As Alexander Galloway argues in *Protocol* (2004), forms of control in the private network are inscribed within the technical rules that define its operation. In this way, the same broader infrastructure that enables a distributed transmission of data operates by centralizing authority through a technical setting that follows a "bi-level logic", actually remains organized through a form of vertical governance. In this sense, the freedom users experience within the use of the global network is not the absence of control but its most direct expression.

From this last point, going back to Carnevali's mention of "free software and open licenses," another crucial dimension of the working of alternative networks is explained: the use of open-source, collectively maintained software that redefines communication technology from within. In such systems, the technical shape of the network mirrors the community's values, encoding distribution and shared responsibility at both the infrastructural and social levels. By contrasting the "bi-level logic" of the main Internet infrastructure, meshed connectivity redistributes control over the vectors through which information moves.[60]

Mesh systems are defined by a malleable structure that can be continuously reconfigured, where routing agreements and data paths are constantly recalculated and updated, demonstrating in practice how alternate forms of networking infrastructure can operate outside privatized models. Examining the lineage that led to their contemporary shape reveals how non-exploitative, communitarian principles can be encoded directly into the architecture of a communication system, offering a new perspective on the distribution of authority and collective governance over the flow of information.

> "A mesh network (...) is composed of antennas owned by the people who want to connect to the network and that communicate with one another, often from rooftop to rooftop, using free software and open licenses."
>
> Cristina Carnevali, "Talk at Hack or DIY(e) 2023, organized by HacklabBO, Bologna, 2023.

A Wireless Lineage

The term "wireless," in the field of telecommunications, refers to the exchange of data between devices without the use of a physical medium. Within the broader category of wireless networks, mesh networks are systems in which data travels through electromagnetic waves between the radio de-

60 ›› Mélanie Dulong de Rosnay and Félix Tréguer, *Telecommunications Reclaimed: A Hands-On Guide to Networking Communities* (Paris: C&F Éditions, 2022), 25

vices that participate in the network.[61]

When connectivity is treated as a shared resource around which an infrastructure is collectively built, then we talk about a *Wireless Community Network* (WCN). WCNs are community-built infrastructures to distribute internet connectivity freely and generally the transmission of data in a given area; their creation is motivated by different factors depending on the context in which they are based. Mostly, these infrastructures are developed to address forms of digital divide,[62] by actively extending meshed connectivity to areas underserved by commercial providers.

A key component of WCNs is defined by shared governance. The organizational models that wireless communities follow may vary depending on the site-specific collective needs: some take the form of associations or cooperatives, others operate as informal volunteer groups. However, the common base is defined by an orientation towards collective stewardship rather than commercial extraction, seeking infrastructures that are not dependent on state or corporate control and that can grow organically.[63][64]

Since a WCN frames connectivity as a shared resource rather than a commodity governed by privatized infrastructure, communities often extend this practice with socio-political commitments.[65][66]

The political tendency of these practices is rooted in a longer genealogy of grassroots communication infrastructures that established the foundational principles upon which WCNs are built.

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The culture of Wireless Community Networks in the European context is rooted in a longer genealogy of grassroots communication infrastructures. This lineage can be traced back to the first experiments in telecommunications carried by countercultural radio movements of the 1960s and 1970s, which framed electro-



Figure 7 ›› Diagram showing how unidirectional antennas spread connectivity in a node-to-node connection. Visualization by the author based on data from Ninux.org Community, *Fondamenti per Costruire una Rete Wireless Libera*, n.d.

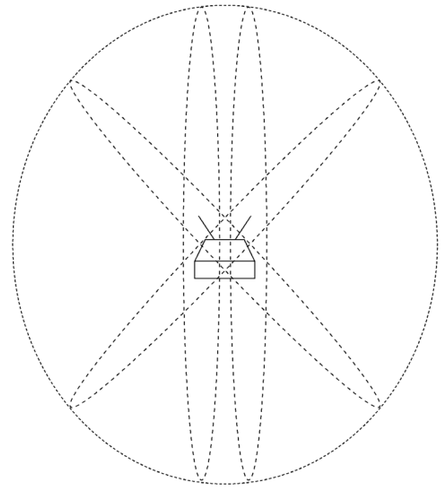


Figure 8 ›› Diagram showing how omnidirectional antennas spread connectivity in space. Visualization based on data from Ninux.org Community, *Fondamenti per Costruire una Rete Wireless Libera*, n.d.

