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Resist the American anti-science movement: free ourselves from the GAFAMs and secure our scientific data

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ABSTRACT

Despite many warnings from the free-software community concerning our dependency to Google, Apple, Facebook, Amazon, Microsoft (GAFAM) and to proprietary software, we are now in the following situation: many of us are dependent, for our scientific production, on proprietary computer programs that belong to US firms and fall under the US Patriot Act. This law voted by the US congress in 2001 allows US state security services to access any data from people or firms without authorization or consent. The current Trump US government officially claimed the use of data from American companies for its own purposes. Public scientific databases are used to detect research programs linked to diversity, climate change, ecology, evolution and cut their funding. WE CAN RESIST !!!

Below are some recommendations.

Keywords open science · free software · data exchangeability · data safety · academic freedom · computer security

*This article may be classified as an **opinion paper**. The authors claim a point of view and recognize it as opposable. This article can also be classified as a **method paper**. In the register of current digital practices of French scientists, the authors recommend proven open-source solutions and document the structure of private companies offering solutions with proprietary software. Given the current state of the world, the authors have chosen not to submit their article to a peer review process. They deliver it to readers as is, but encourage readers to help them improve the article. All authors of the article, listed in alphabetical order, have approved its content.*

After the beginnings of the internet in the 1960s, the Information Technology (IT) industry has gradually developed a business model that is now reaching its limits. What has changed since then?

- The IT industry became more and more concentrated, with legal, ethical and financial issues linked to monopoly situations.
- Under the Trump administration, there is a collision between private and public interests.
- GAFAM are the product of an outdated business model that did not consider the cost of their environmental impacts. Scientific evidences that document Climate changes and Biodiversity crisis clearly show now that human activities, including the development of IT services¹ and particularly AI applications, are a threat for the survival of the humans on Earth. As recommended by IPCC Group 3, we urgently need to change our business model.

On the other hand, human beings kept developing alternative projects. There is a community offering free and open-source softwares (FOSS, La quadrature du Net). There are scientific communities preoccupied by lowering the IT environmental impact, as well as its societal impact (charts to preserve human rights). The free-community business model is building-up, with examples discussed in this document (Like the LibreOffice suite, the Octopuce example, and the chatons).

In the following, we classify our IT usages, quantify our dependency to private firms and/or to the US Patriot Act or to totalitarian foreign countries. We propose free-softwares solutions. The results are summarized in Table 1.

Throughout this document are links to different structures that can help you cut your ties with GAFAM, or any other profit organization. The objectives are not that you quit the GAFAM, but rather that you contribute to the building-up and existing of a scientific community that does not depend on profit organizations. The objectives are to secure IT tools that fulfill basic principles like:

- Any research question is legitimate, provided that it fulfills ethical requirements and scientific integrity principles.
- Scientific exchanges are secured.
- In no way is a scientific opinion, that fulfills ethic and scientific integrity, a reason to be silenced.

¹https://www.greenit.fr/wp-content/uploads/2019/11/GREENIT_EENM_etude_EN_accessible.pdf

Usage	Solution
Professional networking	<u>ORCID</u>
Sharing documents on the Cloud	<u>Nextcloud</u> , <u>Resana</u>
Sharing source code	<u>gitlab</u>
Text processing	<u>OnlyOffice</u> , <u>LibreOffice</u> , <u>L^AT_EX</u> , <u>typst</u>
Finding a free software	<u>Framalibre database</u>
Videoconferences	<u>BigBlueButton</u> (Instance des agents de l'Etat)
Social networks	Mastodon (e.g. <u>sciences.re</u>)
Instant messaging	<u>Signal</u> , <u>Tchap</u>
Emails	<u>Thunderbird</u>
Web browsers	<u>Mozilla</u> , <u>Chromium</u>
Search engine	<u>DuckDuckGo</u> , <u>Qwant</u>
Operating system	<u>Linux</u> (home version <u>Ubuntu</u>)
Home cloud and email resources	<u>chatons</u>

Table 1: To each usage it's free-software, open-source solution

1 Information Technology tools, academic freedom, and sovereignty

1.1 Free/proprietary software

At the heart of the problem is the widely misunderstood notion of IT freedom/free-software/libreware/freedom-respecting software as opposed to proprietary softwares.

