Single Market 2.0: the European Union as a Platform

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Often defined as "unfinished business", the European Union's market integration process appears to have become more fragile than ever at the beginning of the new decade. Already in 2010, the Monti report denounced the existence of a Single Market "fatigue", which made it difficult to complete the market integration process, especially in most difficult areas such as services.[1] Today, Brexit potentially threatens the future attractiveness of the Single Market, by depriving the Union of its third largest economy and leading to an unprecedented thorn in the EU's pride, as a Member of the Union sets sail. At the same time, the post-Brexit single market may become more cohesive and ambitious, as one of the most reluctant Member States leaves the group: the Union may also have the opportunity to re-discover some of the features of continental Europe's legal and economic traditions, from Civil Law rules to state-led industrial policy, which faced obstacles when the UK was in the Union.[2]

Against this background, the challenges for the Single Market project do not end with Brexit. To the contrary, EU policymakers are confronted with a frustrating prospect: as they try to complete the Single Market, technological evolution is pushing the frontier of integration further, requiring new efforts and policies to fully achieve the desired goal. In particular, the digital transformation is changing the traditional, textbook economics of market integration, based on tenets such as economies of scale and the four freedoms. The rise of the digital economy requires a radical change in the policies for the Single Market, as well as in the trade policies that underpin the whole market integration process. Trends such as the virtualisation, servitisation and platformisation of the economy (as described below), coupled with the rise of the Internet of Things and Artificial Intelligence, make market integration at once more appealing and increasingly challenging for EU policymakers, projecting the Single Market into a complete new dimension, in which the "Fifth Freedom" (the free circulation of non-personal data) is intertwined with new concerns with the need to protect fundamental rights, and at the same time secure Europe's technological sovereignty.

As EU institutions were struggling to complete the ambitious Digital Single Market strategy formulated by the Juncker Commission, technology has changed so fast that brand new policy initiatives are needed: the Von der Leyen Commission seems to have marked a significant change towards a more assertive and future-oriented approach to digital policy. The new pillars of the Single Market 2.0 are not focused anymore on platform regulation, data protection and the free flow of non-personal data; while these remain very important pillars, the future of the Single Market will require that the whole internal market is seen as a layered ecosystem, in which infrastructure, rules, protocols and standards become a platform for large and small companies to develop value added solutions to the benefit of all European consumers. This "EaaP" ("Europe as a Platform") approach may also induce a change of terminology: what used to be mutual recognition will now mostly be related to interoperability; what used to be subsidiarity is translated into a choice between centralised, distributed and decentralised governance; open interconnection becomes "open API", and is applied far beyond network industries; and the free circulation of people is enhanced with a strong digital

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[1] See "A new strategy for the Single Market. At the service of Europe's economy and society". Report to the President of the European Commission José Manuel Barroso, by Mario Monti. 9 May 2010.
[2] D Kalff and A Renda, 'Hidden Treasures. Mapping Europe's Sources of Competitiveness Advantage in Doing Business' (2019) *CEPS Monograph* and A Bradford, *The Brussels Effect. How the European Union Rules the World* (Oxford University Press, March 2020).

identity and verification layer. Importantly, especially after the appointment of Commissioner Thierry Breton, the Single Market 2.0 is becoming the *locus* of data spaces and ecosystems as the basic pillars of the future EU "competitive sustainability" agenda.

To be sure, achieving the Single Market 2.0 requires strong political commitment and will not prove easy, if the foundations of economic integration will remain as fragile as they are today. The COVID-19 pandemic has shown very clearly the difficulty of keeping the EU's "crown jewel" alive in times of despair and shortage of essential goods, such as medical protective equipment. The deterioration of the rule of law in some of the Member States (eg Poland, Hungary), the suspension of Schengen, the overall lack of solidarity between Member States and the temptation to use digital technology (*eg*, in the form of contact-tracing apps) in a way that jeopardises fundamental rights, are only a few examples of a more general crisis of the European integration project, which the von der Leyen Commission has barely managed to contain. At the same time, the COVID-19 pandemic is also accelerating the digital transformation, with the online economy becoming paramount for economic and social relations: this, in turn, makes the development of rules and standard for a trustworthy Single Market even more urgent.[3]