61 ›› Mélanie Dulong de Rosnay and Félix Tréguer, *Telecommunications Reclaimed: A Hands-On Guide to Networking Communities* (Paris: C&F Éditions, 2022), 25
According to the definition of vector presented by McKenzie Wark, Wark, *A Hacker Manifesto*, paras. 14, 19, 24, 29, 32, 34, 312–13.)
62 ›› In the context of Wireless Community Networks (WCNs), the digital divide represents structural inequalities in terms of digital connectivity, infrastructure, and technological capacity. It is no longer a matter of whether the individual has access to the Internet, but rather how they access the Internet, at what quality, and under what conditions, Ninux.org Community, *Fondamenti per Costruire una Rete Wireless Libera*, n.d., sezioni "Cos'è una rete wireless?"
63 ›› De Rosnay, Dulong, Tréguer, *Telecommunications Reclaimed*, 32-35
64 ›› Yoo, *Network Theory, and the Past, Present, and Future of the Internet*,164-166.
65 ›› De Rosnay, Dulong, Tréguer, *Telecommunications Reclaimed*, 32-35
66 ›› Baran, *On Distributed Communications Networks*, 1-5

magnetic communication as a collective practice rather than a regulated service, first introducing a "right to autonomous transmission".[67]

However, a major development happened with the global expansion of Internet services in the 1990s, which led to the formation of *Consume.net* (1999) in London. The project, initiated by designer-artists James Stevens and Julian Priest, responded to legal restrictions over the unlicensed laying of fiber-optic cables, with the use of emerging Wi-Fi technologies in the creation of a rooftop-to-rooftop citizens-led network. The initiative later on led to the development of the free2air Wireless Network in 2001 in the same territory.[68]

Inspired by *Consume.net*, a new WCN was developed in 2002 in Germany: the *Freifunk Community Network* (FFCN). FFCN initiated the meetings that led to the creation of the Picopeering Agreement, which marked a turning point in the formalization of the principles that inspired community networking, with an approach that defined a new way to construct these meta-communities: a model in which decision-making power resides with those who actively participate. These experiences then increasingly spread in various shapes and organizational forms all around Europe, such as the 2004 *Guifi.net* born in Catalonia, Spain, or the 2012 *Funk Fewer* WCN in Austria.[69]

WCN's spirit evolved with a focus on international coordination that could be seen in the 2016 WCNs call on EU institutions to be formally recognized and protected as not-for-profit infrastructures within the ongoing telecom reforms of the time. Over thirty European WCNs contributed and mobilized for the successful inclusion of community networks in the European Electronic Communications Code, which lightened the condition for connectivity regulations and consolidated the right to share connectivity through local electromagnetic networks.[70]

The political approach to wireless networking practices found an interesting implementation in the Italian experience of the *Ninux Wireless Community* (NWC) back in 2002.



Figure 9 » Node of the Ninux Community Network in Rome, undated. Source: Ninux.org Community, *Fondamenti per Costruire una Rete Wireless Libera.*

67 ›› De Rosnay, Dulong, and Tréguer, *Telecommunications Reclaimed*, 24-29
68 ›› De Rosnay, Dulong, and Tréguer, *Telecommunications Reclaimed*, 33-38
69 ›› De Rosnay, Dulong, and Tréguer, *Telecommunications Reclaimed*, 33-38
70 ›› De Rosnay, Dulong, and Tréguer, *Telecommunications Reclaimed*, 39-43



Figure 10 » Sticker promoting the Ninux Wireless Community Network, distributed in Rome. Source: Association for Progressive Communications (APC), *Global Information Society Watch 2018: Community Networks* (Johannesburg: APC, 2018).

