

From research to Deuxfleurs and back again: towards digital service infrastructure as commons

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We introduce Deuxfleurs — a hosting collective in France — and summarize its relation to research; we then propose a preliminary analysis of Deuxfleurs’ digital service infrastructure as a Common Pool Resource (CPR). Digital service infrastructure are well-studied in Computer Science from a technical point of view, but their governance is often a blind spot. Conversely, digital commons is an active field of research, but proposed results often ignore the materiality of the infrastructure. Combining the two aspects fits the definition of ”undone” Computer Science and can open interesting research questions.

1 Deuxfleurs, a hosting collective rooted in research

1.1 An overview of Deuxfleurs and its core values

Deuxfleurs is a French hosting collective created as an association in 2020. It aims at providing reliable digital services over the Internet, with a focus on services facilitating human-to-human communication. Currently, the main service is website hosting with more than 600 websites hosted, targeted at individuals and collectives. Other communication services are provided such as chat (Matrix) and email.

Deuxfleurs exists in a context of environmental and social crises, and starts from the realization that mainstream digital systems are, on the whole, mainly contributing to these crises rather than helping to solve them. However, Deuxfleurs believes it is still possible to provide digital services that are socially beneficial while keeping a low environmental impact. This is done by following a set of core principles.

First and foremost, Deuxfleurs promotes a *radical form of sobriety* or sufficiency: the infrastructure operates entirely without datacenters, and all hardware and services are hosted on small second-hand computers. This means that *limits* of the infrastructure are very quickly visible and this is intentional. Having direct visibility on the infrastructure and its limits helps users understand their own impact. For instance, websites have a very low storage quota by default (50 MB) and the current storage usage is shown in the administration interface. Users can increase the quota themselves up to a certain limit: this creates just enough friction to help generate discussion and positive actions from users. Despite these intentional limits, by carefully choosing services and making sure their implementation consumes a low amount of resources, Deuxfleurs can fit a lot of users on its small infrastructure: it estimates that it could easily host 10 000 to 50 000 web sites without significant changes to its operation model.

The second core value is *reliability* and robustness. Small service providers are sometimes not reliable enough to gain mainstream adoption and they remain forever in the ”alternative” category, never being able to seriously compete with established actors. Deuxfleurs has the ambition to promote its model and core values to a wide audience, and thus needs to be itself a credible and reliable service provider. This reliability is achieved through technical processes (redundancy, orchestration, simplicity, automation), through a collective human organization, and through understanding and controlling major dependencies. Deuxfleurs currently hosts more than 700 websites and has successfully gained the confidence of museums, trade unions, and even large metropolitan public authorities.

Third, Deuxfleurs adopts a *critical approach to technology*. In practice, it means designing and developing appropriate technology that embodies the values of the collective. It also means having a clear stance on dependencies and how to manage them. Some dependencies are easily avoided: having one’s own hardware and hosting it ”at home” avoids depending on a datacenter

operator. Some dependencies are unavoidable, however it remains possible to control their impact: electricity, network connectivity, hardware chipsets... Taking dependencies in the more general socio-technical sense, relying on skilled members to create and maintain the infrastructure creates a dependency on society as a whole (for their training, available time etc.).

1.2 From research to Deuxfleurs and back again

Deuxfleurs is rooted in research: it was founded by PhD students from the University of Rennes and Inria. Academic research in distributed systems from both academia (CRDTs [12]) and tech giants (Dynamo [6]) has heavily inspired Garage [1], Deuxfleurs' flagship software project.

In a circular move, the experience acquired by Deuxfleurs in five years of operations is now feeding research. While many small hurdles have been solved in autonomy, fundamental questions remain unanswered and need the slow-paced time of research. The new research questions raised by Deuxfleurs can be technical in the field of distributed systems, or organizational, or even both — for instance, how to ensure resilience of the infrastructure in a socio-technical way.

In this article, we focus on one specific research question: **can Deuxfleurs (its organization, its services, its infrastructure) be considered as a commons?** The goal of studying this question is to understand and better formalise the model followed by Deuxfleurs. One benefit for Deuxfleurs is to apply existing research on commons: how to manage scarce resources, what level of voluntary compliance to the rules is necessary for sustainability, or what are possible resource allocation strategies. Conversely, Deuxfleurs is a fantastic testing ground to experiment and validate new research ideas.

We are at the beginning of exploring this transdisciplinary process. We have started a PhD research work in September 2025 in collaboration with Deuxfleurs, on the subject: *"resilience of digital service infrastructure managed as commons"*.

2 Is Deuxfleurs an infrastructure commons?

We analyse how Deuxfleurs could be considered a commons. To this end, we mobilize the eight criteria for sustainable commons from Ostrom [11]. Another interesting analysis tool is the *bundle of rights* [4], not developed here for brevity.

