

OPEN SERVICES CLOUD OSC

UNLOCK CLOUD
INTEROPERABILITY
TO FOSTER THE EU
DIGITAL MARKET

APRIL 2023



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FOREWORD



Cloud services is a key market for the competitiveness and digital sovereignty of the European Union. The European Commission, the European cloud ecosystem, and to some extent the European citizens have been calling for more interoperability for a long time, and new regulations like the Data Act and the Digital Markets Act will enforce interoperability and data portability for services provided in Europe.

At the Eclipse Foundation, we commissioned this report from DECISION to explore the market and regulations and to evaluate the impact of a new open source initiative for more openness in the cloud: the Open Services Cloud (OSC) initiative.

Thanks to a thorough market analysis, and after interviewing 15 stakeholders, the study shows the current market trends as well as the challenges faced by the cloud ecosystem: consumer lock-in, vendor lock-out, and unbalanced competition. It introduces the OSC initiative and its goal to address these challenges by contributing to an open source solution for interoperability and to foster EU Digital Sovereignty.

We strongly believe that the OSC initiative has the potential to help grow the cloud market significantly, and help European businesses to unlock the potential of cloud computing, enabling them to deploy new applications and services faster, and more efficiently.

Next to the technical and business impact of OSC, the other important aspect tackled by the study is how OSC can help build a solution to comply with the needs for interoperability introduced by the Data Act and the Digital Market Act. Such an open source platform is a powerful enabler for large organisations, as well as small and medium enterprises.

To conclude, this report is important to show the value of an approach like the OSC initiative and its potential to address both technical and legal challenges in a collaborative way. As any project of the Eclipse Foundation, the Open Services Cloud initiative is open to all, and we hope that this report will stimulate your curiosity and push you to engage with OSC.

GAËL BLONDELLE
Chief Membership Officer



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INTRODUCTION

The European Union decided to secure its digital sovereignty with a common vision for 2030, based especially on a European Cloud, a secure digital identity for all, and vastly improved data, supercomputer and connectivity infrastructures¹.

In this context the **Cloud services appear as a key market for the competitiveness and digital sovereignty of the EU**. Accounting for already 203 B€ in the EU in 2022², this market benefits from a forecasted annual growth of 14% over the coming decade and acts as a key enabler for the majority of the 14 strategic industrial ecosystems defined in the EU industrial strategy.

However **some issues are posed by the oligopolistic situation on cloud computing services**.

↳ Firstly the costs of cloud infrastructure services have been rising rapidly in recent years, harming both the competitiveness of European industry and the purchasing power of European end customers in a context of recent inflation.

↳ Then and in spite of the historical strengths of **the EU in application software, the EU ecosystem of cloud services providers³ remains small and limited** in its ability to grow. The EU players only own 13% market shares on the EU cloud services market, a share that tends to decrease over the years.

This situation is largely due to the lack of cloud data interoperability and portability, inducing a distortion of competition in three ways:

1. **Consumer lock-in**. Impossibility for software vendors or client companies engaged with a Cloud Service Provider (CSP) to replace their cloud services suppliers (IaaS-PaaS-SaaS) by other ones.

^{1/} State of the Union Address in September 2020 by President von der Leyen.

^{2/} Including SaaS, PaaS, IaaS, associated IT services and internalized costs of cloud client companies.

^{3/} Providers of SaaS, PaaS and IaaS.

2. **Vendor lock-out**. Impossibility for cloud service providers (IaaS-PaaS-SaaS) to propose their services to software vendors or client companies already engaged with a CSP (likely an hyperscaler).

3. **Unfair competition**. Possibility for a dominant CSP developing a software solution to hamper the quality of its competitors that are using its public cloud service platform (unjustified and discriminatory bundling, tying, self-preferencing pricing, etc.).

Such a situation is a threat for the digital sovereignty of the EU as the entire European economy is facing a risk of dependence on foreign cloud providers and can jeopardize the security and privacy of European data.

There is therefore a need for cloud interoperability. The lack of interoperability and standardization among cloud providers create hindrances for European businesses and governments to switch between cloud providers and ensure data portability. This oligopolistic situation and its consequences would be solved through the building of a legal and technical framework enabling real⁴ Cloud interoperability.

Building cloud interoperability through large scale adoption of Open Services Cloud» appears in the top priorities of the 10 industrial stakeholders (CEO/CTO) interviewed for the purpose of this study along with « foster open-source approaches for software development » and « cybersecurity ».

Furthermore, building cloud interoperability through large scale adoption of Open Services Cloud can only happen through an EU regulation according to a majority of the 15 private and public stakeholders consulted.

The Digital Market Act (DMA) and the Data Act. An EU legal framework to foster cloud interoperability. These current EU regulations are the opportunity to build such a framework as it already contains regulatory obligations related to cloud interoperability and data portability. This study proposes additional amendments that are required from a technical and economic point of view to reach real cloud interoperability and data portability.

The results of this study are of four types:

1. A presentation of the concept of **Open Services Cloud (OSC)** as a technical solution removing some of the cloud barriers in order to simplify and foster services interoperability and portability in the cloud.

2. **An economic modeling approach**. Through a modeling approach, this study assesses the potential of OSC, in case of wide adoption at the EU level following an EU regulation, to foster the growth and lower the prices of the EU Cloud Services market over the 2025-2030 period.

^{4/} Initiatives that pushed towards more interoperability and portability of cloud data and services already exist. However, for several reasons none of them succeeded in creating real / full interoperability or portability. Open Services Cloud (OSC), as presented in this report, ambition to reach this "real / full" interoperability and portability of cloud data and services through the implementation of a subset of APIs, defined by the open-source community, on top of the existing Cloud Services Providers (CSP) backend APIs. This in order to grant OSC deeper control on IaaS-PaaS foundational layers and allow it to build the integration and interoperability capabilities between the different clouds.



The potential economic impact of OSC is twofold:

↳ **Decreasing the prices associated with cloud services for EU consumers.** Through the end of the oligopolistic situation leading to an increased competition. But also, through the economies of scale associated with several technical aspects of cloud (Cloud Centers of Excellence, finOps, cloud migration), thanks to the building of the OSC solution in open-source compared with the existing technical solutions.

↳ **Fostering the growth of the EU digital and cloud ecosystems.** On the one hand, by reducing barriers to entry and reliance on a few cloud giants, OSC can foster the shift from on-premise software to cloud services, therefore driving the growth of cloud services in the EU. On the other hand, by enabling self-operated managed services, OSC should foster innovation and enable new collaboration between players of the cloud value chain (true native cloud services, true industry specific cloud services...). These combined effects are expected to preserve the market shares of the major EU software vendors and foster the emergence of a strong European ecosystem of both SMEs in the cloud services market and IaaS/PaaS providers. These effects should lead to greater adoption of cloud services, leading to greater digitization, thus economies of scale and further cost reduction, in a virtuous circle.

3. **A regulatory analysis.** This study presents the current EU regulatory framework associated with cloud interoperability and data portability, including the last amendments of the EU Data Act. The study shows that the economic impacts of OSC can only be reached in the event the EU Data Act enables and imposes the opening to the public of the necessary backend API of CSP related to IaaS-PaaS foundational layers, opening the door for large adoption at the EU level.

4. An analysis of the **opportunities associated with existing working groups on OSC within the Eclipse Foundation.** The study presents the existing opportunities for companies wanting to join forces in OSC and the synergies between OSC and other cloud-related initiatives in the EU.



I. CLOUD SERVICES: A GROWING AND ENABLING MARKET

The figure below presents **the EU enterprise software value chain in 2022, and the position of the EU players across this value chain.**

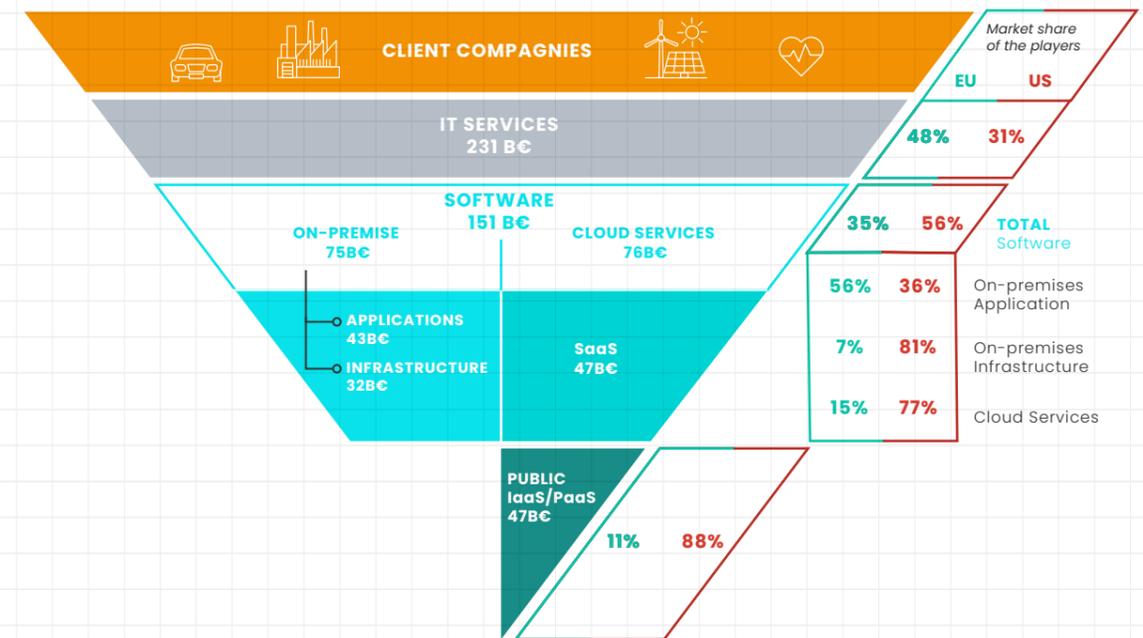
This inverted pyramid enlightens the crucial role played by the enterprise software market for the EU economy:

- Whether directly with an EU market of software and related IT services totaling 382 B€ in 2022, a size comparable to EU industries such as Automotive or Aerospace/Defense/Security.
- Or indirectly, as software plays the role of key enabler in most of the 14 strategic industrial ecosystems defined by the European Commission in 2021.

The EU software ecosystem benefits from historical strengths in IT services, with 48% of market shares in the EU market in 2022, and on-premises application software, with 56% of market shares in 2022.

This figure also enlightens the strengths of the US ecosystem in the EU market, with market shares ranging from 31% in IT services with players such as Accenture, IBM, etc. to 88% in Public IaaS/PaaS with the three hyperscalers Amazon, Microsoft and Google.

The EU software value-chain and competitive position of EU players in 2022



Source : DECISION Etudes & Conseil

Throughout this value chain, the different actors interact ⁴:

- Software vendors:** Also named Independent Software Vendors (ISV), or software editors, this corresponds to any kind of company whose business model consists in developing and selling software. They correspond to the blue part of the value-chain. They can develop “on-premises software”, meaning not relying on any cloud to perform (left of the value-chain), or develop “cloud services” (right of the value-chain). In this case, they are considered as Cloud Service Providers (CSP).
- Cloud Service Providers (CSP):** Correspond to any player of the “cloud service” value chain, offering IaaS, PaaS and / or SaaS solutions. Some CSP, such as hyperscalers, provide integrated solutions from IaaS to SaaS. On the other hand, independent SaaS vendors, as many EU SME, have limited integration (different billing, no consistent logging/monitoring, etc.) and are isolated from user infrastructures, reliant on IaaS/PaaS providers, such as hyperscalers.
- IaaS / PaaS providers:** Players providing the cloud Infrastructures and Platforms (IaaS-PaaS). This market is very concentrated and the three major hyperscalers Amazon, Microsoft and Google, own nearly 80% of the EU market.
- Software client companies:** At the top of the value-chain, these are the end-users of software, coming from most of today’s economic

^{4/} In the remainder of this report, these terminologies will be systematically used.



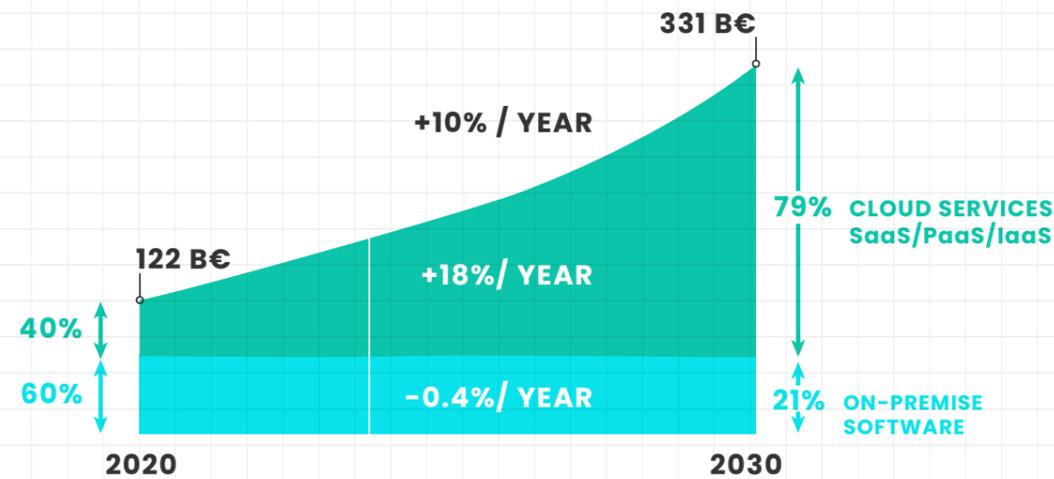
sectors. They use a mix of CSP managed services and on-premises software vendor additional services to build their own solution.

