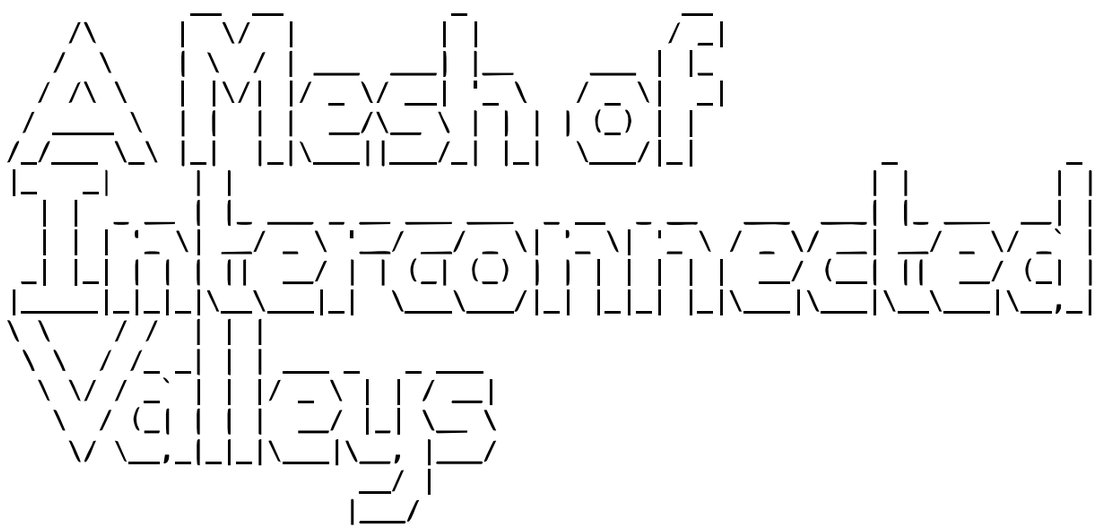




The following section adopts a first-person narrative approach, as it is based on a direct visit to the network in the village of Prunarolo. In this context, WCN practices are examined through the creation of techno-communitarian environments, revealing a form of integration between collectivity and telecommunication architectures.

The Valleys of the Autonomous Net

The Hacker of the Wireless Valley

On 5 November 2025, along with a peer Information Design alumnus, I traveled through the south-eastern valleys of Bologna (Italy) to reach the small village of Prunarolo, located at the foot of Monte Pero. This visit marked a first direct encounter with a territory in which a system of liberated connectivity had been collectively developed. At first glance, the landscape reveals no visible trace of such an infrastructure. Yet within a seemingly ordinary rural setting, residents have established a wireless community network that provides free Internet access across the valley and extends to neighbouring areas.[96]

Due to the small extension of the area, it didn't take long to reach the place of our appointment, as the town was fairly small. The meeting began over coffee inside the kitchen, which was hosting an always-running computer that was the collective server of the valley, after being welcomed by Cristina Carnevali.

Carnevali is a software developer by profession, but most importantly, by her own definition, a hacker. She defines hackers first and foremost as people with an attitude for trying to understand how things work and get inside them, adapting, reusing, and repairing, thus remaining close to the original meaning of hacking: nothing more than a part of computing work. However, in her case, she represents a hacker with a significant role in the creation of the techno-communitarian ecosystem that connects different villages in the municipality of Vasamoggia.[97]

Carnevali progressively entered the Italian hacker scene by attending hacker events such as *Ninux Days* and *Hackmeeting*.[98] It was within the Bolognese hackerlabs, like *HacklabBo*,[99] that she met *Campi Aperti*[100], an agroecological farmers' collective based on cooperative, self-reflective, and critically informed farming practices in the Bologna area.[101]

This encounter reshaped Cristina's understanding of hacking, as she began to identify a structural affinity between hacker and farmer movements. Both rely on the intergenerational transmission of knowledge and cultivate attentiveness to ongoing transformations of the present, and confront expansive, centralizing forces that tend to absorb territories, along with networked interactions. These actors are not only economic or technical but political, as they impose specific models for organizing resources, infrastructures, and social relations. In contrast, federated communities seek to remain rooted in shared principles while respecting internal differences, sustaining collaborative forms that resist centralization.[102] This perspective later took concrete form in the valleys of Valsamoggia, where it was grounded in the situated knowledge of local inhabitants.[103]

