of those law firms is not to take those cases actually to court, they offer people an easy way out by paying a certain sum for an out-of-court settlement. People unaware of their legal rights and maybe scared of entering a prolonged legal battle with an opponent they consider superior, give in and pay. This is a real nuisance and has created a situation of insecurity for participants in Freifunk. However, this is not the only threat to network freedom

in Germany. There are genuine cases, where court cases have been brought by content providers and copyright owners who think their copyright has been infringed.

Freifunk has been battling those problems for a long time and has come up with some creative solutions. One is to build locally a community association which can then obtain the same status as a provider. While this solves the *Störerhaftung* problem it may create new ones such as costly legal obligations for data warehousing. So Freifunk in cooperation with the OpenWRT-Team released the first hundred *Freifunk-Freedom-Fighter-Boxes* – wireless routers flashed with an OpenWRT release configured to route all data via a virtual private network (VPN) through an ISP in Sweden, so that German law does not apply.

Fig. 23. Freifunk Freedom Box on Mainstream TV.

This action, launched in 2012 under the title *Freifunk statt Angst* (Free radio instead of fear)[1] created plenty of publicity. In an initial action, Freifunk gave away one hundred Freifunk Freedom Fighter Boxes. When users logged on to such a router, they got a Splash page which informed them about the political background.[2] According to Jürgen Neumann, one of the founders of Freifunk, the action had always meant to be a temporary publicity stunt. However, the battle against *Störerhaftung* in Germany turned out to be quite a protracted one. And for many people it offered a relatively safe option.

1 Christian Heise, 'Aktion gegen Störerhaftung: Anonym im WLAN an öffentlichen Plätzen mit Freifunk', 14 June 2012, https://freifunkstattangst.de/2012/06/14/aktion-gegen-storerhaftung-anonym-im-wlan-an-offentlichen-platzen-mit-freifunk/.

2 Splash page of Freifunk WLAN Access Point, http://anon.freifunk.net/.

At the same time, the Freifunk Freedom Fighter box was just one step of a larger counter-offensive on many layers. At the time of writing, in November 2014, there were several court cases going on concurrently. As Monic Meisel reported on 27 November 2014, one group of lawsuits had been stopped because the claimant had withdrawn all allegations. They obviously accepted that the accused was a member of Freifunk and that because of its quasi provider-like status there was no liability.[3] At the same time, the public climate also changed. In an article, Prof. Thomas Hoeren[4] reports that a number of court decisions had gone against *Störerhaftung*. Thomas Hoeren is a leading internet law expert in Germany and specialized in issues where technology and restrictions on it infringe on people's civil liberties. According to Hoeren, the liability of node owners is not a foregone conclusion.

Störerhaftung has meanwhile become recognized as an impediment to the development of a creative information society in Germany. The number of open WLAN hotspots in proportion to the number of citizens in Germany is very low. As I can confirm as a frequent traveller, in many countries around the world, finding an open WLAN hotspot is quite easy, but not so in rich and bandwidth saturated Germany. German media, such as *Heute*, the news programme of public national television, have started to recognize that *Störerhaftung* is one of the main reasons why there are so few open WLAN hotspots in German cities, towns and villages.[5] The German coalition government has announced in its coalition agreement to enable open WLAN hotspots in German cities. A number of cities such as Hamburg now also want to realize this. But until *Störerhaftung* is revoked, there will be legal insecurity. A new draft law has been created which, it is claimed will provide legal security for node owners. But the devil is in the detail and this law is so badly drafted that it actually could achieve the opposite, argues Prof. Hoeren.[6]

Freifunk has started a campaign in 2014, which has intensified in 2015, asking its members to write to their MPs to not vote in favor of this law and demand significant changes.[7] Up until March 2015, more than 200 MPs received letters informing them about inefficiencies of this draft law. In my view, these are good steps but need to be intensified.

Wireless community networks are growing up, they are getting a political voice. In such cases the technology itself is not the center of attention but serves as a catalyst to ferment wider political action. The issues and hurdles posed to wireless community networking turn activists into educators of the public. Together with other activists working against surveillance and for

3 Monic Meisel, 'Update zu den Feststellungsklagen', 23 November 2014: http://freifunkstattangst.de/2014/11/23/update-zu-den-feststellungsklagen/.

4 Prof. Dr. Thomas Hoeren, *Schluss mit der Störerhaftung*, Süddeutsche Zeitung, 10 May 2015 https://www.sueddeutsche.de/digital/forum-wer-haftet-1.2473293.

5 Alfred Krüger, 'Funkstille in deutschen Städten', ZDF Heute, 25 November 2014, archived April 2015, https://web.archive.org/web/20150418235850/http://www.heute.de/freie-wlan-netze-funkstille-in-deutschen-staedten-rechtliches-problem-stoererhaftung-36042870.html.

6 Prof. Dr. Thomas Hoeren, *Schluss mit der Störerhaftung*, Süddeutsche Zeitung, 10 May 2015, https://www.sueddeutsche.de/wirtschaft/forum-wer-haftet-1.2473293.

7 Christian Heise, Gesetzesentwurf zur Neuregelung der Störerhaftung: Wie es jetzt weitergeht…, 13 March 2015, https://freifunkstattangst.de/2015/03/13/neuregelung-der-stoererhaftung-wie-es-jetzt-weitergeht/.

open data, their activities raise issues that make the network more transparent for citizens. We can thus see different layers of being political.

On the most basic layer, material access is political, because there are situations and places where the availability of free or cheap broadband is an issue. We are reaching a point where not having internet seriously disadvantages you – you cannot fully participate in society. Freifunk Hamburg, for instance, in this podcast[8] tells about a refugee camp on the premises of St. Pauli church, where Freifunk Hamburg established a free hot-spot, without mightily banging its drum about it. Freifunk is now working with refugees in several cities, providing them with free internet, without advertising this too loudly, because of the many discriminations refugees face (not just in Germany).

While access to the network is one layer on which freedom can be formulated, another layer is the actual shape of the network. In the early 2000s, when free network movements started, broadband via ADSL and cable often came with restrictions, such as no fixed IP numbers and an automatic reset of the network connection once every 24 hours, as well as imbalance between upload and download speed. The actual shape of the network connection, its technical properties, also define how *free* a network is. This affects deep layers of network technology, where access points / providers have powers to filter and monitor traffic. Wireless community networks thus have an important function in educating the public but also politicians about the social necessity of net neutrality.

Finally, also on the layer of applications and content, networks can be more or less free. Here, one of the major sources of insecurity arises through issues such as copyright, or more generally speaking, intellectual property. In countries with a repressive regime, freedom of speech and other issues are also at stake. In my 2004 book *Freie Netze*[9] I tried to systematize those ideas by creating a layered model of network freedom. If demand arises, maybe I will translate and update this model.

In the meantime, however, since I wrote that earlier book, a major economic crisis has happened. Free network activists often appeared to rather robot-like repeat Richard Stallman's dictum that the *free* in *free software* is not about free beer, but about free speech. Well, maybe this opinion turns out, if applied to networks, to be narrow and dogmatic. Free or at least cheap telecommunication is an important issue of our times. Especially after the outbreak of an economic crisis, even in the richest countries, there is a digital divide, as some groups or strata of society tend to have no internet or also no PCs. Such issues are often connected with intractable social problems, where issues of class, economics, gender, ethnicity, all come together.

8 Hamburg.freifunk.net, podcast Freisprech 12, 06 November 2014, https://web.archive.org/web/20150317015328/https://hamburg.freifunk.net/2014/11/freisprech-12.html.

9 Armin Medosch, 'Freie Netze. Geschichte, Politik und Kultur offener WLAN-Netze', Heise Verlag, Hannover 2004, https://ftp.heise.de/tp/buch_11.pdf.

This goes so far that a recent study in wealthy Austria concluded that 600,000 adult Austrians (out of a population of 8.5 million) are affected by functional illiteracy. Digital literacy is thus a major issue which has repercussions for many other areas which affect the basic life chances and citizen rights of people. This poses questions for self-serving views of some free network activists who think their networks are free because they use *free software*. When people have problems with reading and writing, the potentially *liberating* technology actually just creates further obstacles, as more basic problems need to be addressed first.

On the other hand, it is exactly the potential of the internet to create an open knowledge society that makes it still so attractive and which could also benefit disadvantaged people. In the following chapters, I will thus try to address those questions. On the one hand, the paradigm change from industrial to information society has remained incomplete. It has become stuck halfway, where older layers and mindsets prevail and prevent the full emancipatory potential of the Net to be realized (see next chapter The Incomplete Paradigm Shift). On the other hand, I am certainly not the first and only person to have recognized that there are complex relationships between free networks, free software and society. Those problems pose themselves in especially sharp focus when free networks are created in poor countries and rural areas.

6. THE INCOMPLETE PARADIGM SHIFT

Fig. 24. Carnival Against Capitalism –18 June 1999. Photo: Manu Luksch.

This chapter takes a bird's-eye view of history, locating the developments of wireless community networks within a historical transition from industrial to information society. Following the thesis that this paradigm shift has become stuck, creating serious obstacles for realizing the emancipatory potentials of the information society, the conclusion can only be that those obstacles need to be overcome in order to realize *Society in Ad-hoc mode* as a positive, really existing utopia.

The historical context of the problems and issues regarding wireless community networks is what I call an incomplete paradigm shift. The term *paradigm* is used here in a specific and well defined sense. While the *paradigm* has been introduced into the scientific language by Thomas Kuhn's seminal book *The Structure of Scientific Revolutions*,[1] it has been given new meaning by the Innovation School in economics who, building on Kuhn's work, coined the term *techno-economic paradigm*.[2] Christopher Freeman and colleagues at the Science Policy Research Unit (SPRU), a semi-independent research institute connected with the University of Sussex, developed a theory of innovation in industrial societies. They claimed that technological progress since the beginning of the Industrial Revolution did not occur in a linear way, but in bursts and bouts, followed by periods of only incremental change. Influenced by the Austrian economist Joseph Schumpeter and by the Russian econometrist Nikolai Kondratiev, they argued that technological innovation was linked to the business cycle. It had long been known that economic activity in capitalist economies followed patterns of expansion and contraction. There is a short term cycle of three years and a medium term cycle of ten years,

1 Thomas S. Kuhn, The Structure of Scientific Revolutions. Chicago: University of Chicago Press, 1962.
2 Christopher Freeman and Luc Soete, The Economics of Industrial Innovation. 3rd revised. Cambridge Mass.: MIT Press, 1997.

which Marx had already observed and commented on, but it has been Kondratiev, studying long term price developments of staple foods such as grains who found out that there were so called *long cycles* of 50 years, which could be separated in two parts, an upswing of 25 years, followed by a downswing of roughly equal length. Those time periods are not mechanical but research since Kondratiev has confirmed the existence of swings in economic activity of approximately between 40 and 60 years.[3]

The period of a downswing, especially in its later stages, is usually experienced as a severe economic crisis. Schumpeter's contribution has been to show that such a crisis can only be resolved by clusters of innovations. In order to resolve a crisis of a paradigm in decline, a new paradigm has to come into place. This new paradigm will typically consist of new *leading technologies* but also new business models and new ways of working. It is never just the technology alone which allows a paradigm shift to happen, but without technological change it would also not be possible. However, in order for this technological change to happen, mindsets of people also need to change, new laws need to be made, a wholly new business environment needs to be created. That explains why it takes such a long time, 25 years, a whole generation, for a new paradigm to come into place.

The Venezuelan economist Carlota Perez, who also worked with Freeman and SPRU, has developed a stylized model of paradigm change, which gives this whole development some further plausibility. According to Perez, the new paradigm develops inside the womb of the old one.[4] Perez has divided the 50 years of the *long-cycle* into four quarters, separated by an interstice. The first quarter is when innovation gets started, usually by forward looking people, inventors, entrepreneurs, risk taking financiers, but also, I would add, artists, activists, and independent technological innovators. Once they have been able to show the feasibility of an innovation, others jump on the bandwagon and an investment frenzy starts. This will lead to an over-investment and a first crisis – an interim period of uncertainty. Once those insecurities are overcome, the paradigm reaches maturity stage. In this stage, all innovations made before are becoming fully relevant on a societal scale. This is the roll-out phase of the paradigm, when knowledge about new business processes and new patterns of behavior gets widely shared. Once this is achieved, however, the benefits of the new technologies, new business models, new ways of working, start to decrease. Since everybody now knows how to do it, the competitive advantage is gone, and the paradigm enters its fourth and last stage, saturation.

The key point, however, that Perez makes, is that during maturation and especially during saturation phase aspects of a new paradigm are already developed, albeit not yet widely recognized. While the benefits of the existing paradigm can still be exploited, something new is already breeding under the surface. At this stage, however, it is hard to say what the new paradigm will really be made of.

3 Joshua S. Goldstein, Long Cycles: Prosperity and War in the Modern Age. New Haven: Yale University Press, 1988.

4 Carlota Perez, Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages. Cheltenham, UK; Northampton, MA, USA: Edward Elgar Publishing, 2002.

It needs to be pointed out the theories about techno-economic paradigms have serious weaknesses. They imply a quite mechanistic way of historical development and as such, suggest a depoliticized view of history. History is always defined through human struggles which have many aspects, be they of a political, cultural or religious kind. Work under the title *Technopolitics*, initially undertaken by Brian Holmes and Armin Medosch, meanwhile more widely shared by a Technopolitics working group in Vienna, has widened the scope and perspective to not just look at techno-economic but also techno-political paradigms. History is not only defined by economics and technology, but also by politics, which implies raising the fundamental question how we want to live, as individuals and as social groups or classes.

The economic innovation school appears to almost willfully exclude such a political perspective, implicitly suggesting that capitalism itself will continue forever, in one way or the other. But as recent years have shown, the struggle is exactly also about that aspect of the argument, with new social movements in the European and global South suggesting a different type of economic model, often based on commons-types of economic activity where cooperation plays a larger role than competition.

It is now not so difficult to apply those theoretic concepts to recent history. According to Freeman, Perez, and other scholars, the fourth long-cycle had been defined by the industrial mass production of consumer goods, in particular cars, by communications technologies such as radio and television (which relied on a centralized *broadcast* structure) and on cheap energy based on oil and other fossil fuels and nuclear energy. This paradigm reached maturity during the first decades after the Second World War, when it allowed for a long boom of economic expansion, led by the United States. It was successfully copied by nations who had been defeated in that war but now had become the biggest American allies, Germany and Japan, as well as other states in Europe. This industrial paradigm is often referred to as Fordism, after Henry Ford, who invented the core production technology supporting it, the assembly line.