In Italy, community networking practices emerged with the vivid hacker-led culture that defined the country's digital counter-cultural actions and that circulated within centri sociali. It was within this framework that *Ninux* positioned itself as an infrastructure grounded in participatory governance and shared technical knowledge. The project originated in Rome through the initiative of Nino Ciurleo, a computer science student whose formation combined amateur radio practices, hacker culture, and a DIY ethos inspired by the underground scene of the time. Taking inspiration from initiatives such as Seattle Wireless[71], Ciurleo used his self-hosted website, ninux.org — a pun on "Nino" and "Linux" — to gather his first collaborators and begin spreading ideas about the emerging infrastructure within virtual spaces. The distribution of stickers and other informational materials across the Rome area contributed to the creation of the network's initial core nodes.[7273]

Refusing formal organizational structures that required authorization from above, *Ninux* positioned itself as a commons-based, aiming to demonstrate that another Internet — centered on users rather than corporations — remained possible. Since its initial experiment, the Italian WCN continued to develop collectively, reaching around 350 nodes in the 2010s and gradually extending its influence on community networking practices across Europe.[74]

The NWC made contact with other European WCNs in events such as the Wireless Community Weekend in Berlin (2006) and *Wireless Battle Mesh v3* (2010), and this led to the formulation of the country's own event based on the exchange of the community's members, with the name of *Ninux Day* (2009). Such an occasion further fostered a sense of collectivity between the node's creators, advancing the idea of an infrastructural collective good.[75]

Read through the lens of the author Hackim Bey, WCNs experiences as the one carried by Ninux could be understood as forms of "Counter-Net" actions opening free spaces to challenge centralized control, where the focus lies in reclaiming connectivity by distributing authority across a distributed topology. WCNs hack devices with open-source software to repurpose the technical medium through which information travels within the "Web"[76].

These networks operate within and alongside dominant infrastructures. Their autonomy remains partial and contingent, as they rely on external gateways and remain subject to legal and economic constraints in order to distribute and exchange data coming from the Internet. Yet this is the area in which we can precisely find the political relevance behind the WCN's actions: they do not erase the "Net" but rather reconfigure its functioning on a local level, redistributing decision-making, visibility, and maintenance even on the infrastructural level. What is produced is a tactical form of collective autonomy within the existing broader system.[77]

These same ideals could be found in the agreement and manifesto that NWC used as a guide to express the position of their practice: the *Picopeering Agreement* (PPA) and the *Wireless Commons Manifesto* (WCM). [78]

The PPA (2003) is a communal document that was created as a result of a series of meetings between WCN activists, coming from sites such as Berlin, London, and Copenhagen. This agreement became very relevant within WCN's culture as it formulated the role of a WCN participant. Its structure defined principles that ensured communal agreement to provide free transit and open communication between node owners. It aimed to enable separate local networks to start communicating with each other by creating a common ground.[7980]

The *Wireless Commons Manifesto* (2003) emerged within the early 2000s wireless networking milieu. It was conceived as a political declaration to foster a sense of belonging among community networks worldwide, by framing wireless infrastructure as a commons built and maintained by citizens, and by rejecting forms of privatization over the network. The manifesto circulated through mailing lists and hacker communities, increasingly gaining popularity until becoming

