Providing Open Source with Access Rights to Proprietary Platforms via Interoperability Regulation

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Abstract. *Free and open source software (FOSS) is a foundational element of the digital economy. However, monopolistic dynamics of digital markets have created a contradictory outcome: while over 90% of software produced globally contains FOSS, the largest platforms in the world are mainly proprietary. This paper argues that recent developments of interoperability regulation in diverse jurisdictions can provide FOSS access rights to features and functionalities of assets controlled exclusively by dominating platforms. These advancements can level the playing field for FOSS small companies, start-ups and non-profit communities facing dominating platforms.*

1. Introduction: connecting open source, interoperability and digital markets

Emerging as the outcome of an idealistic movement, free and open source software (FOSS) grew to become a foundational element of the digital economy [Benkler 2006], being present in up to 90% of commercial codebases [Nagle et al. 2022] and with an estimated economic value of 8.8 trillion dollars [Hoffmann et al. 2024].

FOSS relates to software which is released under a license safeguarding the "four freedoms" of using the software for any purpose, studying the source code, changing the source and redistributing the software for any purpose [Bretthauer 2002]. Much of the success FOSS has achieved is fostered by licensing schemes disciplining an open and persistent sharing of knowledge materialized in source code, documentation and data [Walden 2022].

However, the extreme dynamics of unregulated digital markets [Wu 2018], characterized by unsustainable and non-reciprocal forms of exploitation [Giblin and Doctorow 2022], result in business models prioritizing excessive forms of economic concentration [Doctorow 2021], disallowing democratic and collective forms of ownership over assets that FOSS, as part of digital commons, is based upon [Broumas 2020].

Since operating systems, browsers, apps stores, search engines and hardware drivers are essential elements of digital devices, they are susceptible to monopoly practices from device manufacturers, software providers and platforms. The more dominant the company is on the market, the easier it can impose abusive contractual practices that violate fair competition and, more broadly, an open and neutral internet [Krämer and Feasey 2021].

Brazil stands at the center of this turmoil. With the massive amount of 175 million active mobile connections [Perez 2025], the Brazilian digital market is deeply exposed to the pervasive dynamics of the duopoly Google-Apple when it comes to mobile devices. Since the country lacks large enough platforms to compete on equal footing with the tech giants, the market remains dependent on the contractual terms and conditions imposed by major foreign platforms [Ferreira et al. 2024].

The negative impact of such corporate power over entire digital environments has sparked reactions to overcome the deregulation-oriented mindset fostered by decades of neo-liberal policies, which allowed the emergence of tech oligopolies [Powers and Jablonski 2015]. Regulatory proposals are emerging in many countries to limit the conduct of the transnational digital companies to promote fairer competition practices in their jurisdictions [Murphy 2025]. Brazil is not an exception. The proposed "Fair Competition Act for Digital Markets (Bill 4675/2025)" [Brazil 2025] provides a legal framework to regulate how the largest companies in the world should behave with respect to fair competition in the Brazilian markets [Fernandes 2025].

The Brazilian bill, like the current international trend, resorts to "interoperability" as a regulatory tool to allow the interconnection of products and services of smaller companies and players depending on the infrastructure of the large platforms [Brazil 2025].

1.1. Object and methodology

This paper elaborates on how interoperability, as a regulatory tool, has been used to mitigate anti-competitive behavior of the dominating platforms from the perspective of FOSS. While the literature dealing with interoperability and digital competition is vast [Martínez 2025], the perspective on how FOSS is impacted by interoperability regulations is lacking. This study aims to fill this gap.

The lack of research in this area is prejudicial for Brazil. The country has a profound historical engagement with FOSS [Foletto 2020]. FOSS has played an important role in the country by providing the public and private sector viable alternatives to proprietary software, mainly in areas related to open science, platform governance and provision of digital public services [Evangelista 2014].

