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REPORT

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INTEROPERABILITY IN DIGITAL MARKETS

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EXECUTIVE SUMMARY

Executive Summary

To ensure contestability and fairness in digital markets, policy makers worldwide discuss whether interoperability obligations are an appropriate regulatory tool to achieve these goals. Thereby, interoperability is often not narrowly defined, and can range from forms of data portability to complete standardisation of interfaces so that consumers can interact across the boundaries of a given service. In this report, we adopt a wide view on interoperability obligations in the context of digital markets that is not confined to the narrow contexts of previous or ongoing competition law cases or the specific interoperability provisions discussed in the Digital Markets Act (DMA). This allows us to derive a more general framework on the scope and effect of interoperability as a regulatory instrument for digital markets that can feed back into the ongoing policy considerations.

We first define different notions of interoperability precisely and highlight that from an economic perspective the differentiation into horizontal and vertical interoperability is crucial. Horizontal interoperability refers to the ability of products and services at the *same level* of the digital value chain to "work together". An example is the ability to send a text message from one messenger service to another. The key feature of horizontal interoperability is that it allows sharing *direct network effects*. By contrast, vertical interoperability allows services that are at *different levels* of the digital value chain to work together. An example is a possibility to run different app stores on the same operating system or to allow alternative identification service providers when accessing a digital service or website. The key feature of vertical interoperability is that it allows to mix-and-match system components. Horizontal and vertical interoperability are thus structurally very different, and their economic assessment is very different. They should thus not be confused in the policy debate.

Our first central insight is that mandated horizontal interoperability is likely a harmful remedy in digital markets, as it tends to enshrine existing incumbency, limits the firms' innovation and differentiation capabilities, and requires enduring regulation. The main reason for this assessment is that in the dynamic context of digital markets, services compete and differentiate themselves by innovating concerning new features, which runs counter to attempts to standardize services. Interoperability, by contrast, requires standardisation and a relatively steady environment. Thus, only a low level of interoperability can be achieved for digital services. This is dangerous because consumers will still gravitate to the larger network to take advantage of the full richness of features. At the same time, horizontal interoperability lowers the incentives of consumers to multi-home services, which is a powerful driver for contestability. We therefore strongly advise against mandating horizontal interoperability in digital markets, where innovation is occurring frequently and multi-homing of services is typically easy to achieve with low transaction costs. In reverse, this means that policy makers should scrutinize and enforce against attempts of digital incumbents to limit consumers' ability to multi-home.

Our second central insight is that vertical interoperability is indeed a powerful instrument for regulating digital bottlenecks, but should be considered only when a digital gatekeeper is vertically integrated, and if there is evidence that vertical integration leads to discrimination or foreclosure of complementors that would not have occurred in the absence of vertical integration. Mandated vertical interoperability should require gatekeepers to provide 'equivalence of input' to non-integrated complementors. That is, whichever interfaces the integrated platform offers to its downstream service should also be offered to third-party complementors on a non-discriminatory basis. Concerns of the hosting platform about security and integrity can in principle be addressed through a licensing regime with oversight by a trusted third party. Concerns for innovation incentives of the hosting platform can in principle be addressed through an appropriate access pricing regime. However, the implementation of vertical interoperability obligations requires the regulator to make difficult and complex trade-offs, and implementation will likely take considerable time and requires careful deliberation.

Vertical interoperability offers innovative complementors an entry point to an ecosystem stack that they are not able to replicate. For efficient and innovative complementors, this can be a stepping stone, which enables niche entry and growth by new firms. The ultimate measuring rod for the success of a vertical interoperability regulation is whether such new complementors could establish themselves as vital competitors in the digital market, innovate and have ventured into other parts of the digital value chain (ecosystem stack), eventually not requiring vertical access to the regulated bottleneck anymore. In this sense, a successful vertical interoperability regulation is transient.

The Commission's proposal for the DMA foresees only vertical interoperability obligations for gatekeepers, albeit only for ancillary services, app stores and side-loading of apps. However, the EP's amendments also include horizontal interoperability obligations for messenger services and social networks. In light of our findings, we suggest not to include horizontal interoperability obligations in the DMA. Moreover, to make the DMA more future proof, we suggest that the application scope for vertical interoperability obligations should be widened also beyond 'ancillary services' and the specific case of vertical interoperability for apps and app stores. However, vertical interoperability cannot apply immediately to gatekeepers, and must be specified with respect to technical and economic access conditions on a case-by-case basis, because it involves complex trade-offs. From experience with access regulation, the implementation of vertical interoperability, i.e., the necessary case-by-case deliberations on trade-offs (e.g., with respect to access pricing), will likely take years and not months in the complex settings of digital markets. Hence, while the DMA may provide the legal basis for such interventions in digital markets, the implementation of vertical integration provisions is likely to take much longer than the six months that the DMA currently foresees for its Article 6 provisions.

01

INTRODUCTION

1 Introduction

Digital markets have achieved high levels of concentration due to significant economies of scale and network effects, leading to the emergence of large digital firms, the "big tech." This has raised growing concerns about the lack of competition in digital markets and their limited contestability and the possible adverse effects that it may have in terms of prices, innovation, privacy, consumer protection, or data governance. In this context, the European Union (EU) has proposed introducing new *ex-ante* regulatory rules via the Digital Markets Act (DMA).

One possible instrument discussed today to strengthen competition and restore contestability in digital markets would be to mandate the interoperability of platforms.

Already over a decade ago, the EC identified the lack of interoperability as one of the most significant obstacles to digitalization, planning to examine measures to encourage significant market players to pursue interoperability-friendly business policies. The Digital Agenda called for standard-setting by the industry, supported by public policy, to promote greater interoperability. Since then, scholars have called for mandated interoperability to strengthen competition in digital markets (see, e.g., Stella 2021, Graves 2021, Riley 2020a, Riley & Vasile 2021, Borgogno & Colangelo 2019).

In this CERRE report, we study whether and under which conditions interoperability is a desirable policy option in the context of dominant digital platforms, taking into account its potential impact on competition and innovation.

We define *interoperability* as the ability of different products or services to 'work together,' meaning that some common functionalities can be used indifferently across them, typically via appropriate information exchange. We then further distinguish between *horizontal interoperability* and *vertical interoperability*. *Horizontal interoperability* occurs when similar products or services operating at the same level of the value chain can work together. *Vertical interoperability* occurs when products or services offered at different levels of the value chain can work together. We focus more specifically on what we call *within-platform vertical interoperability*, which allows third-party developers to supply complements for a given product, service, or platform.

We first discuss the pros and cons of *horizontal interoperability*. Horizontal interoperability allows competition in the market to emerge and be sustainable by transforming firm-specific proprietary network effects into market-level network effects. However, we highlight that horizontal interoperability raises significant implementation challenges. It requires defining and standardizing a set of standard interoperable features, which could prove highly complex and lengthy. Besides, horizontal interoperability may end up being ineffective. If it applies to a subset of mature features, competition will likely quickly shift towards new innovative features. In this case, dominant players may remain focal because consumers would value the possibility to interact with others with the complete set of functionalities. Horizontal interoperability may even be harmful from a dynamic efficiency perspective, as it reduces multi-homing, an essential driver of contestability. Therefore, we recommend that horizontal interoperability be considered only in cases where the pace of service innovation is slow, or multi-homing is limited.

Vertical interoperability allows innovative complementors to enter the market at a given point of the ecosystem stack that they would not be able to replicate. Furthermore, vertical interoperability can represent a stepping stone for an innovative entrant, allowing it to develop and expand in other layers of the value chain. Therefore, we consider that vertical interoperability is a powerful instrument to regulate digital bottlenecks. However, it should only be considered when a gatekeeper is vertically integrated, and there is evidence that vertical integration leads to discrimination or foreclosure of complementors that would not have occurred in the absence of it. We then discuss the implementation of vertical interoperability. We argue that it should be based on the 'equivalence of input' principle, whereby the entrant can have access to the same functionalities, on the same terms, as the vertically integrated gatekeeper. To protect the resilience of the infrastructure, a licensing regime can be implemented to screen potential access seekers with oversight by a trusted third party. An appropriate access pricing regime would ensure that innovation incentives are maintained.

The rest of the report is organised as follows. In Section 2, we propose our definition and categorisations of interoperability, distinguishing between horizontal and vertical interoperability. Section 3 discusses horizontal interoperability and Section 4 vertical interoperability. Section 5 describes the EU legal framework for interoperability. We conclude and present our policy recommendations in Section 6.

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DEFINITION AND CATEGORISATIONS OF INTEROPERABILITY

2 Definition and Categorisations of Interoperability

Broadly speaking, different products or services are *interoperable* if they can 'work together,' meaning that some common functionalities can be used indifferently across them, typically via appropriate information exchange.[1] Interoperable products and services can belong to the same firm or different (possibly competing) firms and operate at the same level of the value chain or different levels. Interoperability may require some degree of standardisation of common functionalities or standardized interfaces between interoperable products and services.

One way to categorize interoperability is to evaluate how well interoperable products and services can 'work together,' that is, to consider their level of technical integration. Another possible categorisation is to distinguish between interoperability at the same level of the value chain (horizontal interoperability) and different levels (vertical interoperability). We describe below these possible categorisations of interoperability. Finally, we discuss other important factors characterising interoperability: its different degrees; whether it is symmetric or asymmetric; and the relation between standardisation and interoperability.

2.1 Interoperability as a level of technical integration

Crémer et al. (2019) propose a categorisation of interoperability according to the level of technical integration and standardisation between the interoperable products or services. More specifically, they consider three levels of interoperability: protocol interoperability, data interoperability, and full protocol interoperability.

With *protocol interoperability*, products or services can interconnect and work together. For instance, protocol interoperability allows third parties to offer complementary services on a given platform (e.g., an operating system) or different systems to interoperate (e.g., Internet of Things devices). The development of standards may be necessary to achieve protocol interoperability.

Data interoperability allows data exchanges between different services in real-time. It can be viewed as an improved, automated, real-time version of data portability. Data interoperability relies on open APIs (Application Programming Interfaces), which allow a given service to access a user's data from another service. For example, data interoperability would enable the development of add-ons for platforms such as Gmail or Slack or data exchange between Internet of Things devices. Service providers may directly share user data, but (real-time) data exchange could also be intermediated by a third party. Crémer et al. (2019) argue that data interoperability provides more opportunities for complementors to interconnect with an existing platform than protocol interoperability. Data interoperability may also enable a new entrant to offer services substituting some of an incumbent platform's functionalities. However, data interoperability may raise security and/or privacy concerns if users lose control of how their data is shared and used.

Finally, *full protocol interoperability* refers to technical standards allowing substitute services to interoperate. For instance, with full protocol interoperability of messaging systems, users could exchange messages with any user of any system. Full protocol interoperability enables a firm to offer products and services that can access a competitor's user base. Therefore, with this form of interoperability, rival firms share network effects, leveling the playing field. Crémer et al. (2019)

[1] Different authors, reports, or laws offer a similar definition as ours. For instance, Kerber and Schweitzer (2017) define interoperability as "the ability of a system, product or service to communicate and function with other (technically different) systems, products or services;" Riley (2020b) as "the ability of internet-connected technologies to work together, for example by exchanging data and accessing functions remotely;" and OECD (2021) as "the ability of different digital services to work together and communicate with one another." In existing laws, the European Directive on the legal protection of computer programs (Directive 2009/24/EC) defines interoperability between computer systems as "the ability to exchange information and mutually to use the information which has been exchanged."

argue that full protocol interoperability requires deeper technical integration and standardisation than the two other forms of interoperability.

In a similar vein, Brown and Korff (2020) define interoperability as "a technical mechanism for computing systems to work together." Thus, they view interoperability as a technical requirement allowing, for instance, users to use common functions across interoperable platforms, such as sending messages or connecting as "friends" or "followers."