However, it is very important to point out that this paradigm also had an economic and political aspect. Because of the economic, political, or simply human catastrophes of the first half of the 20th century and because of the existence of the Soviet Union proposing itself to be an alternative socio-political model, capital was willing to compromise and find a way of co-existence with labor. This manifested itself in concessions to organized labor, such as the right to form trade unions and the agreement to collective bargaining. These institutional arrangements guaranteed rising wages and rising living standards in the USA, Western Europe, and Japan for 25 years. In the 1970s, however, for a combination of reasons this model entered a crisis, and the new techno-political paradigm, the *information society* began, at first under the surface of what was then called *Post-Fordism*.

The 1970s were a period of crisis and transition, when the new paradigm had been kickstarted by the mass production of microprocessors by Intel in 1970-71 making computing small and cheap. This was at first only recognized by an avant-garde of techies, intellectuals, financiers, people who met, for instance, in the Homebrew Computer Club, or worked in research labs such as Xerox Park, where the first GUI was created. Yet by the end of that decade, the first Personal Computers (PCs) were brought to market, and the electronic and digital world started

to capture popular imagination through video games and films such as Tron. Now, rather than continuing with such a chronological narrative, I would like to point out that by the early 1990s, the information society was established, and with the opening of the internet, an investment frenzy started, at the time known as the New Economy. It first hit the headlines of newspapers globally, when the browser company Netscape received two billion dollars for its initial public offering (IPO) at the stock market.

When we now take a look at the old paradigm, Fordism, and the new paradigm, information society or *informationalism*, we can see that in many aspects it has turned to completely the opposite of what had been in place before. Had the old paradigm depended on hierarchical chains of command from top down to the bottom, the new paradigm fostered much flatter hierarchies and cooperation. This found its most pronounced expression in the leading sector, ICT (Information and Communications Technology), where *commons-based peer production* became the new norm. This term, coined by Yochai Benkler, suggests a new cooperative type of production, pioneered in free and open source software.[5] People decide themselves on which projects they want to work and freely associate themselves with software projects. These projects are then often not organized in a completely egalitarian way, sometimes there are so called benevolent dictatorships. But the core issue is that it is free cooperation and that the results of that cooperation are entering a digital commons, a pool of resources which can in principle be used by all.

I could continue now with a much longer list of transitions from the old to the new paradigm, but would rather restrict it to a few core examples. Another important point is the type of media used. Fordism relied on a centralized model of broadcast media, with electronic media such as radio and television sending out their messages to people. *Feedback* was provided mainly through viewer statistics but also focus groups used in product marketing. The informational paradigm is characterized by *pull*-type media, where people either communicate with each other directly, through the internet, or use *on demand* platforms to watch what they want, when and where they want it. This would seem in principle to foster a much more egalitarian media culture, a *read and write* media culture, as Lawrence Lessig, advocate of the Creative Commons licenses for free content, has called it.[6]

The problem at which I wanted to get through this rather lengthy parenthesis is that all those great ideas and innovations have somehow become stuck halfway. It is true that in principle free cooperation has become much more important than hierarchical top-down structures. However, hierarchies have not gone away, and command structures have become established on another level. It is true that the combination of cheap computing power, laptops, and the Net has enabled a much more egalitarian media culture. At the same time, however, new centralized media powers have arisen which did not even exist 20 years ago, companies such

5 Yochai Benkler, The Wealth of Networks : How Social Production Transforms Markets and Freedom. New Haven, Conn.: Yale University Press, 2006.

6 Lawrence Lessig, Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity. London: Penguin Books, 2004.

as Google and Facebook who have acquired a centrality compared to which Henry Ford's business empire pales.

One aspect of this paradigm change which has not been mentioned yet, must be added quickly, which is *financialization* and *neoliberalism*. Finalization describes a process where ever more areas of the economy were reshaped according to principles stemming from high finance and finding their most potent expression in computerized, networked stock markets. This means that even companies who on the surface still mass-produce consumer goods, now act according to a new set of principles. While in the old paradigm, the Fordist multinational corporation had been hierarchically organized, subsuming under one company all kinds of activities – development, production, marketing, catering, cleaning – in the financialized economies of now, corporations have been broken up and shed all those parts which do not promise a maximum of profit. Production typically happens abroad, in so called low-wage countries, while things such as cleaning or catering or transport and logistics are outsourced to companies exposed to breakneck competition.

This system has arisen in tandem with the neoliberal economy. We can say that while financialization is the *mode of production* of the information society, neoliberalism is its political ideology. It suggests as the best way forward a scaling down of the state and its functions, while everything should be ruled by market mechanisms. This, it needs to be said, is an ideology. The reality is different. In neoliberalism, the markets are not free and the states have an important function, but this is rarely ever said. Neoliberalism is now the ruling ideology and as such, it does not have to care about reality. It has won the argument, at least as far as business circles and politicians are concerned, and as a consequence, many rights and achievements of the labor movement have been rolled back. This has led to a much more uneven economic development, with a rising gap between rich and poor. Even the OECD, which itself is a kind of neoliberal think tank of the most developed countries has recently conceded that never before has income inequality been as pronounced as now.

As a result, the paradigm shift has remained incomplete. As Karl Marx and Friedrich Engels had already observed in the mid 19th century, capitalism is technologically innovative. This would create the condition which would theoretically enable a new type of society. The informational paradigm has this potential to enable a knowledge society, a cultural society, where sharing, learning, and the creative realization of the self become core aims. These beneficial aspects and potentials of the liberal technological utopia are constantly undermined by capitalism's need to maintain current social relations. It has to catch the surplus amount of freedom in order to maintain the political status quo. Thus, you have *Störerhaftung*, data retention laws, surveillance, Big Data, the rule of the financial markets, the command of capital.

The bigger sweep of history shows that there is a structural analogy between the distributed or decentralized structure of the Net and the ideals of the revolutionary sixties. The global revolts of '68 were against the docility induced by one-directional, one-dimensional societies of mass production, where TV organized the consciousness of the worker-consumers. The drive for decentralization has come from many corners, but has its origins in the social movements of the 1960s. The foundational technologies of the internet were developed in the late 1960s,

by staff and students at public universities, who made the results of their research public, thus creating the foundations of the digital commons. Inspired administrators such as J.C.R. Licklider were driven by visions of networked digital public libraries.[7]

The information society has inherited those ethical values which have also become embodied in the structure of digital technologies in general and the internet in particular. From this point of view, the Net as it exists today is a mesh network, and it is free and neutral, at least on the level of protocols, as I have written in the first chapter. The information society as such, however, has only been established in core nations in the 1980s and 1990s, and not everyone loves its decentralizing, horizontal, participatory groove. So there are those continuing tensions and contradictions going on, between those forces who still defend their privileges and sources of incomes, but also patterns of thought of the old paradigm, and those who propagate bottom up social self-organization and a free culture of sharing and cooperation. Advocates of free culture need to be careful, however, not to become victims of their own ideology.

As this article on Rhizome[8] has pointed out, there is a connection between mesh networking and decentralization in general, but this opens the danger of a re-centralization. In an article in 2004, I speculated about similar issues, regarding a *Society in Ad-hoc Mode*. We have to be careful not to be carried away too much by those technological and political analogies. A mesh network can also be used by the army. Well, the first mobile ad-hoc networks were developed by the US army. The social version of the ad-hoc mode may have liberating potentials, but we do not need to forget that neoliberalism is the political economy of informationalism, and that means that ever more areas are exposed to financialization. The plutocracy of global finance prefers *ad-hoc* structures such as the G7/8/20 conferences. They like them, rather than more democratically legitimate structures such as the UNO. Globally important decisions are made by ad-hoc committees rather than more democratically legitimized multinational structures. The allocation of the means of social production – and that is what finance is[9] – is regulated by stock markets which are increasingly networked and automated, rather than by considerations about the well-being of people, animals, plants and the sustainability of natural resources. Decentralization can become a dangerous ideology when detached from actual social content. On a political layer, it is then either a form of libertarianism or anarchism.

The negative effects of financially driven globalization have been countered by new global protest movements that emerged as a specific new political culture of the Net in the 1990s. As the old class politics were replaced by a newly constituted *working class*, which has become rechristened as the *multitudes*, new forms of networked protest were pioneered in the 1990s. With support of the Association for Progressive Communications[10] during the Chiapas uprising in 1994, messages from Subcommandante Marco were smuggled out of the Lacandona

7 Morris Mitchell Waldrop, The Dream Machine : J. C. R. Licklider and the Revolution that Made Computing Personal. New York: Penguin Books, 2002.

8 Adam Rothstein, Making Internet Local, Rhizome, 06 November 2014, https://rhizome.org/editorial/2014/nov/6/making-internet-local-mesh-network/.

9 Saskia Sassen, Finance as Capability: Good, Bad, Dangerous, Arcade 2014, https://web.archive.org/web/20150620143536/http://arcade.stanford.edu/occasion/finance-capability-good-bad-dangerous.

10 Association for Progressive Communications, https://www.apc.org/.

jungle via the Net and triggered a global campaign of solidarity which stopped the Mexican army from committing genocide against the descendants of the Maya people.

The increasing financialization during the era of the New Economy peaked in protests against the financial centers and free trade such as June 18th and the Battle of Seattle in 1999. The multitudes got together on the streets, organized in a decentralized way, via the Net. It is no coincidence that June 18th and Seattle were foundational moments for Indymedia. However, those were early high-points of a new form of networked protest that has received various names, from the Arab Spring to the Indignados to Occupy – movements for the right to democratic self-organization supported by a variety of DIY network technologies.

All major protests against G7/8 meetings after Seattle had independent media centers, IMCs, which in some cases were attacked by the police. Ad-hoc networks for mobile devices carried by crowds could make uncensored communications possible, even when mobile phone networks are shut off. The ad-hoc mode, the power of self-organization has become part of a wider epistemological shift in the information society. Starting in the 1980s, but intensifying in the 90s, there was a flood of terms such as *emergence*, *complexity*, *self-organization*, which were spilling over from techno-science into common language. These are all terms which come from a second order cybernetics, the cybernetics of cybernetics, and form an epistemological framework for the network society. In some cases they have become mixed with other terms from the social sciences and philosophy, such as *spaces of flow* and *lines of flight*. In some cases this is just old-fashioned philosophical idealism in a new dress-up. In the worst case, this can become part of an ideology, where neoliberalism, libertarianism (or anarchism), high-tech and finance meet to create new ideologies of power and domination, for which the best example is still Kevin Kelly's book *Out of Control*.[11]

Against this backdrop, I have advocated, already years ago, a political understanding of the term *self-organization*. One of the few coherent concepts for self-organization was developed by the philosopher, psychoanalyst and political activist Cornelius Castoriadis.[12]

Castoriadis' ideas center on autonomy (self-determination) as opposed to heteronomy (outside control). In his view, self-organization is not simply a better model for organization or management, serving instead as a principle for 'the permanent and explicit self-institution of society; that is to say, a state in which the collectivity knows that its institutions are its own creation and has become capable of regarding them as such, of taking them up again

11 Kevin Kelly, Out of Control: The New Biology of Machines, Social Systems & the Economic World. New York: Basic Books, 1995.

12 Cornelius Castoriadis took part in the attempted Communist coup in Greece in 1944. This experience turned him into an opponent of Stalinism and he went to France, where he joined the Trotskyites, soon leaving again due to their authoritarian tendencies. He then founded the group *Socialisme ou barbarie* and the publication of the same name. In his work with this group, he developed his ideas of self-organization, using the example of wildcat strikes, among others. He was one of the first radical socialists in France at the time to publicly criticize Stalinism, as well as publishing critiques of Marx's historical determinism.

and transforming them.'[13] Castoriadis went back to the direct democracy of the Greek city state in order to find out how democracy should reinvent itself today. This vision could also be achieved by using self-organizing technologies such as mesh networks. What is dangerous, however, is any belief that automatically links the technological with the social level of self-organisation.

The protest movements of the late 1990s and the concepts and ideas of free software have inspired new ideas regarding the possibility of self-organization. In the 1990s, this has led to a lively discourse, first, about the digital commons, then about the notion of the commons in general. The rise of the information society enabled an avant-garde of software developers to create the digital commons. As I have described in much more detail in my article *Shockwaves in the New World Order of Information and Communication*[14] the success of the digital commons has then been transposed into other areas. People such as Michel Bauwens of the Peer-2-Peer Foundation are propagating the idea of the commons as a new social model that could be applied in all areas. After the financial crash of 2008, the commons movement internationally has taken up steam. Electoral victories by protest movements in Greece and Spain signal, that a political change has started which could lead not just to a new techno-economic but also to a different political paradigm in which the commons and social justice play a greater role.

While I do not insinuate that every member of the free network movements shares leftist political ideas, I propose to consider such a larger socio-economic environment. The self-organizing mesh network could thrive much better in a self-organizing society. Currently we live in an ongoing era of insecurity. The new paradigm is not yet in sight, its shape remains to be determined. I think that, without this being a foregone conclusion, commons of all types, technological, social, political, could play a much greater role in the next 25 years, while at the same time we need to be cautious regarding the ideology of the information society which has made a language of self-organization, emergence and complexity its own, while actually building new hierarchies and new forms of domination and repression.

6.1 Comment: Brian Holmes: The Long-Awaited Shift is not the Paradigm

Armin, you are a very strict guy when it comes to concepts. From my view that's fantastic and I think you should go a little further with it.

If we are talking *techno-political paradigms*, the informational shift happened, and it was complete. From the 90s onward (with significant precedents in the US a decade before) network technologies under strong corporate and state control provided the communicational glue for a new organizational form that was able to reorganize production on continental and

13 Cornelius Castoriadis, The Castoriadis Reader. Oxford; Cambridge, Mass.: Blackwell Publishers, 1997, p. 30.

14 In Blackwell Companion to Digital Art. Paul, Christiane, ed., Hoboken, NJ: Wiley-Blackwell, 2016, pp. 353-383.

global scales. Of course, financialization represents a speculative excess over global just-in-time organization. But finance has also been a key enabling component of the informational production paradigm. The capacity to raise money on capital markets and use it to create new industrial plants, extractive operations, and distribution chains, all in record time, has been the excruciating history of the last three decades. Finance allowed IT to become productive. The results have built a new Asia.