- A **free software** is distributed under terms that allow users to run the software for any purpose as well as to study, change, and distribute it and any adapted versions. Computer programs are deemed “free” if they give end-users (not just the developer) ultimate control over the software and, subsequently, over their devices. Free does not mean free of charge and private companies can distribute free softwares. They can't sell the code, but provide with services and improvements and are engaged into publicly releasing their improvements. Costs for using free softwares are generally modest, and modest returns generally do not allow for strong investments in the ergonomomy of the IT application. Freedom has a cost.
- A **proprietary software** is mostly a secret when it comes to its coding, and the public isn't offered access to this. All of these pieces of software require you to accept their terms and conditions, and there are limitations with what you can do with the software. The main drawbacks are:
 - The *licencing fees*. Because the end-user is *captured* by the application, he or she prefers to pay money rather than paying time to familiarize with a less ergonomic application.
 - The necessary *acceptation* of terms and conditions that endangers freedom of thought. In the 21st century, many examples reported how private data that leaked from proprietary softwares like Facebook were used for example to influence electoral campaigns².

²https://www.liberation.fr/planete/2018/03/20/fuites-de-donnees-facebook-prend-l-eau_1637706/

- a **freeware**, not to be confounded with a free software, is a software that is distributed free of charge. Notice that a freeware can be proprietary. Known freewares are antivirus softwares, generally distributed free of charge for the general public, with more elaborated versions sold to private firms or public services.

The framasoftware association proposes catalogues of open-source softwares. It's up to you !

1.2 Particular situation in France

While the importance of opening science is now well understood by most french universities and national research organisms, there is some kind of schizophrenia about the challenge related to using and supporting free softwares: on one end, the french interministerial structure for IT applications (DINUM) is currently developing a free-software suite for such programs. On the other end, the french government and many universities and research organisms still support and contract with Microsoft applications. For instance, the french government has just signed a four years contract (152 Millions €) with Microsoft to distribute Office 365 to all national education and research institutes. This is the opposite of the official statement to strengthen numerical sovereignty as explained here.

1.3 We must resist

We are now facing a declared war against sciences from the Trump US administration. Even in France, politicians dare questioning scientific evidences, e.g. to accuse official environmental agencies of political bias. Our duty is to organize the scientific resistance and to secure scientific data.

2 International databases and information systems

Most US scientific information systems are not maintained anymore. There is an urgent need for international policy about existing mirrors, and also for the setting-up of a UNO committee on the safeguarding of scientific data.

Note that after a brief interruption of its services in the beginning of march 2025³, Pubmed, the US-government-funded database of biomedical literature has changed its interface. A new american flag appeared stating that Pubmed is an official website of the United States government. Of course the problem is not the american flag, but rather the Patriot Act. Mirroring Pubmed can be a new challenge.

3 Professional networks

3.1 Challenges

Many of us rely on american giants like Microsoft (Linkedin) or Google (google scholar) for their professional networking.

3.2 Solutions

Alternative solutions exist: for professional networking, there is ORCID, an international non-profit organization, or HAL in France.

³<https://www.nature.com/articles/d41586-025-00674-3>

Close your LinkedIn and GoogleScholar accounts and fill your orcid profile. Change the information on your personal website. ORCID stands for Open Researcher and Contributor ID. It is a free, unique, persistent identifier (PID). This is the first step to build free and open source distributed services to connect Researcher and their work to others. ORCID is an non-profit organization, community driven. In 2025, this is still true and explained here.

4 Sharing documents on the cloud

4.1 Challenges

The most popular tools today are proprietary and owned by Google (Google sheet, Google agenda, etc..) or Dropbox, which are companies located in the USA.