We first need to define *the core resource of Deuxfleurs*. We propose considering both the *hardware* (servers, network) and the *software* that mediates access to said hardware. The hardware is an important part, because it defines the practical resource limits for appropriators, and is often a blind spot when analysing digital systems. However, the hardware is not enough, because Deuxfleurs is not directly offering raw compute resources: users are interested in higher-level services, which are provided using software. Controlling the software is essential for the governance process: to apply collective decisions, stakeholders need to be able to implement them. Deuxfleurs tries to develop its own software when it is highly critical to exert collective control on it, and uses third-party free software for the rest. Including hardware in the core resource puts an emphasis on the materiality of such services and makes them differ from usual works on digital commons where *knowledge* is the core resource. Note that Deuxfleurs contributes to the free software movement, but it does not necessarily adopt the same governance processes. Our software is licensed under the AGPL instead of more liberal licenses, and it is designed to fulfil Deuxfleurs' needs above all.

Secondly, let us define what *resource unit* can be withdrawn from the core resource. We propose a dual definition: first an abstract *capacity for communication* inspired from Guifi.net [10], based on the *software* core resource. A website hosted by Deuxfleurs provides online presence on the web; an email or a matrix account allows to communicate with others. Then, the abstract resource unit translates to concrete *hardware resource units* such as storage space, processing power, network traffic. These are the actual physical resources that need to be shared.

We now analyse Deuxfleurs through Ostrom's eight criteria for a sustainable CPR, leaving out the least relevant ones for the sake of brevity:

1. *Clearly defined boundaries*: There are three core groups: members of the association, users, and technical administrators. *Members* handle the governance of the association, ensure rules are respected, and open accounts for new users. Becoming a new member requires a consensus among existing members. Every year, the members elect a board to handle administrative tasks and handle serious conflicts. *Users* access Deuxfleurs services. They need to be invited by a member and to accept General Conditions of Use. They are welcome to participate in the informal governance processes. *Technical administrators* are members with full access to user data and services. They are responsible for maintaining infrastructure

and services, and for implementing the changes that are decided collectively. Becoming a new technical administrator requires consensus among all members of the association. All technical administrators need to sign a charter of good conduct.

2. *Rules regarding the appropriation and provision of common resources that are adapted to local conditions:* The main challenge is to fairly share computing resources that are voluntarily limited, while still being useful to appropriators. Appropriation rules rely on storage quotas or voluntary limitation, but they are currently not adapted to each usage typology (e.g. a single-page website vs. a music-oriented website). Hosting a server is a provisioning role reserved to technical administrators, because they handle sensitive personal data. Contributing to Deuxfleurs software is another provisioning activity that is more open, following an open source logic.
3. *Collective-choice arrangements that allow most resource appropriators to participate in the decision-making process:* Most day-to-day decision-making happens on public Matrix discussion channels where we avoid using technical jargon, with frequent debates and consultations. There is a monthly video call "by the fireside" where anybody can join to discuss current topics and take part in debates. Finally, Deuxfleurs holds physical retreats twice a year for a week-end, where the most important issues are discussed and decided upon. There is also a formal General Assembly every year, open to all actors and whose result is made publicly available. Finally, members effectively act as *monitors*, because they are morally responsible of the compliance of the users they invited.
4. *Conflict-resolution mechanisms which are cheap and easy to access:* minor conflicts are solved through discussions on public Matrix channels; other conflicts can be discussed during the monthly video call; serious conflicts are handled by the board of the association. Deuxfleurs currently lacks a Code of Conduct but it is planned.
5. *Self-determination of the community recognised by higher-level authorities:* Internet protocols and governance are designed to be very open, allowing Deuxfleurs to provide services freely — although interoperability for email services is becoming harder to ensure. On the legal side, the status of the association makes it possible to decide internal rules in full autonomy.

3 Related work for digital infrastructure as commons

The academic literature on ICT infrastructure managed as commons is quite limited. Community networks have been developed in the last two decades, most notably guifi.net and Freifunk [13], studied by NetCommons. The common governance for these community networks is coming both from sharing the high infrastructure costs and the organisational benefits, as opposed to Deuxfleurs where only the benefits in participatory decisions motivates its governance.

Closest to Deuxfleurs, Cloudy [2] is a community cloud [9] project on top of the well-established Guifi.net network common. While it provides services and shares devices, its common pool resource nature stems from being a sub project in the network which was designed and managed as a commons from the beginning.

CHATONS is a collective of digital service providers with common values such as transparency, solidarity, free software, and respect of their users' data. It has a shared governance process [7] in which Deuxfleurs participates. Each member of CHATONS may or may not be organized as a common.

In academic research infrastructure, projects such as Grid'5000 [3] and Chameleon Cloud [8] could be considered commons: they operate shared resources for a variety of academic actors and they sometimes have a shared governance process. Note that they often do not consider themselves explicitly as commons. Compared to Deuxfleurs, they have a more narrow scope and can be driven by institutional logics.

Finally, *digital commons* have been well studied, but they differ fundamentally from infrastructure commons. They organize around resources that are informational in nature: "data, information, culture and knowledge" [5], which also includes free software. These resources lack materiality, making them *non-rival*: copying information is almost free. In contrast, Deuxfleurs is organized around the materiality of the infrastructure and its physical limits, requiring a different kind of management rules.

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