What has not yet happened is any perceptible shift in the overall mode of development. Yet what your text is about (this chapter, and the whole book) is precisely the emergence, in nuce, of a cooperative mode of development in the key sector of the neoliberal production paradigm, which is obviously information technology. That's the amazing thing. Just as mechanical engineers in the 1910s and 20s were widely seen as progressive, even revolutionary social agents, so software engineers, with their open source coding, have been and still are seen as potentially revolutionary social agents in our time.

What has been missing up to now, in my view, has been the capacity for the cooperative mode of symbolic code creation to organize forms of material production that can be concretely useful to everyday life, beyond the realm of images and signs. The factory mode of production brought many new use values into being, for all social classes. Informational production has thus far remained under the control of the corporations and the state. They dictated its major forms. The paradigm shift was for them.

Yet probably in the time I have been writing this, solar panels have gotten cheaper. Certainly their cost has plummeted over the last five years. We know from the history of techno-politics that a change in energy source is a major change indeed (cf. the book *Carbon Democracy*,[15] a fundamental book for all that interests us). Solar panels become socially progressive in the context of decentralized smart grids, and even more so when they are used to power micro-manufacturing technologies. Under normal circumstances, these are the kinds of techno-political transformations that capitalist oligopolies would do everything possible to suppress (call it the *Tesla syndrome*). Today they are still trying to do that, with the big guns of oil and nuclear power. But climate change, runaway automation and an exponentially increasing global population are not normal circumstances. Unprecedented numbers of people need to survive and thrive in a way that does not constitute a path toward collective suicide. Solar panels, windmills and decentralized micro-manufacturing have a real chance over the next long wave.

Every forty to fifty years, capitalism completes a paradigm shift. Great news for the capitalists! Or to hell with them, I say. Now, as in the 20s and 30s of the last century, what we can struggle for is something far more beneficial. A change in the mode of development itself.

15 Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil*, Verso, 2011.

7. FREE NETWORKS BETWEEN COUNTRYSIDE AND CITY, BETWEEN NORTH AND SOUTH

Fig. 25. Mariposa Hill, Valparaiso, Chile. The blue building on the right is the Torres de Mesana Community Center.

The previous chapter has delved into some of the bigger implications of free networks in relation to the overall historic development. It has described the overall development as an incomplete paradigm shift, characterized by an ongoing structural crisis of the information society. This chapter starts with the question, what makes a network sustainable? On the surface of things it looks like the conditions for growth are better in rural areas, where there are no good alternatives provided by the telecommunications industry. Examples in Spain, Germany, as well as Greece show that there can be successful models that bring together community initiatives with municipalities. This appears to have worked less well in the USA where after a good start in the early 2000s hardly any wireless community networks exist. It seems that the relationship between rich and poor in the US is almost like the relationship between the overdeveloped world and the poor nations of the South. This chapter finishes with a more sustained look into selected projects from the global South.

As the introduction to this chapter has stated, it often looks like the main difference, regarding the demand for wireless community networks, is whether broadband is available at reasonable cost or not. In East Berlin and East Germany, Freifunk found a lot of support initially because of the presence of the OPAL network, a fibre optical backbone which prevented the implementation of ADSL. The availability of broadband often comes down to the difference between the city and the countryside. Therefore, Guifi.net in Spain had its origin in rural Catalonia.

In the countryside in Catalonia, the problem was and is that it is hard to get broadband internet at an affordable price. As the very first chapter has pointed out, Guifi.net originated in Gurb, a small village near the larger town Vic. Twelve years ago, there was no broadband in Gurb, not even for a very high price. Now it is attainable through telecommunications carriers, but the price is very high. The reason, according to Guifi.net founder Ramon Roca, is the collusion between business and politics. The incumbent telecommunications provider has no incentives to change its business practices. Since the liberalization of telecommunications laws in Spain, no significant competitor to the incumbent has arisen. Guifi started in the countryside out of a real need. According to my interview with Ramon Roca, initially they could use a public library as access point:

> One of the things that helped us a lot in the beginning, maybe we did not have the internet at home, but looking at places where there were some public institutions like libraries was a way of sharing the internet. In our case it was a public library, it was paid through our taxes. So we were already paying for that internet access; and they were happy for sharing it. It was free in this case in terms of gratis, so it was paid already by taxpayers' money.

Ramon suggests, there are a number of ways in which community networks and public institutions can cooperate. So this is like an open model of cooperation between community network and the communes, the local small political entities. This is not a one-size-fits-all scheme of *municipal wireless*. There have been several schemes around the world, where cities made full-mouthed announcements about bringing free WLAN to public places, but then soon had to row back for various reasons. What Guifi.net promotes is something else, a suggestion of cooperation between communities and public entities. For the politicians, who want to get re-elected, it is good to support Guifi, because they can say they brought their citizens cheap broadband, and for Guifi support by the municipality makes life much easier. Similar models have also been founded in Germany, where Freifunk communities have entered successful cooperations with local communities or firms; and in Greece, where in the Sarantaporo area wireless community networks[1] are getting built.

The enthusiasm around Sarantaporo is a reminder of how exciting all this has been, as it was in other regions 10 years previously. There seems to be a better chance that community WLAN prospers, when it taps into other needs of a region or community. The fruit and vegetable farmers in Sarantaporo hope to have a more direct access to markets, giving them fairer prices.

In cities such as Barcelona it is different. There, you have various providers offering different types of broadband, from ADSL to cable to fibre optic at relatively affordable prices. The widely shared assumption is that in such a setting there need to be other motivations to participate in a wireless community network; for the municipality the motivation – it seems – to support

1 Sarantaporo.gr, https://www.sarantaporo.gr/. See also the documentary by Personal Cinema, Building Communities of Commons in Greece (1:03:15), July 2016, https://www.youtube.com/watch?v=T5Uj-twO-zc.

such a network is small as the politicians can say that the market provides for all needs. But this is not really true.

I would advise caution with regard to such assumptions. In the still ongoing economic crisis, the price for broadband is not negligible, especially if you are on low income. In cities there is also a digital divide but it is part of a larger divide, of social stratifications in class-based societies where the class structure is often veiled behind a language that implies there is just one large middle class. This class structure often coincides with shifting urban geographies. I think community networks would be wise to adopt strategies which make it a strong point that collective and not-for-profit network provision is also cheaper and fairer; even in the city it gives an economic advantage. The second point is that also in cities it can be beneficial to have cooperation between community networks and political entities.

In Berlin, a benevolent development has been the financial support of the regional government for the Berlin Backbone, built by Freifunk. This gives Freifunk resources to work with, such as money for hardware, access to public buildings but also added legitimacy in the public eye. Getting access to tall public buildings such as the mayor's hall in the Berlin district of Neukölln and using it as a hub for the wireless backbone, has had a very positive impact on the perception of Freifunk by the public and in the media, according to Jürgen Neumann. Freifunk had used some tall buildings and also churches in Berlin for many years for its wireless backbone. Only after getting access to mayor's halls in Kreuzberg and Neukölln, Freifunk suddenly became celebrated as Robin Hoods of network society, especially since they used those buildings not only as supernodes for their backbone but also to distribute open public wireless access. Citizens in some of the more edgy inner city areas of Berlin, can now access the Net on their smartphones and tablets while waiting to conclude some public errands.

It appears that both Guifi and Freifunk have successfully built models for growth of community networks across large metropolitan areas – because this is what is the case, their networks cover not just cities such as Berlin and Barcelona, but whole regions such as Catalonia and Eastern and Northern Germany. The crucial point is to tap into real needs, which are always slightly specific and local, and find a layer where it is possible to bring those needs and resources together. Yet, *resources* in this context means the mobilization of people to come together and cooperate.

This appears to have worked less well in the USA. In the most powerful nation of the world, the USA, the regulatory climate and the general business environment is so strongly pro-business that community networks have a hard time to get going at all. The USA really pose a conundrum. In 2003, 04, 05, there were community networks such as NYC Wireless, Seattle Wireless, and Personal Telco, Portland, Oregon. Those initiatives were quite vocal and participated in regional and international debates. Nowadays you have to search for them like a needle in a haystack. As this article[2] shows, there are still some wireless community networks in the USA. This is really great, but Pittsburgh's mesh network with its 11 nodes

2 Jason Tashea, 12 communities experimenting with mesh networks, Technical.ly, 06 April 2015, https://technical.ly/diversity-equity-inclusion/12-communities-experimenting-mesh-networks/.

looks a bit meagre compared with Guifi's almost 28,000 at this point in time (9 April 2015), or Freifunk's nearly 13,000.

The story of one such project, Wireless Philadelphia, is being told in this report by New America.[3] The city of Philadelphia created a *quango* (a quasi-autonomous non-governmental organization), Wireless Philadelphia, with the aim of creating a city-wide wireless network. However, this quango made the mistake of handing over the commission to build the network to a private company, rather than consider alternatives (such as an initiative by community activists). This created a dependency and weakened Wireless Philadelphia's ability to carry out its declared goals of closing the digital divide. Now, a newly configured Wireless Philadelphia tries to find other ways of furthering network access. The regulatory climate is difficult, to put it mildly. Companies use the courts to prevent cities from supporting non-commercial networks for poorer citizens, as this is considered *unfair competition*.

7.1 Free Networks in the Global South

It is a question that stares you into the face when you study wireless community networks. Hardly any seem to exist in the USA today, despite the work of organizations such as the Open Technology Institute which does its best to promote and study wireless community networks. OTI, formerly part of the New America Foundation (which has been renamed New America[4]), is behind projects such as the Digital Stewards scheme in Detroit, where people are sent into poor areas to raise digital literacy. After the riots in Ferguson and Baltimore in recent months, the world has been reminded that in the USA race and class divisions go through society which are reminiscent of the divisions between the rich overdeveloped world and the poor global South. A scheme such as Digital Stewards reminds of approaches in so called *development projects* with ICT in what used to be the Third World many years ago.

The basic scheme behind such projects was that the good knight from the North came with his horse and shining armor to bring the internet to the suffering people of the South. For *horse and shining armor* think, of course, jeep, laptop, and solar panels. From very early on it was considered a good idea to use wireless networks in poor, rural areas. In my book Freie Netze (2004) I had a chapter about a number of such projects (pp. 152-157). Lee Felsenstein is not just a pioneer of computer science but also a pioneer of community networks, having built the Community Memory project in the Berkeley area between 1972 and 74, probably the first computerized community network in the world. In the 2000s, Felsenstein was involved with the JHAI foundation which undertook ICT projects in Laos and Cambodia. They developed a special purpose computer with low energy consumption and resistant to the extreme climactic conditions to link villages and assist them in important issues such as crop selection and bringing their harvest to markets. Meanwhile, I would assume, many more projects of this kind exist.

3 Joshua Breitbart, The Philadelphia Story. Learning from a Municipal Wireless Pioneer, New America Foundation, ca. 2007, https://web.archive.org/web/20130317002126/http://www.newamerica.net/files/nafmigration/NAF_PhilWireless_report.pdf.

4 New America, https://www.newamerica.org/.

While I would not doubt for one millisecond the good intentions of everyone involved, the problem with those schemes is their one-sidedness and the specific ideas regarding *development* and *aid* they are often connected with. Thomas Krag and Sebastian Büttrich of Wire.less.dk have been involved with Geekcorps and went to Ghana to build wireless networks. They went there well prepared, bringing technology such as the solar energy supported *Autonokit*, a set of hardware and software components that should allow building a wireless community network based on free and open source software in Africa in the countryside. What they had to find out is that our notions of free and open source do not necessarily function in Africa in the same way. In areas where poverty is endemic and education and knowledge are bottlenecks which are an impediment to development, some of the people they had to work with, such as local business people and ISPs were not fond of the idea of sharing knowledge. They were afraid that if they trained people so that they could build wireless community networks, they would walk away and found their own companies.

Fig. 26. Elektra, right hand side, at workshop at Espacio G.

Even where the social separations are by far not as pronounced as in sub-Saharan Africa, obstacles arise from the nature of the social environment. In 2010, Ignacio Nieto reports, an extremely interesting project was launched in Santiago, Chile. After a meeting of free network activists from Latin America in Uruguay, this group, together with long-term Freifunk activist Elektra, came to Santiago to realize a project that would use a wireless community network to connect to a pirate television station. Through the wireless network, an internet portal was created, through which everyone would be able to post video which then would be re-broadcast on the television station. The project very nearly succeeded, but after Elektra, who had provided a lot of the technical expertise, left, technological development stopped. It also seems that there were issues around the appropriation of funds.

Fig. 27. Antenna installation on Mariposa Hill.

In 2014, Elektra was again invited to Chile, this time by Espacio G, an alternative gallery hacker space in Valparaiso. There, poorer areas in the outskirts had been devastated by fire. While people live on the hills, all public services are in the valley. So the idea was to connect the two hillsides through a mesh network. Again, a prototype was built with Elektra's help. In a recent interview she called those types of projects *helicopter drop* projects. As a well-meaning person she participated, but was already aware that this was possibly not very sustainable. And again, soon after Elektra's departure the project fell apart for a number of reasons. One reason, according to Ignacio's report[5] was that the people in the poor neighborhoods of Valparaiso were not motivated enough. They probably did not feel they had a real stake in the project.

It does not necessarily have to be that way. Carlos Rey-Moreno works at the University of Eastern Cape in South Africa. His project, which also received support through the Open Call of the Confine EU project, created a wireless mesh network and Voice-Over-IP (VOIP) project in a tribal area in the Eastern Cape province, where the Mankosi people live.[6] Here, the aim has been from the beginning to involve the community as much as possible to create a sustainable model for a village telco. As Carlos Rey-Moreno told me in an interview, it is important to consider the specific circumstances that came together.

> Mankosi is composed of twelve villages, around which 6,000 people live in 500 households. The average income per household, consisting of around 10 people, is about 53 euros. In this community, there is coverage from mobile telephone operators but they tailor their services for wealthier urban users. South Africa is the second most unequal country in the world when it comes to income distribution. With regard

5 See below under Case Studies: Free Mesh Networks. Two Cases from Chile.
6 Village Telco: Mankosi – South Africa, https://villagetelco.org/deployments/mankosi-south-africa/.

> to mobile communications, matters are made worse by middlemen who go to town and bring the airtime, so that there is a markup for airtime, local people are charged even more than everyone else. We are talking of about 30% of household income going into phone communication, with all the hazards that implies for other areas, such as health, education.