IT Services providers: Corresponding to the “Service” part of this value chain (from the cyan color in the pyramid), IT services providers such as CapGemini make the links between software vendors solutions and client companies ⁵.

The major trend associated with the enterprise software market is the shift from on-premises software to cloud-based software business model. This change started about a decade ago, so 2022 was the first year in which the market value of cloud services in the EU exceeded that of on-premises software.

The figure below illustrates this shift that drives the strong growth of the EU enterprise software market (10% per year). As this trend continues, cloud services should reach almost 80% of the market by 2030, driven by the benefits of SaaS compared to on-premises solutions including scalability, cost-effectiveness, and increased flexibility.

The rise of the software market, driven by cloud services.



Source : DECISION Etudes & Conseil, SITSI

This shift from on-premises software to cloud services puts the positions of the European players at risk. Indeed, the EU ecosystem is dependent on non-European players in the downstream of the cloud services value-chain with 88% of domination stemming from US players. A situation which corresponds to what the European Commission defines as a “strategic dependency” ⁶.

^{5/} They are not at the center of this study that focuses on software and more precisely cloud services.

The Top EU on-premises applications software editors such as SAP, Dassault Systèmes, Siemens Software, Zucchetti, CGM (CompuGroup Medical), Assec or Ericsson are all turning into SaaS providers, therefore increasingly relying on hyperscalers ⁷.

The major hyperscalers dominate the cloud market with an impressive strike force in terms of R&D as well as marketing and sales and will naturally benefit from the shift of the on-premises software towards the cloud services raising a significant risk of dependence for European but also for the entire European economy (see for instance the place that hyperscalers take with car manufacturers in the ecosystem related to autonomous driving).

Consequently, without specific EU regulation enabling real cloud data and services interoperability, it is expected that the overall market share of the EU players on the EU enterprise software market would decrease from 27% in 2020 to 16%, while the market share of the US players should rise from 65% in 2020 to 78% in 2030 ⁸.

^{6/} Based on 3 pillars : 1) Absence of strategic capacities allowing to produce, provide or rely on strategic goods, services, etc. leading to a limited capacity for internal production to substitute exports if needed. 2) Dependency / reliance on a limited number of countries for the supply of goods, services, data, infrastructures, skills, and technologies. 3) Strategic issue: It must be demonstrated that this dependency is of strategic importance for the current and future markets / sovereignty / interests of the EU.

^{7/} They have two possibilities. Either relying on the IaaS-PaaS solutions of hyperscalers, or building their own IaaS/PaaS platforms (SAP, Orange Business, Deutsche Telekom, Dassault Systèmes, etc.). However, it requires significant efforts that many SME cannot afford and once created, their IaaS/PaaS solutions will face the consumer lock-in / vendor-lock-out situation to the benefit of hyperscalers as described in the following chapters of this study.

^{8/} Source: DECISION Etudes & Conseil, SITSI, April 2023.



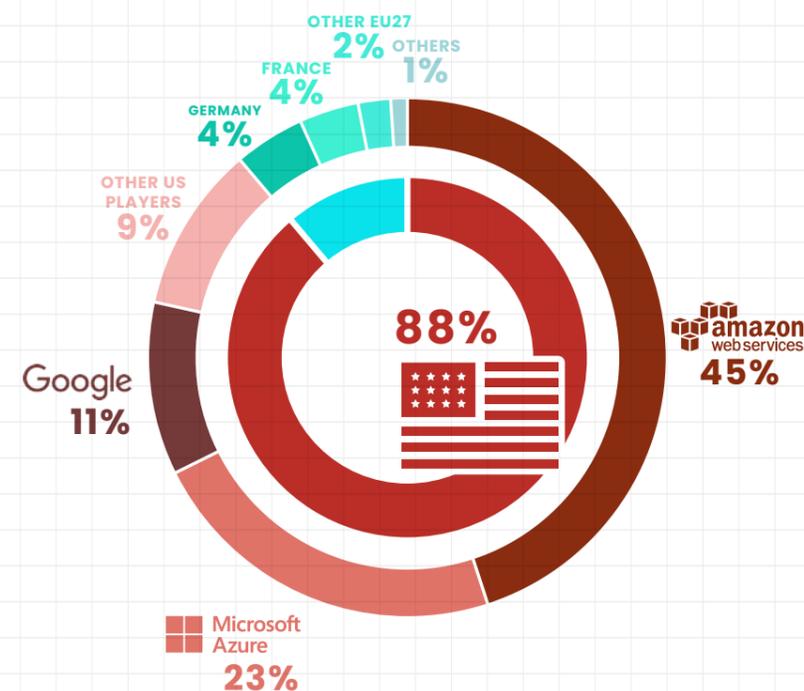
II. ISSUES POSED BY THE LACK OF DATA INTEROPERABILITY ON CLOUD SERVICES

As of today, the cloud hosting market segment (IaaS-PaaS) is dominated by hyperscalers who have several competitive advantages:

1. Market shares: Amazon, Microsoft and Google are the three hyperscalers in an oligopolistic position in the IaaS-PaaS market, especially at the EU level with 79% of market shares in public IaaS-PaaS (cf. figure below).

The leader Amazon (AWS) cornered 45% of the total EU market in 2022 and all the US players gathered 88% of the EU market in 2022. A growing EU's strategic dependency towards the USA will continue to rise since US players market shares should reach 94% in 2030 according to estimates.

Market shares in the European Public IaaS & PaaS market in 2022



Source : DECISION Etudes & Conseil

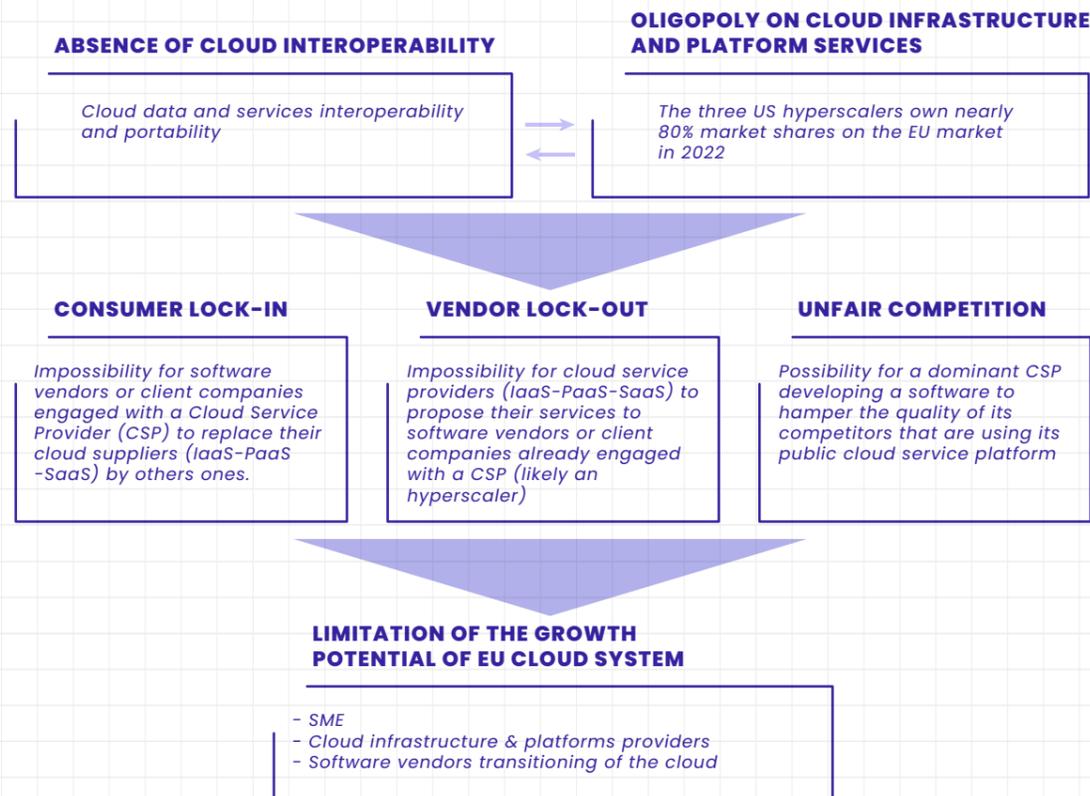
2. Funding Capabilities: Market shares are sustained via broad investment capabilities that hyperscalers benefit from. It increases their dominant position thanks to multiple artifacts that they have put in place:

- The three US hyperscalers have partially locked-down competition due to huge marketing capabilities and the set-up of a widespread sphere of influence across all types of organizations.

- The designed business models encourage a low entry cost to their services thanks to free credits that many companies leverage in their early development stages, knowing that once the companies start scaling up their business, it will no longer be easy for them to relocate their workloads.

- They have built wide training and certification plans that are affordable and regularly proposed for free in order to ensure customers leverage as much as they can their proprietary technical stack, increasing the overall lock-in of the services.

3. Innovation Capabilities: As a consequence of the large funding capabilities, hyperscalers have sustained investments in technologies, either by acquiring tech companies, or building on top of popular widespread open-source projects or by developing specific technical stacks or cross solution integrations. This makes them much more attractive for companies relying on technology innovation to develop their business. As a result, as soon as a business requires large scale data analytics, machine learning or artificial intelligence, it will find broad capabilities within hyperscalers services offerings that make their offers more attractive.



An oligopolistic situation enabled by the lack of cloud interoperability:

The current technology stack of hyperscalers is designed around tailor-made building blocks which ensure consistency and interoperability of the IaaS & PaaS layers that the hyperscalers serve to their customers. However, the underlying backend services of this proprietary stack are not available to third parties⁹. As a result, a software vendor that publishes solutions in hyperscalers' marketplaces provides solutions that cannot leverage the core components of each public cloud and only rely on the mainstream components that are available to anyone.

This means a third-party solution published on a given cloud has very limited integration capabilities with the underlying technology of that cloud platform creating distortion to competition that are described below:

A/ Consumer lock-in. Impossibility for software vendors or client companies engaged with a Cloud Service Provider (CSP) to replace their cloud services suppliers (IaaS-PaaS-SaaS) by other ones.

B/ Vendor lock-out. Impossibility for cloud service providers (IaaS-PaaS-SaaS) to propose their services to software vendors or client companies already engaged with a CSP (likely an hyperscaler).

C/ Unfair competition. Possibility for a dominant CSP developing a software solution to hamper the quality of its competitors that are using its public cloud service platform (unjustified and discriminatory bundling, tying, self-preferencing pricing, etc.).

^{9/} Even when these software services are based on Open-Source platforms, these services are only accessible on the application layer and APIs. Back end APIs remain private to the Cloud Service Provider, limiting capability for other providers to integrate with these solutions. As a result, only the Cloud Service Provider can enrich his ecosystem with native vertical service offerings.

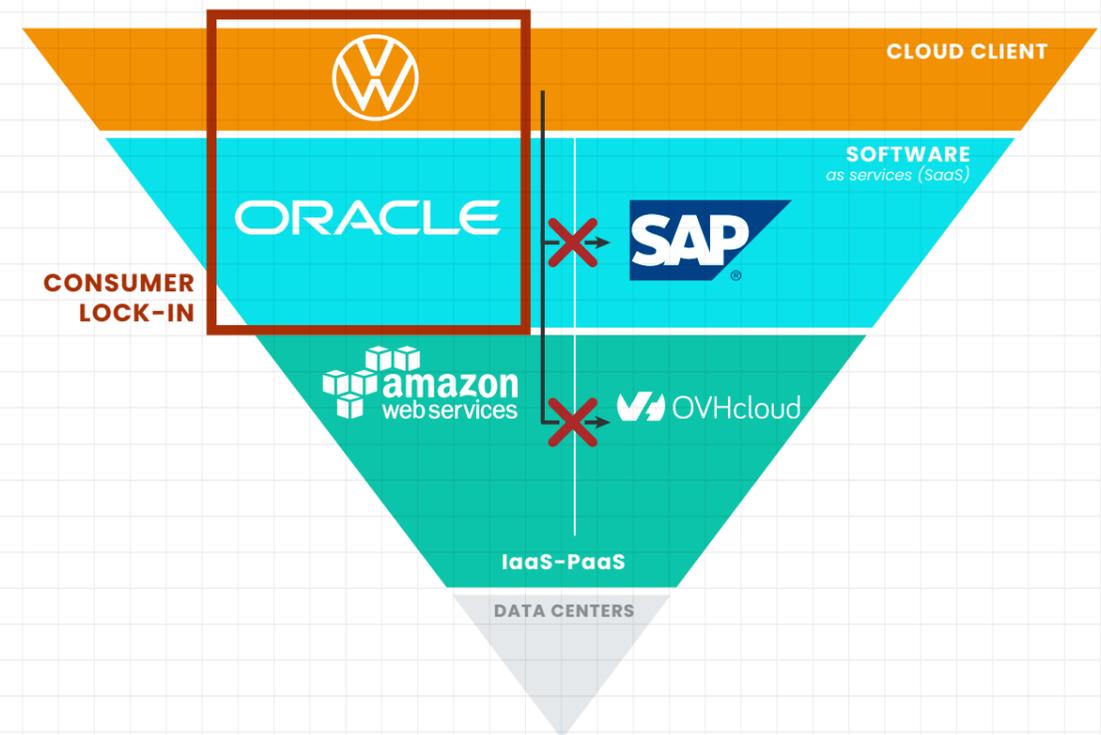
A. CLOUD CONSUMER LOCK-IN AND ITS CONSEQUENCES

Today, all consumers, whether they are Cloud Service Providers (CSP), software vendors, or even end consumers notice the friction created by the cloud lock-in effect.