GitHub is a proprietary platform that allows developers to create, store, manage, and share their code. It is now owned by Microsoft. As any other cloud-based service, its conditions of use can change at any moment and your data and your codes are already being used to train AI or for any other purpose. You can read this blog post about current and potential caveats regarding github : We need to talk about your Github addiction.

4.2 Solutions

In France, Google solutions are competed by the association Framasoft (framagenda, framapad,...) and by the Renater network (universalistes, rendez-vous, filesender,...). More recently, universities and research organisms have installed Nextcloud instances available for their employees. Nextcloud (developped by the German company Nextcloud Gbmh) is an open suite of client-server software for creating and using decentralized and federated file hosting services.

Notice that he French Interministerial IT direction (DINUM) is developping a numeric suite available for all state employees. Among the offered tools, note **Resana**: an instance similar to Nextcloud dedicated to collaborative working.

Many alternatives to GitHub exist, among which sourcehut, codeberg, gitlab.

In France, research institutes have created their own git repositories (e.g. INRAE gitlab based forghemia).

In 2016, the Framasoft association launched a campain called *degoogling internet* that served the creation of numerous decentralized IT associations named chatons that provide citizens with internet and cloud services.

5 Scientific text processing

5.1 Challenges

The Microsoft office suite (Word, Excell, Powerpoint) is going to be replaced by the cloud-based services *Microsoft 365 Copilot*. Microsoft products store your productions in proprietary file formats that cannot be read by non-microsoft softwares. They do not respect the international ISO norm (2006) that prones the OpenDocument format. An open document can be read by any software.

As already stated before, the French Ministry of Education just passed a public contract worth €152 million, awarded without any real competition, to equip central services and higher education institutions with Microsoft solutions, including Office 365. This contract, which will last a maximum of four years, violates the principles of sound management of public funds, transparency, and equal treatment. It aggravates an already excessive and dangerous technological dependence on an American actor, in defiance of European solutions, particularly open-source ones, and in defiance of the recommendations of the DINUM. Such a contract is questioned by the National Council of free software⁴ (CNLL).

5.2 Solutions

There are many alternatives to Microsoft Office like the LibreOffice or OnlyOffice suites, which are quite similar, but also L^AT_EX or typst, which require somehow different learning but eventually save time and have similar capabilities. A minima, change to the LibreOffice suite. Consider L^AT_EX and Typst.

Typst is an open-source, free software, typesetting system developed and maintained by a german company (Typst GmbH, founded by Martin Haug and Laurenz Mädje). It is a markup language, similar to Markdown, **designed to be as powerful as L^AT_EX while being much easier to learn and use.**

Notice that this document has been written with *typst* and the source code is available. The source code is hosted by the chaton from one of the coauthors, La Contre-Voie. Notice that the coauthor pays 12 euros/year for a personal email, a nextcloud and a gitlab instance. The association, whose mode of operation is based on volunteering, should soon be able to finance a full-time employee. This example **proves that alternative and economically sustainable solutions do exist for IT services.**

6 Videoconferences

6.1 Challenges

During the Covid pandemia, the development of videoconference tools was accelerated. There are now two main concurrent systems : **Zoom** and **BigBlueButton (BBB)**, apart from **Teams**, which belongs to Microsoft, with the drawbacks already discussed above.

Zoom is a private company that uses proprietary formats for data exchanges. Its software products have faced public and media scrutiny for security and privacy issues. It does not comply with the European **General Data Protection Regulation (GDPR)**. In 2021, the Zoom company acknowledged sharing of data with Facebook, LinkedIn, and Google.

BigBlueButton is an open source virtual classroom software program originally designed for online education. It is accessible online from any system. Since 2021, it is supported by the French Interministerial IT direction. It guarantees the end-to-end encryption and confidentiality of data exchanges.

The main differences between Zoom and BBB are the IT protocols that are either centralized (with Zoom, data pass through private company servers) or decentralized (BBB uses decentralized servers and end-to-end ressources). For those reasons, the earliest versions of

⁴<https://cnll.fr/news/polytechnique-men-office-365/>

BBB were blocked by some institutional firewalls. This problem has now been solved for most institutions. If you encounter problems with local sites (e.g IRD at Montpellier) please report it to your local IT support.