The project used *mesh potatoes* from the Village Telco project as hardware. Twelve houses were chosen as nodes, with solar panels and antennas. The local people were involved in all aspects of the project, such as choosing the houses and installing everything. It was not always a smooth process, reports Carlos. The locals are used to relying on the tribal elders for all decisions. The result is that not always everything is very transparent. For example, some of the owners of the houses where nodes were installed did not tell everyone else that this new infrastructure was a shared property. After seven months absence, Carlos returned and started a process of public meetings.

> Now we have regular meetings with about ten people meeting monthly, people from every village, so that it has become much easier to reach decisions. This is now beginning to take root, that working together is a better way. They start to apply that to other areas as well. Some sort of transformative effect appears to be taking place, apart from the network as such.

Initially, the plan had been to use the network mainly for voice calls between the 12 villages. But then the villagers raised the demand to also make break-out calls into the telephone net. As a result, a cooperative was formed, which has attained the status of a local network carrier. As a small provider, they could negotiate better conditions with a commercial VOIP company. Carlos stresses that now the project has become self-sustainable. Income is raised by using the solar panels for charging mobile phones for a small fee. Break-out calls can be made at a quarter of the normal costs. The maintenance and the operation of the network is now in the hands of the people of Mankosi. It is true that Western Cape University provided initial capital and that Carlos' role had been important to overcome initial hurdles regarding technological and social issues. He thinks that it had been important that of the 20 months of the project's duration, he had spent around 10 months in Mankosi. At the same time he thinks it had been important that he took care not to impose himself on their decision making processes and allow them to find their own feet. But now he thinks this has created a model that could be replicated with much less work in other, similar areas.

8. THE MIXED POLITICAL ECONOMY OF GUIFI.NET

This chapter throws a closer look at the different models used economically by Freifunk and Guifi. In particular, it investigates in which ways the fact that Guifi has a mixed political economy contributed to its growth. This sub-chapter also investigates the terms in which network freedom is defined and with which other ideas and measures it is connected.

Guifi and Freifunk have chosen different models. In Germany, it seems there is a high ethical stance adopted by volunteers who are building and maintaining networks. The initial *Model 1* as proposed by Consume (see Chapter 1) was that each node should be built and maintained by its owner. But this turned out to be slightly utopian. Building proper, reliable nodes goes still far beyond the capacity of the average user. So in Germany, the networks are built by volunteers, who donate free labor to build and maintain networks.

In Spain that happens too, but in addition to voluntary work there is also the option of having people come to build one's node in a paid capacity. Only slowly I start to understand what a complex *being* Guifi.net is. I am not implying that volunteers in Spain are less idealistic than their German peers. But I would like to high-light that Guifi has created a unique mixed economy where capitalist elements can co-exist with the commons, and vice versa.

Guifi is managing an expanded web of contacts between node builders and node owners via the Guifi website. This website is, by the way, far more than simply a website, but more like a central hub that facilitates the growth of Guifi. A quite elaborate social media system has been built, which allows users to rate network builders, who are often small IT companies, consisting of one or two people. In times of a severe economic crisis in Spain, this enables aficionados of free software and free networks to earn a bit of money. Maybe this gives Guifi a chance to maintain its fast growth rates.[1]

In Germany, it seems, paying people to build networks is anathema to most. The shared ethical stance – which has been voluntarily adopted and not been imposed by anyone – demands that people build free networks through free labor. Both models have their pros and cons. The German model works as long as enough techies are available to donate their time. Even the Berlin Backbone is built without paid labor. The funding from the Berlin Brandenburg Media Agency is only used for hardware and other materials.

The Spanish model seems to work pretty well too. But it can also have centrifugal consequences. Some of those service providers will always want to privatize the network segment they have created. They will try to take their customers with them and build a service provider company. However, the Guifi foundation exists as a governance layer to prevent this.

1 Guifi.net: Node statistics, https://guifi.net/guifi/menu/stats/nodes.

Both, Guifi and Freifunk have become very strong in advocacy. Neither of which sees itself as a centralized company or a network provider. Neither the Guifi Foundation nor the Freifunk Förderverein (not-for-profit umbrella organization) are running those networks. Their task is to advocate the building of free networks in two directions: on one hand, towards the official world of institutions, city, town and village administrations, and internally, regarding the community of active and potential network builders. But there is also a difference, regarding the type of advocacy.

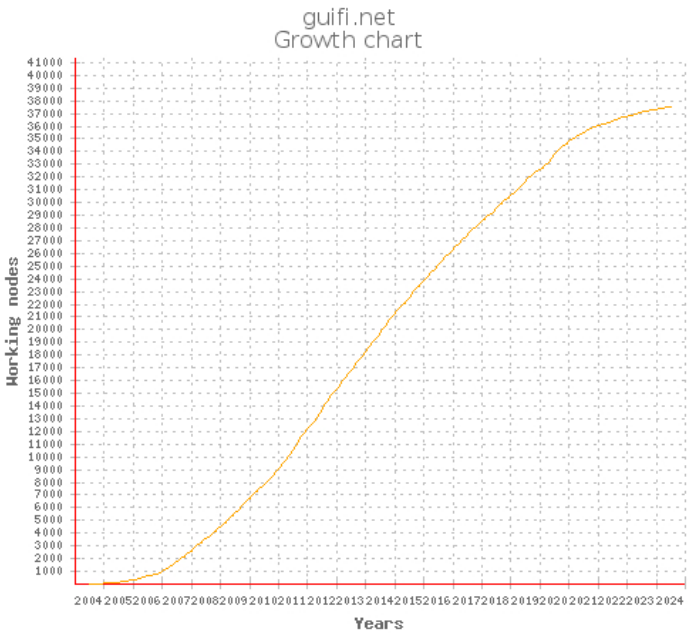

Fig. 28. Guifi growth rates from 2004 with predictions until 2024.

In my view – which I do not claim to be objective and someone can come and correct me – Guifi advocates the right of access to the internet as a fundamental freedom and right for all people more strongly than anybody else, while Freifunk argues slightly differently, advocating the political implications of a free network, free from government surveillance and commercial interests, which may distort network freedom.

Guifi is consciously creating a network commons and uses also the term commons in its language. Ramon Roca:

> The network is managed as a commons. Whatever you have wireless and cable-bound, whichever protocols, and all the economics – which are a lot – have to respect that the network is in the commons. It is not in control of a single person, single company, single point of interest. That does not mean that there can be no business. A lot of business can happen around that but based on the service.

He insists that whoever makes a business there by building the network, planning, and maintaining it, 'has to respect that the return comes from his services. It is not coming from claiming ownership of the network and then asking a higher price to whoever wants to use it. They have to respect the internet as commons.' Ramon Roca:

> We are not building a private internet, we are part of the internet. Internet is the result of the networks, so we are simply a part of that. We have a portion of the internet that works as a commons, and other portions maybe do not work as a commons. And the only thing we have to do is to interconnect. So what happens inside the commons is we do not charge anything for interconnecting.

The mixed economy allows people to build a business model for instance by providing some kind of support after disasters. They guarantee they will bring a node back within four hours for a certain fee. But you are not charging for interconnecting between networks, which is called peering. Guifi are systematically peering, for free, explains Ramon.

> You don't take economic advantage from each other. Don't be intrusive in terms of looking what they are doing, in terms of privacy also, which is taken care by the licenses, and doing the business but not in controlling the network, keeping it as a commons.

In order to do so, it would be good to be able to rely on the state as a benevolent partner. Commons theorists maintain that there should be alliances between democratic governments to create commons enabling legislation. Yet regulation can be easily circumvented. Ramon Roca:

> But even talking in market terms, everybody knows that the market does not work if there is no competition. There are many ways of avoiding competition. So that's why in every country you have a regulatory agency to ensure that happens. When there is an incumbent with too much difference towards the others, there is no free competition and they will do whatever to protect their position, such as to create bureaucratic problems. This is a very long story. And it differs between countries, but often the regulator can be captured by the lobby interests because they are very powerful.

The interests of the incumbent are often more highly on the mind of politicians than the interest of the majority of people. Nevertheless, so far Guifi have been able to fight off any charges, whether they come from government or business.

In order to keep the balance between commercial business and those merely participating in the network as a commons, All users of Guifi.net have to subscribe to *The Compact for a Free, Open & Neutral Network* (FONN Compact). This contract has carefully looked at other examples such as the Pico Peering Agreement and has enshrined network freedom in a small number of principles to which everyone has to subscribe, thus allowing a network to grow which has different property structures, but works as a commons regardless, through its commitment to interconnect. The three principles deserve some closer explanation. I quote:

> It is open because it is universally open to the participation of everybody without any kind of exclusion nor discrimination, and because it is always described how it and its components work, enabling everyone to improve it.
>
> 1. It is free because everybody can use it for whatever purpose and enjoy it as foreseen in the freedoms of the *General principles* section, independently of their degree of network participation.
>
> 2. it is neutral because the network is independent of the contents, it does not influence them and they can freely circulate; the users can access and produce contents independently of their financial capacity or their social condition. The new contents produced by guifi.net are orientated to stimulate new ones, or for the network administration itself, or simply in exercise of the freedom of adding new contents, but not to replace or to block others.
>
> 3. It is also neutral with regard to the technology. The network can be built with whatever technology chosen by the participants with the only limitations resulting from the technology itself.

However, any rule needs enforcement in order to function. Guifi.net has chosen to look at Elinor Ostrom's research on how commons can function and avoid their *tragedy*. From the design principles for a commons, they have chosen '4) Effective monitoring by monitors who are part of or accountable to the appropriators.' This is one of the reasons why Guifi is applying network monitoring methods. It is another thing which initially perplexed me. In the early days of Consume, metering would have been seen as a first step towards charging and thus in opposition to the spirit of network freedom. Ramon Roca disagrees:

> We aim for a net neutrality, not only the commons. That's far from being a religion. To be neutral we should maintain agnostic in all aspects, technology, between volunteer activity or professional activity, allow all uses from free as in beer or commercial services on it..., be safe from governments... not to say about politics or religions. Important not to become fundamentalist.

It seems that Guifi does not only have no problems with metering traffic, but on the contrary, sees it as a prerequisite for building an effective network commons.

> For sustainability of the commons and for managing the network you need capacity planning and economics involved in investments or operating expenses (regardless if there is money in between or not). For sure, it requires metering for managing the network itself, diagnosing where more capacity is required, etc.

As the mixed political economy of Guifi.net includes governments and businesses, the metering also serves the aim of checking if people pay their dues. The condition for businesses and administrations participating in the commons infrastructure is that they have to compensate, by paying back something.

The Guifi.net website is the embodiment of this social and technological construct which is Guifi, a network commons-based on a mixed political economy. The metering capacity also is a necessity for network planning. And recently, Guifi cannot be called a wireless community network anymore, since it has started to deploy more and more fibre. Ramon Roca: 'We started in 2009; we were realizing that fibre was getting much cheaper and also much more reliable and capable; but it's a difficult journey, with lots of bureaucracy, it's a complex project, but still a planning issue.'

Once the new way of working with fibre has been mastered, explains Ramon, it is quite easy to roll out and can be much more cost-effective than anything else. With fibre, Guifi can offer one Gigabit per second symmetric bandwidth. Fibre, Ramon Roca is convinced, is the future.

All those properties together, Guifi's mixed economy, its strength in advocacy, the existence of effective mechanisms for conflict resolution through supervision and its agnosticism, if one can say so, against anything fundamentalist, make this a very open, very adaptable model which is, in my view, the secret of Guifi's success. And Guifi's mixed political economy has allowed it to grow at a rate that has made itself visible in government statistics. Ramon Roca:

> In 2004 the region, Osona with 150,000 inhabitants, was ranked 31st in Catalonia in terms of bandwidth, and now we have ten percent above the average, because it was the first region to reach the European average. So now we can provide that we are the only county in Catalonia that meets the European average, and this year we went above the average. If you look at the statistics you see we make the difference, it's the ten percent. By having alternatives, we can ensure to meet the Digital Agenda 2020 of the European Union. We are maybe a minority, but we are still ten percent. And that ten percent will make a difference.

9. THE OBSESSIVE UTOPIA OF MESH NETWORKS

'The sleeping beauty of mesh has been kissed into life by the community', explains Elektra in her book. The community has made it possible to have decentralized wireless networks which connect small local cells, automatically by intelligent software (Aichele 2007, p. 15). In this chapter, a closer look at developments around mesh networks is taken, based on a study trip to Barcelona, supplemented by further research. This chapter also asks the difficult question, how the mystifications of technology might be overcome. Are better mesh routing protocols really the answer to all problems?

In one of the previous chapters I stated that there is a significant difference between town and countryside. In many rural areas, it is virtually impossible go get affordable broadband internet. This problem has actually furthered the growth of wireless community networks in the countryside. A widely shared view is that it is much more difficult to mobilize people for wireless community networks in urban areas where a variety of possibilities for network access exists and where the urban topology makes networking difficult. This, however, while broadly true, may not always be the case. In some areas in Barcelona, wireless community networks are growing, and they are developing and using the latest mesh network technologies.

Routing is generally a very interesting area. Dijkstra's algorithm is one of the earliest path finding algorithms, written by computer scientist Edsger W. Dijkstra in 1956 and published in 1959. The Dijkstra algorithm is something as basic for the current political and cultural system as cars – or traffic lights – were for the previous one, but nobody knows it, except for experts, computer scientists, techies. It would not surprise me if it was included in the Evil Media book,[1] since this is something that has become part of the technological unconscious. It has an agency of its own, as a repressed force. This is definitely the case with the information infrastructure.

The process of forwarding packets from one node to the next on the Net is called routing. The politics thereby deployed concern fundamental freedoms and rights. Until now, the neutrality of these protocols has been maintained, because they are jointly developed by the IETF and IEEE. The commonality of the Net depends on neutrality on some layer. And even in the turbo-capitalist world we live in this is still safeguarded. Mesh routing protocols are improvements of normal routing protocols.

Pau Escrich is one among a team of researchers working on the Confine project and he is also a Guifi activist:

> I realized that in my district, a Barcelona neighborhood which is called Sants, there was not any node of the Guifi.net project. So, following the approach – think globally, act locally – I started contacting people from the neighborhood. We built a nice group of folks interested in building a free network, and after having some meetings we started deploying nodes. Now, four years after this, we have around 50 nodes in this area.