Cloud lock-in describes the situation of dependency of cloud users (clients, software developers) towards a particular cloud service provider's infrastructure, services, and tools to the extent that it becomes difficult or expensive to switch to a different provider or to an on-premises solution. This can happen when a company invests heavily in a specific cloud provider's ecosystem and tools, which makes it challenging to migrate to another provider due to the cost and complexity involved in rewriting or reconfiguring the applications to fit into the new provider's infrastructure.

Theoretical illustration of the consumer lock-in situation enabled by the lack of cloud interoperability coupled with the oligopolistic situation in cloud services

THE EU CLOUD SERVICES VALUE CHAINS IN 2022



Source : DECISION Etudes & Conseil



Indeed, the ecosystem of components in the foundational layer¹⁰ of public clouds (network, compute, storage) have a very close functional scope but a varying technical stack which is due to the vertical solution development each public cloud provider has done.

The impact of cloud lock-in varies for different stakeholders, including software vendors, CSP and end consumers.

For software vendors:

Consumer lock-in places them at risk of being banned from their cloud platform which constitutes an entry barrier on the cloud services market. An example of how consumer lock-in can be a contentious issue in the cloud computing industry, and how it can lead to legal disputes between companies is the dispute between Oracle and Rimini Street that ended in 2015¹¹.

Consumer lock-in also forces software vendors to take least-common-denominator approaches for their multi-cloud strategies. Multi-cloud strategy is an approach that involves using multiple cloud service providers to meet an organization's computing needs. However, managing multiple cloud providers can be challenging, particularly when it comes to deploying and managing applications across different cloud platforms. In a «least-common-denominator» approach, the organization identifies the minimum set of features that are available across all the cloud providers they use, and builds their applications using those features. This ensures that the applications can run on any of the cloud platforms the organization uses without requiring modifications to the application code. This type of strategy can help organizations manage the complexity of multi-cloud environments and avoid vendor lock-in while ensuring seamless application deployment and management.

For CSP, cloud lock-in is an opportunity for large CSP (hyperscalers) to increase revenue by retaining customers who are dependent on their services. However, it can also lead to complacency and a lack of innovation, as hyperscalers may not feel the need to improve their services or lower their prices if customers are locked in. In addition, the growth prospects of smaller CSPs are highly restrained.

For end consumers, cloud lock-in can limit their flexibility and control over their data and applications. They may find it challenging to migrate their data and applications to a different provider, which can limit their ability to innovate by taking advantage of new features, services, or pricing models.

¹⁰/ Cloud Services Providers (CSP) backend API related to IaaS-PaaS solutions.

¹¹/In this case, Oracle accused Rimini Street, a provider of third-party maintenance and support for enterprise software, of engaging in unfair competition and infringing on Oracle's copyrights. Oracle claimed that Rimini Street was engaging in consumer lock-in by encouraging Oracle customers to switch to their services while making it difficult for customers to switch back to Oracle's services. Oracle also claimed that Rimini Street was illegally downloading Oracle's software updates and patches in order to provide support to their customers. In 2015 Oracle was awarded \$50 million in damages which were reduced to \$28.5 million in 2018.

They may also face vendor lock-in costs such as data conversion costs, integration costs, and retraining costs. Additionally, cloud lock-in limits innovation which should benefit to the end consumer.

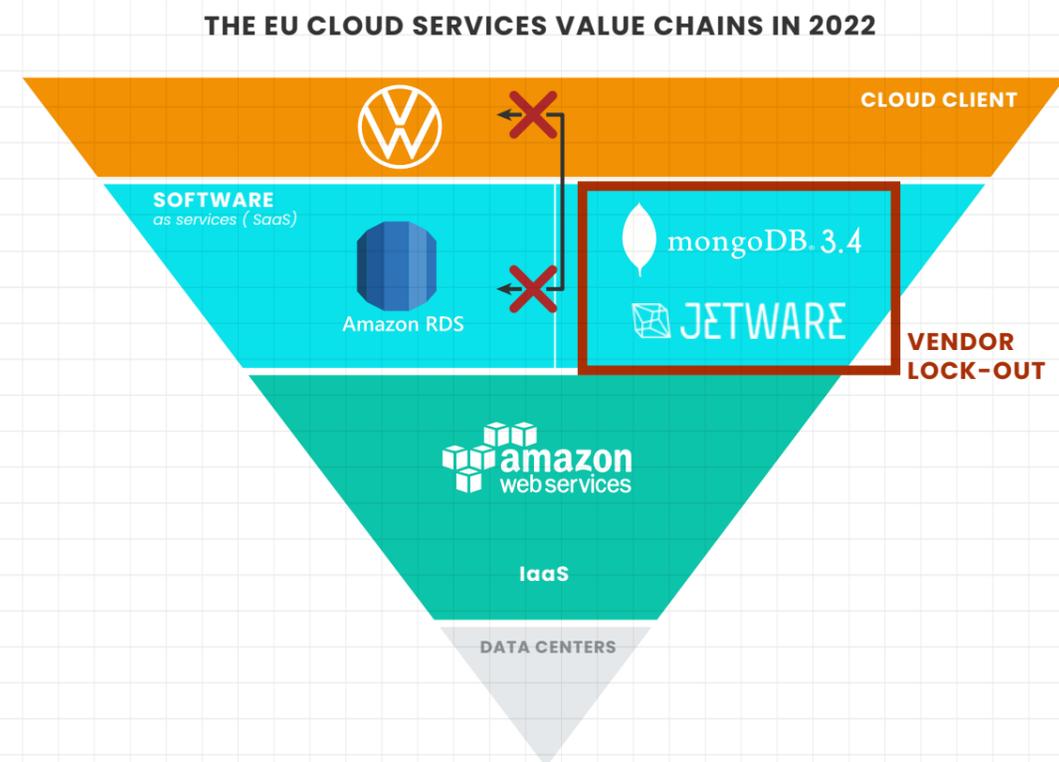
In conclusion, while cloud lock-in creates revenue and stability for providers, it limits competition and innovation, reducing flexibility for end consumers, and increasing switching costs.

B. CLOUD VENDOR LOCK-OUT AND THE INCURRED LIMITATIONS

The vendor lock-out situation corresponds to the impossibility for CSPs (IaaS-PaaS-SaaS) to propose their services to software vendors or client companies already engaged with other CSPs providing IaaS or PaaS due to the purposely created lack of cloud interoperability.

The figure below illustrates the vendor lock-out situation in the use-case of database services. If a SaaS vendor such as Jetware (Italian provider of a MongoDB database service solution) wants to offer its solutions to a client engaged with AWS and its RDS solution, AWS has the capability to simply prevent Jetware from accessing to AWS' IaaS-PaaS solutions and therefore to access to the client.

Theoretical illustration of the vendor lock-out situation enabled by the lack of cloud interoperability coupled with the oligopolistic situation in cloud services



Source : DECISION Etudes & Conseil



When designing a solution or service on a given cloud, software vendors wanting to provide a PaaS or SaaS offering perform an integration of this offer with components that the CSP has made available to them. These allow standard network, compute, and storage components to be combined with software to build a higher-level solution which they will be running for their customers.

By being restricted to consume these components, software vendors in PaaS or SaaS do not have access to all the backend resources that support the publicly available services of the cloud. This comes with multiple consequences:

- ↳ Their integration is limited to both the publicly exposed cloud solutions (general network, compute, and storage resources) in addition to their other published solutions on which they keep control.
- ↳ As a result, this deprives him from native integration with the other managed services either provided by the CSP himself, as PaaS services or by a third-party CSP.

In competition law, such practice can constitute an abuse of dominance under Article 102 TFEU, under the theory of harm named “essential facilities doctrine”¹². 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.

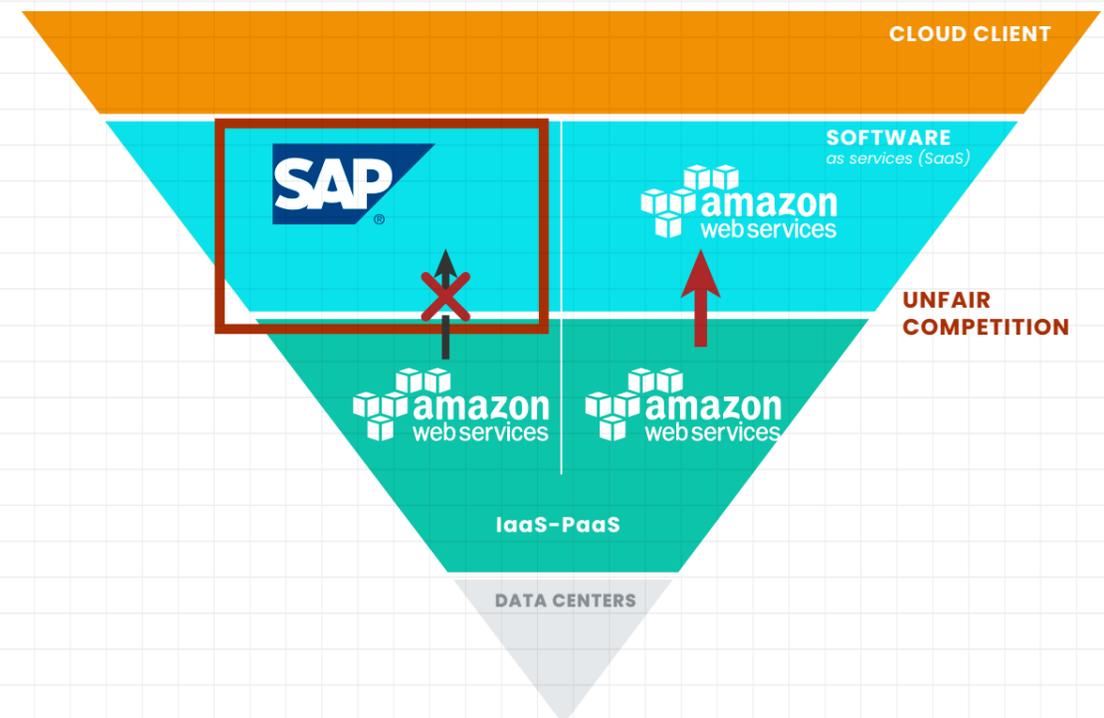
C. UNFAIR COMPETITION AND ITS CONSEQUENCES

The next figure illustrates the situation of unfair competition with a theoretical example involving SAP and Amazon. Due to the consumer lock-in and vendor lock-out situations, if an hyperscaler wants to develop a SaaS solution competing with one or several of its clients as dominant IaaS-PaaS provider, it can use its position to hamper the quality of the offer of its competitors using several means: unjustified and discriminatory bundling, tying, self-preferencing pricing, etc.

This unfair competition can take the form of delivering low quality IaaS-PaaS solutions regarding its SaaS customers that are also its competitors. On the contrary, this can take the form of granting a competitor access to its IaaS-PaaS platform, but at non-justified high costs acting as a form of rent or tax to enter the market. This can even take the form of acquiring shares of the company to grant access to a leading IaaS-PaaS platform.

Theoretical illustration of the unfair competition enabled by the lack of cloud interoperability coupled with the oligopolistic situation in cloud services

THE EU CLOUD SERVICES VALUE CHAINS IN 2022



Source : DECISION Etudes & Conseil

In late 2022, the CISPE (Cloud Infrastructure Services Providers in Europe), a professional association that brings together several European cloud companies, urged the European Commission to quickly address hyperscalers practices, deemed unfair, in the cloud market¹³: “Anti-competitive practices including unjustified and discriminatory bundling, tying, self-preferencing pricing and technical and economic lock-in, continue to be used by dominant software companies to restrict the choice of European companies as they move to the cloud. [...] If allowed to continue, these abuses will inevitably lead to the demise of a European cloud infrastructure sector. European businesses and public sector organisations will be permanently and irrevocably deprived of any option to build, operate or support cloud services using the IT service provider of their choice.”

Two members of the CISPE, OVHcloud and Aruba, have already filed a complaint against Microsoft’s unfair preferencing of its own cloud infrastructure through abuse of software licensing terms.

^{12/} Report “Interoperability in Digital Markets”, Centre on Regulation in Europe (CERRE), March 2022.

^{13/} Executive Summary of CISPE Complaint against Microsoft, Nov 9, 2022 | Complaints.



Illegal tying was for example at stake in the 2007 Microsoft case ¹⁴. Illegal tying corresponds to the situation where 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. This case 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. 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.”

Competition law interventions can be targeted at specific firms in defined markets, for a limited time. However, when it comes to the current status of the cloud market, the situation of unfair competition – enabled by consumer lock-in and vendor lock-out – can be considered as systemic, raising the necessity for:

- ↳ A regulation mandating and enabling cloud interoperability and portability.
- ↳ From the technical and economic point of view, cloud interoperability and portability can only be reached through a vendor neutral software solution built at the ecosystem level, likely in Open-Source.