6.2 Solutions

Several institutional BBB instances are at your disposal.

Any french government employee <https://webinaire.numerique.gouv.fr/>

CNRS staff <https://bbb.cnrs.fr>

INRAE staff <https://bbb.visio.inrae.fr>

Universite Paris-Saclay staff BBB is implemented as a Marsha resource on the Paris-Saclay moodle *eCampus*.

IDEEV staff A permanent course named Salons virtuels IDEEV does exist on *eCampus*. Heads of the IDEEV labs can register you on the course.

In addition, for your personal use, many chatons have included a BBB instance in their services. Notice also that in France, the Octopuce company provides french associations with free accounts to use their BBB instance. Octopuce is a french private company founded by Benjamin Sonntag, who also founded the french association La Quadrature du Net that promotes fundamental freedoms in IT usages and free softwares. The company sells servers and IT management services fully relying on free softwares.

7 Social networks

7.1 Challenges

Social networking sites or apps allow users to share ideas, digital photos and videos, and posts with people within their social network, and thus to inform others about online or real-world activities and events. Internet enables people to connect with others who live in distant locations across the globe, although global social networking without face-to-face exchanges may have societal drawbacks⁵

In sciences, popular social networks are **Facebook** (Meta, owned by Mark Zuckerberg), **Instagram** (Meta, owned by Mark Zuckerberg) , **X** (owned by Elon Musk), **TikTok** (ByteDance, owned by Zhang Yiming), or **Bluesky** (an american profit corporation). Because anybody can say anything on social networks, fact checking is a recognized weakness. Governmental pressures used to force social networks to hire people for fact checking to tackle the challenge of trust and the risk of misinformation, and to mitigate the diffusion of erroneous facts, or incitement to violence and hatred. Unfortunately, Meta and X announced in 2025 that they will cease fact-checking in their social networks, in the name of the principle of freedom of speech. As for TikTok, it is suspected of entertaining disinformation and data privacy violation. In France, note that scientists work on a chart on the ethics of social networks⁶. Bluesky, as a profit corporation, claims considering environmental and social wealth in its governancy but offers no guaranty thereof and is submitted to the US Patriot Act.

⁵<https://droit.cairn.info/revue-les-nouveaux-cahiers-du-conseil-constitutionnel-2017-4-page-69?lang=fr>

⁶<https://doi.org/10.4000/rfsic.3527>

Bluesky is a benefit corporation founded by Jack Dorsey, the former Twitter CEO. While it claims to be decentralized and open source, this is only partially true. The original source code of the protocol is released under MIT licence (really open source) but the long promised decentralization is still awaited as only Bluesky servers can join the network. As predecessors, Bluesky is striving to make benefits⁷, and the future is questionable as \$15M were raised by investors⁸. Among them are Blockchain Capital and they surely wants to be paid back somehow. A millions users platform, centralized, using algorithms would be a good target as Twitter was.



7.2 Solutions

Fortunately, the **Mastodon** social network is an open-source alternative. It is decentralized. Each Mastodon instance has its own moderation rules and its own chart. Mastodon instances are connected together.

The Fediverse (aka Mastodon) network relies on a really open source and free software. Anyone or any organisation can install its own server and join. The software development is sustained by a non profit foundation and everyone can help or donate. This currently works very well and has no shareholders or investors. This makes it a platform of choice for the scientific community as it will never be controlled by a single corporation nor government.

To start with **Mastodon** you can choose your instance (i.e. the server who will host your profile). Anywhere is OK, they are all connected. Each of these instances has their own usage policy and moderation team. If your instance does not suits you, you can freely move your account to another instance.

Among them are:

fediscience.org Social network for publishing scientists based in Germany, open from PhD student to professor.

fosstodon.org Community of like-minded people who enjoy Free & Open Source Software (FOSS).

sciences.re Focused on the French scientific community.