Can code succeed where law and politics have so far partly failed? In the remainder of this chapter, I outline the possible contours of a "Single Market 2.0". Section I below describes the current and the upcoming waves of digital transformation as featuring very different economic paradigms and consequences for EU policy. Section II discusses the reconfiguration of the Single Market as a layered ecosystem and describe the current Digital Single Market Strategy and the upcoming initiatives outlined by the European Commission, and partly affected by the COVID-19 pandemic. Section III provides a layered architecture for the Single Market 2.0 and outlines possible further avenues to speed up reform in a way that is consistent with all the cornerstones of the EU strategy for growth and sustainable development.

I.   Two Waves of Internet Evolution

Information technology (IT) experts traditionally approach architectural problems through modular structures, by distinguishing different layers and components of complex system goods and working through different options as regards on their interoperability.[4] Different choices in this respect lead to more closed architectures (eg the early Apple Macintosh), or more open architectures, in which different layers and components can be produced according to standard specifications by more than one firm (eg the early Microsoft Windows). The history of IT also suggests that no governance architecture is fully open, and typically one or more layers become dominated by one or a few players due to the emergence of network externalities, which lead to "winner-take-all" effects and often highly concentrated market structures at some of the layers.[5]

The Internet is itself depicted as a complex layered architecture, based on a massive physical layer, encompassing fixed and wireless communications systems, submarine cables and satellite systems, massive Internet Exchanges and data centres. The Internet age constituted a major enhancement of the original layered architecture of the personal computer, with the introduction of global-scale networking possibilities between computers and similar

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[3] See Communication from the Commission to the European Parliament, the European Council, the Council, the European Central Bank, the European Investment Bank and The Eurogroup, "Coordinated Economic Response To The Covid-19 Outbreak", COM(2020)112 final, 13 March 2020.

[4] See RN Langlois, 'Modularity in technology and organization' (2002) 49 *Journal of Economic Behavior & Organization* 19-37; RN Langlois and P Robertson, 'Networks and innovation in a modular system: lessons from the microcomputer and stereo component industries' (1992) 21/4 *Research Policy* 297-313. See also H Chesbrough, 'Towards a dynamics of modularity: a cyclical model of technical advance' in A Prencipe, M Hobday (eds), *The business of systems integration* (Oxford, Oxford University Press, 2004) 174-198 and H Chesbrough, *Open Innovation* (New York, Free Press, 2003).

[5] C Shapiro and H Varian, *Information Rules. A Strategic Guide to the Network Economy* (Boston, Massachusetts, Harvard Business School Press, 1999).

devices at the physical layer, and the definition of open protocols and standards that defined the traffic rules for data at the so-called "logical layer". Open standards such as the Internet Protocol and the File Transfer Protocol defined the characteristics of the Internet as a means of communication: as observed already in the 1990s by Lawrence Lessig, in a digital environment, "code, not law, defines what's possible".[6] In the case of the early Internet, the openness and neutrality of the standards defined at the logical layer determined the rise of the Internet as a formidable means of communication between peers, and a vehicle for permissionless innovation, in which at once users could preserve their anonymity ("nobody knows you are a dog", as in Peter Steiner's fortunate New Yorker cartoon in 1993); and developers could work on their applications without having to seek anyone's permission to reach the marketplace.

That said, the Internet exacerbated the features of the original layered architecture of the personal computer: the introduction of a new layer, with an end-to[7]-end architecture and a growing ability to support data flows, generated an explosion in the amount of data available to end users, which in turn converted into a "poverty of attention".[8] The firms that managed to capture a significant share of that scarce resource (user attention), ended up becoming trillion-dollar corporations, or (as they are sometimes called in the economics literature) "superstar firms". Accordingly, the rise of the digital, interconnected economy has also coincided with a rapid, necessary transformation of the ecosystem dynamics, which would soon come back to haunt the early creators of the Internet, facing them with a rising market concentration, a declining neutrality, and gradual attempts to depart from the original end-to-end design.[9] This is what I call the "first wave of transformation" of the Internet.