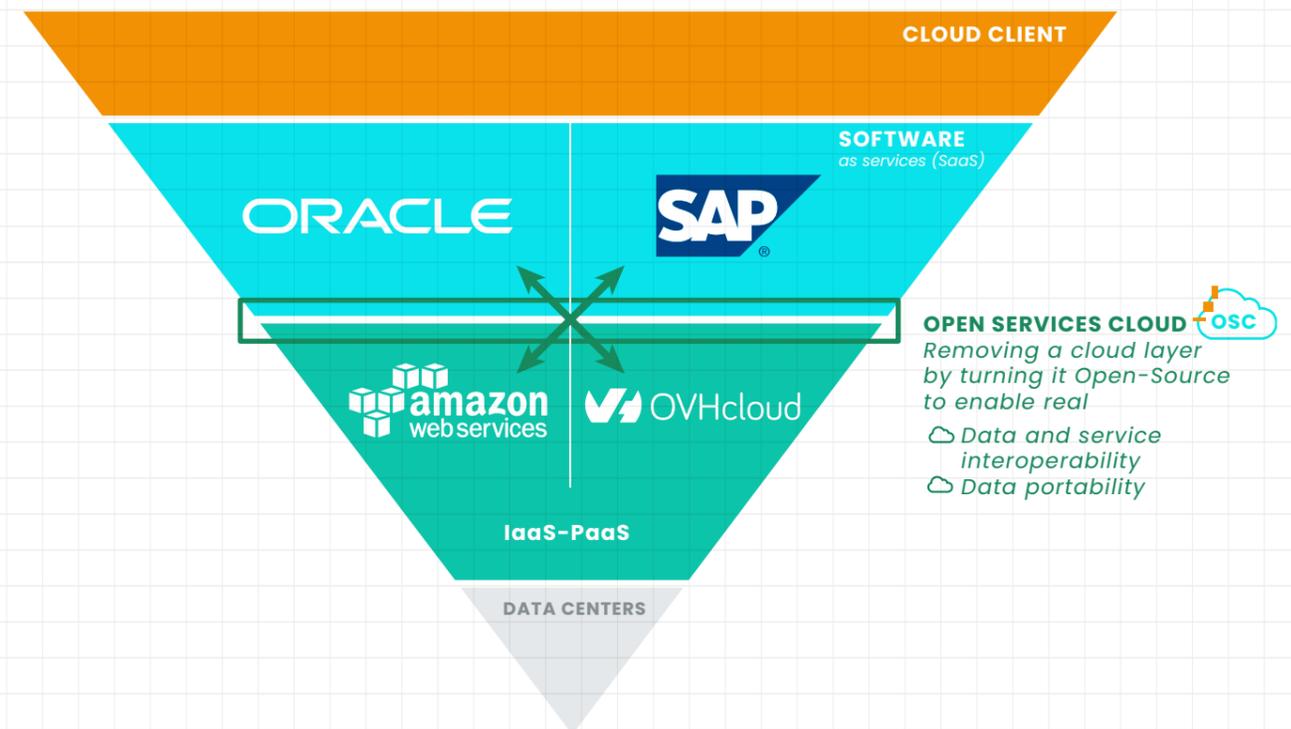
III. THE PROMISE OF OPEN SERVICES CLOUD: BUILDING CLOUD INTEROPERABILITY

A. THE AMBITION OF OPEN SERVICES CLOUD

Open Services Cloud (OSC) concept aims at providing an integrated open-source framework and solution within the existing cloud provider solutions that allows for services and data interoperability in addition to services portability across the different clouds ¹⁵.

Open Services Cloud (OSC) enabling real cloud interoperability

THE EU CLOUD SERVICES VALUE CHAINS IN 2022



Source : DECISION Etudes & Conseil

^{15/} Open Services Cloud is aimed at being vendor neutral, that is an Open Service provided by an open-source ecosystem, rather than an open source software operated as proprietary services.

^{14/} Case T-201/04, Microsoft v Commission, EU:T:2007:289, para 19.



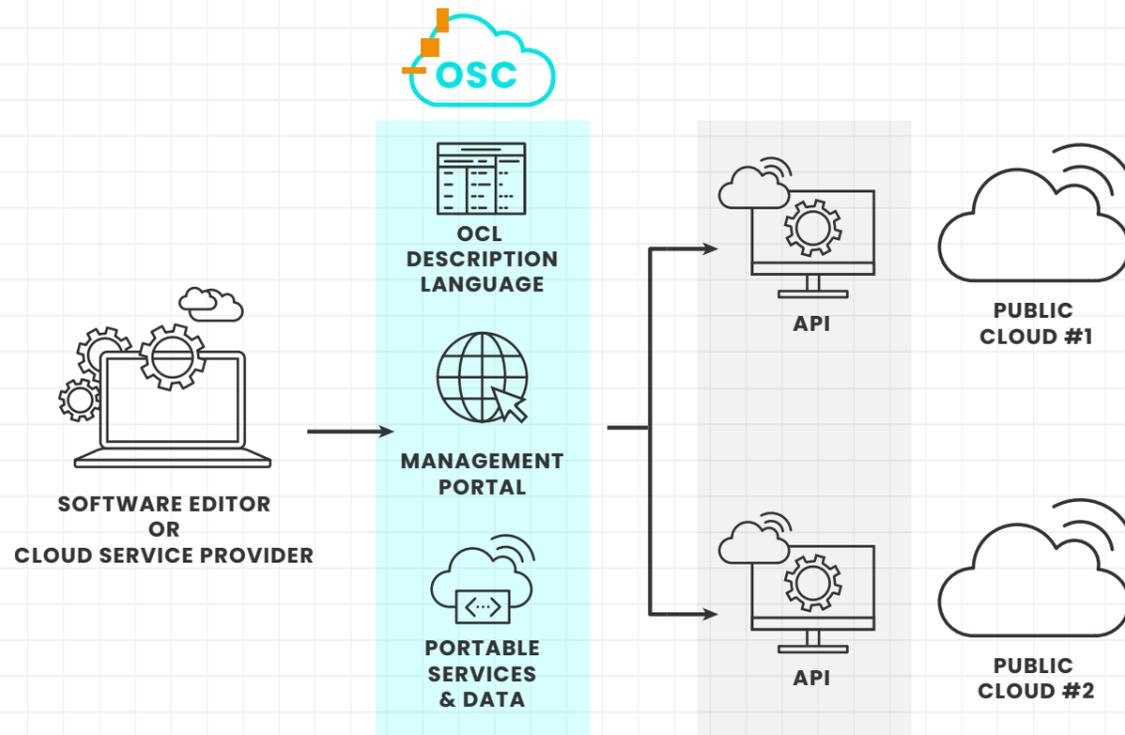
OSC enables mainly vertical interoperability across the Cloud value chain, meaning it allows services that are at different levels of the cloud value chain to work together ¹⁶.

OSC appears as **a solution to foster competition in the cloud computing market by:**

1. **Overcoming the consumer lock-in problem**, users will more easily adopt a transition to cloud.
2. **Overcoming the vendor lock-out problem**, software vendors will more easily enter the cloud service market (lowering of the barriers to entry), and freely grow their cloud services businesses.
3. **Lowering unfair competition** between independent software vendors and hyperscalers.

B. THE CONCEPT OF OPEN SERVICES CLOUD

Open Services Cloud (OSC) is an open-source framework that **aims at removing a layer** and simplifying the inherent complexity of the current cloud offerings by covering multiple aspects:



OCL description language: the framework comes with a cloud neutral semantic layer, Open services cloud Configuration Language (OCL) specific to the OSC which is a descriptive language that allows, via a standardized code structure, to describe services and workload deployments in the cloud. The OCL virtualizes the complexity of the cloud ecosystems, allowing simplified and streamlined deployments in multiple clouds.

Management portal: A central orchestration platform ensures consistency of the deployments across multiple clouds. It enables users to deploy and manage applications on various cloud platforms via a central console while also providing data management capabilities that enable users to store, manage, and process data using various data services removing cloud lock-in.

A Data Solution: This layer aims at removing adherence to proprietary services, meaning no more adherence with cloud storage proprietary stacks.

OSC relies on the Cloud Providers implementing an open source API semantic by deploying an open source or proprietary plugin on top of their backend APIs, to allow Open Services Cloud to consume and control deeper cloud layers such as identity & access management, billing, observability, etc. There is a real synergy with the EU Data Act where these normalized APIs could be governed under the European Standards for Open interoperability and portability specifications.

^{16/} As opposed to horizontal interoperability. See the report "Interoperability in Digital Markets", Centre on Regulation in Europe (CERRE), March 2022.



IV. OVERVIEW OF THE CURRENT EU REGULATION TOWARDS CLOUD INTEROPERABILITY

Over a decade ago, the European Commission identified a lack of interoperability as one of the most significant obstacles to digitalization^{17 18}, planning to examine measures to encourage significant market players to pursue interoperability-friendly business policies¹⁹. The Digital Agenda called for standard-setting by the industry, supported by public policy, to promote greater interoperability²⁰.

In 2020, the European Commission strategy for data²¹ identified the specific problem faced by European businesses *“with multi-cloud interoperability, in particular data portability”*. The same year, the Joint declaration by 27 EU Member States on building the next generation of cloud in Europe pledged for an effort at the EU level to work *“towards one set of joint technical solutions and policy norms in order to foster pan-European interoperable EU cloud services”*.

The Digital Market Act (DMA), which entered into force in November 2022, introduces first obligations for gatekeepers related to data access, data portability and interoperability.

Consequently, one of the focuses of the EU Data Act, proposed by the European Commission in early 2022²² and currently in trilogue discussion between the EU parliament, the EU Council and the European Commission, is to set new milestones to enable cloud data interoperability and portability.

^{17/} Report *“Interoperability in Digital Markets”*, Centre on Regulation in Europe (CERRE), March 2022.

^{18/} EU Commission, *A Digital Agenda for Europe*, Brussels, 19.5.2010, COM(2010)245.

^{19/} See EU Commission, *A Digital Agenda for Europe*, Brussels, 19.5.2010, COM(2010)245.

^{20/} Eu Commission, *A Digital Agenda for Europe*, para 15.

^{21/} *Communication from the Commission ‘A European strategy for data’*, COM/2020/66 final, 2020.

^{22/} *Proposal for a Regulation of the European Parliament and of the Council on harmonized rules on fair access to and use of data (Data Act)*. COM/2022/68 final.

A. CLOUD INTEROPERABILITY IN THE EU DATA ACT

Articles 23, 24, 25, 28 and 29 of the Data Act aim at removing a part of the friction when transitioning from one cloud to another (from one data-processing service to another) while introducing the core concept of cloud interoperability. This will be achieved by introducing new regulations related to termination of services, exit fees, securing data transfers and data and/or metadata retrieval and defining the governance to define and implement cloud interoperability.

Following the existing version of the EU Data Act, a part of the EU market could already onboard Open Services Cloud (OSC) for the multiple benefits it brings forth.

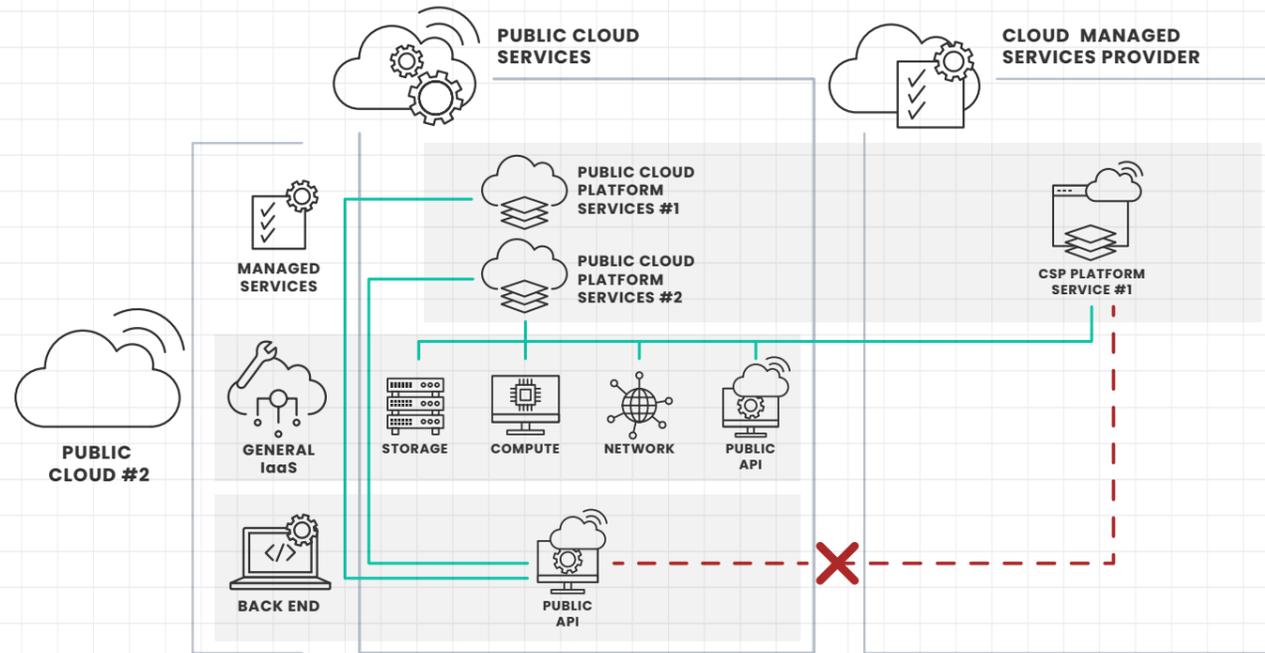
B. PROPOSAL FOR REACHING REAL CLOUD INTEROPERABILITY

However, should the Data Act be extended with further features, adoption of Open Services Cloud and real cloud interoperability could be drastically increased. In particular, **the wide adoption of OSC enabling real cloud data interoperability and portability requires the implementation of a subset of APIs, defined by the open source community, on top of the existing Cloud Services Providers (CSP) backend APIs**. This would grant OSC deeper control on IaaS-PaaS foundational layers and allow it to build the integration and interoperability capabilities between the different clouds. This set of APIs would cover the functional scope described below:

- ↳ Billing APIs to have precise, fine grained controls on the cloud financials and economic model.
- ↳ Identity & Access Management APIs.
- ↳ Integrated Logging APIs & console access.
- ↳ Observability APIs to better understand the back-end metering and performance.
- ↳ Data driver APIs to be able to structure and normalize the foundational data layer of the public Cloud.