96 ›› Field notes from a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.
97 ›› Cristina Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
98 ›› Hackmeeting is a well-known event within Italian hacker communities. It is centered on activities and talks that revolve around thematics regarding the politics of free software and the shared reproduction of knowledge, Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
99 ›› HacklabBO is an autonomous hackers collective located in Bologna, founded on principles of horizontal decision making and the ideals of free software, infrastructure independence, and free information exchange. HacklabBO, "HacklabBO," PDF file, on date January 20, 2026, https://hacklabbo.indivia.net/hacklabbo1
100 ›› Campi Aperti is an organization based in Bologna, made up of artisanal producers and citizens, which recognizes food production as a communal and political activity, advocating for autonomous markets and local chains instead of certification schemes. Campi Aperti, official website https://www.campiaperti.org/chi-siamo/carta-dei-principi/.https://www.campiaperti.org/chi-siamo/carta-dei-principi/, on date 20 january 2025.
101 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
102 ›› Cristina Carnevali, *Dialogo tra una hacker e una contadina*, (Gli Asini, 2022), translation form Italian by the author.
103 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.



Once moved to the valley around 2017, Cristina quickly realised that the area was almost completely disconnected. As she states, this area was left for years in a "dark zone of capitalism and connectivity"[104]; due to unprofitability, no provider seemed interested in extending connectivity in these territories. Hence, these areas were living in the digital divide, as connectivity in this part of the Apennines had not been available, and, in many cases, even wired connections were unstable or altogether absent. Even in households officially served by high-connectivity plans, the connection was barely usable, arriving slowly and unreliably, often at a cost that was entirely disproportionate to the actual service reaching the valley.[105]

Several attempts were made to obtain a stable connection, but none of them worked. It was only when Cristina decided to apply the knowledge she had accumulated over the years that things finally changed. Drawing on her experience within the Italian hacker scene, she proposed to build a grassroots network, created and managed collectively by the valley's inhabitants, to give connectivity back to the area.[106]

One core aspect of the autonomous networks of the valley is the ability to transform into qualities what would normally be perceived as limitations: connectivity is not a service to be purchased or a technical object imposed from above, but an infrastructure collectively built and maintained. And after that first point-to-point connection built in Valsamoggia, node by node, they extended their own mesh throughout 4 other valleys in the area: Valsamoggia, Val di Venola, Val di Marano, and Val di Croara.[107]

Before antennas, cables, and routers, their network was made of community gatherings, meetings, distribution of roles, commitment, and the sharing of collective work. In fact, one of the key aspects of the network was ensuring it was built on a non-hierarchical organization model.[108]

Here, the relationship with the association *Campi Aperti* influenced the structure of the social network. The critical thinking that the association was already practicing toward forms of aware consumption and collective self-reflection made the terrain



Figure 12 ›› The antenna "Ninux-561d87" in Val di Croara. Photograph by the author, documentation from a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.

104 ›› Carnevali, conversation with the author,
October 3, 2025, translation from Italian by the author.
105 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
106 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
107 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
108 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.

particularly fertile for discussion on the emergence of alternative telecommunications systems.[109] From that moment onwards, during the community's meetings, consensus did not mean unanimity, and dissensus was not treated as an obstacle but as an informative part of the process, allowing the group to understand its direction without excluding anyone.[110][111]

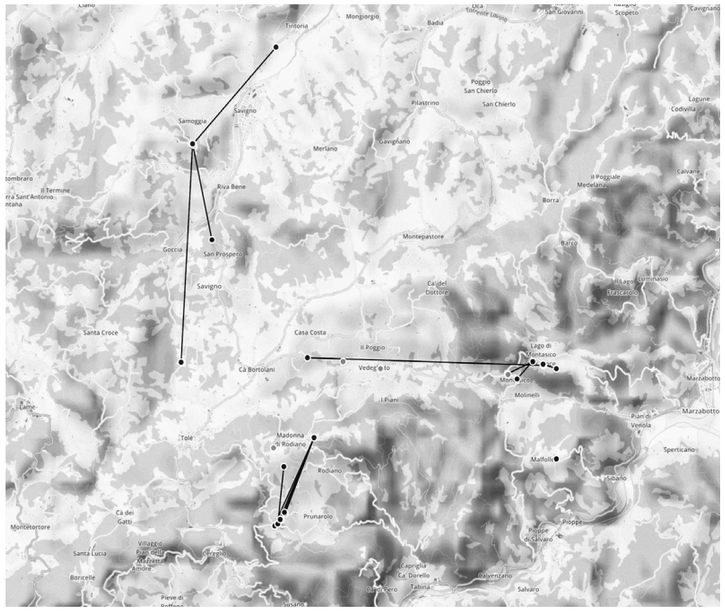
A Mesh of Interconnected Roofs

After an initial exchange with Carnevali, the conversation shifted toward a small cabinet-like repository, a repurposed wardrobe filled with electronic devices, many of them opened or modified so that their circuit boards were exposed. We examined the shelves. The first object Cristina picked up was a small antenna, the type most frequently used in the network. From there, she began to share her knowledge, weaving together technical explanations with practical, hands-on insights.[112]