Therefore, the methodology involves an interdisciplinary approach that connects legal and policy interpretation to back up the main goal of understanding access rights and interoperability regulation from the perspective of FOSS. For that, three case studies are taken from the international debate, and then compared with the Brazilian proposed Bill 4675/2025:

- The European Union (EU)'s Digital Markets Act (DMA) [European Union 2022];
- Japan's Mobile Software Competition Act (MSCA) [Japan 2024];
- The United Kingdom (UK)'s Digital Markets, Competition and Consumers Act (DMCCA) [United Kingdom 2024].

These statutes are the most important ones using interoperability to regulate digital markets in the last decade [Murphy 2025]. These laws regulate how platforms should grant access to competing players services interacting with the operating systems, app stores, browsers and hardware instances.

1.2. Structure of the study

The line of argument develops as follows. Interoperability is presented as a multidimensional concept within the regulatory apparatus for digital markets (Part 2). Then, an examination follows of the relationship between FOSS and interoperability regulation (Part 2.2). Part 3 offers a primer on the requisites to make interoperability effective. The international debate on interoperability regulation is contextualized with the current Brazilian experience in Part 4. The conclusion points to future research in the area of interoperability governance and FOSS (Part 5).

2. Interoperability as a regulatory tool

In its most basic aspect interoperability can be understood as the ability to make two or more systems interconnect. Some functionalities these systems have in common can be used interchangeably via appropriate information exchange [Bourreau 2022]. As a multidimensional concept, however, interoperability can be viewed from numerous perspectives, including the regulatory one [Rezaei et al. 2014].

The taxonomy of interoperability includes definitions that are i.a. technical (e.g. interface specifications and communication protocols allowing common functionalities across devices and systems), semantic (e.g. data with the same meaning and structure), organizational (e.g. aligned business processes) and legal (e.g. enabling organizations operating under different legal frameworks, policies and strategies to work together) [European Commission 2017].

APIs, protocols, standards and formats have been used as mechanisms in regulatory processes to mandate shared access to an input or infrastructure, defining the terms and conditions of transactions among industry players and even in the design of products and business models [Brown 2020]. In this sense, interoperability has been used as a tool to level the playing field between small and large players by facilitating the entry of competitors in the markets [Scott Morton et al. 2023].

2.1. Interoperability and dominating platforms

Due to its stringent effects, interoperability may face resistance by the dominating platforms. Depending on their circumstances, these platforms can benefit from the interoperability mandate or step back and react when their assets become important enough to be subject to interoperability obligations [Eisenmann et al. 2009].

Tech platforms can be large companies with a central role in the digital economy. They have specific business models controlling essential features of digital goods and services. They serve different economic actors (e.g. developers on one side and consumers on the other) and heavily rely on data collection for their activities [Ferreira et al. 2024]. While the terminology referring to these companies may vary depending on the jurisdiction, there is some agreement over their definition [Cristofari 2023]. This paper refers to them as “dominating platforms” because although there are also smaller ones, digital markets suffer from the unbalanced power of the dominating ones.

When it comes to digital devices (especially the mobile ones), the more important that the features and components are for developers and consumers, the more entrenched the position of these platforms becomes in digital markets [Krämer and Feasey 2021].

These companies have cross-border presence, have millions of customers in the countries in which they operate and have dominating power over entire sectors of the digital economy [Ferreira et al. 2024]. An example is the duopoly exercised by Apple and Google in the market for mobile operating systems [Krämer and Feasey 2021].

Monopolies, unbalanced corporate power and market entrenchment are not recent phenomena [Zittrain 2008]. The continuum can be tracked back to the emergence of industrial society [Tarnoff 2022]. However, before the digital age, private monopolies could be dissolved in several ways [Cristofari 2023]: they were nationalized, broken down or prohibited from entering determined markets; sometimes the state itself provided competition; in other cases stringent regulation was imposed on them. Now that the digital economy is characterized by extreme returns to scale, network externalities and dependence on data, the challenge is to conciliate open, contestable and fair markets in the face of the ever-concentrating aspects of dominating cross-border tech platforms [Schweitzer et al. 2019].

It then becomes evident how interoperability is a powerful tool to regulate dominating platforms. By providing access rights to competitors, dominating platforms should open up their assets and enable them to interconnect and operate with the ones from the competitors [Scott Morton et al. 2023]. These assets are features and functionalities in software, hardware and data, as well as components and infrastructure upon which competitors rely and that cannot be easily replicated [Bourreau et al. 2022].