71 ›› *Seattle Wireless* was a wireless community networking project launched in Seattle during the early years of the 2000s, with the goal of constructing a community-owned, open-access wireless network in Seattle. The success of Seattle Wireless provided one of the earliest examples of a community networking movement that could be used as an example by others worldwide, De Rosnay, Dulong, Tréguer, *Telecommunications Reclaimed*, 39-43
72 ›› De Rosnay, Dulong, and Tréguer, *Telecommunications Reclaimed*, 45-49
73 ›› Association for Progressive Communications (APC), *Global Information Society Watch 2018: Community Networks* (Johannesburg: APC, 2018) 162-165
74 ›› Association for Progressive Communications (APC), *Global Information Society Watch 2018: Community Networks*, 162-165.
75 ›› Association for Progressive Communications (APC), *Global Information Society Watch 2018: Community Networks*, 162-165.
76 ›› Bey, *T.A.Z.: The Temporary Autonomous Zone*, 106–14.
77 ›› Bey, *T.A.Z.: The Temporary Autonomous Zone*, 106–14.
78 ›› *Wireless Commons Manifesto*, 2003, Wireless Commons, https://personaltelco.org/wiki/WirelessCommonsManifesto (accessed February 13, 2026).
79 ›› De Rosnay, Dulong, Tréguer. *Telecommunications Reclaimed*, 30-34
80 ›› *Pico Peering Agreement v1.0* (2003), https://picopeer.net (accessed February 13, 2026).