The following section attempts to illustrate technically these requirements. In a given cloud, the technological stack of services is built in the following way:



- A set of services available to all end consumers and service providers, which are delivered via storage, compute and network services. This composes the IaaS layer of a Public CSP. On top of these are more advanced services in which elasticity and service automation are implemented, the PaaS layer. Both IaaS & PaaS layers of a given Public Cloud Service Provider can be controlled via a public API available to all.

- The cloud itself has a backend layer, which is the supporting foundation of the IaaS & PaaS services. This foundation relies on private APIs that only the Public CSP has control on.

The impacts of this technical layout are multiple:

- Only Public CSPs have the control on the backend level of their services. Some of these controls have direct effects on data portability or normalization of reversibility of the data.

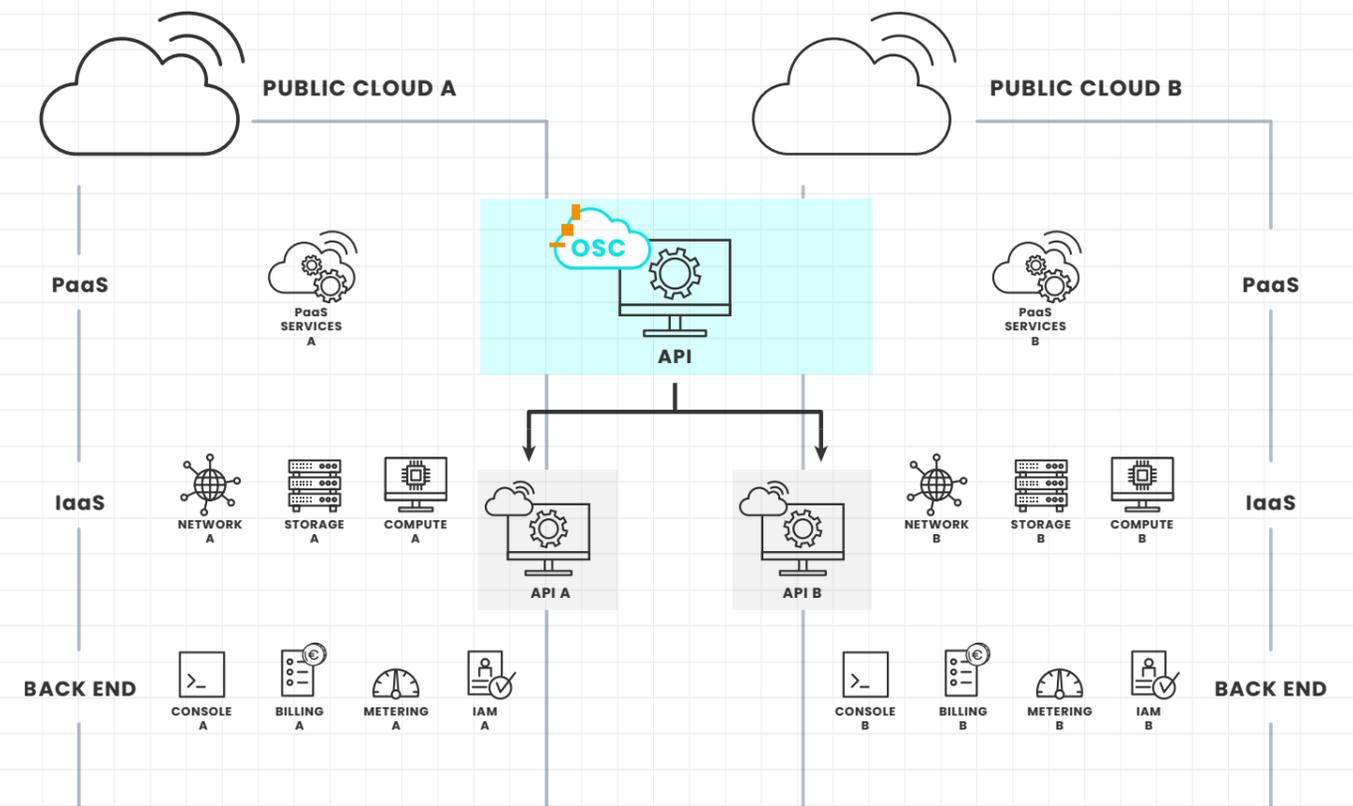
- Should Cloud Managed Services Providers publish services in a given marketplace, they will only have a very limited subset of APIs to define and operate their services. As a result, they will never have a rich ecosystem integration like the Public CSP has on their technical stack, reinforcing the unfair competition but also creating the vendor lock out effect.

This could be mitigated should a fraction of the backend APIs of the Public Clouds be available to provide deeper control over the services and their integration. This would for example cover, but not be limited to:

- Billing APIs to have precise, fine grained controls on the cloud financials and economic model.
- Identity & Access Management.
- Observability APIs to better understand the back end metering and performance.
- Data driver APIs to be able to structure and normalize the foundational data layer of the public Cloud.

Such opening to the public of API should not negatively affect the competition on the cloud services market as the API inducing market differentiation are linked with upstream part of the cloud value-chain (PaaS-SaaS). This is also the reason why maintaining standardized OS solutions regarding such backend API should not be detrimental to the innovation pace on cloud services.

With these issues solved, portability would be greatly simplified and interoperability would be supported by the deployment of new cloud neutral open source solutions, closing the gaps linked to cloud lock-in:





V. ECONOMIC IMPACT OF AN EU REGULATION ENABLING CLOUD INTEROPERABILITY BUILT IN OSC

This chapter uses an economic modeling approach to assess the impact of a large-scale introduction of a functional Open Services Cloud (OSC) solution enabling real cloud data interoperability and portability on the EU cloud services market over the 2025–2030 period. Such EU wide deployment of an OSC solution starting in 2025 would be driven by an EU regulation opening to the public of the necessary backend API of Cloud Services Providers (CSP) related to IaaS–PaaS foundational layers.

Key modeling hypotheses

- ↳ The EU Data Act enters into force in every EU Member States by early 2025.
- ↳ It enables and introduces obligations related to the opening to the public of the necessary backend API of Cloud Services Providers (CSP) related to IaaS–PaaS foundational layers.
- ↳ Such OSC is deployed at the EU level from early 2025.

Overview of foreseen total economic impact over the 2025–2030 period

1 PRICES OF CLOUD SERVICES



LOWER TECHNICAL COSTS TO RUN CLOUD PLATFORMS
Economies of scale on Multi-cloud management, finops Cloud migration at no (few) costs

COMPETITION ON THE CLOUD MARKET
Towards the end of the oligopolistic situation thanks to real cloud interoperability
Similar effects to regulations on telecoms services (Mobile Number Portability)...

2 GROWTH OF THE CLOUD SERVICES MARKET



SHIFT FROM ON-PREMISE SOFTWARE TO CLOUD SERVICES
OCS to accelerate the shift towards cloud services
Thanks to the end of vendor lock-out & unfair competition

ENABLE SELF-MANAGED CLOUD SERVICES
Enabled by the opening of low-level APIs of IaaS/PaaS providers
Increased a adoption of data analytics & AI solutions in cloud

3 SUPPORT THE EMERGENCE OF A STRONG EU CLOUD SERVICES ECOSYSTEM



ENTERPRISE SOFTWARE EU COMPANIES
Supporting EU software vendors in their shift towards the cloud and through self-managed services

CLOUD SERVICES SMES
Reducing barriers to entry on cloud services for SMES

Source : DECISION Etudes & Conseil



A. LOWERING PRICES OF CLOUD SERVICES

The impact on lower prices for cloud services should take place in two ways: on the one hand through the increase in competition induced by the real cloud interoperability and on the other hand through lower costs associated with cloud management.

1. The foreseen impact of more competition on the decrease in prices

To have a baseline scenario of the potential impact of cloud interoperability and portability enabled by OSC on the lowering of cloud services prices, a first methodological step is to analyze whether some comparable cases occurred in the past. The most similar situation found as a benchmark is the introduction of Mobile Number Portability (MNP) on the telecommunication market in the OECD countries that occurred since the late 1990s.

In 1998²³, the EC made it mandatory for all EU Member States to open to competition their national telecommunication market. The objective was to make it easier for users to switch between telecommunication services providers. In that case, the most important and most studied measure was Mobile Number Portability (MNP), which allowed clients to keep their number while switching telecommunication services providers. In a subscription-based market, switching between service providers can be costly for consumers. When switching costs are large, a market leader is likely to take advantage of them to retain a large market share and to increase its price. MNP was adopted by 64 countries between 1997 and 2011.

According to most of the impact assessment studies, **the introduction of MNP decreased the prices of phone communications between 4.15% to 13.5% and on average by 8.4% over a period of 5.5 years** thanks to both reduced porting time and porting charges.

Like for what happened with the introduction of Mobile Number Portability (MNP) on the EU telecoms service market, introducing cloud data and services portability through OSC should lead to an increasing competition on prices and therefore a lowering of prices on the cloud services market.

The telecommunications market before liberalization in Europe and the cloud services markets in Europe today share several characteristics, including digitization, scalability, global reach, interconnectivity, regulatory oversight, etc. They also have similarities in terms of regulatory frameworks / market monopolies and barriers of entry but also some differences in consumer preferences. According to economic theory, if two markets share similar characteristics we can assume that the opening of one market will have similar effects on prices as the opening of the other.

SOURCE	IMPACT	IMPACT BY YEAR	PERIOD DURATION	REGION
VIARD (2007)	-7.8%	-1.6%	5 YEARS	THE USA
GRZYBOWSKI (2008)	-8.2%	-2.1%	4 YEARS	THE EU
LYONS (2009)	-8.5%	-4.2%	2 YEARS	31 OECD MEMBERS
LYONS (2009)	-13.5%	-2.2%	6 YEARS	31 OECD MEMBERS
CHO & AL (2016)	-4.15%	-0.6%	7 YEARS	15 EU MEMBER STATES
AVERAGE	-8.4%	-1.5%	5.5 YEARS	

Therefore in this study, the baseline scenario in terms of price decrease induced by the cloud interoperability of **OSC will rely on the average price decrease of -1.5% per year** observed through the impacts of the MNP on the phone communication market in Europe.

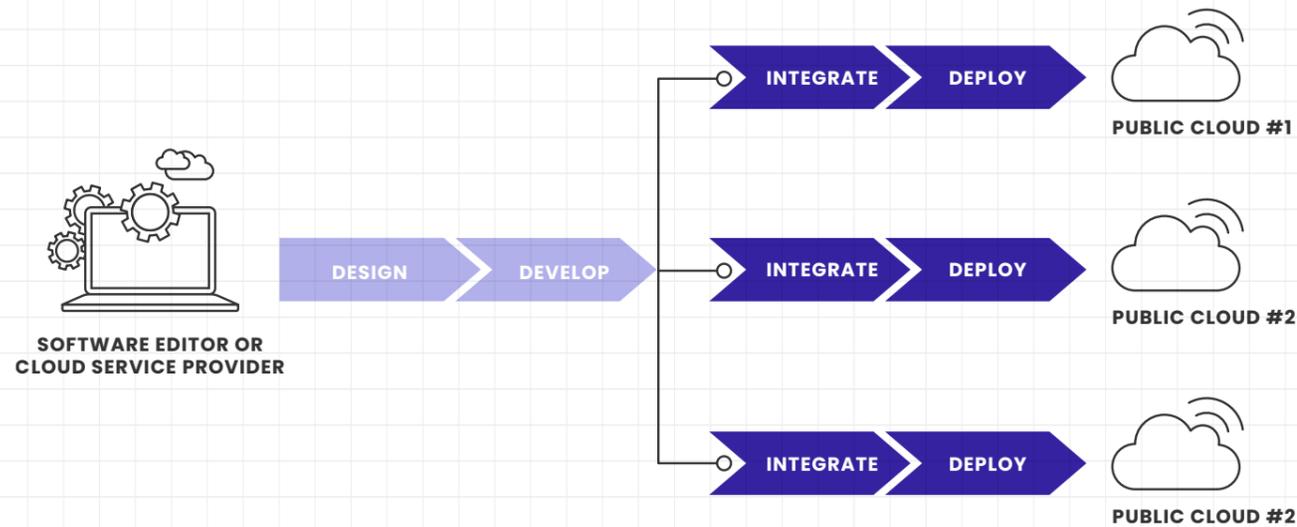
2. Open-Services Cloud: Lowering technical costs of running cloud platforms

The technical costs associated with Cloud services should be decrease in three ways through the large scale deployment of OSC:

A. Cloud Centers of Excellence (CCOE): Most cloud-deployed companies are running a CCOE. This core team is instrumental in articulating the company cloud strategy, defining cloud deployment standards such as the type of components that are allowed to be consumed in each cloud, the roadmap accountability to follow up on component lifecycles and the deployment and integration standards for those components. In most countries, the market for cloud subject matter experts that contribute to running a CCOE is very tense and the introduction of OSC would bring two benefits:

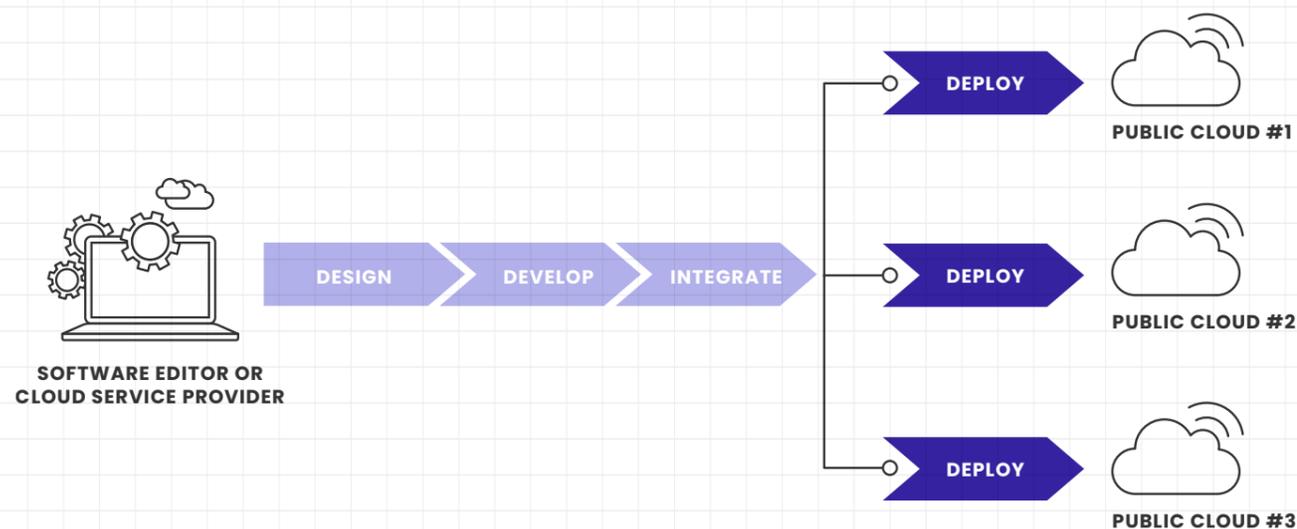
- ↳ It would lower the skills barriers to deploy and monitor services in the cloud, simplifying talent selection as the market could refocus to an Open Source standard rather than seek expertise amongst all the existing development factories (code repository, automated build and deployment pipeline solutions) and Infrastructure as Code solutions.
- ↳ It would reduce the integration effort of software in any cloud as the deployment descriptors would be made available by software vendors and / or managed Cloud Service Providers (CSP). Indeed, managed CSP and software vendors face a challenge of cloud integration.