2.2 Horizontal vs. vertical interoperability

In this report, we distinguish between *horizontal interoperability*, when the interoperable products or services operate at the same level of the value chain, and *vertical interoperability*, when they operate at different levels.[2]

Figure 1 shows examples of horizontal and vertical interoperability based on what we call an 'ecosystem stack.' The figure represents the ecosystem stack for mobile devices; however, similar ecosystem stacks exist in other contexts. We use the term *ecosystem stack* in analogy to the 'protocol stack' used in computer science to denote the logical stacking of various protocol layers (e.g. transport layer, routing layer, access layer), each of which provides a dedicated functionality to the layer directly underneath it. This allows for a modular design, where different layers can be mixed and matched. Almost all technical systems use such a layering approach implicitly or explicitly, as it allows for a robust yet flexible design. Innovation can occur at each layer (module) independently without disrupting the functioning of the system as a whole. In software systems, each layer provides its functionality through one or several Application Programming Interfaces (APIs). Where to draw the lines between different layers and which functionalities/APIs to provide to upper layers is usually a design choice and not inevitable. In the following, we denote the firm controlling such an ecosystem stack, or a specific layer therein, as a *platform*.

We talk of *horizontal interoperability* when similar products or services operating at the *same* level of the value chain can work together. For instance, horizontal interoperability would allow users of different messaging applications to communicate with each other (in the same way users of different communication networks can communicate with each user thanks to network interconnection) or users of a social network to post messages on other social networks.[3] Typically, horizontally interoperable products or services are substitutes, and hence, competitors. At the limit, the definition extends to products or services that are independent. Note that horizontal interoperability is not restricted to the upper (application) layers but can also occur at lower layers (e.g., to allow interoperability of a COVID tracing application at the operating system level, as shown in the figure).

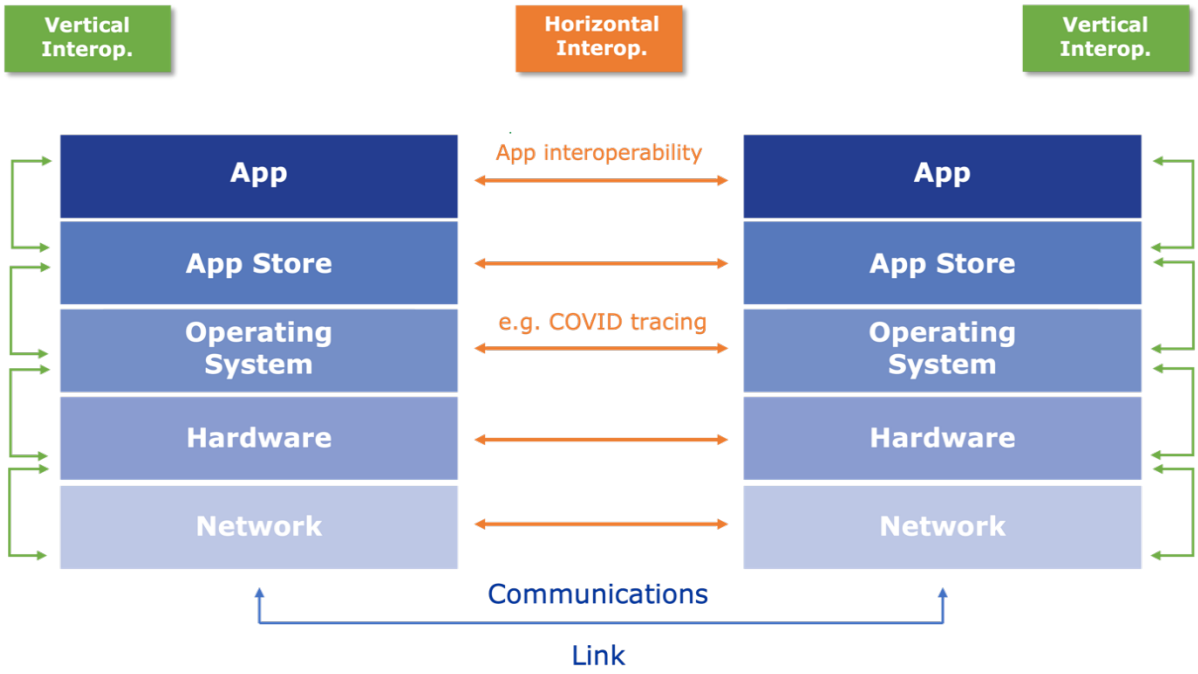
With horizontal interoperability, competing platforms share *direct* network effects. For instance, users of Gmail can send and receive emails from users of Outlook.com, and vice versa, increasing the size of the network of webmail users and leveling the playing field between the two services. Thus, Scott-Morton et al. (2021) argue that this form of interoperability[4] eliminates proprietary direct network effects, which would favor large players, and reduce barriers to entry.

[2] The distinction between horizontal and vertical interoperability has also been proposed in previous academic literature and policy reports. See, inter alia, Farrell and Simcoe (2012), Kerber and Schweitzer (2017), Brown (2018), Riley (2020b), and German Monopoly Commission (2021).

[3] Our definition of horizontal interoperability therefore corresponds to the definitions proposed, for instance, by Kleber and Schweitzer (2017), Riley (2020b), and OECD (2021).

[4] They refer to it as "between-platform interoperability".

Figure 1: 'Ecosystem stack' with instances of horizontal interoperability and vertical interoperability, exemplified in the context of a mobile ecosystem.



Different from horizontal interoperability, *vertical interoperability* occurs when products or services offered at different levels of the value chain can work together. Vertical interoperability comes in two flavors.

Within-platform vertical interoperability allows third-party developers to supply complements for a given product, service, or platform.[5] For instance, with vertical interoperability, third-party developers can integrate their products (e.g., apps, games, services, etc.) within a social media platform. Farrell and Simcoe (2012) refer to this form of interoperability as "vertical compatibility."[6] They say that the platform is "vertically open" if third parties can supply complements without the platform's permission and that it is "vertically closed" otherwise. Vertical openness is typically achieved via the provision of open (public) APIs. In this report, we will rather consider an intermediate level of vertical openness, where APIs are made available to third-party complementors, but access to those APIs is restricted and requires the permission of the platform.

Within-platform vertical interoperability ensures that the provision of complements by third parties is not degraded by the platform (Scott-Morton et al., 2021). Indeed, a platform may have the ability and incentive to degrade access for complementors, for instance, to self-preference its vertically integrated products or services (CMA, 2020). Vertical interoperability ensures that this does not happen. Therefore, in the words of OECD (2021), this form of vertical interoperability promotes competition *within* digital platforms or ecosystems.

Cross-platform vertical interoperability is a more powerful form of vertical interoperability. It requires within-platform vertically interoperability but, on top of that, third-party developers can offer their

[5] This form of vertical interoperability corresponds to the definition proposed by Kleber and Schweitzer (2017) ("the interoperability of a product, service or platform with complementary products and services"), and OECD (2021) ("the ability of digital services to incorporate data, content or functionality from an upstream provider"). See also Riley (2020b).
[6] More precisely, Farrell and Simcoe (2012, p.37) define vertical interoperability as the "*ability of those other than the platform sponsor to supply complements for the system.*"

complementary products or services to the different platforms operating in the market.[7] Therefore, it requires, in particular, that the interfaces between the platforms and the third-party suppliers (e.g., APIs) are standardized to some extent.

With cross-platform vertical interoperability, competing platforms share *indirect* network effects. Suppliers of complements can multi-home on various competing platforms. Thus, this form of vertical interoperability promotes competition *between* digital platforms or ecosystems.

In this report, we focus on *within-platform* vertical interoperability (without using the notion of vertical compatibility, i.e. openness) and, to simplify the exposition, we refer to it as vertical interoperability.

Note that *cross-platform* vertical interoperability corresponds to a mix of *within-platform* vertical interoperability and *horizontal* interoperability due to the necessary standardisation of vertical interfaces. Therefore, the objections that lead us to reject horizontal interoperability (except in specific circumstances) would also apply to *cross-platform* vertical interoperability, as well as the benefits we see from *within-platform* vertical interoperability. A more thorough assessment of *cross-platform* vertical interoperability would be an area for further investigation.

2.3 Other characteristics of interoperability

2.3.1 Different degrees of interoperability

Interoperability may come in different degrees, and we can think of a continuum between no- and full-interoperability (Kerber and Schweitzer, 2017). For instance, Scott-Morton et al. (2021) explain that an interoperability requirement for a social media like Facebook would apply to a set of "standard" functionalities (e.g., exchange of text, images, video, or calendar), leaving aside other, "non-standard" functionalities. The degree of interoperability can then be defined as the relative amount of interoperable ("standard") functionalities.

Various reasons may make it efficient to opt for partial rather than full interoperability. First, achieving interoperability may come at a cost for the different players (Kerber and Schweitzer, 2017), pushing for an intermediate level of interoperability, for instance, if some functionalities would be extremely difficult and costly to interoperate. Second, a higher degree of interoperability may reduce the possibilities of differentiation between market players. An imperfect level of interoperability would allow them to differentiate with respect to the "non-standard", non-interoperable functionalities (Scott-Morton et al., 2021), increasing variety to the benefit of users. It would also stimulate innovation for new, "non-standard" functionalities.

2.3.2 Symmetric vs. asymmetric interoperability

Interoperability can be symmetric or asymmetric.

For instance, the study by the CMA (2020) on online platforms and digital advertising explains that cross-posting on social networks is asymmetric. Facebook allows users of rival social media to post content on Facebook. However, the ability of Facebook users to post content from Facebook to other social media is limited:

"We further note that social media platforms may not offer APIs on a reciprocal basis. For example, when Facebook featured the 'Publish Actions' API, which allowed consumers to post content onto the Facebook platform from other social media platforms, consumers were unable to post content from the Facebook platform onto other social media platforms. This asymmetry in consumers' cross-posting abilities may have favoured Facebook by leading to greater and more varied content being

[7] Farrell and Simcoe (2012) refer to this form of interoperability as "horizontal compatibility," that is, the ability to share complements across multiple platforms.

shared on Facebook compared to the social media platforms from which content is shared." (CMA, 2010; p. 142)

This example illustrates that horizontal interoperability can be symmetric or asymmetric. By contrast, vertical interoperability is only asymmetric, by construction. Indeed, vertical interoperability means that a platform gives (one-way) access for third-party suppliers of complements against a remuneration (in monetary terms or through access to data), but not the other way round.

Horizontal interoperability may end up being asymmetric because a player degrades the quality (degree) of interoperability in one way (the Facebook example above). Asymmetric interoperability may also arise as a consequence of "adversarial" interoperability, that is, when a third party offers a product or service interoperable with a rival's product or service, but without the latter's consent.[8] Adversarial interoperability can be avoided, for instance, with the help of intellectual property rights or by changing technology frequently.

2.3.3 Standardisation and interoperability

Horizontal and vertical interoperability require the standardisation of common functionalities and standardised interfaces.

Standardisation may occur *ex-ante*, before any decisions regarding interoperability are made. In this case, the technical possibility of achieving interoperability exists from the start, and the cost of doing so is, therefore, *a priori* low. However, even in this case, firms may still refuse to allow for interoperability. For instance, even though telecommunications networks are based on standards, with the technical ability to interconnect, the AT&T 1982 antitrust starts from the fact that AT&T refused to offer access to competitors. This example illustrates that there may be many legal and commercial tactics that firms may adopt to inhibit or prevent interoperability, even when it is technically feasible.

The necessary standardisation to achieve interoperability may also occur *ex-post*. In this case, the cost of achieving interoperability is even higher since firms have to elaborate standards and agree on them. In markets with dominant players, small and large firms may have conflicting incentives, as shall discuss below, which may make the possibility to reach an agreement difficult.

[8] See Doctorow (2019).

03

HORIZONTAL INTEROPERABILITY

3 Horizontal Interoperability

3.1 Competition in the market

Horizontal interoperability has pro-competitive effects. It makes market players share their "proprietary" network effects, and hence, allows competition in the market to emerge. However, horizontal interoperability may also have downsides or limits.

3.1.1 Pro-competitive effects of horizontal interoperability

With horizontal interoperability, a firm's users can interact with the user base of any other firm providing interoperable products or services. For instance, a user of a given messaging app could send messages to users of any other app. Therefore, competition in the market can emerge between suppliers of interoperable products and services, despite network effects.

As Scott Morton et al. (2021) put it, interoperability redefines the "property rights" on the network effects. Without interoperability, network effects are firm-specific and proprietary. Therefore, firms have strong incentives to expand their proprietary network to offer larger network benefits than their rivals. The market may eventually tip in favour of one firm; competition in the market cannot be sustainable in this case. By contrast, with horizontal interoperability, network effects are aggregated into market-wide network effects; they become a public good. Consequently, instead of competing on network benefits, firms compete on other dimensions that matter for users, like quality or privacy, for instance. Since network effects are neutralised, the market cannot tip, and competition in the market is sustainable.