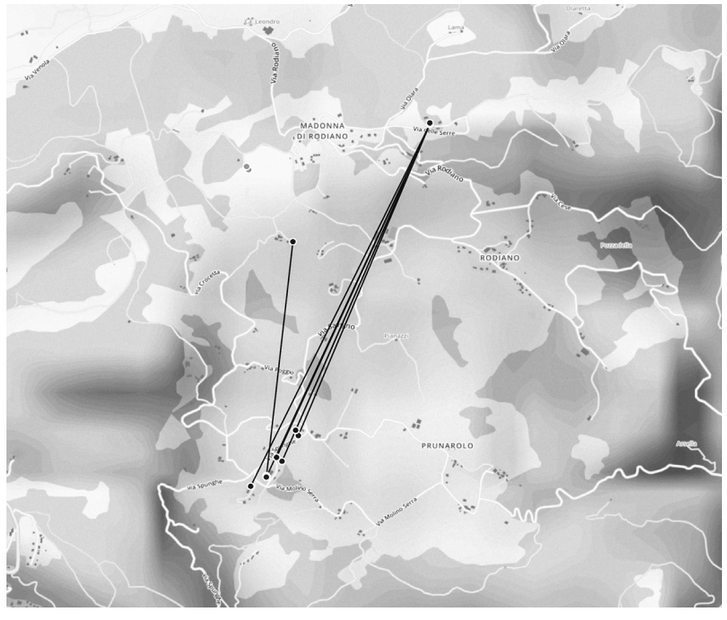
Part of her work and experiments emerges from practices of reuse: antennas discarded by large connectivity companies and common-use routers are recovered, repurposed, and reflashed with open-source software such as the Libremesh framework, of which Carnevali herself is a developer. *LibreMesh* makes sure that devices can dynamically establish routing links, allowing the network to remain flexible and adaptive. This simplifies the addition of new nodes and the reconfiguration of the overall topology.[113]

LibreMesh emerged from parallel wireless experimentation projects in Argentina, Catalonia, and Italy. In 2013, during the BattleMesh meeting in Berlin, activists realized that they were independently developing very similar firmware. Instead of continuing along separate paths, they decided to collaborate and create a modular, accessible framework designed to support collective maintenance.[114]

Developed within hacktivist communities, *LibreMesh* explicitly connects technical design with political intention. Its website states: "Free Networks, Free Society," signaling how software architecture embodies a broader political vision. The term "Libre" evokes freedom — it refers to freedom of speech — while "mesh"



Figures 13 ›› Map representing the network of the valleys. Source: the Valsamoggia Community Network digital archive, "Mappa Nodi," accessed December 12, 2025, https://mappe.antennine.org/en/map/nodi_4#11/44.318690/11.096878.



Figures 14 ›› Map representing the network of the valley of Croara. Source: the Valsamoggia Community Network digital archive, "Mappa Nodi," accessed December 12, 2025, https://mappe.antennine.org/en/map/nodi_4#11/44.318690/11.096878.

109 ›› Carnevali, Talk at Hack or DIY(e) 2023, translation from Italian by the author.
110 ›› Carnevali, Talk at Hack or DIY(e) 2023, translation from Italian by the author
111 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
112 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.
113 ›› Pau Escrich, Gui Iribarren, developers of LibreMesh, conversation with the author, January 23, 2026
114 ›› Escrich, Iribarren, developers of LibreMesh, conversation with the author, January 23, 2026

denotes a network topology resistant to centralized control. In this sense, knowledge sharing and free information flow are not external ideals imposed upon the infrastructure; they are inscribed directly within its code.[115][116]

When she closed the cabinet, Carnevali led us outside into the backyard. She explained how in this network, the antennas are given insect names, while the indoor routers are named after plants, and then pointed the roof: we saw an antenna, *Scutigera*. *Scutigera* channeled the network signal into her home. The antenna was high up on the building, and while looking at it, it's very easy to view *Tasso* and *Neomantix*, two nearby devices with a similar shape and placement.[117][118]

Here, Carnevali explained: Mesh nodes exchange data over unlicensed ISM (Industrial, Scientific, and Medical) bands[119], primarily at 2.4 GHz and 5 GHz. The accessibility of these frequencies, together with low-cost hardware, allows WCNs to develop as grassroots infrastructures built on distributed local configurations.