1 Matthew Fuller and Andrew Goffey, *Evil Media*, MIT Press 2012.

Pau and colleagues started using new technology based on mesh routing protocols. Most of Guifi.net does not use mesh protocols, but standard routing technology such as the Border Gateway Protocol (BGP). In such a network, a group of routers under a single administrative policy – an Autonomous System (AS) – is managed using BGP for interior and exterior routing. If you compare an AS with a country, the router controls entrance and exit to that country. The benefit is that for nodes inside this *country* it is not necessary to know the route to each and any other node on the net, it only needs to know the nearest gateway router.

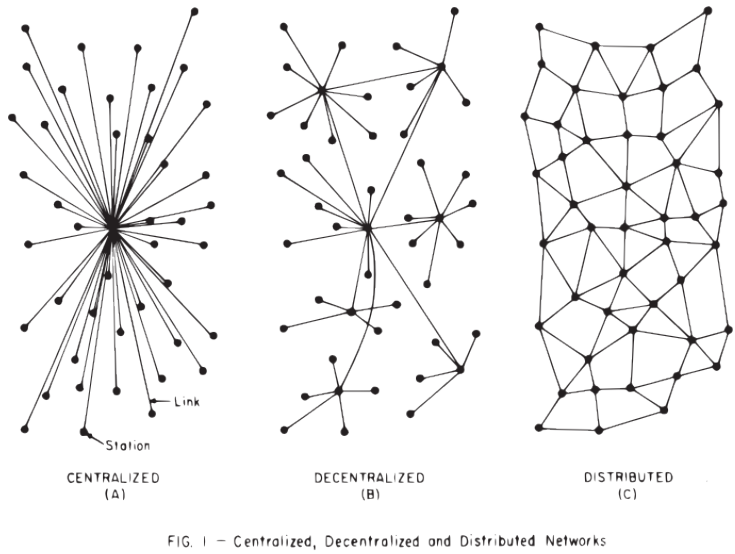

Fig. 29. Paul Baran, Network Topology.

The resulting network topology is one that could be described as decentralized, according to the classification of Paul Baran's seminal study from the early 1960s (see image above). A decentralized topology is a mixture between a hierarchical, star-shaped network and a completely distributed or mesh network, without any nodes taking on a notion of a center.

In Catalonia, Guifi.net has a decentralized topology with SuperNodes which are connected with each other and to which are connected many Nodes, which are only connected to the SuperNode, but not to each other. This works reasonably well but does not fulfill the criteria of the wireless community network dispositif which demands a more egalitarian topology. Pau Escrich:

> The SuperNode network creates what we call the Backbone, and this Backbone network is decentralized, but the level below (the Nodes layer) is very centralized, and it represents more than 80% of the network devices. So this is an actual control point; the groups, individuals or companies controlling these SuperNodes are the actual managers of the network. This is what we are trying to skip by developing and using QMP.

QMP stands for Quick Mesh Project, a GNU/Linux distribution based on OpenWRT and specifically made for mesh networks. QMP is based on a predecessor project which was developed in the context of another community network initiative. In 2007, a small group in Gracia, a pleasant neighborhood in Barcelona, which extends from just behind Sagrada Familia into a more leafy and hilly area, started a small mesh network called GSF. Roger Baig, a key figure in Guifi.net, was involved in this. Roger Baig, according to his self-description, had been involved in free software since the 1990s and 'installed a server in each village around my area. Initially', he said, 'I was not so skilled in networks, still learning, so OpenWRT was fresh air for me.'

The group looked for funding and managed to win a contest organized by a foundation named PuntCat (dot-cat are Top Level Domain managers). They received 15,000 Euros to start the project, reports Pau Escrich.

The development of QMP then started seriously after 2010, when a small group of convinced mesh networkers dedicated themselves to building a new distribution from scratch. Part of this group was the German Axel Neumann who at the time also lived in Gracia. After three years they launched the first stable release, and QMP is now used at many places around the world.[2] Axel Neumann is key developer of BMX6,[3] one among a number of the latest incarnations of B.A.T.M.A.N.,[4] a mobile ad hoc mesh network protocol.

Axel Neumann is writing software for the Confine project. He is helping to run the testbed, Community Lab. He is also main developer of BMX6, one of a number of B.A.T.M.A.N. forks. Axel was fascinated with complex problems early on, problems such as how to make a map of a landscape that constantly changes; or how to have routing tables in a network where constantly nodes appear and disappear? Axel was getting interested in B.A.T.M.A.N. through Freifunk. Pau Escrich:

> B.A.T.M.A.N. was born in Berlin as an alternative to OLSR. Its approach is different for a node running the routing protocol; instead of knowing all the network topology (as OLSR does), in B.A.T.M.A.N. every node only knows its new best step to reach any other node in the network. So if all the network participants are doing the same, the user data will be routed from one side to the other following always the best path. This approach is called distance vector.

B.A.T.M.A.N. is actually an acronym and stands for *better approach to mobile ad-hoc networking*. The initial idea came from Corinna *Elektra* Aichele, who also started developing it, and was soon joined by Axel Neumann in this effort. To cut a long story short, after B.A.T.M.A.N. emerged as an alternative to OLSR – the latter the first mesh protocol which became more widely used by the community – a rivalry developed which inspired the *Battle of Mesh Networks*.

2 Quick Mesh Project (qMp), https://qmp.cat/.

3 Bmx6 in OpenWRT, n.d., archived December 2013, https://web.archive.org/web/20131220025032/http://bmx6.net/projects/bmx6.

4 Open-Mesh: B.A.T.M.A.N., https://www.open-mesh.org/projects/open-mesh/wiki.

This is a kind of contest, where community networkers meet to test and compare different protocols.[5] Meanwhile, a number of different flavors of B.A.T.M.A.N. exist besides BMX6.

B.A.T.M.A.N. is a distance vector protocol. OLSR is a link state routing protocol where every node has a map of the network and can make decisions about where to send packets first. Distance vector, Axel explains, is more like I send somebody on a hike without giving him a map, but telling him to look out for the signs. Distance vector is more simple, in a certain way, but has other consequences. The signs have to be put in place and they have to be kept up to date. This is done by flooding the net with messages from the target node. Axel is now working on BMX6, trying to improve the way how this flooding of messages is done. 'Speaking in the abstract,' Axel explains, 'it is like compressing data.' Pau Escrich:

> We choose BMX6 because it fits our requirements: scalability, good performance, capable to run on a low-resources machine and IPv6 support. In addition Axel Neumann, its main developer, is a good friend of the Guifi.net community and he joined the QMP team, so we are really having a routing protocol which is very adapted to our needs.

Programmers such as Axel and Pau are deeply fascinated about the capacities of mesh protocols like OLSR or B.A.T.M.A.N. in terms of self-organization. In the network topology of Guifi.net as described above, a SuperNode may control 50 or 100 nodes. While the backbone is decentralized, the leafs are very centralized. For community network activists, the network topology is not just a technical issue, it also expresses a political desire. Pau Escrich:

> When I was a kid, I was enthusiastic about Che Guevara, Gandhi and these people in history who changed the world and fought for the freedom of ordinary people. I also liked computers a lot. So I found the free software movement as a perfect scenario to follow my ideas.

The mesh networking community is striving to build a completely egalitarian, uncensored, free and open network. Axel Neumann believes that the future belongs to multi-policy routing. Each node decides autonomously but still everything works together. In Community networks, it would be too much asking constantly for meetings to make policy decisions. B.A.T.M.A.N. advanced, the other main B.A.T.M.A.N. fork, uses Layer 2 of the internet. The user feels like hanging on one switch, but Axel says he cannot be sure how far this can scale. Axel would propose to have a cloud using B.A.T.M.A.N. Advanced and BMX for long distance connections. Locally, the user will be able to move from cell to cell as with a mobile phone.

Distributions with several mesh protocols are already in actual use in Spain, Germany, Austria, Argentina, and Nicaragua, in Chile possibly too. A major effort for a new distribution is called LibreMesh.[6] It is an attempt at globalizing the Freifunk firmware undertaken by several

5 The Wireless Battle Mesh is an ongoing annual convention: Wireless Battle Mesh, https://www.battlemesh.org/.

6 LibreMesh, https://libremesh.org/.

community networks across continents, including Freifunk, Ninux, and Guifi, together with people in Argentina.

The latest Freifunk distribution, Kathleen, also has B.A.T.M.A.N. and OLSR installed. It offers a lot of improvements in the direction of auto-configuration and ease of use and better management of IP spaces and DNS services.[7] With regard to the politics of Freifunk, I was able to make interesting observations when a massive flamewar broke out between someone, who apparently wanted to use the Freifunk label for his own cause, and everybody else.

The discussion about what makes a network *free* or *open* was raging on WLAN-News, one of the main Lists for exchange on Freifunk issues. The story, which had rumbled already through local Freifunk lists, was that one wannabe entrepreneur wanted to do something *like* Freifunk and with its endorsement and under the subdomain, but with policies contradicting some rules. It seems he wanted to make his own network and use a tall building, paying someone to have a router there on his balcony.

The ensuing discussion was like a look into the collective psyche of the Free radio community. The community objected to a whole range of issues, but one of them was that the other network would not mesh. Admittedly the *entrepreneur* did not make his own case easier with a very angry tone, accusing Freifunk of acting like a closed shop. The whole idea smacked of opportunism. But what I found interesting was the emotional intensity with which mesh was argued as a political project. Only the mesh network is really a free network.

On one hand, I do believe that things such as LibreMesh can make a difference, since it creates the possibilities of a global, independent infrastructure, the network commons, reclaimed by its users.

In political terms, this could either be described as libertarian, or anarchist or grassroots, bottom-up, self-organized democracy. The desire of mesh network developers is to give the net a technical structure which makes it difficult to impose any top-down control structure.

In my ears, this sounds a bit like the initial idea behind the internet in the first place. However, as the history of the Net has shown, such a decentralized structure on the technological level does not make the Net immune from other forms of centralization and control. Capitalism knows many ways of bending and taming the liberatory potential of new technologies. Google is the best example, it can exert control without directly owning the whole of the Net, it does not need to shape the traffic flows of the Net at control points such as routers or hubs.

In my conversations with community network activists, I tried to explain that a decentralized network can also serve top-down organizations and vice versa, that a centralized network could also serve the struggle of a movement for freedom. This winter, I visited the Museum of Revolution in Havana where you can see the radio transmitters built by technicians for

7 For a history of Freifunk firmware releases, incl. Kathleen, see Freifunk, Berlin: Firmware https://wiki.freifunk.net/Berlin:Firmware.

Fidel Castro and Che Guevara. There was nothing decentralized about this technology, but it served the purposes of the revolutionary struggle perfectly well. Whenever I try to make such an argument, it seems I am running against walls.

'If you have a centralized network you have a weak network; distributed things are the basis for the freedom of technologies', Pau insisted. The *freedom of technologies* is constituted by the three freedoms of Eben Moglen introduced earlier in this text: free software, free networks, free hardware. Basically, everyone from Guifi.net whom I interviewed repeated those three freedoms to me like a mantra.

Pau Escrich and Roger Baig are part of a group of community networkers and researchers, who work at Universitat Politècnica de Catalunya (UPC), Barcelona, Spain in the framework of the EU funded project Confine.[8] This project brings together community networkers, but also academic computer scientists and telecommunications researchers, to build Community Lab, a testbed for many new WLAN applications.

One of them is Llorenç Cerdà-Alabern who is an Associate Professor at UPC. He also lives in the district of Sants and wanted to contribute something practical to this project. So he put an antenna on his roof which has now become a hub in the mesh in Sants built using QMP. Llorenç thinks that this cooperation between networking enthusiasts and academic researchers is beneficial because the community is much more oriented towards practical results whereas researchers can look further into the future.

Llorenç is using his position in the network topology to conduct some experimental measurements and to write papers about it.[9] He has also written a topology generator, a tool that visualizes the network between Sants and UPC.[10]

The community network provides the unique opportunity to have live field tests running, studying relatively large scale wireless networks under real conditions. Ivan Vilata-i-Balaguer is also working in the Confine project. His responsibility is to provide services for the implementation of the testbed, Community Lab.[11]

'We have the community device', explains Ivan, 'we chose to run the experiments on a separate device.' The community lab testbed is actual hardware, a device which is put next to

8 Confine Project (2012-2015), archived October 2015, https://web.archive.org/web/20151003180403/https://www.confine-project.eu/.

9 For instance: D. Vega, L. Cerda-Alabern, L. Navarro, and R. Meseguer. *Topology Patterns of a Community Network: Guifi.net*. In 2012 IEEE 8th International Conference on Wireless and Mobile Computing, Networking and Communications (WiMob), 612–19, 2012. doi:10.1109/WiMOB.2012.6379139.

10 The resulting page is definitely worth studying: Bmx6 Wireless Mesh, Sants-UPC, http://dsg.ac.upc.edu/qmpsu/index.php.

11 For those more technically interested, there are some slides here: Ivan Vilata-i-Balaguer, Community-Lab: Exploring the Future Internet on Community Networks, slides of talk at FOSDEM 2014, archived May 2016, https://web.archive.org/web/20141126225209/http://wiki.confine-project.eu/_media/pub:community-lab-intro_fosdem-2014.pdf.

nodes at community networks, and on this device are running some experiments. So they had to ask a lot of questions, explains Ivan, questions such as 'How do we manage all this hardware? We are talking about nodes on the community network which can be used to run experiments.'

Most research is usually done in controlled environments, by research groups, but there are no users. In a community network with real users, explains Ivan Vilata-i-Balaguer,

> 'the experiments must not overwhelm the community network with traffic, must not crash it, when experiments crash, and it also should not affect node ownership, so we cannot expect total control from the testbed operator; we had a lot of open topics to think about and we had to find an architecture that meets all these requirements.

The research devices can be used for different experiments, remotely controlled from servers hosted at an organization called Pangea. According to Ivan Vilata-i-Balaguer, in July 2014 there were 120 to 130 research nodes, of which about 90 were in perfect working condition, 'but we are expanding the testbed and developing the software.'

The maintenance of the research devices is an issue, because most of the nodes belong to individual node owners, so updating of the software and keeping the nodes in working-order is precarious. As a result, now most of the nodes which are connected to a research device 'are operated by people who work for CONFINE, so the communication overhead is not so big', explains Ivan. Confine merges community network and academia in the same project. It enables, for example, advanced monitoring capacities which can be used by Guifi.net to have a transparent network and enforce the rules and principles of the network commons. It also enables more experimental topology generators such as the one by Llorenç Cerdà-Alabern; but this is just a fraction of what is going on.