Interconnection of telecommunications networks represents a classic example of the pro-competitive effects of horizontal interoperability. For instance, a user of a given mobile operator can call any other mobile user, irrespective of her host network, as all networks are perfectly interconnected. Thus, the relative sizes of the networks play no role in the consumer decision to join one operator or another, and mobile operators compete on different dimensions, such as prices or the quality of service.[9]

Horizontal interoperability also reduces entry barriers. A new entrant does not need to reach a critical mass of users for the demand for its product or service to take off. From the start, it can offer access to a vast network of users through interoperability and compete on a level playing field with incumbent players.

Finally, interoperability facilitates the switching of users since they can access the same market-wide network by using any service or application. In other words, there are limited "collective switching costs" that would impede consumers to switch. In a context where different new networks compete to attract consumers and there is uncertainty about their relative advantages, interoperability thus reduces the risk of "excess inertia," when users prefer to wait and see which network will win before deciding which one to join, retarding adoption inefficiently (Farrell and Klemperer, 2007). However, if a legacy network already exists, consumers may have a low incentive to switch to a new network as it is interoperable with their current one.

Summing up, horizontal interoperability may increase overall efficiency. If this is the case and firms do not compete (e.g., if they offer independent products), they should internalise these efficiency benefits and decide to make their products and services interoperable voluntarily (Farrell and Klemperer, 2007).

[9] Interestingly enough, dominant telecommunications operators can try to restore the role of proprietary network effects in the competition by setting different prices on-net and off-net, which Laffont, Rey and Tirole (1998) refer to as "tariff-mediated network externalities." If on-net prices are lower than off-net prices, consumers have an incentive to join the same network as their friends and family.

However, firms may be competitors, which is the type of situation we are interested in. In this case, interoperability may affect competition, and hence, the firms' incentives to make their products or services interoperable.

The reference study in the academic literature on the impact of interoperability on competition is due to Cremer et al. (2000). More specifically, the authors compare the incentives of a large network and a smaller network to accept horizontal interoperability. They show that interoperability has two effects on firms' profits. First, it increases consumer demand, which benefits both firms. Indeed, when interoperability is in place, users can interact with users of their patronized network, but also with the users of the rival network (possibly with a degraded quality of service if the degree of interoperability is less than full). Therefore, their utility increases due to larger network benefits, stimulating adoption for both networks, and firms can set higher prices. Second, interoperability reduces the quality advantage of the large firm in terms of network benefits. Indeed, by joining the small network, consumers have access to (almost) the same network of users as if they join the large network. Therefore, interoperability benefits the small network, which becomes more competitive, but hurts the large network. Cremer et al. (2000) conclude that the large network has less incentive to accept interoperability than the small network.

Therefore, even if it would be efficient, large networks may resist horizontal interoperability, while small networks would push for it. Interoperability may thus not emerge endogenously, and making it mandatory may be the only wait to implement it.

3.1.2 Downsides and limits of horizontal interoperability

Horizontal interoperability may have various downsides and/or limits, which have to be balanced with the potential pro-competitive effects.

Costs of implementing interoperability

Achieving horizontal interoperability may entail various organisational and technical costs to standardize the interoperable functionalities and develop standardized interfaces between interoperable products and services. We believe that these costs are important; we will come back to this question below when we talk about implementation challenges. The standardisation of interfaces may also constrain the design of these products and services, in particular if changes of design require an upgrade of the interfaces.

Besides, as discussed above, horizontal interoperability may reduce the differentiation between networks or platforms in terms of network benefits (Cremer et al., 2000). Interoperability may also leave little room for differentiation if the set of non-interoperable (or "non-common") features is small. Therefore, there may be a risk of loss of variety for the consumers, a concern that has been raised in recent policy reports (CMA, 2020; German Monopoly Commission, 2021; German Federal Network Agency, 2021).

Previously dominant platforms may remain focal

For very simple services, horizontal interoperability could be full, levelling the playing field between small and large players.

However, for more complex services, horizontal interoperability is likely to be imperfect, due to the high complexity or costs of making all functionalities interoperable. In this case, such an obligation would typically involve a definition of a subset of interoperable functionalities. For instance, in its report, the CMA (2020) argues that interoperable functionalities must be: (i) directly helpful in overcoming network effects; (ii) not highly innovative (to leave room for differentiation and innovation); and (iii) not harmful in terms of consumer privacy. Thus, functionalities that would not meet these criteria should not be made interoperable. In a similar vein, Scott Morton et al. (2021) state that, to implement horizontal interoperability, one would need to define the "standard" functionalities that are the most valuable for users and would be interoperable, leaving aside other non-standard, differentiated features.

If the degree of interoperability is indeed imperfect, competition is still shaped by the level of proprietary network effects specific to each firm. With a larger customer base, a dominant firm would thus keep a competitive advantage due to its larger network. In this case, consumers may be inclined to opt for the "focal" dominant platform, where most other users are, to communicate with the full set of functionalities, using interoperability to communicate with users of small networks.

In line with this idea, a representative survey by the Federation of German Consumer Organizations (2021) has found that, in the presence of interoperability, only 16% of the respondents would switch their messenger from the dominant network (WhatsApp) to another network. To evaluate the impact of interoperability on the propensity to switch, one would need to compare this number (16%) to the percentage of people who would switch absent interoperability. Therefore, this share of switchers overestimates the effect of interoperability on switching.

Competition on new features may make interoperability inoperative

With an imperfect degree of horizontal interoperability, some functionalities are common and interoperable across platforms, while others are specific to each platform.

Scott Morton et al. (2021) argue that the "common" (interoperable) features must be the most valuable for users, and thus the "non-common" features should be the less valuable ones. In this case, interoperability would leave little room left for differentiation for market players and raise risks of homogenisation of services as discussed above.

However, in practice, "common" functionalities are likely to be features that have reached a sufficient level of maturity to be standardised. If consumers value new features, these common features may appear less appealing. In this case, competition will shift towards "non-common" features and market players will thrive to differentiate from their rivals by developing new ("non-common") functionalities. Innovation for new features could happen at a fast pace, making them essential in consumer choice of one platform or another. In other words, intense competition for new functionalities could make interoperability rapidly inoperative (though it would have encouraged innovation and new features to the benefit of the consumers).

One possible policy response would be to incorporate progressively new, innovative features into the set of common, interoperable functionalities. However, such a policy would be costly to implement and could harm innovation incentives by limiting the appropriability of new innovative features. Besides, with limited information, policymakers would face a critical timing issue, with the risk to make new features interoperable either too early or too late.

Interoperability as a substitute for multi-homing in achieving competition in the market

Multi-homing occurs when users use more than one platform for the same or a similar service. Multi-homing is another element that can mitigate tipping in digital markets, and thus, favour competition in the market.

By multi-homing, users benefit from having access to larger networks and differentiated product or service features. However, they may also incur various monetary and non-monetary costs (e.g., privacy costs). The extent of multi-homing at the market level thus depends on the relative magnitude of these benefits and costs for users.

For hardware products (e.g., smartphones), multi-homing is likely to be very costly for users, thus remaining marginal. On the other hand, for software products (e.g., apps), costs may be relatively low, yielding high levels of multi-homing. For instance, a representative survey of the German Federal Network Agency (2020) shows that 73% of users of messenger services multi-home messenger services.

Note that dominant firms may also have an incentive to limit multi-homing and the ability to do so via loyalty programs or contractual terms (e.g., parity clauses).

Interoperability may reduce multi-homing. Indeed, interoperability allows users to access all networks, as multi-homing, but at lower costs.[10] The only benefit of multi-homing relative to interoperability (if imperfect) is that users can access each network with the complete set of functionalities.

Existing empirical evidence shows that interoperability and multi-homing are seen as substitutes by users. The report by the German Federal Network Agency (2020) cited above found that consumers do not have a clear preference for interoperability over multi-homing. About half of them would appreciate interoperability, but the other half would not. A report by WIK (2018) also showed in a survey on messenger services that consumers prefer multi-homing because it allows them to communicate with distinct social groups using distinct services – possibly also using different features that these services offer, catering to the needs of the respective social groups.[11]

Therefore, from a policy perspective, interoperability and multi-homing may represent substitute means to achieve the same goal: sustainable competition in the market. Reducing the extent of multi-homing may have an ambiguous effect on the likelihood that this goal is attained.

Implementation challenges of horizontal interoperability and their consequences

Last, but not least, another limit to horizontal interoperability concerns the implementation challenges and their consequences.

As already discussed, for digital services, horizontal interoperability is likely to be imperfect. Therefore, one must decide which functionalities to include in the set of common, interoperable functionalities, and which ones to leave aside. Various reports (e.g., CMA, 2020; Scott-Morton et al., 2021) have provided guidelines on the economic criteria to consider for including a functionality into the set of interoperable features. But we think there are also important technical and organizational challenges attached to this process.

Interoperable functionalities must be standardised, and relevant interfaces (e.g., APIs) defined and standardised. In practice, standardisation is often a long and complex process. Coordination between stakeholders is necessary, and many technical problems must be solved. However, stakeholders may have conflicting incentives, in particular large and small players, as we stressed above. Finally, the more features are to be standardized, the more complex and lengthier the process is likely to be.

Yet, as this process of standardisation of interoperable features is underway, innovation for new features or new products or services develops at a fast pace. Therefore, when the standardised and interoperable functionalities are introduced, they may be already outdated.

In some cases, as we discussed above, standardisation may pre-exist interoperability. In this case, the technical costs of implementing interoperability are lower (e.g., if it simply means opening up existing interfaces). However, as we have argued, dominant players may have the incentive to resist interoperability with their smaller competitors, and therefore, to find legal or technical ways to retard its successful implementation.

Besides, once established, standards are often difficult to change and may become frozen in time. For instance, Internet protocols such as SMTP or IPv6 do not evolve anymore, even though there might be a strong demand for updates (e.g., to improve the security of SMTP). All in all, in a blogpost, Signal argues that centralized protocols are better equipped to adapt and to keep up with the pace of innovation than decentralized protocols.

As an example of these difficulties, in 2007, the telecommunications industry launched a project to replace SMS messages with a richer text message system, the so-called Rich Communication Services (RCS) protocol. However, it is only in 2016, that is, nine years later, that the GMSA published specifications (RCS Universal Profile), allowing interconnection of RCS messages between

[10] In the context of messaging services, interoperability would also allow to set up groups with users of different services.
[11] There may be other reasons for using distinct services to communicate with distinct groups, for instance, depending on the preferences of the user who initiated the group.

operators. In the meantime, there have been of course many new features introduced by proprietary messaging services.

Our conclusion is thus that the implementation challenges associated with horizontal interoperability are significant and represent an important downside of this form of interoperability.

3.2 Competition in *versus* for the market

Competition in digital markets can take two forms. When there are strong tendencies to concentration due to significant economies of scale or network effects, the market is likely to tip in favor of one firm. In this case, firms compete for the market to become the dominant player. Conversely, interoperability or multi-homing may limit the tendency of the market to tip and allow competition in the market to emerge and maintain.

When there is already a strongly dominant player, creating conditions for competition in the market to emerge and be sustainable allows some form of competition to exist, despite the underlying tendency of the market to tip in favor of the dominant player. In this respect, horizontal interoperability, which has this effect, may be desirable from a social welfare point of view.

However, interoperability only allows for competition in the market. First, this is because users can stick to the dominant platform and still benefit from an entrant's new network via interoperability. In other words, the dominant players are likely to remain 'focal,' limiting the possibility of entrants to expand and develop. Second, interoperability reduces the possibilities of differentiation between suppliers, as it induces a degree of commonality between their products or services. As dominant players remain focal, it also means that implementing horizontal interoperability requires ongoing regulation, as if it were lifted, the market would risk tipping again in favor of them. Besides, a dominant firm may constantly seek to undermine technical interoperability by non-technical means, which requires regulatory oversight.

However, from a long-term perspective, if an innovative entrant enters the market with superior technology, it would be efficient that it takes over the market and replaces the incumbent. Therefore, it is desirable from a social point of view that competition for the market remains possible, something that interoperability does not allow for.