She then continued explaining the configuration of the Prunarolo network: *Scutigera*, along with the other antennas spread around the valley, is facing *Ninux-561d87*, which is the node that anchors the whole network to connect to the internet.

A WCN requires a gateway to an Internet Service Provider (ISP) to then access the wider web, and *Ninux-561d87* is the only antenna in the region that has a direct line of sight to the upstream ISP antenna located on the other side of Monte Pero, the mountain that blocks the direct signal in the valley.[120]

Before the installation of the *Ninux-561d87*, the residents had already pinpointed the location on the hillside where the signal could be received. Through discussions among the residents, they were able to determine that most homes lacked any internet connection at all, but one home was able to receive a weak signal. From this, the residents of Prunarolo were able to organize as a group and redirect the electromagnetic signal from the ISP antenna to the valley below.[121]

Carnevali emphasized that telecommunications companies exercise significant power over how territory is shaped: they decide where antennas are installed, which technologies and topologies are used, and even what information can be censored. For now, she explained, the network still relies on these companies for its upstream connection, yet the infrastructure itself still has the power of being collectively owned and self-managed. If the community were able to operate as a free ISP, it would gain a direct link to the backbone instead of depending on external entities. Unfortunately, due to strict laws placed in Italy, the road to reach the objective is not so straightforward.[122]

In the context of outbound connectivity, Carnevali continued to say that the community provided its own Internet connection. Since it was a shared connection, there had to be an agreement to make sure that the use was in harmony and that no one's work was being interfered with. This is how the community deals with the limitations imposed by commercial services.[123]

These conditions also resulted in experiments with the infrastructure of the collective server and the local mesh. In the valley, services within the collective can be distributed among various nodes. An example of this is a *PeerTube* service used for video streaming. Carnevali explained how video files spread much faster within the local mesh than over the ISP connection, which has traffic limits. This often makes the internal network more efficient than the Internet connection.[124]

In this regard, *PeerTube* serves as a tool for maintenance documentation and internal streaming, as well as a testing ground for autonomous models of content distribution that function independently of corporate platforms.[125]

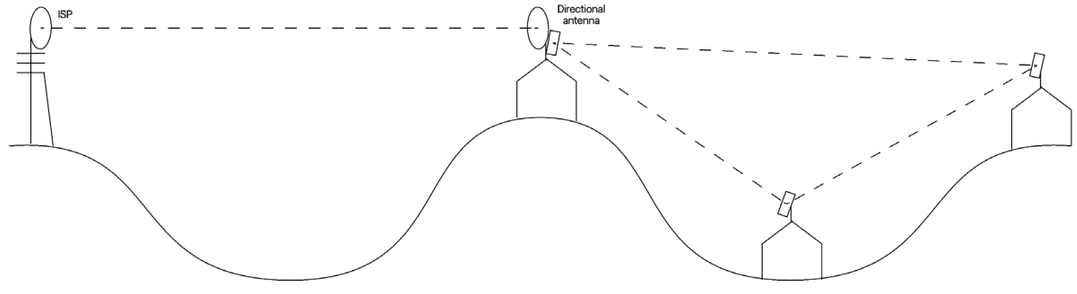


Figure 15 ››Diagram showing how a Wireless Community Network connects to an ISP to distribute Internet connectivity within its system. Visualization by the author based on data from Ninux.org Community, *Fondamenti per Costruire una Rete Wireless Libera*, n.d.

115 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
116 ›› Escrich, Iribarren, developers of LibreMesh, conversation with the author, January 23, 2026.
117 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali
118 ›› Carnevali, conversation with the author, October 3, 2025, translation from Italian by the author.
119 ›› ISM stands for Industrial, Scientific, and Medical, and it refers to the radio spectrum originally reserved for non-communication purposes. However, some of the ISM frequency bands, such as the 2.4 GHz band and the 5 GHz band, have been allocated for unlicensed communication, which has made them the foundation for the development of Wi-Fi networks,enabling the development of community-based wireless networks, Ninux.org Community, *Fondamenti per Costruire una Rete Wireless Libera*, "Banda ISM o spettro libero," Translation from Italian by Author.
120 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.
121 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.
122 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.
123 ›› Cristina Carnevali, *Dialogo tra una hacker e una contadina*, 2022, translation form Italian by the author.
124 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.
125 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.