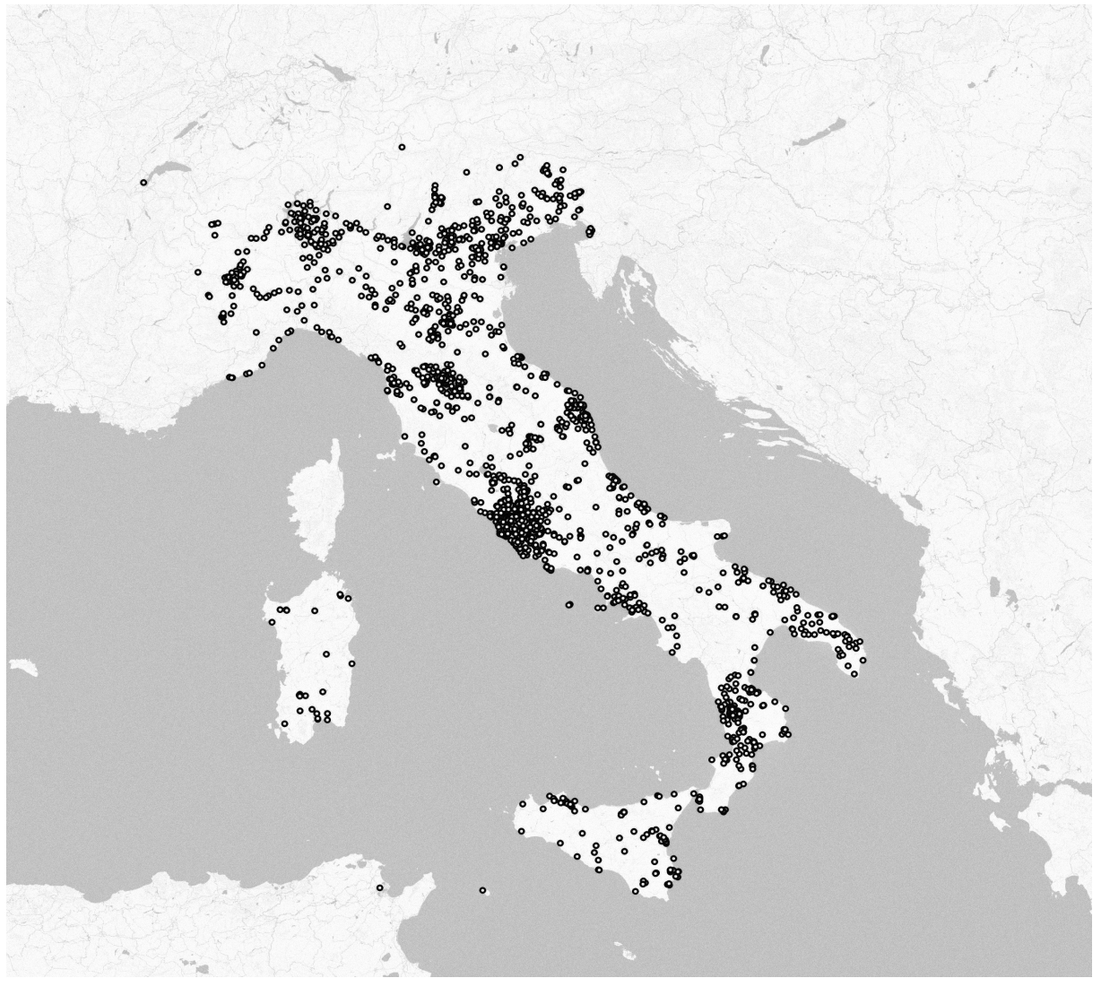


Figure 11 ›› Map of the nodes composing the Ninux Wireless Community Network. Data visualization created using QGIS, based on data from Ninux.org, September 11, 2025.



a reference point for wireless movements across Europe, including Italy's *Ninux Wireless Community*.[81][82]

Its manifesto form establishes a set of principles for mesh networking in a communitarian environment. A key principle is expressed by "non-discriminatory routing", stating that traffic flows should circulate freely regardless of their origin or content. Here, it is put in written words that a network should be open and based on constant mutual agreements. This approach is supported by the principle of "organic growth," which promotes minimal bureaucracy, facilitates the addition of new nodes, and preserves distributed ownership.[83] The manifesto concludes with the idea that the internet should be used and its inner working content shared: "The more it is used by the community, the greater its value".[84] The WCM expresses an ideal of reframing connectivity as a common good, named "the Wireless Commons", "built using unlicensed spectrum," and that would "dismantle commercial, technical, social, and political barriers for the common good".

Michael Hardt and Antonio Negri's theory of the commons could be used to extend the WCM ideas in the context of Italian network practices. Hardt and Negri frame contemporary production as increasingly becoming biopolitical, as knowledge, communication, and social cooperation become primary productive forces, and social interaction itself generates value. In this case, the WCM asserts the Wireless Commons, opposing the privatization perpetuated by commercial infrastructures that reduce connectivity as a tool to extract value, enclosing what could be collectively produced.[85][86]

While not erasing forms of control, the infrastructure proposed by the WCM aims to rearticulate communication as a shared resource, mirroring the practice that Hardt and Negri define as the "fourth call" of the multitude, as they acted towards the appropriation of the fixed capital.[87]

By integrating "Wireless Commons" ideals in its network architecture, Ninux's quality could be seen in its active intention in ensuring that telecommunications remained free-to-access, even by opposing laws imposed against such practices.

In fact, the early development of Ninux unfolded within a restrictive legal framework as, at the time, the *Pisanu*[88] and *Gasparri*[89] laws imposed administrative and technical burdens on activities providing free Wi-Fi nets. These laws treated grassroots initiatives as telecom operators, requiring them to implement a form of identity verification and data retention requirements, which conflicted with the distributed nature of the WCN. This forced the Free network to develop in a gray juridical area in its first years.[90]

Events such as the 2013 revelations disclosed by Edward Snowden[91] — which first exposed forms of scale of global surveillance embedded in the backbones of Internet architecture — shifted the perspective on the use of these digital infrastructures, which started to be seen as more than mere experimental technical projects, and more as alternatives to centralized service providers. During this period, *Ninux* experienced a significant increase in participation, almost doubling the number of its nodes.[92]

Ninux Community Network signified a new direction in the field of Wireless experiments: emerging experiences of communal infrastructural building, that came from a political ferment integrated in a lineage of previous hacker and countercultural experiences. In this context, a further extension of the hacker role in communitarian practices emerged with the integration of "wireless commons" ideals within the digital architecture itself. Ninux.org actively reclaimed hardware and technical knowledge to constitute a new form of social repository, which was expressed in the form of accessible guides and events such as *Ninux Day*, which opened the participation for new members.[93] *Ninux* actively challenged property rights on connectivity and the infrastructure that enables its transmission. In this sense, NWC could exemplify a "call for non-sovereign institutions" — in Hardt and Negri's terms — through a format in which the "multitude" can manage its own cooperation and decision-making without collapsing into either state control or private ownership.[94]

Today, *Ninux.org* remains part of the broader European community network movement, maintaining active nodes across Italy and continuing to participate in transnational exchanges.