By contrast, multi-homing allows both for competition in the market and competition for the market. It allows for competition in the market as a new entrant can quickly attract a critical mass of users and generate network effects. Multi-homing also keeps the possibility of competition for the market intact. For instance, if the entrant's product turns out to be highly superior to the incumbent's product, the market may tip in favor of the entrant.

Therefore, introducing horizontal interoperability may involve a trade-off. On the one hand, interoperability allows competition in the market to emerge swiftly and be sustainable, increasing static efficiency. On the other hand, interoperability may undermine the incentives of consumers to multi-home, reducing the possibility of competition for the market, which would lower dynamic efficiency.

The solution to this trade-off depends on (i) the extent of multi-homing (which depends on the benefits and costs of multi-homing), and (ii) the likelihood of entry of an innovative entrant. If multi-homing is costly, and hence, negligible, or the likelihood of entry of an innovative entrant is low, implementing horizontal interoperability to foster competition in the market is desirable. This is the conclusion of Scott-Morton et al. (2021), for instance, who argue that competition in the market is more efficient than competition for the market because nascent rivals can be buried by incumbents, the frequency of arrival of potential rivals can be too low from a social point of view, and users face high switching costs.

However, if multi-homing is easy and cheap for users and there are good chances that an innovative entrant may eventually enter, imposing horizontal interoperability risks to be harmful from a social welfare point of view.

3.3 Policy implications

We consider that, even though horizontal interoperability has the benefit of allowing competition in the market to develop swiftly and maintain, it raises important implementation challenges for the standardisation of interoperable features and relevant interfaces. If the standardisation process is lengthy and complex, interoperability may end up applying to only a small set of mature features that do not matter to consumers.

Consequently, consumers will still gravitate to the larger network to take advantage of the full richness of features. At the same time, horizontal interoperability reduces the incentives of consumers to multi-home, which is a powerful driver for contestability in digital markets.

We therefore strongly advise against mandating horizontal interoperability in digital markets, when innovation is occurring at a fast pace and multi-homing is easy and cheap.

We recommend that horizontal interoperability if it should be mandated, be restricted to products or services where (1) innovation is slow-paced, and functionalities are relatively simple and steady over time (e.g., basic payment services), or (2) multi-homing is difficult or expensive (e.g., where multi-homing requires additional costly hardware).

04

VERTICAL INTEROPERABILITY

4 Vertical Interoperability

4.1 Benefits and risks of vertical interoperability

Vertical interoperability is closely connected to the concept of 'modularity' (Baldwin, Clark and Clark 2000) and bears several advantages, as Farrell and Simcoe point out: It increases variety because it allows consumers to "mix and match" (Matutes and Regibeau 1988) system components; it facilitates entry because it lowers the cost of redesign; it thus strengthens competition in complementary markets; it allows for the distribution of innovative labour and open innovation (Baldwin and von Hippel 2011); and it facilitates simultaneous design experiments, which is especially fruitful in complex environments where the value of complementary innovations and the locus of demand is uncertain (Farrell and Simcoe 2012, Baldwin and Clark 2000).

Indeed, vertical interoperability and modularity was also the founding principle of the Internet, which provided a modular design through access layers (known as the protocol stack), that interoperate with each other through well-defined interfaces. Each layer offers an independent functionality (e.g., RF-access, routing, reliable transmission), which can be updated and replaced without affecting the integrity and functioning of the system as a whole, thus allowing mix-and-match (e.g. different RF-access technologies, such as WiFi, Bluetooth and Ethernet) and complementary innovation (e.g. updated WiFi or Bluetooth standards) of different layers.

In the same spirit, it is argued that vertical interoperability would spur competition and innovation in the complex ecosystems that are constituted by platforms in the digital economy, e.g., in the context of integrated mobile devices, or online platforms (Mozilla 2021). While in principle the same modular and layered architecture often exists here, access to the modules is often restricted, which thus limits complementary competition and innovation.

Vertical interoperability and modularity of design also bear some caveats, however. While modularity facilitates innovation to occur independently in each of the modules, in such a federated innovation environment it is difficult to reconfigure the module design as a whole and to shape the systems' technological trajectory (Almirall and Casadesus-Masanell 2010). While vertical interoperability and 'openness' are likely to increase the value of the platform as a whole, it is often more difficult for the platforms to capture large parts of their value alone. This is a leading explanation why it is often observed that platforms tend to be more open to outside complementors initially, to increase value of the platform as a whole, but tend to be more closed once they are established, so they can capture more of the platform's rents (Eisenmann, Parker and van Alstyne 2009). In digital markets often a third, hybrid strategy emerges, where the platforms 'absorbs' those platform complementors (through acquisition, exclusion or head-to-head competition with a like product) that provide the most valuable complements (Eisenmann, Parker and van Alstyne 2009).

We have already pointed at economic efficiencies related to vertical interoperability, especially static efficiency due to competition by complementors, and dynamic efficiency due to innovation by complementors, as well as positive externalities due to increased value of the platform as a whole from the availability of more complements. However, there are also some counterweighing economic inefficiencies (Farell and Weiser 2003).

First, vertical interoperability, in contrast to vertical integration, gives rise to classic inefficiencies of vertical separation (see, e.g., Copenhagen Economics 2020). This includes double marginalization, as both the system provider as well as the complementor may levy a mark-up on prices. The issue of double marginalization is of lesser concern, however, in cases when there is a strong competition by complementors, or when complementors offer their products for free and do not directly levy a price on consumers. Moreover, vertical interoperability may reduce economies of scale and scope. However, there may also be diseconomies of scale and scope in complex systems, as the platform is itself constrained by resources, such as skilled labour, and transactions costs, such as increased complexities of managerial decision making. Another important inefficiency of vertical separation is

related to information asymmetries and the hold-up problem. Complementors may underinvest in platform-specific investments, because this creates a dependency on the platform, which the platform can exploit.

Second, vertical interoperability may lower the dynamic efficiency of the platform, as rents from innovation may need to be shared with or are dissipated by complementors. For example, such a trade-off has been identified in the context of the 'open access' debate for telecommunications infrastructure (Krämer and Schnurr 2014).

Finally, vertical interoperability may distort the platforms' ability to maintain an optimal degree of 'openness' with respect to complementors. For example, Boudreau (2010, 2012) finds an inverted U-shaped relationship between innovation and openness, suggesting that platforms should restrict entry by complementors. Being too open to complementors not only bears the risk of low quality complements, but also reduces innovation incentives of high-quality complementors, as they face too strong competition. This relates to the commonly assumed inverted U-shaped relationship between innovation and competition (Aghion et al. 2005).

In conclusion, the economic and technical assessment of vertical interoperability is very different from that of horizontal interoperability. We argued that under horizontal interoperability concerns arise with respect to static efficiency (lock-in with the inferior network) and dynamic efficiency (lack of innovation potential due to standardisation). By contrast, as we argue below vertical interoperability is generally pro-competitive and thereby increases static efficiency. However, the view of dynamic efficiency is more nuanced and the assessment differs fundamentally for the platform (access provider), and the complementors (access seekers). Requiring the controller of an 'essential facility' to provide access to third parties generally lowers innovation rents and incentives to invest in the creation of the facility (Krämer and Schnurr 2014). In reverse, opening up the essential facilities allows entry of complementors and decentralized innovation to occur by those complementors. It is well understood from the regulation of those essential facilities, ranging from essential patents to telecommunications infrastructure, that public policy needs to strike a balance between these two opposing impacts on dynamic efficiency when imposing access.

Specifically, public policy needs to navigate the complex space of when, how, for whom, and at what compensation to mandate vertical interoperability. These can be roughly differentiated into technical access conditions and economic access conditions. The technical access conditions entail, e.g., who defines which features and functionalities are given access to, how security and integrity is being maintained, performance criteria for the interface, how changes to the interfaces can be implemented, and how such changes are notified. The economic access conditions entail, in particular, who is eligible to receive access and the appropriate compensation scheme for access. Navigating these dimensions is complex and has been subject to a substantial body of research and cases in various industries and contexts. We do not attempt to provide a comprehensive summary here, nor do we consider specific cases (which are currently being deliberated in legislative processes). Instead, we provide some general comments in the context of digital markets, where 'essential facilities' are predominantly in software (rather than physical assets – hardware), and occur at certain layers of the ecosystem stack (see, e.g., Krämer and Feasey 2021), as highlighted in Section 2, where vertical interoperability can be generally provided through access to APIs.

4.2 When should vertical interoperability (not) be considered as a remedy?

Platforms that are not vertically integrated have strong incentives to provide vertical interoperability to encourage complementors to join their platform and to spur innovation. However, as noted above, even non-vertically integrated platforms have incentives to control and limit the access to their platform, as platforms that are too open, have proven to be less conducive to innovation than platforms with a tighter control (Boudreau 2010, 2012). Thus, restricted vertical interoperability

should not be taken as an indication of exclusionary behavior or market failure per se, especially if the platforms are *not* vertically integrated across its platform ecosystem stack.

Incentives to welcome complementors in a non-discriminatory fashion are distorted, however, for vertically integrated firms (i.e. operate at adjacent levels of the 'ecosystem stack'), and compete also in a downstream layer against some complementor that is reliant on access in the upstream layer. Only in this context, classical competition and regulatory issues in vertical relationships such as margin squeeze (Bostoen 2018), sabotage (Mandy 2000), and other forms of self-preferencing (Padilla, Perkins and Piccolo 2020) arise. A famous example in this regard is the competition case against Microsoft in 2004[12]. Until Microsoft became a competitor in the market for work group servers, it had freely provided information about its interfaces with Microsoft's client PC operating system; but after entry in the server market, it ceased to provide the information, which reduced the degree of interoperability and hence the quality of competitors' products in the server market (Kerber and Schweitzer, 2017).

Thus, in our view, a necessary (but not sufficient) test before mandating vertical interoperability is the existence of a vertically integrated gatekeeper; or the clear intent of the gatekeeper to venture into related downstream markets. We recognize that this test is crude in the sense that in data-driven platform markets, "related markets" are not well defined (Krämer, Schnurr and Broughton-Micova 2020, Krämer and Schnurr 2021). An non-integrated platform (e.g., an e-commerce platform which is not also acting as a seller on the platform) may yet have distorted incentives to provide access to complementors, because it anticipates that it has privileged access to data may facilitate entry into a seemingly unrelated market (e.g., for voice assistants). It is also in this context of an interconnected digital economy that the lines between vertical interoperability and horizontal interoperability may become blurred. Widening the mandate for vertical interoperability obligations under such considerations may, however, be too far-reaching.

Furthermore, the proposed test is also not sufficient, since vertical integration alone does not warrant policy intervention. Indeed, as discussed above, it is well known that vertical integration also bears several efficiency advantages, such as avoidance of double marginalization and hold-up problems.

In principle, vertical interoperability may be mandated under an ex-ante regulatory regime, or as the result of an ex-post competition law case (see Section 5*)*. The case of Microsoft mentioned above was trialed under EU competition law as a 'refusal to deal' and Microsoft was mandated to provide sufficient information about the interfaces to facilitate (vertical) interoperability. The case has established an important legal precedent and resulted from a complex weighing of trade-offs. Specifically, the Commission proposed an "incentive balance test", whereby the potential loss of innovation incentives by the access provider must be weighed against the potential gain in innovation by the access seekers (Kerber and Schweitzer, 2017).

More recently, the Digital Markets Act established a proposal for an ex-ante legal framework under which vertical interoperability can be mandated for 'ancillary services' to 'core platform services', such as providing crucial access to APIs of the operating system (core platform service) that allow third-party payment services (ancillary services). However, the provisions of the DMA also result from a case-by-case analysis that was indeed inspired by previous or ongoing competition cases (see Section 5).

More generally, mandated vertical interoperability is a strong market intervention and needs a clear theory of harm and justification. The three-criteria-test established in the context of telecommunications regulation also seems to be useful yardstick here. Thereby ex-ante regulation of the bottleneck resource is only warranted if there are i) high and non-transitory barriers to entry,

[12] EU Commission, Decision of 21 April 2004, COMP/C-3/37.792 – Microsoft; CFI, Judgment of 17.9.2001, Case T-201/04 – Microsoft Corp.

ii) no tendency towards effective competition, and iii) if competition law is considered to be insufficient.