Techno-communitarian Perspectives

Once you see the network architecture of the Valleys of Valsamoggia, it's impossible to miss how deeply this infrastructure is shaped by the landscape geography. In the network, every choice has a reason behind it: each antenna has a carefully chosen orientation, and every link depends on whether the houses are in line of sight with one another. As you see this scenario, it's clear how this place seeks balance and collectiveness: every node in the community-built network carries its own story. Each antenna, a small component of a larger system that feels almost alive, becomes a symbol of a community reclaiming its electromagnetic space.[126]

Avery Gordon introduces a new perspective in approaching the utopian, not as a distant horizon or an abstract ideal that yet has to materialize, but as an active scenario that takes shape in the present. This perspective becomes tangible in autonomous network initiatives, as these projects do not simply imagine a new reality; they begin constructing it in practice, establishing their own forms of value, reasoning, and collective organisation. In fact, self-built networks challenge top-down logics by creating environments that are reclaimed collectively in both hardware and software components.[127]

Here we could extend by introducing the ideas exposed by David Bollier and Silke Helfrich in *Free, Fair and Alive*.[128] Framing the commons not as a resource but as a practice: the "commoning," defined as structured through social life, peer governance, and provisioning. In the context of "commoning", a shift in the perception of identity takes place, moving from a form of "Isolated-I" to a form of "Nested-I", towards a form of collectiveness grounded in the acknowledgment that "individual flourishing is rooted in collective well-being".

Deleuze describes the creation of "dividuals" in the state of diffuse control,[129] which, in this context we could identify as the hierarchical private network model. In this context, the relationship between the individual and the collective is also altered. The subjects are no longer addressed as



Figure 17 ›› The antenna *Ninux-561d87* in Val di Croara. Photograph by the author, documentation from a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.

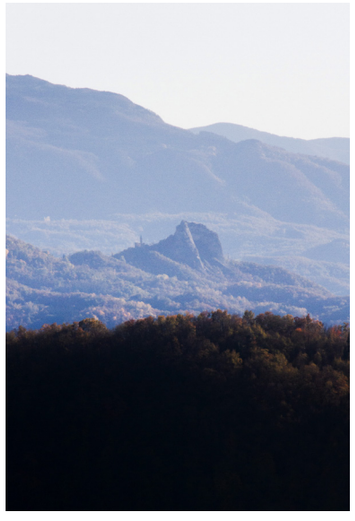


Figure 16 ›› Sasso di Vigo, where the valley's ISP antenna is located. Photograph by the author, documentation from a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.

126 ›› Field notes from a research visit to the Valsamoggia valleys, hosted by Carnevali.
127 ›› Gordon, *Some Thoughts on the Utopian*, 18–24.
128 ›› Helfrich and Bollier, *Free, Fair, and Alive*, 41–42, 143–44.
129 ›› Deleuze, *Postscript on the Societies of Control*, 3-4.





Figure 18 ›› The antenna *Ape* in Val di Croara. Photograph by the author, taken during a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.



Figure 19 ›› The antenna *Falena* in Val di Croara. Photograph by the author, taken during a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.

coherent individuals, but rather fragmented and divided entities that can be classified and regrouped in different systems. Defined now as "dividuals", they circulate as data, samples, profiles, or entries within the information repositories. In this context, the practice of power is expressed through aggregation and continuous recalibration.[130]

The idea of "Nested-I" could be used to exemplify the shift opposing the formation of "dividuals" into a collective infrastructural generation that WCNs undertake when placed in situated realities. The example of Valsamoggia shows how such a contemporary utopian practice can emerge in a small village like Prunarolo through the exchange of knowledge, by proposing new ways of organising a techno-rural, small-scale society by "refusing formal organizational structure that required authorization from above."[131] These initiatives break away from technological determinism and, through acts of active world-building, make room for different futures where connectivity architectures are built upon a "sphere of trust".[132]

In his work *Neither Vertical nor Horizontal* (2021), Nunes argues that most movements do not operate as a single unified structure, but as an ecology of interconnected actors, practices, and scales. Nunes's conception of the "distributed" is not defined by the absence of centers, nor does it imply a form of decentralization; rather, it's described as a configuration composed of multiple centers. These centers operate at different scales and temporalities; some may be temporary and informal, others may be more stable and enduring.[133]