²³/ Full liberalization was delayed in Portugal and Greece until 2000 and 2001, respectively. There were also delays of a few months in Ireland, Luxembourg and Spain.



In the current multi cloud context, software vendors today will only offer templated deployment capabilities on a limited number of clouds due to the high effort to deploy these. For the clouds they have selected, this also means high maintainability efforts to keep all the integration patterns of the software on the different clouds, translating into increased costs to maintain coherence of their services.

With the support of the OCL of OSC, software vendors will be able to define a unique deployment sequence and apply it to any cloud, opening both the opportunity to cover a broader market, in clouds they are not yet integrating with, but also the drastic reduction of the development of the software integration to each of the clouds they have retained.



B. FinOps: FinOps is a set of practices that helps organizations to manage their cloud spending effectively. It is an emerging field that combines financial management and cloud computing. FinOps is all about optimizing cloud costs by using data-driven techniques to monitor and analyze spending patterns, identify areas where costs can be reduced, and improve cost efficiency.

By implementing Open Services Cloud (OSC) against the technological stack of a given CSP providing public IaaS-PaaS, a software vendor or managed Cloud Service Provider (CSP) could have much finer control over the deployed solutions, allowing it to adapt to the Public Cloud regular cost profile changes by relocating services where needed.

C. Cloud portability: By providing a standardized way to deploy workloads in any cloud, OSC removes the barriers of redeploying workloads elsewhere, allowing for more mobility and drastically reducing the friction of redeploying workloads across multiple clouds. This gives more freedom and mobility for companies to adapt to a highly changing market where customer expectations around data are constantly being reshaped, requiring integration to large scale data warehouses, machine learning and intelligent artificial solutions. However, as currently only a few companies migrate their existing workloads, the reduction of costs induced by OSC would remain on both relocation efforts in addition to egress costs.

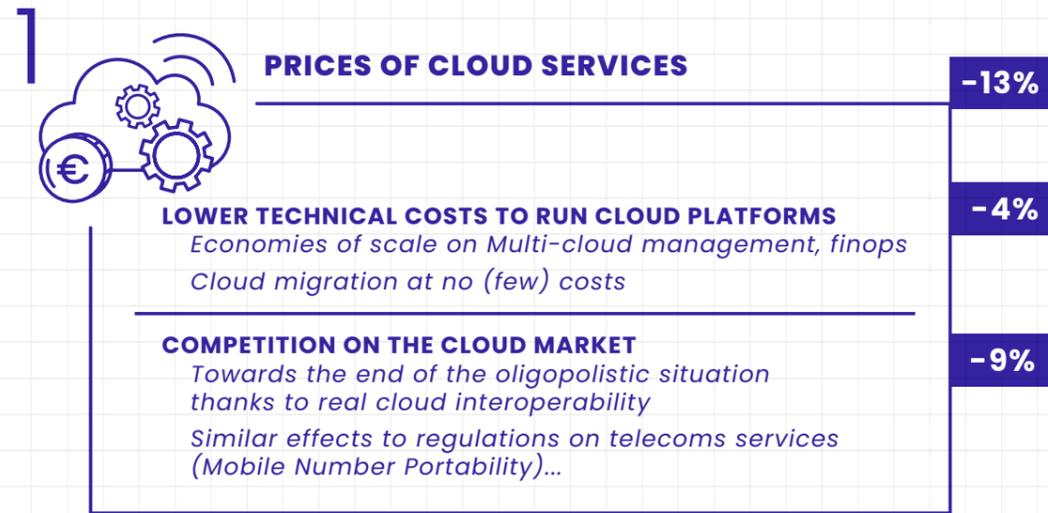
In total, we estimate a maximum decrease of prices of cloud services induced by OSC through the reduction of the technical costs of running cloud platforms of -4% over the 2025-2030 period.

3. Results of the modeling approach

Overall, as shown on the next figure, **the large-scale introduction of a functional OSC solution enabling real cloud data interoperability and portability on the EU cloud services market over the 2025-2030 period could decrease the prices of cloud services in the EU by a total of up to -13%.**



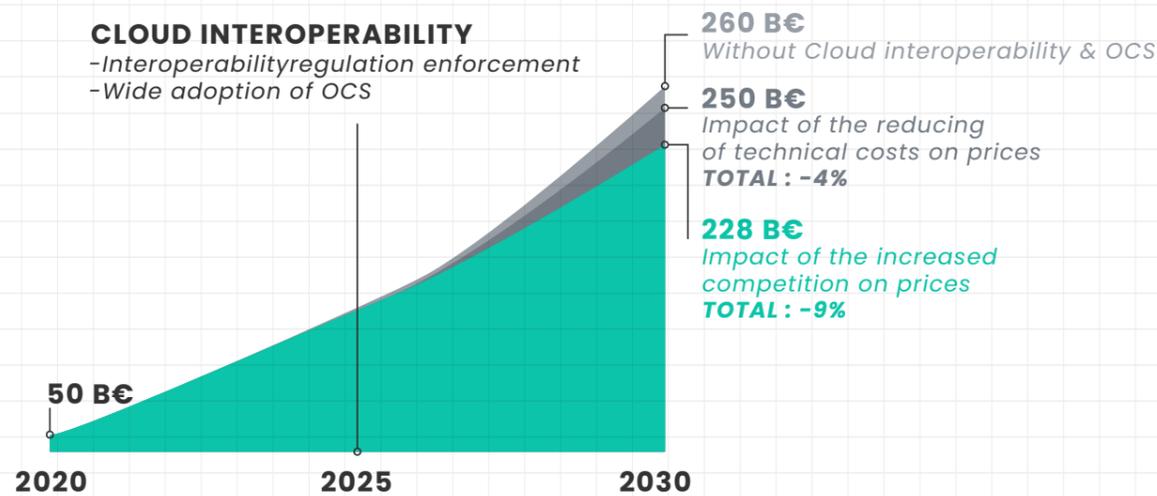
Economic impact of OSC on prices over the 2025-2030 period



Source : DECISION Etudes & Conseil

The results of the modeling approach is shown on the diagram below. The impact on prices is expected to be progressive and linked to the rhythm of deployment of OSC. We have no evidence that such lowering of prices would continue after 2030, so that the figure of -13% corresponds to the potential definitive impact of OSC on cloud services prices.

Cloud services spendings in the EU (IaaS-PaaS-SaaS)



Source : DECISION Etudes & Conseil

This corresponds to up to **78B€ that could be saved for cloud client companies and consumers in the EU** over the 2025-2030 period.

B.FOSTERING GROWTH OF THE ENTERPRISE SOFTWARE MARKET

The impact on growth of the enterprise software market should take place in two ways: on the one hand, the development of self-managed cloud services should generate new growth perspectives for any software developer. On the other hand, the deployment of Open Services Cloud (OSC) should increase the pace of the shift from on-premises software to cloud services, inducing additional growth for cloud services.

1. Enabling self-managed cloud services

Self-managed cloud services enabled by OSC require the opening to the public of the necessary backend API of Cloud Services Providers (CSP) related to IaaS-PaaS foundational layers. This translates into the following impacts:

True native cloud services (end-to-end)²⁴. In this scenario, the ecosystem of CSP and software vendors would have better integration services on a given cloud allowing for the ecosystem to be enriched via consolidation of offers. For instance, a given service provider providing an ERP solution could easily integrate in his deployment the vertical offer of a related service provider, covering a service such as data analytics, shifting the paradigm of vertical integration to horizontal service integration. As a result, CSP providing IaaS-PaaS solutions would benefit from a larger services catalog on which they can extend their own services.

These enhanced capabilities would translate into moving from a situation where they compete with their ecosystem to a situation of new selling opportunities: cross composable service offerings with broader baselines of infrastructure, broader scope of internal and partner services, etc. This paradigm shift in the Cloud Service Provider scope of services would cascade into the following effects gradually over the 2025-2030 period:

- Customers benefiting from the enhanced and agnostic services would increase pressure on the remaining players of the market to get the same service as the one provided by the early adopters of Open Services Cloud.
- In parallel, market players would gradually adopt Open Services Cloud. The ecosystem around that solution will allow for much greater flexibility in deploying agnostic managed services across the different clouds.

^{24/} True cloud services refer to a set of managed services that respect the cloud standard principles. Indeed, in the current European ecosystem, there are multiple layers of maturity of cloud managed services and software solutions. Some are built on robust and cloud native foundations whereas others are hosted on more traditional & static technological stacks. With the introduction of OSC, solutions should evolve to a more cloud native deployment. True cloud services will be reached when the majority of the provided managed services will implement the core functionalities of cloud:

- On-demand self-service
- Broad network access
- Resource pooling and elasticity, allowing shaping of resources dynamically to meet changing demand contexts
- Rapid elasticity
- Measured service tied to a pay per use financial model
- Multi-tenancy



Enabling true industry specific cloud services: As a consequence of the impacts above, the introduction of Open Services Cloud will also reshape vertical solutions of the cloud market as it would allow to create true industry specific clouds (e.g., manufacturing, FSI, healthcare, etc.). On research segments, this would greatly increase innovation and collaboration between research centers and universities due to OSC drastically simplifying cloud consumption, leading to an accelerated pace of innovation and growth of these services.

Reducing software development costs of independent software vendors. Most of the resources of software vendors are currently dedicated to adjusting their offers in SaaS to the platforms of Cloud Service Providers (IaaS/PaaS). Thanks to OSC, these efforts could be relocated to other development topics, creating value and extending cloud service offerings.

In total, we estimate **a maximum additional growth of enterprise software induced by OSC** through the enabling of self-managed services **of +7% over the 2025-2030 period**. This corresponds to up to **44B€** of additional growth for software developers in the EU over the 2025-2030 period.

2. Fostering the shift from on-premises software to cloud services

The shift from on-premises software to cloud services is already occurring at a fast pace. However, OSC should fasten this pace in two ways:

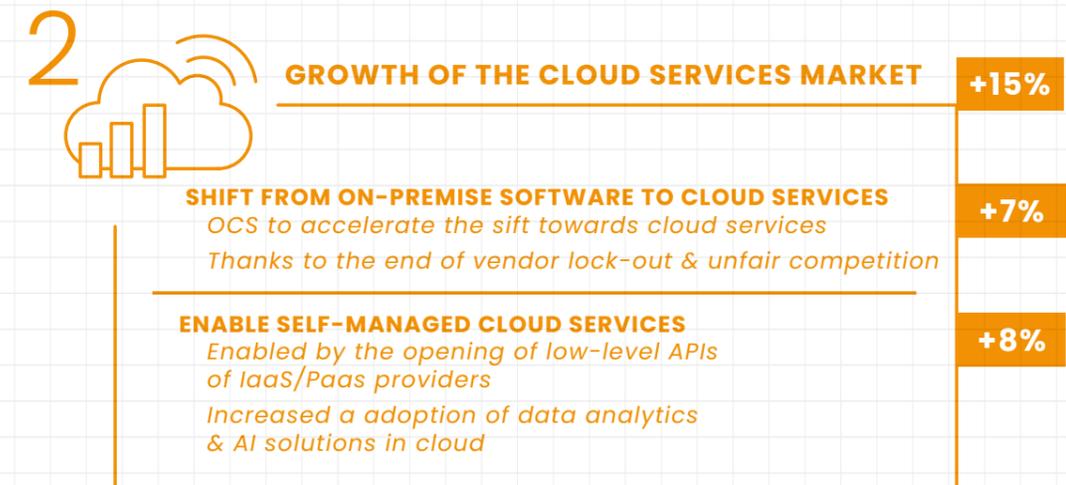
- ↳ By removing barriers to entry on the cloud services market through the end of the vendor lock-out, the end of the consumer lock-in, the end of associated possibilities of unfair competition on cloud services from hyperscalers.
- ↳ By enabling self-managed cloud services.