4.3 Defining the technical access conditions (APIs) for vertical interoperability

After it has been established that vertical interoperability can be a welfare-enhancing remedy that is warranted to resolve competition or innovation bottlenecks, the issues shift to the technical and economic conditions under which vertical interoperability should be provided. As detailed in Section 2, interoperability can occur at different levels of integration, ranging from data interoperability to protocol interoperability. Moreover, different sets of functionalities and data streams can or cannot be made accessible to complementors.

In what follows, we always presuppose '*equivalence of input'* as the guiding principle for vertical interoperability. This means all complementors should be given the same technical access conditions as the platform's downstream affiliate. That does not preclude the existence of non-discriminatory conditions for providing access, however, when complementors fulfill these conditions, they should be provided equivalent access, irrespective of their identity. Such equivalence of input regulation has indeed already been pursued and proposed in several industries, including telecommunications.[13] Nevertheless, there remains room for discussion on how 'equivalence of input' is achieved, in particular regarding the degree of autonomy with which the platform can define the interfaces through which vertical interoperability is achieved.

One approach is that the platform has full autonomy in defining the interfaces, but is required to provide non-discriminatory (equitable) access to these. This includes full transparency about the access conditions, and the specifications of the interface. Non-discrimination also entails notice in due time to access seekers if specifications are changed. This approach leaves the access provider with the greatest discretion. On the one hand, this allows the access provider to adapt changes in the fastest possible way. This may be required to preserve security and integrity, e.g., in response to zero-day exploits, but may also facilitate innovation. At the same time, it allows the platform to engage in acts of "sabotage" (Beard, Kaserman and Mayo 2001), such as to engage in changes of the interfaces and their specifications very frequently, the use of non-standard-compliant formats, or to impede access in other ways such that the ability of access seekers to compete effectively is diminished (Riley 2021). Such acts of both cost-increasing, as well as demand-decreasing sabotage of downstream rivals in vertically integrated industries, are well documented, both empirically as well as theoretically (Mandy 2007). In practice, such attempts to obstruct interoperability are "notoriously difficult to deal with" as they often come in disguise as or mixed with "product innovations" or "security measures" (Kerber and Schweitzer, 2017). From a legal perspective, no accepted test for "interoperability obstruction" has evolved yet in the EU (Kerber and Schweitzer 2017).

Another approach would set up a multi-stakeholder process that defines the specifics of the interface, especially for it to adhere to common, public standards (see, e.g. Mozilla 2021). This could be done through formal standardisation organisations, or some other process with regulatory oversight. The advantages and disadvantages of this approach are, in principle, the flip-side of the previous approach, where the platform has full autonomy in defining the interface. In the extreme, this approach could result in regulating the gatekeeper like a public utility, with the regulator defining the interface and its standards and monitoring compliance. In our view, this would not be desirable in the fast-paced environment of digital markets, as the regulator generally lacks technical expertise

[13] See, for example, Commission recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment (2013/466/EU). Official Journal of the European Union, L251, 13–32.

and – even more so – market expertise to be able to adapt APIs and technical access conditions quickly enough.

However, also standard-setting organisations are too slow-moving for defining software standards (in comparison to standards at the device layer) (Riley 2021), and the consensus reached by standard-setting organizations is not necessarily the best option, as they need to balance the interest of the different parties involved (Eisenmann, Parker and van Alstyne 2009, Farrell and Simcoe 2012, Kerber and Schweitzer 2017). It is therefore not evident, that it is best to outsource the technical definition of APIs for vertical interoperability to third parties.

Farrell and Simcoe (2012) suggest that it may be fruitful to pursue different "paths to standardisation" in parallel, as each has its advantages and disadvantages. In the present context, this could mean that the platform has, in principle, autonomy over the technical access conditions. That is, it can decide freely which functionalities one layer of the ecosystem stack provides to the next layer. However, when specifying the details of the APIs and data formats, these should adhere to standards set by standardisation bodies, in case such standards exist. In case they do not exist, standardisation bodies should address these gaps and propose a solution, which may then become the standard. Until then, the proprietary de facto standard can be used. Regulators can revert to their natural role as mediators in this process, stepping in only in case the access provider does not adhere to the proposed standard or brings forward arguments why the proposed standard is not suitable that need to be evaluated. Of course, this process bears many challenges as well, such as the issue that the initial use of the proprietary standard may have created path dependencies that are difficult to overcome later when a more formal standard should be adopted instead. However, this proposal also encourages incumbents to use open and established standards as much as possible in the first place, to prevent disruption later. Anticipating such issues, the regulator may also take a more active role in mediating the standard-setting process. Regulators may have to find new ways of (collaborative) oversight here. In this context, we note the emerging idea of anticipatory regulation (Armstrong, Gorst and Rae 2019).

4.4 Defining the economic access conditions for vertical interoperability

The economic access conditions under which vertical integration shall be provided are even more complex than the technical conditions for access, where a rule of thumb is provided by 'equivalence of inputs'. As such, it will always require careful case-by-case analysis.

4.4.1 Who should receive access?

In our view, vertical interoperability does not require that access must be "open" in the sense that APIs are publicly exposed and complementors can use them without prior checks. Access licenses can be granted (by the platform, a trusted third party, or a regulator) based on objective criteria, such as the license seeker demonstrating that it meets certain security and (privacy) compliance standards. The licensing regime may also involve restrictions on certain usage scenarios or business models as long as this is done in a non-discriminatory way (see below). For example, licensing conditions with respect to privacy and security may be particularly strict for third-party parental control apps, but third-party complementors should be allowed to meet these standards. On the same grounds, licenses can be revoked if misconduct is detected. For example, Scott-Morton et al (2021, p. 22) suggest a licensing regime when providing access to alternative app stores on mobile operating systems. This is not unprecedented in the very context of digital platforms. For example, within its Developer Enterprise Program Apple grants large companies a certificate to develop and distribute apps outside of the App Store, effectively enabling side-loading. While Apple claims that the program was occasionally abused (Apple 2021, p. 20, e.g., by Facebook in response to which the Developer Enterprise Program license of Facebook was revoked, see Owen 2019), the Developer Enterprise Program is still maintained by Apple[14], suggesting that overall it is not an overwhelming

[14] See https://developer.apple.com/programs/enterprise/

threat to integrity and security. Similarly, Apple is providing other means for installing apps outside of the App Store for registered developers, such as for Beta-Testing, for example through TestFlight[15] (a special app on iOS), or by having the app notarized[16] (only available for macOS).

It is also worth highlighting that complementors may not only reduce but also increase security and privacy standards in comparison to the competing service of the platform. For example, alternative app stores could be more stringent on consumers' privacy protection than existing dominant app stores (cp. Kollnig et al 2021 for potential lacks of privacy protection by leading app stores). It is thus misleading to think that complementors may always be determinantal to the safety and privacy of the hosting platform ecosystem. They could likewise encourage competition for more safety and privacy.

The fundamental question is, of course, what is the normative basis for granting or denying access, and relatedly, who has authority over defining those rules?

From a normative perspective, the rationale for granting and denying access to specific types of complementors is not always obvious and must be well defined. However, in practice, difficult normative trade-offs and strategic interactions will inevitably arise as complementors may supply products or services that have an ambiguous (positive or negative) impact on other parts of the value chain, or other complementors. Consider the example of "ad blockers", i.e. apps or browser extensions which filter out advertisements from apps or website. On the one hand, ad blockers seem to be a welcomed complement for consumers, as they alleviate them from ad nuisance. On the other hand, ad blockers jeopardize advertising-funded business models, on which the vast majority of mobile apps rely. Moreover, ad blockers may yield several complex strategic reactions that go beyond those first-order effects. For example, ad-funded content providers may raise their level of advertisement in response to the advent of ad blockers, which hurts those consumers that have not installed an ad blocker (Anderson and Gans 2011); or content providers may react by introducing a subscription-based business model instead of an ad-funded business model, which may hurt those consumers with lower income.

It is difficult to imagine that a public authority is an arbiter for such complex (business) decisions and the one who picks winners and losers from the outset. Likewise, it is often difficult to walk this line for platforms and some have even called for a stronger role for regulation to guide their actions (Zuckerberg 2019).

In principle, similar arguments as on the authority of defining the technical access conditions can be made with respect to access control. One approach is to grant the platform full autonomy over granting access licenses under a non-discrimination obligation. While the decision which complements are acceptable and which are not, is difficult to make for platforms, it is their core decision. As we have discussed above, in the absence of vertical integration, platforms incentives are likely to be aligned with consumer welfare considerations, and thus there is usually no need to intervene. In the presence of vertical integration, the "non-discrimination" obligation (called 'equitable' interoperability by Scott-Morten et al 2021), ensures that platform and complementors have to play by the same rules. For example, if the provider of an app store chooses to deny access to providers offering ad blocking functionalities, then it also cannot offer a similar functionality itself – in the app store or in other layers that it controls, e.g., as a built-in function of the operating system or the browser.

Another approach is to set up a trusted third-party, or an oversight board, which is invoked for complex decisions with ambiguous business and welfare effects. This was also a suggestion that has been made in the context of content moderation of social media platforms and implemented, for

[15] See https://developer.apple.com/testflight/
[16] See https://developer.apple.com/documentation/security/notarizing_macos_software_before_distribution

example, by Facebook[17] (Newton 2018). Here again, as with the definition of technical access conditions, a two-step approach may be in order. That is, by default the decisions on granting access based on the predetermined rules are being made by the platform directly – subject to non-discrimination. However, in case there is uncertainty or disagreement on how the rules were applied and whether they were applied in a non-discriminatory way both the platform and complementors can appeal to a trusted-third party, which may review these decisions. Public authorities step in only to initiate this process and to review its effectiveness. Similar mechanisms are already foreseen by the Platform-to-Business (P2B) Regulation and the Digital Services Act.

4.4.2 What should be the price for access?

Even with a licensing regime in place, exposing APIs to the external actors may require considerably more consideration and costs, compared to building a vertically integrated service internally, with only private APIs. This relates not only to fixed costs, but likely also entails continued marginal and incremental costs of providing access, e.g., from awarding and revoking licenses, and monitoring and compliance enforcement of license holders. These additional costs of opening the APIs must not necessarily be borne by the access provider alone and can be redistributed through an access pricing regime. In the context of infrastructure regulation, different access pricing regimes have been used and proposed in the past (see, e.g., Laffont and Tirole 1994, Armstrong, Doyle and Vickers 1996, Valetti and Estache 1999).

Access pricing is generally very complex, both in theory and in practice. In practice, access pricing is predominantly constrained by information asymmetries. Thus, regulators strive for solutions that rely on information that they can assess in practice, such as observable market prices (as opposed to demand elasticities, for example). With this constraint in mind, the optimal approach is also theoretically disputed.

Typically, the access price is derived by distributing the direct costs relating to the use of the infrastructure by third parties plus adding a reasonable risk mark-up on costs, which shall compensate the access provider for its efforts and risks in establishing and maintaining the infrastructure. The access pricing methodologies differ in how they derive the direct costs and the mark-up. For example, direct costs can be measured based on actual costs (which may be inflated and now much lower due to technological progress), replacement costs (which reflect technological progress, but are still based on possible inferior design choices), or based on theoretical costs of an efficient firm that seeks to replicate the infrastructure (which are typically much lower than the actual costs). Similarly, mark-ups can account for risks and innovation rents in different ways, and may or may not account for the access providers' incentives to engage in non-price discrimination and foreclosure. Generally, a lower mark-up encourages entry and innovation by complementors, but reduces incentives of the current (and future) access providers to invest and build in the infrastructure. The main question driving the access pricing regimes in practice is thus what the primary objective of the regulator is.

For example, in telecommunications, an elaborate cost-based access price was devised based on an engineering model that computes the forward-looking long-run incremental costs (FL-LRC), based on a hypothetically efficient access provider. This approach was believed to send the right make-or-buy signal for potential entrants, avoiding inefficient duplication and bypass of the local loop (Laffont Tirole 2001). By contrast, the Efficient Compontent Pricing Rule (ECPR) was designed with 'competitive neutrality' in mind (Baumol, Ordover and Willig 1997). That is, its primary objective was to minimize incentives for foreclosure and non-price discrimination (which is costly to monitor and to enforce by the regulator), as it compensates the access provider fully for its opportunity costs of providing access (foregone rents from providing access).