When applied to the techno-communitarian environments of WCNs, the framework developed by Nunes can be used to understand the way these networks restructure centralization. The WCN could be framed as a form of "organizational ecology", that is collectively organized and that distributes authority within its system. The concept of "distributed leadership" mirrors the modality through which bottom-up mesh networks constantly distribute information flows along their nodes. Although certain nodes or actors may temporarily function as "organising cores" of the system, this does not equate to a rigid hierarchy. Instead,

130 ›› Deleuze, *Postscript on the Societies of Control*, 3-4.
131 ›› Helfrich and Bollier, *Free, Fair, and Alive*, 13, 75, 93, 98
132 ›› Helfrich and Bollier, *Free, Fair, and Alive*, 13, 75, 93, 98.
133 ›› Nunes, *Neither Vertical nor Horizontal*, 26–27, 163–64, 174–80.



the resulting authority remains "contingent, relational, and embedded" within the network.[134]

Accordingly, a Community Network should not be viewed as a model that eliminates control, but rather one that relocates it by placing collectivity at the heart of technological development. Through the structural and social choices embedded in its architecture, their relevance is also seen in a hacker practice that places collectivity as the base of structural development.

WCNs as the one seen in the Valleys of Autonomous Networking generate ecosystems in which technical development, maintenance, and governance are shaped through shared agreements and peer-to-peer forms of organization. Connectivity is thus reframed into a negotiated practice sustained through active participation.[135]

The creation of this environment is gracefully mediated by the action of the technical agent that, through the action of hacking, reworks existing conditions and resists the constraints of ownership and proprietary control. The community network of Valsamoggia could be seen as an example where the hacker becomes an agent of change, a facilitator of technical access, and someone who helps others understand, maintain, and take ownership of their technological environment. Technically skilled members of the WCN deliberately step back so that decisions are made only once everyone has reached a sufficient level of understanding. Drawing on Nunes' definition of "distributed leadership", this scenario exemplifies an horizontal, anti-hierarchical forms of distribution of knowledge and authority that ensure a collective understanding and governance reflected in the technical working of the infrastructure itself.[136]

The hacker in this context recognizes that "privatizing information and knowledge transforms them into commonified 'contents'", constraining the "freedom of information developing freely".[137] As modern economies become increasingly reliant on informational production, the expansion of traditional property rights into this domain is viewed less as a safeguard for innovation and more as a structural impediment to collective growth and experimentation:[138]

> "Everywhere, the desire to open up the virtuality of information, to share data as a gift, to appropriate the vector of expression is represented as the object of a moral panic, as a pretext for surveillance and for restricting technical knowledge to 'competent authorities'."
>
> McKenzie Wark, A Hacker Manifesto, 2004, para,73.

134 ›› Wark, *A Hacker Manifesto*, paras. 32, 34.
135 ›› Nunes, *Neither Vertical nor Horizontal*, 26–27, 163–64, 174–80
136 ›› Nunes, *Neither Vertical nor Horizontal*, 26–27, 163–64, 174–80.
137 ›› Wark, *A Hacker Manifesto*, para,73

The
Mutable Net



A Mesh of
Interconnected Valleys



Figure 20 ›› Picture of Val di Croara. Photograph by the author, taken during a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.



Figure 21 ›› Picture of Val di Croara. Photograph by the author, taken during a research visit to the Valsamoggia valleys, Prunarolo, Bologna, Italy, November 5, 2025, hosted by Cristina Carnevali.

> "Everywhere, the desire to open up the virtuality of information, to share data as a gift, to appropriate the vector of expression is represented as the object of a moral panic, as a pretext for surveillance and for restricting technical knowledge to 'competent authorities'."[139]

We can recognize in the actions of the technically skilled member of the WCN in the valleys a further development of the figure identified in Italian hacker history, a "cybertician"[140] in continuous exchange with the community. In contexts such as the one defined by the Appenine-situated network, hacking actions materialize in an infrastructure of which development places collectivity at its heart. Acknowledging that information itself can become a tool of power, as a mesh-node, they exchange data and distribute knowledge and power instead of centralizing it. In situated environments, WCNs reshape the very notion of a network by pushing it beyond its technical function: through their own mesh of connections and by treating it as a commons, they generate spaces where social change takes place, building alternatives to the models proposed by dominant institutions.

138 ›› Wark, *A Hacker Manifesto*, para,73
139 ›› Wark, *A Hacker Manifesto*, para,73
140 ›› Bey, *T.A.Z.: The Temporary Autonomous Zone*, 111.