Please consider supporting the instance you've chosen. This is how the fediverse works, without advertisements, without recommendation algorithms, ensuring independancy and freedom for a very low cost (sciences.re only needs 29€ per week for hosting thousands of accounts).

8 Instant messaging

8.1 Challenges

Instant messaging has changed our life, by replacing face-to-face exchanges. The most popular instances are **Messenger** (Meta, owned by Mark Zuckerberg), **WhatsApp** (Meta, owned by

⁷<https://www.bbc.com/news/articles/c8dm0ljg4y6o>

⁸<https://techcrunch.com/2024/10/24/bluesky-raises-15m-series-a-plans-to-launch-subscriptions/>

Mark Zuckerberg), **Signal** (open source, developed by the American firm Signal Messenger LLC and funded by the Signal non-profit organization), and **Telegram** (open source code but data transit via a private server. The head office of Telegram is located in Dubai. Telegram is suspected of acquaintance with Russia).

Popular instant messengers are the properties of GAFAM. Even if your messages are encrypted, they own all other data: who you talk with, how frequently, your location, your IP address, websites you visit, contacts... They use it to any purpose benefiting their business, improve their AI or resell your habits to third parties. They are all under US Patriot Act or Chinese constraints.

More sophisticated instant messaging, merely dedicated to instant team working have been developed. **Discord** (US company Discord Inc founded by Jason Citron) is a proprietary software based on IT servers networks. Each server embeds voice and video calls, as well as persistent chat rooms. In 2024, Discord developed the open-source *DAVE* protocol that ensures end-to-end encryption of voice and video calls, but not of private text messages. **Slack** is a proprietary software (owned by the US company Salesforce).

8.2 Solutions

Signal is a better choice than Messenger or WhatsApp to ensure your privacy. No ads. No trackers. No kidding. Full encryption, from your discussion to your contacts : Signal is not able to rebuild your social network from external data.

Mattermost is an open-source, self-hostable online chat service with file sharing, search, and third party application integrations. It is maintained and developed by Mattermost Inc. The US company founded by Ian Tien and Corey Hulen generates funds by selling support services and additional features that are not in the open-source edition. Mattermost is integrated into GitLab as “GitLab Mattermost”.

In the free-software world, note **Matrix**, an open standard and communication protocol for real-time communication developed by the [Matrix.org foundation](https://matrix.org). Matrix.org foundation is registered as a non-profit UK Community Interest Company. The mission of the foundation is *to act as a neutral custodian for Matrix and to nurture it as efficiently as possible as a single unfragmented standard, for the greater benefit of the whole ecosystem, not benefiting or privileging any single player or subset of players*. It is managed through an open governance process that provides a safety-net to ensure the project stays independent and true to its goals. It relies on donations.

Element is a free software of instant messaging developed by *New Vector Limited* (a UK private company) that uses the Matrix protocol.

Notice that the French Interministerial IT direction (DINUM) is developing a **numeric suite** available for all state employees. Among the offered tools, note Tchap: the instant messaging secured end-to-end, that can be shared with unofficials through peer-to-peer recognition. It is based on a [free software](https://www.element.io/), open source development, and is a derived version (fork) from Element.

Every public organisation in France can join **Tchap**, as well as any staff employed by the French government.

9 E-mail communication

9.1 Challenges

Echanging e-mail messages requires two things: a **communication protocol** and a **client software** which allows writing and reading messages. Clients can be *thick* (a software installed in your computer) or *thin* (a webmail app). Known thick clients are Microsoft Outlook and Thunderbird. Whatever the client, the communication protocol must be standardized to allow communication between different types of distant computers, possibly having different clients. The main issue is thus related to **inter-operability**. Initially, the communication protocols were standard (SMTP for sending, POP or IMAP for receiving) with Request For Comments (RFC) specifying the way an e-mail must be written (headers, subject, machines that routed it). Such standard protocols were supposed to evolve collegially to maintain inter-operability between all clients. However, Microsoft *Outlook* — be it the thick client pre-installed in Windows OS or the thin client OWA used in a web browser — uses *Exchange* instead, which is a non-standard proprietary protocol. *Exchange* replaces IMAP, POP, and SMTP. Even though it is supposed to include standard protocols, *Exchange* evolves unilaterally according to Microsoft needs. *Exchange* e-mails embed non-standard Microsoft-specific binary modules in disregard of standards, and at the expense of the good operability of other clients. Also, deep integration into Windows brings along its lot of security flaws. Whenever a functionality introduced by Microsoft raises a security issue, only Microsoft can correct it. Notice that the advantages of such integration only benefit Microsoft users.