[17] See https://oversightboard.com

Similarly, FRAND (fair, reasonable and non-discriminatory) licensing prices in the context of standard-essential patents are intended to avoid hold-up problems (in particular "patent ambush"), as complementors have to make considerable standard-specific investments, which makes them vulnerable to ex-post opportunistic behavior by the patent holder. Thus patent holders must commit ex-ante to a menu of FRAND licensing terms before such standard-specific investments are made.

These examples of access pricing methodologies are not meant as blueprints for implementation of access pricing in the context of digital markets. Rather two general conclusions can be drawn from this discussion in the context of vertical interoperability in the digital economy. First, access pricing must be devised with a clear objective in mind to set an appropriate mark-up on the direct costs of providing access. Higher mark-ups tend to preserve better innovation incentives of the platforms and to counteract incentives for non-price discrimination. Lower mark-ups encourage competition and innovation by complementors, and even an access price of zero may be reasonable if marginal costs of providing access are indeed near zero. Low, or even zero, mark-ups also counteract margin squeeze, which becomes an issue as soon as there is a positive access price. Indeed, margin squeeze may be especially difficult to detect and enforce in digital markets, where output prices are not readily observable (e.g., because the price to consumers is established through advertisements or consumer data) than in other industries where the output price is observable. Regulators must strike a balance taking the specifics of the case into account. If establishing the platform has been particularly risky (e.g., measured by the amount of specific sunk investments that have been made in establishing the platform), requires continued innovation by platforms, or if non-price discrimination and foreclose are of concern and difficult to detect and enforce, then access prices should be set in favor of the access provider. In the reverse case, access prices can be set lower to favor entry, competition and innovation by complementors.

Second, the timing at which access prices are announced, and the commitment to these prices is decisive. Ideally, whatever the access pricing regime is, it is important to fix the determination of these prices ex-ante, so both the platforms as well as the complementors can internalize it in their decisions and when they make platform-specific investments. Having said this, we also note that in the complex and dynamic environment of digital markets, it is difficult to specify the determination of access prices for each possible digital bottleneck that may arise in the future.

4.5 Long-run considerations and path-dependencies of vertical interoperability

Providing access on regulated terms may also create path dependencies that are difficult to deal with politically later. Based on the regulated terms of access, a new industry may develop, which is reliant on access. On the one hand, this is, of course, the intended goal of vertical interoperability. On the other hand, this makes it more difficult to change the regulated terms of access as some access seekers will always be hurt by those changes – some more than others. This issue occurs at two levels.

First, conditions or specifications of access may change, while access is – in general – still being provided. For example, consider the case where the access provider, say due to privacy considerations, chooses to cease access to certain functionalities or data -- even if this occurs on a non-discriminatory basis, i.e. including a "data silo" with respect to its downstream functionality. Some access providers may have crucially relied on that functionality or data, and hence will complain (to the regulator) that it is disproportionally hurt by this decision of the access provider, and demand that the functionality or data continues to be accessible through the interoperable interface. This raises the same questions as for the licensing procedure discussed above, however now with the additional twist that an arbiter would not only decide about the entry (who is provided a license and who is not) but forced exit.

Second, at some point in the future, the regulated bottleneck may indeed not be a bottleneck anymore. For example, if regulated access was indeed a success, former access seekers may have

used the regulated access as a stepping stone and managed to duplicate the bottleneck or to develop their competing ecosystem, essentially not requiring access anymore. Other, less successful access seekers, may, however, still rely on regulated access. Or it may be that in the long-run technological progress may have rendered new bottlenecks elsewhere, and made the regulated bottlenecks obsolete. What is then the appropriate framework to decide that vertical interoperability should not be provided anymore; even if that would mean that some firms, who are still requiring access for their business models, would be foreclosed?

Generally, we conceive these problems as less problematic in the digital economy than in some of the other industries in which access regimes have been established (e.g., telecommunications, energy, (open) banking). In the digital economy, bottlenecks are usually software-defined and thus platform-specific investments are also made in software. For example, Krämer and Feasey (2021) find in the context of mobile ecosystems that digital bottlenecks are constituted by the operating system and app stores, but not by the hardware as such. The reason is usually that network effects arise rather at the software level than at the hardware level. It, therefore, seems that software-based complementors can more easily repurpose their investments in talent (e.g., programmers, marketing experts, managers) and infrastructure (e.g., servers and other IT hardware) and redirect it to other platforms or digital markets in case changed access conditions make this necessary. In case new bottlenecks arise and existing ones become obsolete, the relatively low level of sunk investments will not keep complementors stranded.

05

THE EU LEGAL FRAMEWORK ON INTEROPERABILITY

5 The EU Legal Framework on Interoperability

Over a decade ago, the European Commission identified a lack of interoperability as one of the most significant obstacles to digitalization,[18] planning to examine measures to encourage significant market players to pursue interoperability-friendly business policies.[19] The Digital Agenda called for standard-setting by the industry, supported by public policy, to promote greater interoperability.[20] Since then, scholars have called for mandated interoperability to strengthen competition in digital markets (e.g. Stella 2021, Graves 2021, Riley 2020a, Riley & Vasile 2021, Borgogno & Colangelo 2019). Interoperability requirements oblige platforms to ensure access and interoperability with their infrastructures, without necessarily requiring specific steps for how such capabilities are to be achieved (EFF 2021, p. 16). Platforms must "allow competitors to work with their internal systems on behalf of users whose data lives elsewhere" (EFF 2021, p. 17).

Interoperability requirements can concern data portability (Krämer, Senellart and de Streel 2020) and (back-end) interoperability. The discussion below focuses on the legal possibilities for and challenges of interoperability requirements.

5.1 Competition law

Interoperability has been a remedy in competition cases, notably in the *Microsoft*[21] case. Denying interoperability to competitors can constitute an abuse of dominance under Article 102 TFEU, under two main theories of harm: the essential facilities doctrine and illegal tying.

Under the essential facilities doctrine, a dominant firm can be prohibited from using a bottleneck in the market that it controls as an entry barrier. The essential facilities doctrine has obtained particular importance in the digital economy because the largest online platforms have created infrastructures that competitors rely upon – and they often compete in the markets they have created (Hurwitz 2020, p. 1034).

Denying interoperability can also constitute illegal tying if two different services offered by the same dominant provider are only offered together and cannot be used in the same way with a functional competitor. Tying was at stake in the 2007 *Microsoft* case, which clarified that EU competition rules can compel dominant firms to grant access to their interface and provide interoperability with competitors or business users. Competitors urged Microsoft to share detailed technical information on its interfaces that would allow them to interoperate with Windows. According to Microsoft, releasing such information would discourage it from innovating (see further Kades & Scott Morton 2020, p. 25). The European Commission concluded that the negative impact on competition outweighed the effect on innovation incentives. Relevant was that Microsoft had attained an "overwhelmingly dominant position", which particularly gave it the "special responsibility" pertaining to dominant firms (Portuese 2021, p. 24). It found that Microsoft abused its dominant position by refusing to provide interoperability information to developers and "to allow its use for the purpose of developing and distributing products competing with Microsoft's own products."[22]

As the *Microsoft* case illustrates, EU competition law provides the tools to force dominant companies to grant access to some of their interfaces or data on equal terms (Portuese 2021, p. 24; Caffarra & Scott Morton, endnote 16). Next to the refusal to deal as a possible theory of harm, degrading data portability or interoperability could also be a method of implementing anticompetitive margin squeeze, bundling, or increasing switching costs (Mancini 2021, p. 41).

[18] EU Commission, A Digital Agenda for Europe, Brussels, 19.5.2010, COM(2010)245 fin., p. 3.
[19] See EU Commission, A Digital Agenda for Europe, Brussels, 19.5.2010, COM(2010)245 fin., p. 15.
[20] EU Commission, A Digital Agenda for Europe, para 15.
[21] Case T-201/04, Microsoft v Commission, EU:T:2007:289.
[22] Case T-201/04, Microsoft v Commission, EU:T:2007:289, para 19.

Competition law interventions have the advantage of being flexible: they can be targeted at specific firms in defined markets, for a limited time (Mancini 2021, p. 24). However, lengthy proceedings can limit their effectiveness in fast-moving markets (Krämer, Senellart & De Streel, 2020, p. 80). Several other policy measures are available to implement interoperability, including standardisation and horizontal or sector-specific regulation (Kerber & Schweitzer 2017, p. 44 ff.; Crémer et al 2019, Mancini 2021, p. 24). Regulation, for instance mandating interoperability, can be preferable in digital markets characterized by network effects, as it can reduce entry barriers (Scott Morton et al 2021, p. 6). Regulation moreover has the advantage of being faster and more preventative than competition law enforcement (Mancini 2021, p. 41). It is also likely to be less time-consuming if the issue comes up regularly (Kades & Scott Morton 2020, p. 31).[23]

5.2 Digital Markets Act (DMA)

5.2.1 Interoperability in the DMA

The 2020 Digital Markets Act lays out regulation for digital gatekeepers, introducing new obligations for core platform providers designated as "gatekeeper". Several of these obligations, listed in Articles 5 and 6 DMA, aim to address the concern that gatekeepers could use bundling or self-preferencing to exclude inventive entrants, and appropriate the profits from the innovation via a competing offering of their own (Larouche & De Streel 2021, p. 549).[24] Interoperability obligations are one way to address this concern. As the DMA (Preamble, para 52) notes:

"[g]atekeepers may also have a dual role as developers of operating systems and device manufacturers, including any technical functionality that such a device may have. […] Such access may equally be required by software applications related to the relevant ancillary services in order to effectively provide similar functionalities as those offered by gatekeepers. If such a dual role is used in a manner that prevents alternative providers of ancillary services or of software applications to have access under equal conditions to the same operating system, hardware, or software features that are available or used in the provision by the gatekeeper of any ancillary services, this could significantly undermine innovation by providers of such ancillary services as well as choice for end users of such ancillary services. The gatekeepers should therefore be obliged to ensure access under equal conditions to, and interoperability with, the same operating system, hardware or software features that are available or used in the provision of any ancillary services by the gatekeeper."

The DMA contains several provisions relating to interoperability and data portability:

- Article 6(1)(c) requires interoperability of operating systems with third-party software applications or software application stores;
- Article 6(1)(f) mandates interoperability of ancillary services;
- Article 6(1)(h)) requires real-time data portability;
- Article 6(1)(i)) requires business-user access to their own and end-user data

The obligations in Article 6(1)(h-i) provide for one-way, "read-only" access to data, and hence primarily concern data portability but not vertical interoperability. In our terminology, they represent an instance of asymmetric data interoperability. The requirements in Article 6(1)(c) and (f) concern vertical interoperability, but not horizontal interoperability.

Article 6(1)(c) requires gatekeepers to allow the installation and effective use of third-party software applications or software application stores using or interoperating with their operating systems. These software applications or software application stores must be accessible by means other than

[23] Referring to Baker (1993).

[24] As Larouche & De Streel 2021, p. 549 note, this is inspired by competition law cases such as Case T-201/04 Microsoft v. Commission, EU:T:2007:289; Microsoft (Explorer) (Case COMP/AT.39530) Commission Decision of 16 December 2009; Google Search (Shopping) (Case COMP/AT.39740) Commission Decision of 27 June 2017; Google Android (Case COMP/AT.40099) Commission Decision of 18 July 2018.

the core platform services of the gatekeeper, meaning that Article 6(1)(c) prohibits tying practices whereby a gatekeeper only allows access to third-party software through another of its core platform services (see also Petit 2021, p. 536).[25] In addition, Article 6(1)(e) requires gatekeepers offering operating systems to eliminate technical restrictions that prevent a user from switching to other software and services. Gatekeepers may take proportionate measures to protect the integrity of their hardware or operating system.

Article 6(1)(f) Draft DMA grants access and interoperability rights to providers of ancillary services. It mandates that gatekeepers that supply operating systems provide third-party providers of ancillary services access to and interoperability with their operating system on equal conditions as those that apply to their ancillary services. In practice, this for instance allows users to create social media accounts using an existing profile from another provider ("Sign in with Google"), or to use a third-party payment system.

The requirement of equal access and interoperability also includes hardware and software features that are available to the gatekeeper. Third parties do not need to be competitors of the gatekeeper – all ancillary services need to be treated equally. This interoperability requirement promotes platform disintermediation, limits leverage into related markets and contributes to the contestability of digital markets (De Streel et al 2021, pp. 13 & 47). It has been suggested that the obligation was inspired by the *Apple Mobile Payments*[26] investigation (Akman 2021, p. 11). Recital 52 DMA indicates that the provision would concern technology such as the near-field communication chip that the Apple iPhone currently restricts for exclusive use by ApplePay (see also Cabral et al 2021, p. 18).