A. The First Transformation of the Internet: Virtualisation, Servitisation and Platformisation

During the past two decades, the Internet has undergone a swift transformation, which led to the emergence of a more diverse layered architecture, and very peculiar forms of governance that hardly existed in the "brick and mortar" world. Understanding them is useful to identify the direction taken by the EU institutions in trying to reap the benefits of the digital ecosystem, at the same time minimising its associated risks.

First, the emergence of an end-to-end infrastructure, fuelled by growing computing capacity, high capacity networks and wireless connectivity, grandly expanded the possibilities of the digital economy to permeate the economy. The emergence of cloud computing made it possible for small companies to avoid buying or leasing hardware and downloading software and applications: these traditional transactions were replaced by "everything as a service", which led to enormous advantages both for individuals and businesses. The transition towards a "cloud era" allowed personal devices to become increasingly agile, while users were able to access hardware and software located in the cloud, as well as retrieve their files from cyberspace. Put more simply, a limitless "office LAN" where the main server was not located downstairs, but potentially on the other side of the globe.[10] This was the realisation of the so-

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[6] L Lessig, *Code and other Laws of Cyberspace, Basic Books* (1999).

[7] D Autor, D Dorn, LF Katz, C Patterson and J Van Reene, 'The Fall of the Labor Share and the Rise of Superstar Firms' (2020) 135(2) *The Quarterly Journal of Economics* 645-709.

[8] HA Simon, 'Designing Organizations for an Information-Rich World' in M Greenberger, *Computers Communication, and the Public Interest* (Baltimore, The Johns Hopkins Press, 1971) 40-41.

[9] MA Lemley and L Lessig, 'The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era' (2001) 48 *UCLA Law Review* 925. A Renda, 'Competition, Neutrality and Diversity in the Cloud, Communications & Strategies' (2012) 85 *1st Quarter* 23-44; A Renda, 'Net Neutrality and Mandatory Network-Sharing: How to disconnect the continent' (2013) *CEPS Policy Briefs* and A Renda, 'Antitrust, regulation and the "neutrality trap"' (2015) *CEPS Special Report* 104.

[10] Cloud computing is a general-purpose technology of the IT field which became widely available in the late 2000. Vaquero et al (2009) define it as "a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically reconfigured to adjust to

called "age of access" already evoked by scholars in the 1990s. An age in which products and services are dematerialised to an extent that ownership and property rights become less important, and access rights become gradually more dominant.[11] The progress observed in ubiquitous connectivity and in compression techniques, coupled with enhanced possibilities to capture end users' attention, has gradually led to the emergence of access-based services. These include a variety of new business models, from pure streaming-based content access services (Netflix, Spotify) to intermediate forms (Apple Music + iTunes + Apple TV) which contemplate both ownership and access; and the so-called "sharing economy", based on a combination of network effects, granularity, and reputational effects (eg Airbnb, Uber). Many of these services rely on the "cloud" as a key resource for virtual access and use of IT resources.[12]

Thanks to the end-to-end nature of the Internet, the digitisation of information and ever-increasing capacity and connectivity, many parts of the economy have gradually transitioned towards virtualisation and servitisation, two intertwined phenomena that made the economy more agile, but also came with a price to pay in terms of inequality.[13] The "uberisation" of many sectors such as passenger transport, accommodation, child care, handyman jobs, IT work (eg Mechanical Turk, Upwork) and low-skilled jobs and many other markets has led to extreme situations in which humans, themselves, are offered "as a service".[14]