The project is also providing data sets from those measurements for other researchers.[12] This page gives an overview of all the partners and activities, such as Athens Wireless. Ninux in Italy, Funkfeuer and many more.[13] As part of the project, a whole range of social projects have been added through an open call.[14] One of those projects is CONFLATE, which uses 'the new Research Devices of Ninux.org to deploy a simple (but practical) OpenFlow based DASH Live Video Streaming service for real users of Ninux.org,' informs the website. This and other projects will be topics of future articles.

However, at the risk of being seen as a party popper, I feel the need to also share an observation which stems from rather long-term engagement in the field. It seems that many participants in this movement display facets of what Joseph Weizenbaum called the obsessive-com-

12 Confine Wiki, Open Data Sets, archived November 2014, https://web.archive.org/web/20141126212934/http://wiki.confine-project.eu/experiments:datasets.

13 Community Lab, archived December 2014, https://web.archive.org/web/20141217005023/http://community-lab.net/.

14 Confine Wiki, Selected Open Call 2 experiments, archived November 2014, https://web.archive.org/web/20141126212458/http://wiki.confine-project.eu/experiments:opencall2.

pulsive programmer. In his 1976 book *Computer Power and Human Reason*,[15] Weizenbaum, as a big critic of computer science from within, wrote this famous passage about the

> bright, young men of disheveled appearance, often with sunken glowing eyes, [who] can be seen sitting at computer consoles, their arms tensed and waiting to fire their fingers, already poised to strike, at the buttons and keys on which their attention seems to be as riveted as a gambler's on the rolling dice.

The real issue here is not about appearances and also not about finger-pointing at computer enthusiasts or techies, as I prefer to call them. We should not make techies culpable for what are actually the contradictions of this society. In the knowledge economy, almost everyone is quite compulsive about their work, and in the 21st century many people have become *hackers* according to McKenzie Wark's definition.[16] In *Fun and Software*, a recent book edited by Olga Goriunova, one of the pioneers of Software Studies, the authors treat this subject in a more even-handed way.[17] Wendy Hui Kyong Chun and Andrew Lison argue that there is a dialectic at work between fun and exploitation.[18] Techies such as Linus Torvalds write software *just for fun* but their political naivety makes them also subject to exploitation. For some, the fascination with technology, which itself is not the real problem, can turn into a compulsive obsessive disorder.

The real problem seems to be not the obsession, which is actually driving innovation, but the one-sided belief that there is a technological fix for each and any social ill. The bigger question rumbling throughout this book is whether community networks can alter the course of technology and whether a different relation between technology and society can emerge which could help to make society more democratic. The simple answer to the first part of the question is almost certainly a bold Yes!, of course. Community Lab certainly helps to generate a lot of data to improve mesh protocols and develop new methods and services. Yet the second part of the question is much more complex and demands further explanations.

In capitalist societies a heightened division of labor develops which drives people into increasing specialization. As a result, information and communication technology (ICT) is for most people a black-box. They use it, but have no idea how it works. This allows to create what Critical Theory used to call the *mystifications of technology*. Societies get ever more fragmented, whereby small elites command a lot of power by using money and technology. To ordinary people then it looks like they are controlled by technologies, mistaking social relations for relations between things.

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15 Joseph Weizenbaum, *Computer Power and Human Reason: From Judgement to Calculation*. W.H. Freeman & Company, 1976.

16 McKenzie Wark, *A Hacker Manifesto*. Harvard University Press, 2009.

17 Olga Goriunova, Fun and Software: Exploring Pleasure, Paradox and Pain in Computing. Bloomsbury Publishing USA, 2014.

18 Wendy Hui Kyong Chun and Andrew Lison *Fun Is a Battlefield: Software between Enjoyment and Obsession*. In *Fun and Software: Exploring Pleasure, Paradox and Pain in Computing*, 175–96. London / New York / Paris: Bloomsbury Publishing USA, 2014.

As technology becomes *mystified* in this way, the solution to the problem appears to be to create even better technology.

While techies, as individuals and citizens, might actually disagree with the political status quo and desire a free and egalitarian society, the course of technology as such – driven by their own free labor, produced out of their obsession with creative computing – exacerbates those divisions between powerful elites and ordinary user-citizens. Techies passionately belief that Free and Open Source Software (FLOSS) will help to counter such developments. But while those technologies are transparent to experts, for ordinary people they are as opaque as a brick wall. Social mechanisms intrinsic to the techie community actually make matters worse.

The idealistic techie communities who produce FLOSS tend to have a missionary zeal about them and are very tightly knit *communities of practice* who have created their own rules and codes, literally and metaphorically. This world, as highly complex as it has become, of practices and ethics, has few connections with the rest of society – it works well within the community, where everybody carries the same rules and values, but is completely impregnable for non-members.

Just to give an example, it is completely beyond me why the testing of different mesh protocols has to be called *battle mesh*. People who are otherwise really nice and sensible are using, without further questioning it, a militarized language. This is a put-off for many people who may otherwise be interested in joining those communities. The problem goes even further. Mobile ad-hoc networks have initially been developed by the US military. The new and improved mesh network protocols are almost certainly used by the military again. Mesh protocols can be used for creating swarms of semi- or fully automated weapons in a battle field. These are issues that most people involved would want to avoid. When directly asked, they give evasive answers.

The *mystifications of technology* could be reversed by a two-way process which I tentatively call the socialization of technology. If more people learn about how ICT works, it will become much less easy to use and abuse those technologies by the powers that be. The socialization of technologies would also imply that there are closer links between the people who develop technology and those who use it. This was the idea behind participatory design which was pioneered in Sweden in the 1970s. Community networks in principle carry great hopes for initiating and furthering such processes of participatory design and socialization.

In reality, however, when I tried to find empirical evidence for those claims, I mostly gathered evidence to the opposite. I wanted to find out what drove people to work on those issues and how they developed the criteria for their code. And the answer was in 90 percent of cases that the criteria were implicit, that they were following a shared tacit consensus according to which the coders developed the code. The question of a *user* of a software lies at the bottom of concerns, as the developers – or like-minded people – are the users themselves.

This self-referentiality of community network activists extends to the three *laws* of Guifi.net. When asked about the freedom in free networks, everybody was quick to come up with the answer that this freedom was based on the open, free, and neutral character of the net. The reality is that the initial utopia of self-provision of networks is not really attainable. Most networks are built and maintained by professionals and the users, by participating in such networks, learn little or next to nothing about the technology. It remains a black-box and thus mystified.

Yet for exactly that reason, *mesh* is so important in upholding the decentralized utopia. If every node can mesh, you do not need expert knowledge at each node. The dream of mesh, however, is a Promethean fantasy inherent to all such technology, it is a form of the automatic utopia. The idea is that community networks will proliferate freely once mesh software is perfectly working and available.

In the meantime however, the actual problems and possible impediments come from the social sphere, where lobby groups and continued neoliberalism lead to a difficult environment for community networks. At the time of writing, Freifunk in Germany finds itself in a renewed battle against *Störerhaftung*, the law according to which a node owner is responsible for anything that a user might do. This law seems to have been created particularly to support the interests of the copyright industry. Now, the German coalition government is drafting a new law which, if passed, would make wireless community networks next to impossible.[19] The problem is a political one, not one of the efficiency of battling mesh networks.

19 To support the Freifunk campaign against the new draft law, follow this link: 'Christian Heise, Wir brauchen eure Hilfe – Helft mit die Störerhaftung für WLANs zu stürzen!', 10 March 2015, https://freifunkstattangst.de/2015/03/10/wir-brauchen-eure-hilfe-helft-mit-die-stoererhaftung-fuer-wlans-zu-stuerzen/.

10. TOWARDS THE NETWORK COMMONS (CONCLUSIONS)

Fig. 30. Andrews Road, London, May 2005 (from Monoskop[1]).

Based on a recent trip to Germany, where vibrant new communities have triggered discussions about what makes the essence of Freifunk, I am suggesting that the future of wireless community networks lies in the notion of the Network Commons.

In the course of this book project, I have studied wireless (and wired) community networks trying to establish the current status of this movement. Two main research questions have guided my inquiry. First, I wanted to see if and how wireless community networks connect with larger questions such as communications freedom; and second, I wanted to find out if those networks can play a role regarding the democratization of technology. This second question has two aspects. One regards the development of technology itself. Wireless community networkers are not just consumers and users of technology, they are also actively developing it. My question was, if technologies, developed by a community, are fundamentally different from technologies developed by companies and what would make such a qualitative difference. The second aspect regarding the democratization of technology concerns the role and function the respective technology plays within a community of users. In informational capitalism, technology in general and ICT in particular are key social agents. They are not just neutral tools but connected with wider social issues. Intricate knowledge of technologies, however, is restricted to narrow strata of society. The gap between high-priests of ICT and users, for whom it is a black box, goes across society and political divides. My assumption is that a lack of knowledge also furthers other inequalities, economic and political ones. If

1 https://monoskop.org/images/c/c3/Armin_Medosch_1962-2017.pdf

wireless community networks thus further knowledge about network technologies, because the development and application is embedded in a wider community, then it could be said that they further the *socialization of technologies*.

When starting this study, I soon became aware that any proper method applied to the research question would require vast quantities of empirical research which, due to the limitations of this project, I would be unable to conduct. It would require, for instance, to gather comprehensive empirical evidence about who participates in those networks, what their backgrounds are and which ways of participation exist. That would mean to engage in field work doing hundreds, not dozens of interviews. My work has been supported by an EU grant in the context of the CONFINE project. I was employed by Verein Funkfeuer, Vienna, on a part-time contract of less than one working day per week for 14 months. I thus soon decided that I could only do qualitative research. My main methodology used was participatory observation, conducted through interviews, research visits, websites, and mailinglists. I conducted about 20 interviews of different lengths and intensity.

By and large I think that my research questions have been validated. Those were interesting questions to ask and they merit further attention. However, the nature of my research questions does not allow for a yes or no type answer. Any answer would necessarily be a complex assessment of a complex matter. My main case studies were Freifunk, Germany, and Guifi, Spain. In both projects, people are at work who share a certain set of ethics and their goals coincide with my research questions. They are building wireless community networks with the aim of furthering communications freedom, free speech, access to knowledge and information. This answers the first main research question, whereby important qualifications are to be made.

The second question regarding the democratization of technologies yields more mixed results. The intention of the communities involved, in principle, is to further the democratization of technology, but there are different views on how this is best achieved. As I have analyzed in the previous chapter among some members of the developers' and activists' community, mesh network routing protocols are idealized as a technological fix to all problems of wireless community networks. There is a widely shared belief that once there exists firmware that is really easy to install which also uses mesh routing protocols, then nothing can stop wireless community networks. This type of firmware now more or less exists. The Quick Mesh Project and also the latest releases of the Freifunk Firmware meet those requirements to a large degree. However, this still leaves open the question how easy it is to install and configure such software. And even if that part becomes solved, there are other issues regarding installation of antennas, energy supply and so on and so forth – technical hurdles are bound to continue to exist. Therefore, the main question regards the nature of participation in these projects, in particular the relationship between the core of activists, those people who participate in the network and society at large. I have been trying to find out, to which degree developers consider demands arising from the community and to what kind of extent a knowledge transfer happens between techies and users. As I was lacking the means to answer those questions through a broad scientific study, which would require a different project with a significantly higher level of funding, I can only address those questions as an observer, participant and interpreter.

10.1 The Dispositif of the Self-Organizing Network

On 14 May 2015, I was invited to give a talk at the OpenTech Summit in Berlin. This was followed, on the 15th and 16th, by the Wireless Community Weekend at c-base, also in Berlin. At the OpenTech Summit I presented the summary of my findings. What I said, was about the following:

In my view, ideas about wireless community networks in Europe were first raised by initiatives such as Consume and Free2air.org in London, around the year 2000. While there existed other initiatives as well, nobody else made such a concerted effort, not just technologically but also ideologically, intellectually, in furthering those ideas. As I have described it in the first chapter, Consume produced a dispositif of the network commons, an idea, but also material support structures and a set of methods which enabled the building of a network commons. I am aware that I am slightly misappropriating this term by Michel Foucault. Foucault's notion of the dispositif is largely concerned with how power is distributed in society. The dispositif of the network commons is concerned with the distribution of a type of network that is free from hierarchical power relations as far as possible. Consume's *Model 1* was the idea of a network where each node is owned and maintained by its users. There is no centralized entity, neither technologically speaking (no supernodes which can become control points), nor organizationally. There should not be a company or other type of organization which runs the network. The network would be created through a process of social self-organization. An important aspect of self-organization would be provided by organizing workshops in regular intervals and having local meeting points which allow people to come together and share ideas, knowledge, skills, technologies.

The dispositif of the network commons traveled over the English channel and found support in Germany. In Berlin, a group of people came together and started, first, a regular meeting at c-base, called Wavelöten, and soon Freifunk (free radio), an initiative to build network commons, first in Berlin, later all over Germany.

Independently of Freifunk a similar initiative had started in Austria, called Funkfeuer (radio beacon). Funkfeuer had the advantage of being able to start on the basis of an existing installation. In the late 1990s, early 2000s, the provider Sil had been one among the most innovative internet companies in Europe and worldwide. As I have written in my article *Kreative Milieus* (2012[2]), Sil was the result of a creative milieu, of the coming together of artists, hackers, designers, and an entrepreneurial spirit. The company was among the first in Europe to offer fixed leased line broadband internet via ADSL for competitive prices through a partnership with two other small providers called Vienna Backbone Service (VBS). In the late 1990s VBS/Sil was looking into ways of consolidating its success by moving into the wireless medium. The artist-engineer Franz Xaver, while working for Sil, created Funkfeuer, a wireless network on the rooftops of Vienna, built to professional standards. But that proved too costly for Sil, which was, after all, a commercial company. Sil abandoned the effort and for a while the antenna

2 Armin Medosch, 'Kreative Milieus'. In *Vergessene Zukunft: Radikale Netzkulturen in Europa*, 1. Aufl., pp. 19–26. Bielefeld: Transcript, 2012.

and router installations lay silent. Then a new initiative formed around the young computer technician Aaron Kaplan to revitalize Funkfeuer. He had actually read an early draft of my first, German, book on Freie Netze which gave him the idea. Initially, Funkfeuer also operated a free WLAN hotspot in Vienna's Museum Quarter, in cooperation with the NGO Quintessenz. The hotspot served the purpose of showing that an open public WLAN access point could be operated without submitting to regulations regarding mandatory data retention. To cut a long story short, Freifunk and Funkfeuer became resounding successes.