The interoperability obligations are placed in the category of rules "susceptible of further specification", meaning that Article 7 DMA leaves the possibility for a "regulatory dialogue" regarding these obligations (see further Akman 2021, p. 12). However, the obligations are directly applicable and readily enforceable. As pointed out in Section 4, the regulatory dialogue seems inevitable with respect to implementing vertical interoperability, as details about the licensing and access pricing regime need to be fixed ex-ante.

The Commission's Proposal proposes only a limited interoperability obligation, given the narrow focus in Article 6(1)(f) on interoperability with ancillary services. Access and interoperability to core services are not envisaged (see also Berberich & Seip 2021, p. 46). The DMA does not define "core platform services" but contains a list of types of digital services it covers: online intermediation services; online search engines; online social networking services; video-sharing platform services; number-independent interpersonal communication services; operating systems; cloud computing services; and advertising services. Some core services are already subject to existing EU law that may address some of the concerns related to digital gatekeepers. For instance, messaging services are already subject to transparency and interoperability obligations under the Electronic Communications Code[27] (see also De Streel et al 2021, p. 12).

Ancillary services are defined as "services provided in the context of or together with core platform services, including payment services as defined in point 3 of Article 4 and technical services which support the provision of payment services as defined in Article 3(j) of Directive (EU) 2015/2366, fulfillment, identification or advertising services". Identification service means "a type of ancillary services that enables any type of verification of the identity of end-users or business users, regardless of the technology used".[28] In practice, the interoperability requirement will thus cover payment

[25] This obligation was arguably inspired by Case COMP/AT.40716 Apple - App Store Practices, 16 June 2020 (Opening of Proceedings); see https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_AT_40716. See Akman 2021, p. 11.

[26] Case COMP/AT.40452 Apple – Mobile Payments, 16 June 2020 (Opening of Proceedings); see https://ec.europa.eu/competition/elojade/isef/case_details.cfm?proc_code=1_AT_40452.

[27] Directive (EU) 2018/1972 of 11 December 2018 establishing the European Electronic Communications Code (Recast), OJ L 321/36.

[28] Draft DMA, Article 2(14).

services, but it is not entirely clear what other services would be covered under ancillary services (De Streel et al 2021, p. 63).

The limitation of interoperability requirements to ancillary services has been criticised, given that "technical restrictions on end users' ability to switch and multi-home and limitations on interoperability can be concerns in a wide range of circumstances beyond operating systems and ancillary services" (Akman 2021, pp. 11-12). The limitation to ancillary services means that the draft DMA does not mandate interoperability for what is "the most significant case of walled gardens", namely instant messaging and social media (Cabral et al 2021, p. 22). It only requires interoperability for the ancillary services related to them, such as logins and payment services. Cabral et al (2021, p. 22) call for extending Article 6(f) to "industry-standard features of the core platform services of the gatekeeper". Others have also argued that the interoperability obligations in the DMA should be broadened (e.g., EPRS 2021, p. 7).

In practice, Article 6(1)(f) may already cover a range of different aspects of the gatekeepers' core platform services, which may not have been intentional or proportionate, and which may be difficult to implement effectively (De Streel et al 2021, p. 54). An interoperability requirement that covers services far more wide-ranging than payment services could unduly limit innovation (De Streel et al 2021, p. 63). A broader interoperability requirement is opposed by some because of the privacy and security risks involved (e.g., Barczentewicz 2021, see further Section 5.3.2) below).

Another point of critique is that in the Commission's proposal security and integrity safeguards are not provided for in the obligation for ancillary service interoperability. Interoperability obligations should not reduce security and integrity on platforms to the detriment of users. A gatekeeper needs to be able to protect user safety, security, and privacy when a functionality it offers interoperability on is misused by a third party. The licensing regime proposed in Section 4.4.1 is a means to achieve this. It has been proposed to extend the safeguard clause provided in Article 6(1)(b-c) to the interoperability obligation for ancillary services ex Article 6(1)(f) (De Streel et al 2021, p. 89).

5.2.2 Positions of the Council and the EP

These points of critique are reflected in the positions of the European Parliament and of the Council. On November 25, 2021, the Council of the European Union reached an agreement on the draft DMA. The European Parliament adopted its Report on the DMA with a vote in the plenary session of the European Parliament on 15 December 2021. In 2022, the DMA has entered into trialogue negotiations, with the goal of reaching an agreement on a final text for the DMA.

The European Parliament's Committee on Internal Market and Consumer Protection's position introduces amendments on, among other things, the list of core platform services, the designation of gatekeepers, and the obligations imposed on them (see further Andriychuk 2021). IMCO proposes more extensive interoperability obligations than the Commission's proposal. The amended Article 6(1)(f) requires designated gatekeepers to "allow business users, providers of services and providers of hardware free of charge access to and interoperability with the same hardware or software features accessed or controlled via an operating system […] that are available to services or hardware provided by the gatekeeper" (see also Karanikioti 2021).

IMCO also proposes new obligations for providers of messaging services and social networks. Providers of "equivalent core platform services" should be allowed to interconnect with the gatekeeper's social network services and a number of independent interpersonal communication services, like messaging apps, upon their request and free of charge. To avoid discrimination, this interconnection must be provided under equal conditions and quality to that available or used by the gatekeeper, its subsidiaries, or its partners. In practice, this means that gatekeepers such as WhatsApp and Facebook offering communication services and social networks will have to ensure interoperability with competing services, such as Signal (see also Bongartz 2021). As noted in Section 3, we view such an obligation with some skepticism.

5.3 Legal challenges

5.3.1 Implementation and enforcement

The Preamble of the DMA is clear in its legislative intent, noting that "the lack of interconnection features can affect users' choice and ability to switch due to the incapacity for end user to reconstruct social connections and networks provided by the gatekeeper." However, implementing and enforcing an interoperability requirement is not without its challenges (Mancini 2021, p. 44, Riley & Vasile 2021, p. 56, Hurwitz 2020, p. 1052).

First, effective implementation of interoperability obligations is likely not feasible in the six months prescribed in the proposed DMA. In this regard, there could be a trade-off between speed and effectiveness (De Streel et al 2021, p. 56).

Second, as we have pointed out in Sections 3 and 4, it will be necessary to actively monitor and enforce the interoperability requirement. If the incentives among stakeholders involved diverge, a dominant platform may seek to limit the benefits of interoperability measures for its rivals (Mancini 2021, p. 44). While public authorities should take the lead role in monitoring the obligation (Kades & Scott Morton 2020, p. 47), it may also be necessary to impose monitoring trustees to oversee implementation (Mancini 2021, p. 44).

Finally, it may be difficult to determine ex-ante what specifically must be done for a platform to be considered offering sufficient interoperability (Riley & Vasile 2021, p. 56). When disputes occur, it will be necessary to adjudicate on questions such as whether a platform was justified in refusing third-party access to an API on security or data protection grounds (see Section 4), or if it may be a cover for anticompetitive strategies (Mancini 2021, p. 44).

5.3.2 Privacy and security risks

One motivation for mandated interoperability may be to protect privacy, by promoting innovation and competition and giving users the ability to better control their data (Mancini 2021, p. 24, referring to Swire 2020 and Riley 2020b, p. 96). Interoperability allows third parties to develop add-ons that modify services to better protect users' privacy, such as a privacy settings manager (EFF 2021, p. 24). By providing users with an "exit" option when the platform does not offer them sufficient data protection, interoperability reduces lock-in effects and fosters competition (EFF 2021, p. 24).

At the same time, expansive interoperability requirements imposed to promote competition may lead to concerns about data protection and security.[29] Privacy and security risks may arise when platforms open up new data flows to third parties (EFF 2021, p. 21). Platforms will likely face attempts to misuse interoperability through clearly criminal activity, but potentially also more ambiguous attempts that are harder to identify (Barczentewicz 2021, p. 3). Open APIs thus create vulnerable entry points that access providers need to protect against cyber threats. One way to do so is for access providers to review APIs to ensure that they do not pose risks to privacy or cyber security. Another possibility is to restrict access to APIs to licensed third parties (cf. Section 4.4.1) Overall, protecting APIs against privacy and security risks is likely costly to access providers. These costs will need to be reflected in access pricing (cf. Section 4.4.2).

There could be a conflict between the growing demand for interoperability and the growing demand for privacy (Alexander & Stutz 2021, p. 36). Platforms themselves also put forward the need to protect users' privacy as a justification for denying interoperability.[30] In relation to mandated data portability, platforms need to be able to identify their users to ensure the data goes where it should (EFF 2021, p. 26). Interoperability requires platforms to create new interfaces allowing competitors to connect their users (EFF 2021, p. 27). While this will expose large amounts of data, many platforms already do this through their APIs. To protect their users, platforms can and do revoke API

[29] Mandating interoperability may also run into antitrust issues, as it requires coordination between firms (Hurwitz 2020, p. 1051).
[30] Alexander & Stutz (2021) name the example of Apple's privacy standards as a feature of its App Store.

keys if necessary (EFF 2021, p. 21). Mandated interoperability would mean that some of the discretion to decide when to revoke access to third parties would be taken away from the platforms (EFF 2021, p. 28).

When introducing interoperability obligations, the possibilities of gatekeepers to protect users against privacy and security risks need to be taken into consideration (see e.g. De Streel et al 2021, p. 89). Privacy and security risks may pose a limit on the degree of openness that should be mandated through interoperability (Mancini 2021, p. 43). At the same time, the tension of denying interoperability with suppressing competition needs to be considered (Alexander & Stutz, p. 36).

Some consider the present privacy and security risks reason to reject a broad interoperability requirement (Barczentewicz 2021). Interoperability of ancillary services arguably does not pose as big of a privacy risk as mandated interoperability of core services, such as instant messaging services, because a more limited scope of data needs to be exchanged (Barczentewicz 2021, p. 2). It still may pose risks if users poorly secure identification services, and if it becomes more difficult for gatekeepers to protect their users – for instance with end-to-end encryption – when allowing for interoperability (Barczentewicz 2021, p. 2). Moreover, an interoperability obligation would need to ensure that the privacy restrictions on one platform will apply equally when the user's data is shared with other platforms, regardless of that other platform's own privacy rules (Santesteban & Longpre 2021, pp. 6-7, Santesteban & Longpre 2020).

Some consider that the requirements of the GDPR pose challenges to achieving interoperability (Dnes 2021). At the same time, the GDPR – particularly if its enforcement is strengthened[31] – also appears to be an important aspect of mitigating privacy risks when mandating interoperability (Barczentewicz 2021).

5.3.3 Intellectual property rights

The design of interoperability measures could also raise questions about the protection of intellectual property rights. Under competition law, there is a narrow range of circumstances in which a dominant company can be obliged to provide access to or license its intellectual property rights (Hoffmann & Otero 2020, p. 266).[32]

APIs are one of the technical means to facilitate interoperability. APIs can be open or restricted, determining whether third parties have access to it. Owners may choose to make an API public if third parties can deliver benefits to the platform by contributing to it. Restricted APIs, in contrast, are treated as trade secrets by the owners (Hoffmann & Otero 2020, p. 266). Both copyrights and patents may be relevant in the context of APIs.

While computer programs as such are excluded from patent protection,[33] computer programs with a technical character are not.[34] Relevant is whether the invention remains abstract, in which case it cannot be patented, or is put to specific, technical use, in which case it can be patented (Vishnu 2020). For API implementations, the technical effect might take place (Hoffmann & Otero 2020, p. 265).

Copyright protection of APIs is a controversial topic. The ideas and principles underlying any element of a computer program or its interfaces are not protected by copyright, but the expression of API

[31] See e.g. beuc.eu/publications/beuc-x-2020-074_two_years_of_the_gdpr_a_cross-border_data_protection_enforcement_case_from_a_consumer_perspective.pdf , https://ec.europa.eu/info/sites/default/files/1_en_act_part1_v6_1.pdf?utm_source=POLITICO.EU&utm_campaign=10cd56c923-EMAIL_CAMPAIGN_2020_06_24_10_35&utm_medium=email&utm_term=0_10959edeb5-10cd56c923-190069369

[32] Referring to AG Jacobs Opinion in Case 53/03 Synetairismos Farmakopoion Aitolias & Akarnanias (Syfait) and Others v GlaxoSmithKline AEVE [2005] ECR I-4609, para. 66. See also Brinsmead (2021).