In total, we estimate **a maximum additional growth of cloud services induced by OSC** through the fastened pace of shift towards cloud services **of +8% over the 2025-2030 period**. This corresponds to up to **50B€** of additional growth for cloud services providers in the EU over the 2025-2030 period.

3. Results of the modeling approach

Overall, as shown on the figure below, **the large-scale introduction of a functional Open Services Cloud (OSC)** solution enabling real cloud data interoperability and portability on the EU cloud services market over the 2025-2030 period could foster the growth of **cloud services in the EU by a total of up to +15%**.

Economic impact of OSC on the growth of the Cloud Services market over the 2025-2030 period

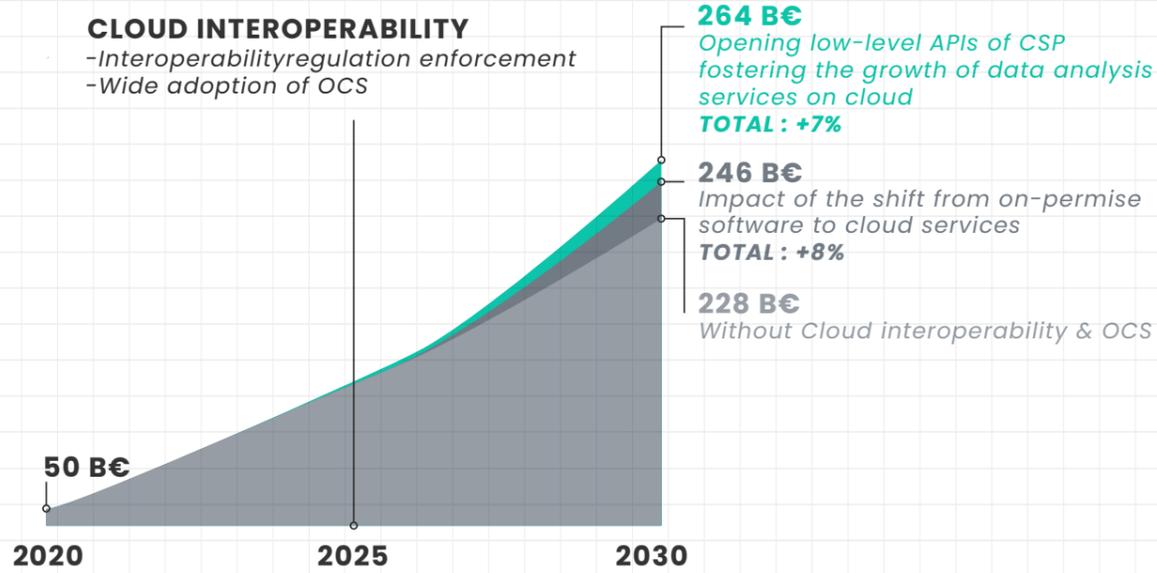


Source: DECISION Etudes & Conseil

The results of the modeling approach is shown on the next figure. The impact on growth is expected to be progressive and linked to the rhythm of deployment of OSC and its indirect effects such as the development of self-managed cloud services. After 2030, the introduction of OSC should continue to foster the growth of cloud services, although the shift from on-premises software to cloud services should reach its ends by 2040. The additional growth enabled by self-managed cloud services should be perpetual and go beyond 2040.



The EU cloud services market (IaaS-PaaS-SaaS)



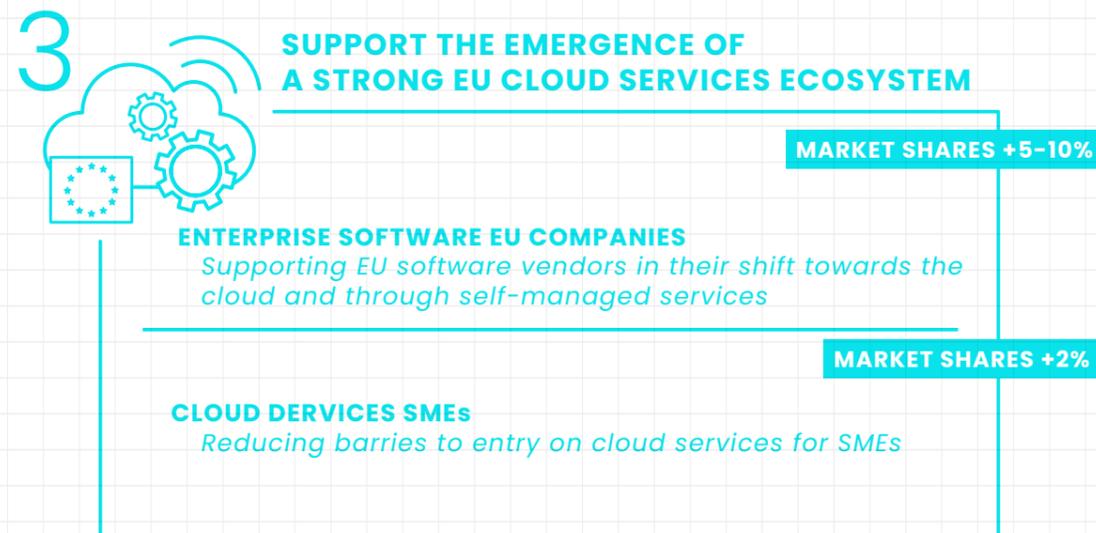
Source : DECISION Etudes & Conseil

This corresponds to up to **94B€ of additional growth for software developers in the EU** over the 2025-2030 period.

C. SUPPORT THE EMERGENCE OF A STRONG EU CLOUD SERVICES ECOSYSTEM

The figure below illustrates the potential impact of implementing an Open Services Cloud (OSC) solution on the EU cloud services market between 2025 and 2030. This solution could improve cloud data interoperability and portability, thereby potentially strengthening the EU cloud services ecosystem.

Economic impact of OSC on the EU cloud services ecosystem over the 2025-2030 period



Source : DECISION Etudes & Conseil

The potential support to the EU software ecosystem is twofold:

↳ **The companies headquartered in the EU can gain up to 5 market share points on the EU enterprise software market.** Indeed, the market shares of these companies in the enterprise software market are mainly threatened by the shift towards cloud services associated with the oligopolistic situation in this market induced by the lack of cloud interoperability. In the current situation, leading EU software developers (such as SAP) shifting towards cloud services are obliged to deploy enormous efforts in order to run their solutions on all large cloud providers and maintain their services on different clouds. By introducing cloud interoperability and enabling self-managed services, OSC would therefore strongly support the EU software developers in their transition to cloud.

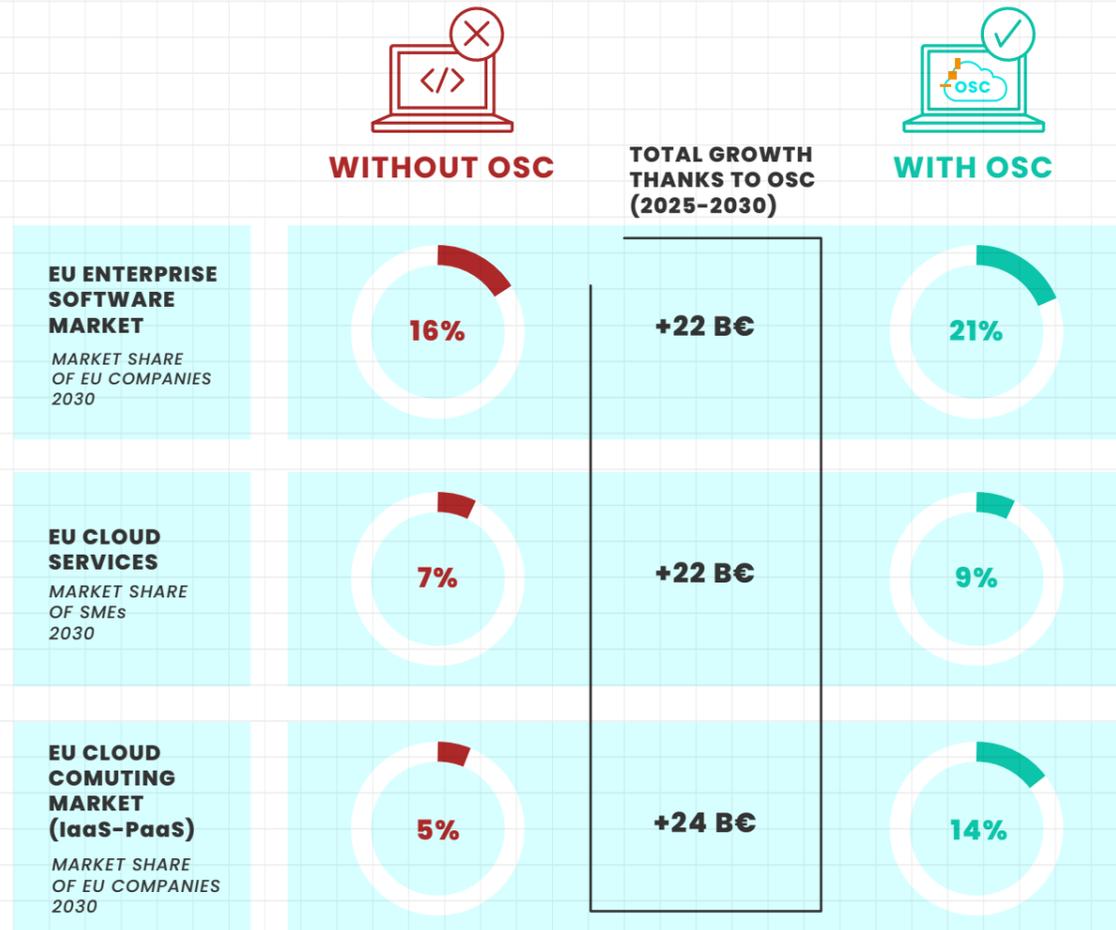
The EU Cloud Services Providers (CSP) providing IaaS and PaaS solutions could even gain up to nearly 10% market shares on the EU IaaS-PaaS market by 2030 in the “OSC wide adoption scenario” compared to the “without OSC” scenario, as interoperability induced by OSC would significantly lower the capabilities for hyperscalers to preserve their current oligopolistic position.

↳ **SMEs can gain up to 2 market share points on the EU cloud services market.** Thanks to the lowering of barriers to entry on cloud services induced by the end of the vendor lock-out possibility or alternatively the end of the dependency towards a specific hyperscaler and the associated opportunities for unfair competition. For instance, cloud services SME would have the opportunity to select cloud services and data providers that best suits their needs without facing the lock-in effect. The development of self-managed cloud services would also ease and fasten the adoption of cloud for SMEs.



The figure below summarizes these impacts and the associated potential gain for the EU economy.

Overview of the economic impact of OSC on the EU industrial ecosystem



Source : DECISION Etudes & Conseil

D. SUMMARY OF THE IMPACTS BY TYPE OF PLAYER

The table below summarizes the economic impact of a wide adoption of OSC by type of players across the cloud value chain.

Impact of OSC by type of players across the cloud value chain in the EU market (2025-2030)

PLAYERS		DECREASE OF PRICES	GROWTH
CUSTOMERS	EUROPEAN COMPANIES USING CLOUD	-7% TO -13%	
INDEPENDANT SOFTWARE VENDORS	SOFTWARE VENDORS (CLOUD AND ON-PREMISE)		+7%
	SaaS VENDORS		+15%
	EU SaaS VENDORS		+34%
CLOUD SERVICES PROVIDERS (CSP)	IaaS-PaaS VENDORS	THE DECREASE OF PRICES INDUCED BY COMPETITION ON IaaS/PaaS LOWER MARGINS OF CSP BY: -4% TO -9%	+15%
	EU IaaS-PaaS VENDORS		+279%

Source : DECISION Etudes & Conseil

One can notice a net positive impact for every player. The only players that should suffer from a negative effect of OSC are the IaaS-PaaS vendors. Due to the increased competition on IaaS-PaaS and the lowering of the oligopolistic situation, the decrease of prices of -4% to -9% for customers should be associated with a decrease of their margins of -4% to -9%.

However, from the point of view of the EU market, this corresponds to the lowering of oligopolistic rents on cloud services. In addition, this negative impact is counterbalanced for the small EU IaaS-PaaS vendors ecosystem (whose main players are OVH, SAP, Orange Business, Ionos, Leaseweb, Deutsche Telekom, Scaleway and Dassault Outscale) as the combined impact of OSC should foster their growth by up to +279% on the 2025-2030 period (nearly +50% a year), clearly resulting in a positive net effect for them.

E. THE IMPORTANCE OF THE EU REGULATION ENABLING WIDE ADOPTION OF OSC

The economic impacts of OSC, as presented above, can only be reached in the event of a large-scale adoption of OSC at the EU level. A critical mass of both Cloud Service Providers (CSP) and software vendors is required to build a functional solution in Open-Source but also to induce the market effect at the EU level.



The economic impacts as presented above, can also only be reached from a technical point of view in the event of an **opening to the public of the necessary backend API of CSP related to IaaS-PaaS foundational layers**.

As a consequence, **the economic impacts presented can only be reached in the event the EU Data Act enables and imposes the opening to the public of the necessary backend API of CSP related to IaaS-PaaS foundational layers**, opening the door for large adoption at the EU level.

The table below presents the differences in the results of the modeling approach depending on whether or not a European regulation has been put in place requiring the opening to the public of the necessary backend API of CSP related to IaaS-PaaS foundational layers over the 2025-2030 period.