2.2. FOSS and interoperability regulation

Policymakers have increasingly relied on "platform openness", understood as open and interoperable ecosystems, as a strategy for strengthening competition, resilience and innovation in digital markets [Meyers 2026]. By leveraging freedom of choice, interoperability and democratic control over data, new regulations create synergies with FOSS [Lasota 2023].

FOSS development models prioritize open and persistent sharing of knowledge via permissive (in comparison with proprietary) license terms that privately regulate the open and transparent interactions among members sharing information, resources and artifacts with low entry barriers [Serpico et al. 2024]. Adopting a culture of openness by default, FOSS may conflict with large platforms' restrictive approaches towards interoperability.

For instance, many of the diverse GNU/Linux operating systems, browsers, app stores, payment systems and other important programs are developed by small companies, start-ups and even non-profit communities [Hoffmann et al. 2024]. Providing them with interoperability to proprietary-dominated environments can lead to a level playing field between them and the dominating platforms [Doctorow 2023].

3. Access regulation: the first step towards interoperability

Software interoperability relies on common interfaces, standards, protocols and formats to make a product or service work with an existing product or service [European Commission 2017]. But in environments controlled by dominating platforms, the mere process of getting access to features and functionalities controlled by them cannot always be easily established [Scott Morton et al. 2023].

Refusal to interoperate is not illegal per se. Platforms may have reasons and incentives to refuse access, to resist interoperability and to turn themselves to intra-platform compatibility [Eisenmann et al. 2009]. The right to select business partners pertains to freedom to conduct business in many jurisdictions. However, antitrust law has developed some doctrines specifying a duty to deal on non-discriminatory terms and conditions and, more generally, the existence of a principle of equal treatment [O'Connor 2025]. In circumstances that can be detrimental to competition, certain behaviors, such as interrupting an established commercial relationship, refusing to initiate new supplies, denying access to crucial inputs or infrastructures, or withholding intellectual property, can constitute abuse of a dominant position [Motta and Peitz 2025].

Similarly to the network and telecommunications industries, access rights to software can be regulated via "fair and reasonable and non-discriminatory (FRAND)" licensing [Manganelli and Nicita 2020]. However, it is worthy mentioning that FRAND licensing is sometimes at odds with FOSS. Normally FRAND terms include the expectation that there will be multiple, negotiated, bilateral relationships between patent owners and code users. FOSS licensing regimes do not include side-tracks but provide universal grants. FRAND assumes the possibility of further negotiations over royalty-based licensing. FOSS licensing is automatic without the need for further authorisations or concessions [Phipps 2019].

3.1. The challenges of enforcing interoperability obligations

Achieving effective interoperability can be challenging. Technical difficulties, circumventing practices and weak oversight may render enforcement efforts ineffective [Bourreau et al. 2022].

Dominating platforms can hinder interoperability in a variety of ways. They generally lead to restricting freedom of choice, enhancing lock-ins and increasing switching costs [Scott Morton et al. 2023]. Concrete examples include [European Commission 2025a]: (a) imposing conditions that unduly differentiate and grant access between third parties; (b) imposing discriminating conditions towards the platform's own services and products; (c) preventing competing solutions and use cases; (d) providing implementations that are not properly tested, secure or stable; (e) failing to consider the needs of third parties or to provide assistance; (f) failing to provide adequate and up-to-date documentation.

End-users also may also suffer from faulty interoperability [Doctorow 2025]. This relates to difficulties or inefficiencies that hinder or affect the end-users' ability to complete a task or achieve their goal in the shortest possible time and with the least effort with their digital devices [European Commission 2025a].

In this context, "interoperability-by-design" represents the gold standard when regulating access rights to competitors [Martínez 2025]. Regulators aiming at this standard should consider enforcing obligations that: (i) make features and functionalities of the dominating platforms available to competitors without undue restrictions; (ii) request documented and maintained access to interfaces over time; (iii) consider the demands of competitors when designing, updating or deprecating the interoperable solution. For some features, a mere lifting of a contractual or technical restriction might be sufficient. In other cases, the gatekeeper might need to implement the prerequisites – including software com-

ponents. Such broad access with the same features allows competitors to offer their services and innovate on an equal footing with the platform [European Commission 2025a].