Although participation in the network has declined compared to its earlier phases — as the broader wireless movement lost some of its cultural momentum — NWC continues to exist in more locally defined, often rural contexts. In these areas, while frequently implemented to address connectivity gaps, its original spirit remains present in infrastructural and communitarian choices.[95]

comes an agent of change, a facilitator of technical access, and someone who

81 ›› Wireless Commons Manifesto, 2003, Wireless Commons, https://personaltelco.org/wiki/WirelessCommonsManifesto (accessed February 13, 2026).
82 ›› Pico Peering Agreement v1.0 (2003), (accessed February 13, 2026)
83 ›› Wireless Commons Manifesto, 2003, Wireless Commons, (accessed February 13, 2026).
84 ›› Community Wireless Definition, 2003, Wireless Commons, https://personaltelco.org/wiki/WirelessCommonsManifesto (accessed February 13, 2026).
85 ›› Michael Hardt and Antonio Negri, Commonwealth (Cambridge, MA: Harvard University Press, 2009), 139–41, 282–83.
86 ›› Michael Hardt and Antonio Negri, Assembly (Oxford: Oxford University Press, 2017), 40–41, 161–64, 185–86.
87 ›› Hardt and Negri, Assembly, 110-120.
88 ›› The Pisanu measures, which were implemented in 2005 by Interior Minister Giuseppe Pisanu as a measure to combat terrorism, were highly stringent for service providers who wanted to provide public Wi-Fi access, and it was practically difficult for grassroots level Wi-Fi hotspot provision to happen, thereby inhibiting the spread of public Wi-Fi hotspots in Italy. The measures, which were highly criticized for inhibiting the free use of public Wi-Fi, were repealed in 2011, Association for Progressive Communications (APC), Global Information Society Watch 2018: Community Networks, 162-165.
89 ›› The Gasparri Law, or Law n. 112 of 3 May 2004, was a thorough reform of the media and communications sector, which redefined the broadcasting, spectrum, and licensing regimes of the digital age, including the regulation of wireless communication and the authorization of operators under a new integrated communications system, Association for Progressive Communications (APC), Global Information Society Watch 2018: Community Networks, 162-165.
90 ›› Association for Progressive Communications (APC), Global Information Society Watch 2018: Community Networks, 162-165.
91 ›› The "Snowden revelations" reframed how WCNs were viewed. In June 2013, the leak of classified documents by the former U.S. National Security Agency (NSA) contractor Edward Snowden revealed the existence of extensive global surveillance programs, which included mass metadata collection and the interception of communications at the level of Internet backbone infrastructure, disclosing a form of surveillance embedded within the very architecture of global telecommunications networks. The documents also indicated the extent of cooperation between intelligence agencies and technology corporations, challenging the idea of the Internet as a neutral or emancipatory technology, Association for Progressive Communications (APC), Global Information Society Watch 2018: Community Networks, 162-165.
92 ›› Association for Progressive Communications (APC), Global Information Society Watch 2018: Community Networks, 162-165.
93 ›› Silke Helfrich and David Bollier, Free, Fair, and Alive: The Insurgent Power of the Commons (Gabriola Island, BC: New Society Publishers, 2019), 41–42, 143–44.
94 ›› Helfrich and Bollier, Free, Fair, and Alive, 41–45 83-89 133-144
95 ›› De Rosnay, Dulong, and Tréguer, Telecommunications Reclaimed, 52-54



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.

The hacker in this context recognizes that "privatizing information and knowledge transforms them into commonified 'contents'", constraining the "freedom of information developing freely". 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:

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" in continuous exchange with the community. In contexts such as the one defined by NWC, 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.

The
Mutable Net



Building the
Commons