TYPE OF IMPACT	WITH EU REGULATION	WITHOUT EU REGULATION
LOWERING PRICES OF CLOUD SERVICES	13%	1%
LOWER TECHNICAL COSTS TO RUN CLOUD PLATFORMS	4%	1%
HIGHER COMPETITION ON THE CLOUD MARKET	9%	
GROWTH OF THE ENTERPRISE SOFTWARE MARKET	15 %	1%
SHIFT FROM ON-PREMISES SOFTWARE TO CLOUD SERVICES	8 %	1%
ENABLING SELF-MANAGED CLOUD SERVICES	7 %	
SUPPORT THE EMERGENCE OF A STRONG EU CLOUD SERVICES ECOSYSTEM		
MARKET SHARE OF EU CLOUD SERVICES COMPANIES	10%	1%
MARKET SHARE OF SMES ON CLOUD SERVICES	5 %	1%

Source : DECISION Etudes & Conseil

As shown in this table, without the required EU regulation, the impact of OSC on cloud services prices and growth can only remain very limited with a maximum of respectively -1% and +1% in 6 years. Similarly, the impact of OSC on the EU cloud industry should remain very limited, rising the market shares of both EU cloud services companies and SME cloud services companies by a maximum of 1% in 6 years.

This illustrates the crucial importance of the **inclusion in the EU Data Act of the mandatory opening to the public of the necessary backend API of CSP related to IaaS-PaaS foundational layers**.

F. WHAT BUSINESS MODEL TO BUILD OPEN SERVICES CLOUD?

Given that Open Services Cloud (OSC) corresponds to a solution to be built at the level of the entire EU ecosystem, open-source appears as the preferred solution, especially given the fragmented EU software industrial landscape.

However, several Open Source business models exists, and there is a specific distinction between “community open source” and “commercial open source”²⁵:

1. Commercial open source is software that usually has a single or dominant proprietor who will manage the software according to their commercial interests.
2. Community open source is software that has no single proprietor and whose copyright is broadly distributed. This includes foundations like the Eclipse Foundation, where the copyrights stay with their contributors, and also the Apache Software Foundation, who formally may be the proprietor of their projects (they collect the copyright), but by way of processes and bylaws clearly acts as a representative of a community and not for commercial interests.

The advantage of the “community open source” business model is its characteristics of **full transparency and vendor neutrality**, removing any obstacles relating to the contribution to the construction of the solution from a large diversity of actors, which corresponds to the current situation of the European ecosystem of software developers.

This is the reason why from the technical and economic point of view, cloud interoperability and portability can only be reached through **an Open Services Cloud solution built at the ecosystem level through a “community open source” business model, implying full transparency and vendor neutrality**.

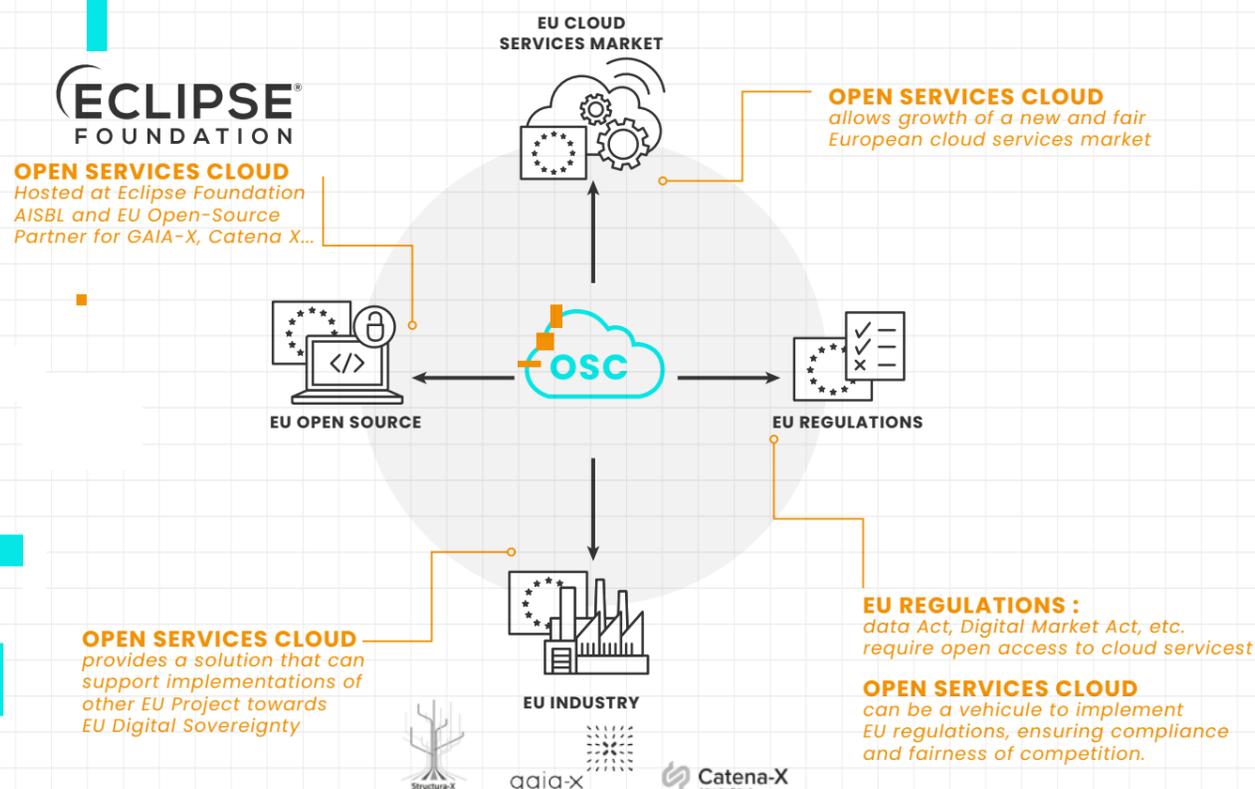
^{25/} As defined by Dirk Riehle, Professor of Computer Science at University of Erlangen



VI. SYNERGIES BETWEEN OPEN SERVICES CLOUD (OSC) AND THE EU CLOUD ECOSYSTEM

The figure below illustrates the interactions an Open Services Cloud (OSC) solution would have with the existing Cloud ecosystem in the EU:

Synergies of OSC with the European Cloud ecosystem - Towards digital sovereignty



Source: Eclipse Foundation, DECISION Etudes & Conseil

1. A solution built in Open-Source. Open Services Cloud needs to be built in Open-Source and therefore hosted within an OS foundation. The Eclipse Foundation, as the biggest Open Source foundation headquartered in Europe and strongly involved in cloud initiatives, can host such development.

2. Interactions with the EU Regulations. EU regulations tend towards cloud interoperability that can only be fully reached through a functional OSC solution. OSC can be a vehicle to implement EU regulations, ensuring compliance and fairness of competition.

3. Interactions with the EU industry. Europe is setting key industry standards around dataspace, data privacy, and digital sovereignty. Gaia-X²⁶ and Catena-X²⁷ are major new initiatives rooted in Europe that will shape global cloud development. Open Services Cloud provides a solution that can support implementations of these data space initiatives, for instance ensuring the portability of the associated cloud managed services required to operate these data spaces.

4. Interactions with EU Clouds. As shown in our modeling approach, Open Services Cloud (OSC) is to foster the growth of cloud services in the EU. OSC could in particular propose an extension of the Eclipse Dataspace Connector in order to cover native interconnection with the nine common EU data spaces.

The upcoming regulatory framework can only be beneficial to the scope extension of the OSC initiative. Still, without the introduction of these new policies, OSC has a broad development potential in addition to growth opportunities that we shall detail in this section.

A. MARKET FOCUS FOR EARLY ADOPTION

Europe holds the largest count of companies that were primed on topics related to digital sovereignty and a very strong open-source ecosystem. This represents a huge market opportunity for Open Services Cloud due to a very diverse ecosystem of small cloud providers in Europe in addition to an increasing demand for digital sovereignty. These actors would most likely be the early adopters of Open Services Cloud, generating the first focus on the capabilities unleashed by this platform. The early adoption candidates could be:

- ↳ Companies or organizations that, in their overall commitments, need to respect neutrality and portability of services. These would be all the governmental institutions and NGOs where services are tied to fair competition across public markets.
- ↳ Strongly regulated industries that most comply with portability of services and are strongly encouraged to protect personal / patient data (hospitals, and general healthcare services for instance).

²⁶/ 2500+ participants across 500+ institutions.

²⁷/ 28+ partners from the automotive industry.



↳ Companies or organizations that need rely on massive surge of compute resources to run their business (players of the data analytics, machine learning and artificial intelligence segments).

↳ The other type of early adopter would be the companies or consortium of companies that work on a vertical industry segment, providing integrated solutions. Some insurance consortia of companies defined their application ecosystem and struggled to deploy a common foundation across the complexity of each of the companies of the consortium. Indeed, this means constantly adapting the deployment and handling the friction around cloud specific integration. The fact of being able to describe the full application stack in a unique way, via the OCL semantic layer, would facilitate the future deployments of these solutions.

B. OPEN-SOURCE PROJECT COLLABORATION ALLOWING COMPLIANCE BY DESIGN

Gaia-X is a European project supporting European digital sovereignty that aims at establishing an ecosystem on which data structures are federated. The project aims at building a secure backbone on top of Open-Source technologies with a common repository of software components.

While aiming at supporting promotion of rules and guidelines, the Gaia-X framework comes with a labeling system which tags the data according to its type. The Gaia-X labeling for cloud services is a set of standards and requirements for cloud service providers that seek to be certified as Gaia-X compliant. The labeling provides customers with a clear and transparent way of understanding the security and data protection measures implemented by cloud service providers.

Open Services Cloud could enrich the process around this labeling, bringing in new capabilities.

↳ Being able to deploy more broadly Gaia-X.

↳ Building in compliance by design through a wide option of standards.

As a result, companies already included in the Gaia-X initiative could directly benefit from the Gaia-X and Open Services Cloud synergy, extending the scope of the solution a bit further.

C. INDUSTRY REGULATIONS THAT COULD BENEFIT TO OPEN SERVICES CLOUD

The industry market is progressing towards a more sustainable world, where fine grained control of the footprint of emissions and resource consumption can become a competitive advantage to market players. In cloud services hosting, this translates into being able to report carbon emissions linked

to each company's cloud footprint and potentially mitigating high consumption sites by redeploying workloads elsewhere.

For Open Services Cloud, this could be an opportunity in a further evolution to factor into the solution new reporting metrics and aggregate a normalized carbon footprint of the different cloud services deployed in most clouds, covering the emerging requirement for GreenOps.

GreenOps refers to civilian activities that aim to reduce the environmental impact of operations or promote environmental sustainability. In the cloud computing market In the context of cloud computing, «GreenOps» refers to the practice of incorporating environmental sustainability into the operations and management of cloud-based services and infrastructure. This includes measures such as reducing energy consumption, using renewable energy sources, minimizing waste, and improving the efficiency of data centers.

The goal of GreenOps in cloud computing is to reduce the carbon footprint and environmental impact of cloud-based services and infrastructure, while also improving the efficiency and reliability of these services. By adopting GreenOps practices, cloud providers and users can reduce their environmental impact and contribute to a more sustainable future.



VIII. CONCLUSION

Key findings of the economic modeling approach

The wide adoption of a functional Open Services Cloud (OSC) enabling real cloud data interoperability and portability would have the following impact for the EU cloud services market over the 2025–2030 period:

1. A decrease in prices of cloud services for EU consumers of up to 13% (2.2%/year).
2. An additional growth of cloud services of up to 15% (2.5%/year). This would represent an additional growth of +94B€ for the European economy over the 2025–2030 period.
3. +5 points of market shares for companies headquartered in the EU on the EU enterprise software market (+10 points for EU Cloud Service Providers).
4. +2 points of market shares for SME on the EU cloud service market, from 7% to 9%. This would represent an additional growth of +22B€ for the European SME over the 2025–2030 period.

These effects would then lead to more adoption of cloud services, which would lead to more digitalisation, leading to economies of scale and additional cost reduction, in a virtuous circle ²⁸.

28/ By supporting the market share of EU-based companies in the EU market, OSC should also support their international development and foster their global market shares. More generally, this study focuses on the deployment of CSOs on a European scale, but the effects of scale would be even greater in the case of a global deployment. In the event that such a deployment takes place following a European deployment, European cloud service providers would benefit from their position as early adopters in order to increase their market share internationally.

Key findings of the legal analysis

The EU Data Act, following the Digital Market Act (DMA), includes obligations related to cloud interoperability and data portability. However, the existing version should lead to an only very limited deployment of Open Services Cloud (OSC) and cloud data interoperability and portability.

As a consequence, the economic impacts presented above can only be reached in the event the EU Data Act enables and imposes the opening to the public of the necessary backend API of CSP related to IaaS-PaaS foundational layers, opening the door for large adoption at the EU level.

Indeed, the wide adoption of OSC enabling real cloud data interoperability and portability requires the implementation of a subset of APIs, defined by the open source community, on top of the existing Cloud Services Providers (CSP) backend APIs. This would grant OSC deeper control on IaaS-PaaS foundational layers and allow it to build the integration and interoperability capabilities between the different clouds. This set of APIs would cover the functional scope described below:

- ↳ Billing APIs to have precise, fine grained controls on the cloud financials and economic model.
- ↳ Identity & Access Management APIs.
- ↳ Integrated Logging APIs & console access.
- ↳ Observability APIs to better understand the back-end metering and performance.
- ↳ Data driver APIs to be able to structure and normalize the foundational data layer of the public Cloud.

If the topics covered in this Open Services Cloud Study are important to you, please reach out to the Eclipse Foundation (cf. contacts on the following page) to see how you can make a difference.



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