Indeed, the client installed on the end-user's computer needs to communicate with a server software that implements the transmission protocol. Whenever your institution chooses *Microsoft Exchange*, the overall compatibility will always be slightly better with the Microsoft suite, and this may bias the whole institute's staff towards using Microsoft proprietary software, with all the associated issues raised above.

Communication is a critic issue in the present context. Struggling to impose the respect of inter-operability standards is essential for our technical autonomy and for the safety and confidentiality of our communications.

9.2 Solutions

The most critical thing is the choice of the communication protocol. This is usually not within the reach of basic staff members. However, we could pass on the message across the relevant decision makers.

Still, choosing a free software as client can push up the process in the right direction. There are two types of clients:

- Thick clients, that are directly installed on the computer and take charge of the whole process locally. Many of them are proprietary, like Microsoft *Outlook* which is installed by default on Windows systems or *Apple Mail* on Mac systems. These proprietary solutions present the issues and risks discussed above. They should be replaced by free software such as **Thunderbird**. There are many other client softwares, free or not.
- Thin clients, also called *web mail apps*, which depend on a web browser. Such clients are also often proprietary (Outlook Web App - OWA). This raises the question of which web browser is used. Web browsers are often pre-installed with the operating system, like Microsoft *Edge*

in Windows systems or *Safari* in Mac systems. Notice that *Chrome* is owned by Google. Alternatively, choose free-softwares like Firefox or Chromium which are free softwares.

10 Operating system

10.1 Challenges

The choice of our operating system can have strong consequences on the software tools we will use for the different tasks listed above. Generally, *proprietary* OSs present the issues mentioned above for all proprietary software, and in addition, they tend to favor their own software ecosystem at the expense of the freedom of the user. This is the case for instance with Microsoft *Windows 11* in which AI invites itself in our offices without us to be necessarily aware of it, and at a significant environmental cost. An interesting feature of OSs is that each of them requires some initial learning, a kind of ‘entry ticket’ that is acquired very early in our life, and once we’ve got used to an OS, it is quite uncomfortable to change, even for another one that’s not really more complicated, but simply different.

10.2 Solutions

The only widespread free OS today is LINUX, which is available under different distributions implementing different choices e.g. for the desktop interface. Choosing a LINUX based OS will always drive the user towards free software tools, so to make it simple, all issues discussed in this document will mostly be minimized.

However, if we consider that we’re stuck to our present OS, taking good care of using free softwares for all IT applications listed above can significantly minimize the impact on our freedom and safety and confidentiality of our data.

11 Conclusion: the hard way to academic freedom

On one hand, you’ll find hard to change your IT habits. Yes, *LibreOffice* is less user-friendly than *Microsoft* because *Microsoft* is a profit organization that pays thousands of people to make your IT life more attractive, against only dozens of people and a lot of volunteer work for *LibreOffice*. The aim of *Microsoft* is to capture you (or your organization) as a client and to make profits. Since the 16th century, that is how human societies have been functioning, and profit organizations have been ruling the world. But the world is now changing in many ways.

The violence of the attacks of the Trump government against sciences and education urges us to find new ways to secure scientific data and exchanges. Solutions do exist in the line of the usage of free softwares and the opening of the data. It’s up to you to change your habits. It’s going to be less comfortable and perhaps a hard way. What is, for you, the price of academic freedom ?

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