3.2. Maintaining interoperability over time

The fact that interoperability should not be considered a one-off target implies how the platform should perform maintenance over time and how regulators should carry out oversight. Interoperability solutions involving FOSS benefit from permissive access to software components, APIs, protocols and documentation [Lasota 2023]. This synergy can be supported by proper governance which would monitor, enforce and improve interoperability solutions [Meyers 2026].

Interoperability governance establishes processes for making decisions about the right technical and commercial mechanisms for the implementation, support and maintenance of interoperability frameworks [European Commission 2017]. Implementation issues include: (a) costs of developing, implementing and supporting interoperability; (b) balancing security, safety, privacy and other principles that interoperability can affect; (c) balancing discretion over stability of the interoperable solution, innovation and new developments in the market; and (d) development and adoption of common standards in the market [Meyers 2026].

In the short run, interoperability can depend on the structures maintained by the platforms themselves. Competitors may bear the costs of making their services compatible with the APIs/technical solutions in order to make their products interoperable with the assets of the dominating platform [Scott Morton et al. 2023]. However, in the long run, moving towards mutually agreed industry-wide standards and protocols is the logical way forward [Meyers 2026].

Setting standards opens up a whole new dimension with its own characteristics and challenges. For instance, some standards can follow an institutionalized path, being specified by "standard bodies", e.g. ISO or INMETRO. Others arise through extensive or widespread use of a particular technology, regardless of whether it was developed collaboratively or by one company [DeNardis 2011]. In both cases, platforms may implement proprietary standards and restrictive frameworks that are incompatible with FOSS [Phipps 2019]. Even implementations of a given standard may not be fully interoperable with FOSS [Butler et al. 2020]. In this sense, "open standards" offer a way to conciliate standardization process and FOSS [Lasota et al. 2025].

4. Interoperability regulation in the international debate

While large digital platforms have created unprecedented levels of global communications, commerce and democratization of information, the unregulated aspects of digital markets not only have distorted competition but also have posed critical risks to human rights with serious consequences for democracies [Wu 2018]. Departing from a passive role based on a laissez-faire approach to a more active regulatory position, regulators around the world are setting stricter behaviour rules on economic and commercial activities in digital markets [Flew and Fiona 2022]. This section provides a bird's-eye view on how interoperability has been included as part of regulatory packages in the countries that innovated in the last decade by passing legislation for improving competition in digital markets.

4.1. EU: broad interoperability obligations

By mandating broad and coercive interoperability obligations, the EU Digital Markets Act (DMA) [European Union 2022] aims at enhancing fairness and contestability of digital markets [Bourreau 2022]. The DMA does not apply to all platforms. The law sets up very high quantitative and qualitative thresholds for the platforms to which it will apply (called "gatekeepers"). For instance, the company should have at least 45 million monthly customers in the EU. Besides, the DMA applies only to systems where the company exercises gatekeeping power (called in the law "core platform services"). These include operating systems, browsers, app stores, messaging apps, social networks, AI systems and others. At the time of this study, the law applies only to Alphabet (Google), Amazon, Apple, Booking, ByteDance (TikTok), Meta and Microsoft [European Commission 2025b]. The interoperability mandate in the DMA is broad. The law requires interconnection between competing messaging services (Article 7), unfettered installation of software (sideloading) and access to functionalities of operating systems or hardware capabilities of devices (Article 6.4 and Article 6.7). In all these cases, access should be provided "effectively" and "free-of-charge". The DMA permits gatekeepers to introduce measures limiting interoperability to protect the "integrity" of their designated systems.