Both networks initially grew rapidly. Freifunk in Berlin was propelled by the lack of availability of affordable broadband in certain areas. In former East Berlin, after German reunification, German Telekom installed a fibre optic network called OPAL. The same story was replicated in towns and regions across the former GDR, in cities such as Leipzig. Because of the OPAL fibre network, those areas could not receive cheap ADSL broadband access. Freifunk has had a strong argument. By joining Freifunk, people could gain fast internet access almost free of cost. In Leipzig, Freifunk soon had 900 nodes, in Berlin at one point more than 1000. At the same time the German and Austrian free network communities were fervent developers of mesh network routing protocols. At first, OLSR was adopted, then B.A.T.M.A.N. was developed out of the heart of the community. Freifunk and Funkfeuer also developed organizational ideas of their own which went beyond what Consume had dreamed up. It can thus be generalized that they did not just adopt the dispositif of the network commons, but contributed to it significantly. One key difference was that Consume was very British in a certain sense, that it had a strong libertarian or anarchist ideology at heart, which at some point becomes impractical when it comes to organizational issues. Those ultra-liberal instincts amount almost to a fear of doing anything that may be seen as prescriptive or normative. The ideology of Consume was that the network had to grow by itself. But the reality was that the moment key protagonists of Consume withdrew from publicly advocating it, it stopped developing at all and then fell apart. Since around 2006-7 Consume stopped being a publicly recognizable entity. Freifunk and Funkfeuer, on the other hand, soon founded a *Verein* each. A Verein is a registered non-commercial association which allows doing things collectively without running a business. Freifunk Germany from the very start was adamant that *Förderverein Freie Netze* was no umbrella organization under which all other Freifunk initiatives had to be subsumed. And most importantly, the *Verein* was not to be mixed up with the function of a provider. Its role was merely to give the movement a kind of backing by doing fund raising and giving it a voice also publicly, when talking to politicians and regulators.

As I have already written in previous chapters, while Freifunk was growing rapidly throughout the 2000s, German law – or rather *legal practices* always had maintained a threat to the movement through so called *Störerhaftung*. This means that if a private person offers an open WLAN hotspot this person can be made responsible for infringements committed by users. There had been precedents in German law where people were made responsible for illegal filesharing over their open WLAN. This, however, was not even the main source of the problem for Freifunk. The real trouble is that there are law firms in Germany which make it their business model to send threatening letters to everyone suspected to have broken the law. They send out mass letters to people supposedly running open WLAN routers threatening to sue them unless they settle out of court by paying a certain sum. It is very rare that such a

case actually comes before a court because this is not really the intention of those law firms. Their intention is to scare people so that they will give in and pay them money.

Such practices discomforted Freifunk activists. Therefore, the Förderverein Freie Netze created a workaround, the Freifunk Freedom Fighter Box, a WLAN router configured in such a way that it creates a VPN (a secured virtual private network) which routes internet traffic via a provider in Sweden. If no data packet hits German ground, German legislation does not apply. This created a lot of publicity but also adversity. Elements of the German press accused Freifunk of a lack of patriotism by going through a Swedish provider. Thus, Freifunk diversified the method. It also found German providers who allowed tunneling to them. When access is provided by a bona fide provider, *Störerhaftung* does not apply because providers, like telecoms, are not liable for violations of laws by their users.

Providers, however, have other obligations. It has been only relatively recently, in April 2014, that the EU data retention directive has been brought down by a decision of the European Court of Justice. Member states are keen on reinstating a similar law which forces providers to store communications data for later usage. This would be in total opposition to the values held by the free networks community, I would assume. Anyway, the issue I want to get at is that there is no ideal solution. Following the example of Förderverein Freie Netze, many local Freifunk initiatives also formed a registered association and attained the status of an internet service provider which made them exempt from liability for the actions of their users.

10.2 The New Ideological Divide

In my presentation at the OpenTech Summit, I argued that the belief in mesh networking technology as the *golden bullet*, the magical solution to all problems, was mistaken. While techies believed that technology would provide the fix for all problems, the real problems were of a social and political kind and not easily solvable through technology alone. I presented this with a punchline. I said that while hackers in the past had told newbies always to RTFM, which stands for *Read the Fucking Manual*, I am now telling hackers my own version of RTFM, which in my case stands for *Read The Fucking Marx* (whereby Marx does not just literally mean Marx but all Marx inspired social theory and critique). I honestly expected to get booed when I would say that, but actually I was cheered on. Later I was to find out that my speech had touch on open points of lively ideological discussions going on inside the Freifunk community.

As I found out through discussions around the barbecue at the Wireless Community Weekend (WCW) on the following day, Freifunk had gone through a specific curve in its development. After growing rapidly almost throughout the 2000s, German IT infrastructure providers had upgraded their infrastructure, which meant removing the OPAL obstacle to broadband via ADSL. As the obstacle for getting broadband was removed, the incentive for joining Freifunk was lessened. At around 2009 it started getting quiet around Freifunk. But then the Snowden affair kickstarted a new wave of free wireless networking. As people realized, through the revelations of whistleblower Edward Snowden, how widespread snooping on their communications habits was, both by the state but also by private companies, they also realized that the *free* in Freifunk had other connotations as well rather than just cheap internet. A range

of new initiatives started, especially in former West Germany, where Freifunk had not been that strong during its early years.

For instance, it was only in 2011 that Freifunk Rheinland[3] was founded (Freifunk in the Rhine valley). In 2013, it celebrated its 100th node, in May 2015, it had more than 1000 nodes. Freifunk Rheinland understands itself as a loose connection of local networks in currently 42 towns. It has servers at major internet exchanges and is also member of RIPE (regional internet registry for Europe). In the vicinity of it, there is also Freifunk NRW (North Rhine Westphalia). Actually, it calls itself *Verbund freier Netzwerke*[4] which insinuates that it is an actual umbrella organization which represents all the smaller networks belonging to it. This is a hierarchical organization which is not in the spirit of the original idea.[5]

However, to take things further, having a web-based forum is something that is anathema to most Freifunk people of an older generation. Some new initiatives are presenting themselves to the public in a way which is not in the decentralized spirit of the original model at all. There are initiatives which present themselves and act as a kind of alternative internet service provider. This goes deep into the way how technology is used. There is a new version of the Freifunk Firmware, called Gluon, which allows remote software updates. Freifunk Munich recently proudly informed its members about the successful remote upgrade of the firmware of 300 routers. Remote software upgrades of this kind fly in the face of the network commons dispositif. Some other people have even opened a Freifunk shop[6] where you can buy hardware which has the Freifunk firmware pre-installed. Freifunk Firmware, by the way, now exists in two main versions and more than 40 flavors.

The bottom line is that there is a new generation of activists who do not share the same set of values at all. It seems that they see the building of a Freifunk type of network as some sort of sport, proudly announcing when they break another quantitative landmark (1000+ nodes!). There is quite a variety of those new initiatives and one should avoid generalizing too much. Some initiatives are actually very close to the ideas of the original dispositif of the network commons. Others have barely hidden commercial aspirations. And others again, whilst operating under a non-commercial *Verein* (registered association) and subscribing to the basic set of values, have condescending views of the people who participate in their networks, whom they see as end-users. Some of those differences may be based on a generation gap. Whilst it is always dangerous to classify a whole generation under this or that label, just because they have been born at around the same time, what seems obvious is that younger people have grown up within the neoliberal information society. They are net-savvy and naturally use the techniques of Net 2.0, but they have also been shaped by consumer society and a certain

3 Freifunk Rheinland, https://www.freifunk-rheinland.net/.

4 Verbund freier Netzwerke Nordrhein-Westfalen (VFN-NRW), Über den Verein, achived October 2015, https://web.archive.org/web/20151011083542/https://vfn-nrw.de/uber-den-verein/.

5 This is claimed in this Forum post which created 254 responses so far: Freifunk Forum, FreifunkNRW weiterhin irreführend, March/April 2015, https://forum.freifunk.net/t/freifunknrw-weiterhin-irrefuhrend/3448.

6 Freifunk Shop, Herzlich Willkommen im Freifunk-Shop!, archived November 2015, https://web.archive.org/web/20151114002919/http://freifunk-shop.net/.

competitive attitude prevalent in the neoliberal age. This sort of edginess makes itself felt in forum postings which are outright hostile to Förderverein Freie Netze.

The association created in Berlin in 2003, which has done so much for the network commons, gets denounced as an obstacle to growth. Its set of values – which can be summed up in the slogan Decentralize! – is even considered *dogmatic* or *fundamentalist*. They call Freifunk Berlin the *legacy* organization, as if this was an obsolete version of Freifunk, insinuating that the new model is better adapted to the contemporary landscape and has more efficient ways of growing networks.

Jürgen Neumann and Monic Meisel of Förderverein Freie Netze try to counter those tendencies in a measured way. In those cases where the Freifunk logo and name are clearly abused for commercial ventures, they are working with lawyers to fight against that. The ideological differences they try to work through by raising a discussion about the original values.

10.3 Memorandum of Understanding

At the Wireless Community Weekend (WCW) 2015 a *Memorandum of Understanding*[7] was released which summarized the original ideas of Freifunk and called for an open debate. At the same time a national *Advisory Council* was formed which should serve as supervising instance in disputes about domain names and related issues. If that will help is not clear. In the week after WCW the general mood seems positive, as the new initiatives were received positively by the community. The Memorandum of Understanding and the Advisory Council are part of a larger change in strategy. Förderverein Freie Netze does not necessarily advocate the foundation of a Verein (registered association) for each local initiative. They now say any group of people can make a Freifunk initiative, recognizing that the structure of those *Vereine*, so well known in Germany, tends to attract the wrong kind of people who are experts in that type of community organizing. A negative example is provided, unfortunately, by Funkfeuer Vienna. This has become a tightly run organization, very inward looking and barely communicating with the outside world. It seems significant also that Funkfeuer is stagnating, the number of nodes has roughly been the same for years, and the website has hardly any new content. While Freifunk and Guifi.net communicate with the world through thousands of channels, Funkfeuer oozes the spirit of self-contained nirvana of nerd. The prevalent attitude is similar to those of HAM radio amateurs, a tightly knit group of males who like to experiment with latest technology. Benefits to society may arise in times of natural disasters, but apart from that it is not evident if or in which ways this once so vibrant initiative participates in wider social issues.

Freifunk, on the other hand, as Elektra remarked with a laugh, has arrived in the mainstream of German society, with all pros and cons. In the region of Franconia, in the south, Freifunk has been adopted by the local branch of the CSU, the Christian Conservative party. Local and regional newspapers are full of articles about Freifunk, not always positive. It seems that

7 'Memorandum of Understanding', *Freifunk Blog,* 15 May 2015, https://blog.freifunk.net/2015/05/15/memorandum-understanding/.

Germany is a more politicized society, where issues such as surveillance, privacy, network freedom, and communication freedom are of concern for a growing number of people.

All those things were debated hotly at the WCW. The spectrum of opinions stretches from those who think that routers with pre-installed firmware, serviced and maintained from remote by experts, are the way forward. Others think that this is a consumerist ideology which has nothing in common with the original idea. They insist that the transfer of knowledge between core activists and users is an important facet, that there should be no Freifunk shops, no pre-installed software. If that implies that growth is much more slow or even stalls, than that is the price. They are convinced that upholding the original idea is much more important than quantitative success, expressed in numbers of routers flashed. But is there such a thing as the original idea? Has not the idea of what a free network is already changed? Has not the very success of Freifunk and Guifi shown that the idea of Consume was a tick too Utopian, that it needed a less fundamentalist, slightly less decentralized approach? On the other hand, a centralized structure such as Funkfeuer, based on a *Verein* (registered association) and a closed community of males with an affinity for technology, can create a network which functions as a commons for its participants but appears as a closed network to the outside world. While being a closed community, Funkfeuer can still make important contributions to the development of experimental network technology.

11. CONCLUSIONS

After considering all evidence, it seems a proven fact that community networks make unique and important contributions to communications freedom and the democratization of technology. Major European networks such as Guifi and Freifunk are growing at exponential rates which creates all kinds of stress and problems, but this is in turn just a sign of their vibrancy. Community networks have also demonstrated that they can make invaluable contributions in poor and thinly populated areas. Those success stories, however, are precarious, always threatened by the general tendencies of the neoliberal information society. The course of development of the information society, which has been characterized by an incomplete paradigm shift, is itself not yet a foregone conclusion. The combination of computer networks and computational devices has potentials for emancipation and empowerment, but also repression, exploitation, and disenfranchisement. Within that scenario, the relation between society and technology is a key issue. Wireless community networks have the potential of closing the digital divide and furthering knowledge about ICT in society, creating more sensibility about how people can make better use of those technologies. But this social aspect is not universally shared by all activists. Even in the world of free networks, where free and open source software is used, elitist attitudes sometimes prevail, which only reinforce other social divisions of wealth, class, education, gender. Therefore, the dispositif needs to be fundamentally revised. It needs to be spelled out what a free network is.

In my view, and this is my real conclusion out of my engagement over more than ten years, it is more productive to ditch the notions of Free networks and wireless community networks and speak of the Network Commons. The Network Commons is not a solution that already exists, but something which yet needs to be defined. The attempts at defining the free in free networks in the past centered on the so called Pico Peering Agreement. But this was very minimalistic, overly determined by English anarchic-libertarianism. What is now needed is a definition of the Network Commons in a strong and normative sense, something that can be read as a kind of constitution and even be turned into a legally binding and accepted license, such as the Creative Commons license package. The idea of the network commons stood at the beginning of this book and also at its end. It is not a ready-made solution but an open horizon to be explored.

12. NETWORK COMMONS CASE STUDIES AND CORRESPONDENCE

Fig. 31. Mauricio Roman, installing a mesh router. Cerro Mariposa (Butterfly Hill), Valparaiso.

This chapter contains contributions by a range of authors on separate topics and case studies.

12.1 Ignacio Nieto: Free Mesh Networks. Two Cases from Chile

Fig. 32. Ignacio Nieto, installing a mesh router. Cerro Mariposa (Butterfly Hill), Valparaiso. Photo: Mauricio Roman.

This article starts with a short introduction to free networks, followed by a summary about free networks in Latin America. The article then tells in more detail the story of two attempts at making free networks in Chile, in both cases linking the idea of free networks with specific artistic and socially engaged goals, reports Ignacio Nieto, who has been involved in both projects.