[33] European Patent Convention, Articles 52(2) and (3).

[34] Hoffman & Otero 2021, p. 265 refer to the Guidelines for Examination Part G II 3.6; EPO T 1173/97 and EPO G 3/08.

specifications and implementations can be (Hoffmann & Otero 2020, p. 264).[35] The Computer Programs Directive provides for an exception to copyright infringement to achieve interoperability, under several conditions. This reflects the importance to competitors of having access to API information in digital markets. The Directive however does not impose a positive obligation to disclose interoperability information (Hoffmann & Otero 2020, p. 265).

Access to API information might not always be indispensable to achieve interoperability (Hoffmann & Otero 2020, p. 267). If it is, licensing contracts specifying the terms and conditions under which developers can have access to the API are relevant as well (Hoffmann & Otero 2020, p. 268). Nevertheless, proposals for mandated interoperability need to assess conflicting IP rights and trade secrets protection needs more thoroughly (Hoffmann & Otero 2020, p. 271).[36]

In conclusion, three main legal challenges still need to be further assessed to make an interoperability requirement effective. *First*, it needs to be worked out how interoperability will be practically enforced. *Second*, privacy and security risks may be a valid justification for limiting the scope of the interoperability requirement. *Third*, the interplay with intellectual property rights to API systems needs further attention.

[35] Referring to Article 1(2) Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs, as well as cases C-393/09, Bezpecnostni
softwarova asociace - Svaz softwarovd ochrany v Ministerstvo kultury [2010] ECLI:EU:C:2010:816, paras 41-43, and C-406/10, SAS Institute Inc. v World Programming Ltd [2012] ECLI:EU:C:2012:25, paras 35 and 39.
[36] This issue was also debated in relation to the GDPR, see e.g. De Hert et al 2018.

06

CONCLUSIONS AND POLICY RECOMMENDATIONS

6 Conclusions and Policy Recommendations

Mandated interoperability has been used as a regulatory instrument in network industries as well as a remedy in previous competition law cases. It is therefore not surprising that interoperability is also discussed as a "super tool" (Scott Morton et al 2021) for the regulation of digital markets, where strong network effects are prevalent.

The DMA proposes selected (vertical) interoperability obligations, which were likely inspired by prior and ongoing competition law investigations, rather than wanting to adopt a more general obligation (Akman 2021, p. 11-12).[37] Albeit most of the new obligations for gatekeepers can be linked to a recent competition law case, the DMA goes beyond competition law: it is a regulatory instrument meant to address the systemic risks for competition resulting from the characteristics of platform markets where gatekeepers are present (Schweitzer 2021, p. 23). In this context, mandated interoperability can also be considered a regulatory remedy, that sets the proposed DMA apart from competition law instruments (see also Larouche & De Streel 2021, 553).

In this report, we have adopted a wider view on interoperability obligations in the context of digital markets that is not confined to the narrow contexts of previous or ongoing competition law cases. In doing so, we derive a more general framework on the scope and effect of interoperability as a regulatory instrument for digital markets that can feed back into the considerations of the DMA as the key regulatory framework for the economic regulation of digital gatekeepers in the EU. While these insights might not feed into the current Trilogue negotiations anymore, their generality makes them future proof and can thus inform a future review of the DMA, which will surely be necessary as other digital gatekeepers emerge and the list of core platform services, as well as some of the detailed Article 5 and 6 provisions require updating. We have also pointed to several complex trade-offs when mandating (vertical) interoperability, which can inform policy makers implementing the DMA.

The first central insight that emerges from our report is that policymakers must be very precise when defining interoperability, and especially **need to differentiate between notions of horizontal and vertical interoperability**. Horizontal interoperability refers to the ability of products and services at the *same level* of the digital value chain to "work together". An example is the ability to send a text message from one messenger service to another. The key feature of horizontal interoperability is that it allows sharing of *direct network effects*. By contrast, vertical interoperability allows services that are at *different levels* of the digital value chain to work together. An example is the possibility to run different app stores on the same operating system. The key feature of vertical interoperability is that it allows to mix-and-match system components. Horizontal and vertical interoperability are thus structurally very different, and their economic assessment is very different. They should thus not be confused in the policy debate.

By contrast, other characteristics of interoperability, such as the degree of interoperability (data interoperability vs. (full) protocol interoperability), which have been highlighted in some other policy reports (e.g., Crémer et al 2019), are not of first-order importance. They represent different shades of grey that need to be deliberated only after a horizontal or vertical interoperability regime is considered.

Our second central insight is that **mandated horizontal interoperability is likely a harmful remedy in digital markets**. In practice, horizontal interoperability will never be perfect and can only achieve limited interoperability between a set of common features. Thus, network effects for the dominant platform remain, while at the same time interoperability reduces the incentives of consumers to multi-home. This means that – **contrary to popular belief – horizontal interoperability can be anti-competitive and has the potential to enshrine the dominance**

[37] Referring, for a matching of DMA obligations with competition law investigations, to OECD (2021), pp. 31-32 and to European Commission, Staff Working Document, Impact Assessment Accompanying the Document Proposal for a Regulation of the European Parliament and of the Council on Contestable and Fair Markets in the Digital Sector (Digital Markets Act), 15 December 2018, SWD(2020) 363 final, pp. 53-60.

of digital incumbents. This anti-competitive effect of limited horizontal interoperability has been overlooked in previous literature.

Our skepticism with regard to horizontal interoperability is reinforced by the fact that horizontal interoperability requires some degree of standardisation, which has proven to be difficult and slow moving in the past. Standardisation also limits the innovation potential, as conformity to the standard has to be maintained. Many market participants, entrants and incumbents alike, therefore reject the notion of mandated interoperability.

We therefore strongly advise against mandating horizontal interoperability in digital markets, where innovation is occurring frequently and multi-homing of services is typically easy to achieve with low transaction costs. In reverse, this means that **policy makers should scrutinize and enforce against attempts of digital incumbents to limit consumers' ability to multi-home**, as multi-homing can be a powerful tool for disrupting consumer lock-in due to network effects.

On the flip side, **there is scope for horizontal interoperability to be beneficial if**:

(1) The services to be made interoperable are relatively homogenous and have a stable set of features that are not subject to frequent innovation. If this is the case, a high degree of interoperability can be achieved and maintained over time.

and/or

(2) Multi-homing involves significant transaction costs and cannot be easily pursued by consumers. For example, arguably both conditions are met by standard (fixed-line or mobile) voice telephony services. There is little differentiation between the services of different providers, and multi-homing is expensive as it requires maintaining different contracts and devices. Thus, mandated horizontal interoperability, which is of course is long established, is useful in this context. However, these conditions are typically not met by digital services, not even messenger services, which compete with respect to feature richness, security and privacy.

Our third central insight is that **vertical interoperability is indeed a powerful instrument for regulating digital bottlenecks**.

However, we suggest that **mandated vertical integration should only be considered in the case the digital gatekeeper is vertically integrated**, and if there is evidence that vertical integration leads to discrimination or foreclosure of complementors that would not have occurred in the absence of vertical integration. For example, such evidence may arise as a platform changes the access conditions for complementors to this effect after becoming a complementor to its platform. While vertical integration and evidence of foreclosure represent a necessary condition, additionally a clear theory of harm must be demonstrated, taking into account the specificities of the case, before imposing vertical interoperability obligations. In designing the scope of the interoperability requirement, it needs to be assessed where competition is most feasible or where competition harms are likely to occur (Mancini 2021, 24 & 43). This also depends on the intended goal of regulators, which should therefore be identified. The DMA sets out 'contestability' and 'fairness' as its regulatory goals. However, both terms are not (yet) well defined by the DMA itself and lend themselves to broad interpretation.

Based on the notion of '**equivalence of input'** vertical interoperability requires a vertically integrated platform to provide eligible complementors the same level of access to the platform as its affiliated complementor.

We suggest that platforms subjected to vertical interoperability can establish a licensing regime, which lays out the rules and conditions for access for complementors. The **licensing conditions can include considerations about security, integrity and privacy, but those conditions need to be applied in a non-discriminatory way**. The licensing conditions may also exclude certain business models by complementors. **A trusted third party or oversight board should be**

established to consult on difficult decisions which have an ambiguous business or welfare effect. Hence, day-to-day decisions on access are being made by the platform directly – subject to non-discrimination – and both the platform and complementors can appeal to a trusted-third party, which may review these decisions. Public authorities step in only to initiate this process and to review its effectiveness. Similar mechanisms are already foreseen by the Platform-to-Business (P2B) Regulation and the Digital Services Act, but they are not yet closely tied to the interoperability provisions in the DMA.

In contrast to horizontal interoperability, vertical interoperability does not require a formal standardisation process. We propose that the **access provider has autonomy when designing the interface provided to complementors.** This leaves it with the necessary flexibility to meet business needs and to pursue innovation. However, licensed third-party complementors should be provided with the same level of integration as the affiliated complementor. **The role of regulator is to oversee compliance with the non-discrimination obligation and that the interfaces are provided with sufficient transparency and performance for complementors.** We also suggest that the regulator encourages the platform to employ open standards where possible in its interfaces. In case such standards do not yet exist, **regulators should initiate that standardisation bodies develop suitable standards**. Regulators may then consider imposing this standard to be used by the platform.

Finally, to preserve innovation incentives by the platform subjected to vertical interoperability, **the licensing regime may also involve a regulated access price**. Access pricing regimes must be devised with a clear objective in mind and depend strongly on the specifics of the case. Regulators face a difficult balancing act when choosing between higher mark-ups over the direct costs of providing access, to preserve innovation and investment incentives of the platform owner, and lower mark-ups to encourage competition and innovation by the complementors.

If done right, vertical interoperability has the potential to promote static and dynamic efficiency by promoting competition on the merits between integrated and non-integrated complementors and striking a balance between innovation incentives by the platform and the third-party complementors. In particular, it offers innovative complementors an entry point to an ecosystem stack that they are not able to replicate. **For efficient and innovative complementors, this can be a stepping stone, which enables niche entry and growth by new firms**. However, while we see promise in regulating vertical interoperability, the lessons from previous cases (e.g. the Microsoft case) and industries (e.g., telecommunications) have shown that **such a regime requires careful deliberation and likely years to be established**. The ultimate measuring rod for the success of a vertical interoperability regulation is whether such new complementors could establish themselves in the digital market, and have ventured into other parts of the digital value chain (ecosystem stack), eventually not requiring vertical access to the regulated bottleneck anymore. In this sense, **a successful vertical interoperability regulation is transient**, as the formerly regulated digital bottlenecks no longer have the ability to act as gatekeepers – at which point vertical interoperability obligations should be lifted. Ironically, former gatekeepers will then usually have an incentive to maintain vertical interoperability nevertheless, as they will compete with new platforms for acquiring complementors. At the same time, digital bottlenecks may occur elsewhere that become susceptible to being regulated for vertical interoperability.

By contrast, **horizontal interoperability is never transient**. Once established, it needs to be maintained as otherwise network effects would let the market tip again to a single provider very quickly.

The Commissions' proposal for the DMA foresees only vertical interoperability obligations for gatekeepers, albeit only for ancillary services, app stores, and side-loading of apps. However, the European Parliament's amendments also include horizontal interoperability obligations for messenger services. In light of our findings, **we suggest not including horizontal interoperability obligations in the DMA.** Moreover, to make the DMA more future proof, we suggest that **the application scope for vertical interoperability obligations should be widened also beyond**

'ancillary services' and the specific case of vertical interoperability for apps and app stores. As we have laid out in Section 4, vertical interoperability cannot apply immediately, however, and must be specified with respect to technical and economic access conditions on a case-by-case basis, because it involves complex trade-offs. From experience with access regulation, the implementation of vertical interoperability, i.e., the necessary case-by-case deliberations on trade-offs (e.g., with respect to access pricing), will likely take years and not months in the more complex setting of digital markets. Hence, while the DMA may provide the legal basis for such interventions in digital markets, the implementation of vertical integration provisions is likely to take much longer than the six months that the DMA currently foresees for its Article 6 provisions.

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