4.2. Japan: interoperability for mobile ecosystems

Japan stepped up its regulatory framework in 2024 by enacting a law targeting mobile ecosystems, including operating systems, browsers, app stores, and search engines [Japan 2024]. Similarly to the application of the DMA, the Japanese law only applies to "designated providers". The platforms falling under the scope of the law cannot prevent other business operators from using the features in equivalent performance that are controlled by the provider's operating systems (Article 7). Although written differently and not explicitly mentioning the term "interoperability", this disposition in the Japanese law has similar effects to the vertical interoperability obligations of the DMA. However, differently from the DMA, the Japanese law does not require free-of-charge interoperability. In relation to limitations, the law allows the providers to mitigate cybersecurity risks when granting interoperability [Japan Fair Trade Commission 2025].

4.3. UK: lacking binding interoperability rules

In 2024, the United Kingdom passed the "Digital Markets, Competition and Consumers Act (DMCCA)" [United Kingdom 2024] to promote fair competition and prevent unfair practices in digital markets. Similarly to the EU's DMA, the law targets large platforms with "significant market status" based on their market power and strategic significance. However, while the DMA adopts a more prescriptive regulatory framework towards interoperability, the DMCC focuses on addressing specific caused harms by the lack of interoperability. For instance, in 2026, the UK Competition and Markets Authority opened consultation on potential interventions to enable developers to request interoperable access to functionality from Apple [Competition and Markets Authority 2026]. The regulator is concerned with the lack of transparency and specific criteria for assessing interoperability requests. The company is proposing a set of commitments as a self-regulatory measure to improve the internal process for providing competitors with interoperability. The measures include feedback channels for developers, transparent criteria for decision making and review mechanisms.

4.4. Brazil: interoperability as a market regulation tool

The proposed "Fair Competition Act for Digital Markets" (Bill 4675-2025) aims at updating the legal framework to deal with dominating platforms [Brazil 2025]. Similar to the DMA, the law applies only to companies with "systemic relevance". However, instead of listing all the obligations with which the dominating platforms should comply, the Brazilian law allows more flexibility to the regulator to address platform-business contractual imbalances by determining where to intervene [Fernandes 2025]. Interoperability is considered in Brazil a critical regulatory instrument to promote competition in the market [Ferreira et al. 2024]. The bill includes obligations forcing the platforms to provide free and effective interoperability through appropriate technological interfaces between their infrastructure and third-party services and products (currently Article 47-E).

The Brazilian proposal is consistent with the highest European standards for interoperability. The free of charge provision surpasses the Japanese and the UK approaches, creating a greater potential to achieve effective interoperability. Mandating coercive obligations in the text of the law increases the chances of its enforcement. In comparison, the UK's lax approach has received harsh criticism from stakeholders who fear that the dominating platforms will be able to degrade interoperability without legal consequences [OWA 2026].

High standards in the law require substantial oversight and enforcement efforts. In the EU, due to the possibility of non-compliance with the interoperability obligations, the European Commission conducted two additional regulatory processes against Apple [Martínez 2025]. In Brazil, a complaint made by the local e-commerce platform Mercado Livre against Apple in 2022 resulted in the Brazilian regulator CADE imposing measures in 2025 on Apple to increase freedom of choice for iOS developers and users regarding app distribution channels and in-app payment [Conselho Administrativo de Defesa Econômica 2026]. If passed, the bill 4675-2025 will enhance the Brazilian authority's competence to investigate and regulate the behavior of dominant platforms, leveraging the potential to make digital markets more competitive in the country.

5. Conclusion and future research

The ubiquity of FOSS in the digital economy was not able to prevent the monopolistic dynamics of digital markets. Small FOSS companies, start-ups and non-profit communities, although developing competing solutions to the bigger players, remain in a disadvantageous position due to the anti-competitive practices of dominant platforms. Interoperability regulation has the potential to change this scenario, but the challenges are considerable. Regulatory oversight and enforcement should not be considered a one-off target; they will demand substantial efforts from regulators.

The recent developments involving interoperability regulation are happening on a global scale. Diverse countries are stepping up their efforts to introduce more competition in digital markets. The limited overview of this study cannot cover all these occurrences and further research is necessary. In particular, investigation will be needed to determine how advantageous interoperability governance models will become to FOSS, increasing its competitiveness to face the products and services of dominating platforms.

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