Free networks have made possible new alternatives that allow to think about autonomy from the commercial ISP system and be able to share information between peers and on an equal basis. Free servers have allowed creating services on the Net which are not determined by

commercial interest and which are not governed by the desire to control information. However, they have also led to the overcrowding of the spectrum for IEEE 802.11 technology.

In 2001, *NYCwireless* has been created as a nonprofit organization that promoted and enabled the growth of free, wireless, public access to the internet in the city of New York and surroundings. Several free networks have emerged with similar objectives, both in Latin America and in the world. Standing out is Guifi.net, for its rapid growth, a project which began to take shape in 2004 near Barcelona. On November 17, 2006, the National Youth Council of Catalonia gave to guifi.net the award for most innovative partnership project, as a pioneering project which enabled new forms of participation, beyond offering free internet. Guifi.net provides resources to the community and interconnects the rural world, while bringing closer young people to new information and communication technologies. In the year 2008, a private foundation for a Commons Telecommunications Network, Open, Free, and Neutral, Guifi.net, was legally established as a platform for cooperative R & D and as a forum for institutions, organizations, and companies interested in participating in a global project for the development of infrastructure and network services.

The development and growth of these communities resulted in the development of free software, focused on replacing the routers' factory firmware to allow greater control and the ability to incorporate new features. In early 2004, based on a Linux kernel, the first release of OpenWRT appeared. Currently it has a repository system that installs around two thousand applications, and there are versions for a lot of different architectures, compatible with various routers and inexpensive computers. This facilitated the emergence of several derivative projects which have contributed to the development of the state of the art.

One case was Netsukuku, a firmware developed by the Italian hacklab Freaknet, makers in 1998 of the first hack meeting. Its proposal arises with the idea of creating a pure network that would use chaos theory in the sense that it is created and maintained autonomously, adapting to mutations in the network connections. Binding of management algorithms of a pure network with fractal algorithms and mathematical theories of chaos is one of the features that give Netsukuku the power to create a diffused and distributed, non-centralized, anonymous, anarchic, uncontrollable, and finally, autonomous network. The goal is that anyone, anywhere, anytime can immediately connect to the network without having to go through bureaucratic controls or having to sign contracts. The IP address which identifies a computer will be chosen randomly and unambiguously (the eventual IP *collisions* will be resolved by a hash table), so the IP number will not be associable to a precise physical location (its server), and those routes, formed by a huge number of nodes tend to have a high complexity and density as they do not allow the tracing of a particular node, due to the complexity and randomness allocator IP. In May 2010, Andrea Lo Pumo, as part of the Netsukuku project, published his dissertation *Scalable Mesh Networks and the Address Space Balancing problem*.[1]

1 Andrea Lo Pumo, Scalable Mesh Networks and The Address Space Balancing Problem, dissertation submitted to the University of Cambridge, 31 May 2010, https://archive.org/details/scalable_mesh_networks_and_the_address_space_balancing_problem-andrea_lo_pumo.

There are several algorithms for mesh routing, among them OLSR, B.A.T.M.A.N., and PA-SHWMP. Currently open source developers struggle to find the best routing protocol. That is why they meet once a year for a Wireless Battle Mesh.[2]

In Latin America, the creation of collective-oriented implementations of free networks began to settle early, in far more precarious circumstances than in the so-called first world countries. One of the first known cases is Buenos Aires Libre, also known as *BAL*. Originally, the group was called WirelessZonaSur and was then known as FreeBaires. Although there is little clarity about its foundation, it was apparently circa 2001 that it started developing as *Buenos Aires Libre* (BAL), with the objective of implementing a data network, free and community-based, for the City of Buenos Aires and its surroundings, connected with services like Wikipedia in Spanish, including community-based services. Jointly with the installation of nodes, BAL conducts outreach and training, where the building of antennas with household items is taught. They have participated in events like *Wikimania* (2009) and the free culture festival *Fabrica de Fallas* (Failures Factory), organized by Radio La Tribu since 2008, and have contributed to the emergence of other free networks such as FerNet, Rosario, MontevideoLibre or LugroMes, who have excelled in developing the firmware Nightwing and have recently cooperated in developing a version that can meet the specific needs of BogotaMesh, a free network that has a precursor in Andres Burbano, the first free network project in Bogota in 2007.

In 2010, BAL organized the first Jornadas Regionales de Redes Libres (JRRL, Regional Conference of Free Networks) in which free networks from Argentina, Uruguay, Brazil, Chile, Colombia and Paraguay meet. During the second JRRL in Tacuarembo, Uruguay, work on the preparation of the manifesto of Latin American free networks began, which was finished and presented publicly in the third JRRL, conducted within the framework of the 12th International Free Software Forum (FISL) in Porto Alegre, Brazil. This event also included the participation of Elektra, developer of B.A.T.M.A.N. (Better Approach To Mobile Ad-hoc Networking), among with Rodrigo Troian from RedeMesh (Brazil) and Hollman Enciso from Bogotá-Mesh. Together, they traveled to Santiago, Chile, to deploy an open network using the mesh routing protocol B.A.T.M.A.N.-adv, in a community called La Victoria (The Victory), the first occupied area in Latin America. We established our base station at Channel 3, a pirate television UHF frequency station that began their transmissions during the late nineties. The station's editorial line is left-leaning, connecting with the 70's in Latin America. This particularity mixed with the idea of centralized signal transmission was why we chose it. We proposed a project for FONDART, the National Funds for the Arts of Chile, and we won it. We installed five nodes in different houses in the La Victoria area.

The project that was funded, focused on the transmission of digital video in an internet portal. Any person in reach of the radio signal of these free network nodes could access the web portal and see and hear the videos transmitted from Channel 3. Elektra, from B.A.T.M.A.N. protocol, funded by FONDART, was invited to work technically to install the network.

2 Wireless Battle Mesh, https://www.battlemesh.org/.

A mesh network was working in the winter of 2010 in La Victoria. We could *see* all nodes and also the web portal, but we could not transmit video from Channel 3. Elektra left it in that state, and afterwards the person in charge conducted bad management, taking the money of the project for his own purpose. So the group that was working on the mesh network broke up and the mesh network was abandoned.

A second free network project was run when the curator of Encuentro de Cultura Digital (digital culture gathering) met Elektra in Berlin. The curator spoke with me and we decided to invite Elektra again, funded by the New Media Department of the a Chilean Ministry of Culture, Arts and Heritage.

We established our base in Espacio G,[3] an alternative gallery hacker space in the city of Valparaiso. One of the curatorial ideas was to work with the people who had lost everything to the fires during the summer of 2014 in Valparaiso. So a prototype was developed and installed in two community centers and two houses in ButterFly Hill. Technically speaking, the network was based on an infrastructure which combines antennas, software, and a social network that can be freely used. In the sense of the context, the installation of this network up on a hill broke typical communication flows. Topologically, people who live in the hills, usually have to go down to communicate in a verbal or non verbal way. All the services of the city (school, stores, baths etc.) are in the plain, far away from the places we installed the network. This produced a new form of communication that impacted directly on the way the city was organized, generating new forms of activity that have nothing to do with other urbanized public or private spaces.

Conclusion

Technically speaking, these technologies are difficult to install, manage, support, and train. Chile is not a rich country, and especially the community members who work in these projects, have no free time to work on this network.

In the first case, technically speaking it was impossible to transmit digital video to the community. The mesh network was too weak, besides we got economic problems that broke the group and we never prepared a final document to give back to the FONDART evaluators.

In the second case, Mariposa Hills are far away from Espacio G and we did not have any financial support to go on with the project. Also, people at Valparaiso were not motivated enough to go on with the project. The distance is too great and the community of hackers in Valparaiso is a very close-knit community. As for myself, I live in Santiago, so it was quite expensive for me go there and work for free.

3 Espacio G, archived May 2015, https://web.archive.org/web/20150505210255/http://www.espacio-g.cl/.

12.2 Letter to Fidel and Raul Castro

Fig. 33 Cuba Libre.

Dear Fidel and Raul,

Recently, I had the opportunity to visit Cuba as a tourist. I would like to use this opportunity to send you a letter. I really do not want to be seen lecturing two great leaders such as you, by offering my unasked advice, but my suggestions are simple and constructive as you will see, so please take the time to read this letter.

First of all, my heartfelt congratulations on the release of the three heroes from the Cuban Five. This is indeed a victory and a recognition of Cuba's independence and right to self-determination.

I happened to be in Cuba when that announcement was made. That day, we traveled from a tourist hotel in Varadero to Playa Larga/Caleton, at the Bay of Pigs, also known as Playa Gíron. In Varadero, staff were gathering in front of a large flatscreen television showing Telesur TV – the Cuban CNN. We could understand what was going on by reading the scrolling subtitles.

This was truly a historic date. We were traveling as tourists, as I said, and I have not done any substantial reading on Cuba, I will openly admit. Neither as a journalist nor cultural theorist I am a Cuba specialist. And I was not going to comment on those big historical dates either. I just wanted to provide some way of expressing my gratitude of having spent three weeks in a wonderful country with wonderful people. We enjoyed our holiday tremendously and surely will be coming back.

Fig. 34. High-rise with socialist abdominal belt in Havana.

But between all the bliss of Sun, Sea, Salsa (the music and the food) we found one thing lacking. This was the internet, particular in its wireless form, through WLAN. The internet, if it was offered, was always locked into a room, which can be unpleasant in a hot country. It was also expensive and slow, if it worked at all. Being expensive is maybe the least important point, but since this is more a matter of principle, allow me to make a proposition.

The internet is not to be treated just as any other commodity. It is, like with Marxism itself, something that does not become less by getting used. Through its usage, it becomes more valuable, because it allows people to exchange information directly and engage in unfiltered, two-directional people-to-people communication. It also gives people an opportunity to access wide areas of knowledge and to learn about contemporary affairs as well as study history.

The internet gives those with less power a chance in many different ways. They can communicate directly from remote places with people all over the world and get their message through, just like the Zapatistas did in Chiapas in the 1990s, sending messages directly from the Lacandonian jungle to the world.

Fig. 35. Street scene in Havana.

The internet is not a commodity like any other commodity. I would like to thus add a recommendation. In order to further the internet in Cuba and give Cuban people a fair chance in the globalized world, the techniques of free wireless (and wired) community networks could be applied. Those projects are taking the principles of *agricultura urbana* to new technologies.

Worldwide, currently there exist several movements for the creation of free networks – wireless community networks as a self-provided internet. One such group is Guifi.net[4] who originate from Catalonia, Spain, and are now operating all over Spain and beyond. Here, people use ways of pooling their skills and some small funds for materials, to build a wireless internet in the sky. With such methods, large scale networks can be constructed, shown by many examples such as Guifi, Freifunk in Germany, Ninux in Rome and Italy, Athens Wireless. There are now examples also much further south, such as Valparaiso Mesh.

These networks operate like cooperatives, pooling their resources to have cheap wireless broadband. In some cases it has been shown to be more interesting to lay fibre optical cable, also as part of a community network which is shared as a *commons*. This idea of the pooling of resources in the network commons has emerged directly from the capitalist core. It is one of those *events* in history which confirm the idea of Marx and Engels, that the capitalistic revolution of the means of production creates the condition for the social revolution. The network commons creates conditions for capitalism to surpass itself. So in its dialectical movement, capitalism creates the conditions that allow the network commons to emerge, but then it also fights it.

4 Guifi.net, https://guifi.net/.

On one hand, the network commons in particular, and the wider free and open source software movement in general, represents the surplus of the utopian values of liberal capitalism, on the other hand it points at a stage surpassing it. This possibility of surpassing is fought by the conservative forces within capitalist societies. So they try to hinder it, by using all kinds of laws and measures, like copyright and surveillance, from fully developing, and thereby stifle and undermine the potential which the free exchange between people may have.

But I am convinced that the community-based method of network deployment is the best for Cuba, in particular with regard to cost, resilience and people's participation. Those community networks, because they are built and maintained by their users, tend to be quite resilient during natural disasters. They are also resilient in case capitalist infrastructure breaks down, due to the crisis-prone mode of development of capitalism. They allow people to organize their own telecommunications and therefore make digital networks more transparent to their users.

If there is any idea that Cuba might adopt such a community-based model, I am sure, the activists from cooperative wireless networks everywhere will be happy to give advice. I personally can not offer any practical support, as I am a writer who chronicles those developments. By letting you know these things I am not following any commercial interest. If necessary, I can help to get in contact with the right people from the free wireless movement.

Last not least, I would like to express my personal admiration for your achievements and express my heartfelt support for the future development of *project Cuba*

yours sincerely,

Armin Medosch, February 2015.

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Theory on Demand #58
The Rise of the Network Commons: A History of Community Infrastructure
Author: Armin Medosch

The book in your hands is a message in a bottle that washed ashore ten years after it was sent. Armin Medosch began documenting self-managed local networking initiatives with his book *Freie Netze* published in the German language in 2004. He iteratively developed *The Rise of the Network Commons* in draft chapters published on his website, *The Next Layer*, from 2013 until 2015, before his death in 2017.

The Rise of the Network Commons is a cultural history of 'the exciting world of wireless community network projects' that spread from its origins in London, Berlin, Vienna, Copenhagen to Spain, Greece, North- and South America, and Africa. While deploying cutting-edge technology, the movement is made up of technical, social, and artistic hackers with a range of backgrounds and skills.

This is the twofold thesis that Armin develops in this book: Involving ordinary people in building a network commons has a profound emancipatory effects on them. At the same time, doing so contributes to the democratization of technology: As a community we can begin to shape future technologies to serve our local needs rather than benefit commercial interests.

As a history of community infrastructure, The Rise of the Network Commons is a highly topical narrative for strengthening the resilience of our local *last mile* digital infrastructures and re-enforcing regional digital self-sovereignty through direct community participation and knowledge sharing. We build the wireless commons by becoming sovereign neighbors of practice and expertise.

Armin Medosch (1962 – 2017) was an Austrian media artist, journalist, curator, theorist, critic, and a pioneer of internet culture in Europe. As art activist, he co-initiated the transformation of the ship MS Stubnitz, a former GDR deep-sea fishing vessel, into a floating art space. He is well recognized as a journalist and as the co-editor of Telepolis. As an academic he earned a Master of Arts in Interactive Digital Media at the University of Sussex and a PhD at Goldsmiths, University of London and continued to his last days to publish, teach and research.

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