The end-to-end, digitised nature of the Internet also determined the rise of peer-to-peer interaction in various forms. The transition towards an access-based economy initially affected audiovisual content, creating significant disruption (first with peer-to-peer file-sharing, later with streaming-based services that almost restore the industry's profitability). Later, the rise of the collaborative economy reached unprecedented levels: in 2019 Bank of America Merrill Lynch valued the worldwide sharing economy at USD250b and further estimated that USD6 trillion in commerce could be disrupted by the sharing economy across sectors such as transportation, travel, food, retail and the media. This, representing approximately 8% of global GDP, is supported ia by the fact that eight of the world's 10 largest start-ups based on valuation are in fact sharing economy businesses. And is likely to be further exacerbated by the impact of the COVID-19 pandemic, which led to an explosion in the demand for online services.

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a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized Service Level Agreements". See L Vaquero, L Rodero-Merino, J Caceres & M Lindner, 'A Break in the Clouds: Towards a Cloud Definition' (2009) 39 *Computer Communication Review* 50-55. Cloud architectures are conceived to be very simple for end users but feature a very complex architecture "behind the curtains". As an example, Apple's iCloud allows the syncing of various devices with the cloud, such that the end user always enters the same environment regardless of the device used to connect to the network. Similar strategies have been pursued for the end user market by Google (Android), Microsoft (Azure) and Amazon (AWS). The most widely acknowledged taxonomies of cloud computing are those that relate to the basic cloud "modes" (ie Public, Private, Hybrid) and the main cloud "types" (ie Saas, AaaS, IaaS, PaaS). The provision of platform as a service (PaaS), for example, leaves more control of the configuration to the client that mere application as a service (AaaS) or software as a service (SaaS) modes. At the same time, private clouds are certainly more customized to the client's needs than hybrid or public clouds, which however enjoy clear economies of scale.

[11] See ia RW Gomulkiewicz, 'The License Is the Product: Comments on the Promise of Article 2B for Software and Information Licensing' (1998) 13(3) *Berkeley Technology Law Journal* 891.

[12] A specific case is 3D printing, which leads to a de-materialisation of the product, but rather than its remote access, entails a remote re-production of the product. This changes the role of the players active in the production cycle: in 3D printing, the borderline between manufacture and service provision is blurred due to uncertainty as to who should be assumed to be the manufacturer of the product, particularly when a 3D printer has been used somewhere in the value chain.

[13] The servitization (or "servicification") of the economy is a well-known process that largely pre-dates the Internet era. Hojnik (2016) reminds that the de-industrialization of developed economies started in the 1950s and the value added by manufacturing as a percentage of GDP is now below 15% in most OECD countries, and that "economic studies show that servitization is one of the economic megatrends of modern society, along with globalization, encompassing a broad range of business models that are currently occurring on the market"

[14] See J Prassl, *Humans as a Service. The Promise and Perils of Work in the Gig Economy* (Oxford, Oxford University Press, 2018).

The proliferation of information sources and the need to store and retrieve data for a multitude of user transactions also led to the rise of a fierce competition for user attention (so-called "competition for eyeballs"). The explosion of Internet traffic in the 1990s and 2000s, powered by parallel streams of evolving technologies (data storage, broadband communications, data compression, innovation in traffic management) led to an emerging need for solutions that would reduce complexity: this solution was spontaneously developed by market forces, and mostly took the form of industry convergence towards a limited number of de facto industry standards at the higher layers of the architecture.[15] Today, the digital ecosystem has evolved into a much more diverse environment: the original open internet architecture co-exists with various multi-sided platforms, which coordinate, steer and manage the innovation taking place at the higher layer of the Internet architecture. This phenomenon, often called "platformisation", bears far-reaching consequences for innovation, competition and public policy.[16]

While a full review of the impact of platformisation on public policy would go beyond the scope of this chapter, it is worth looking at the peculiar governance features of platforms, as well as their impact on value distribution in the digital economy. A close look suggests that they are different from the traditional corporations. They are, indeed, a hybrid between the firm and the market, compared to the traditional distinction made in social sciences.[17] So-called multi-sided platforms are hierarchical structures serving various categories of users, in which most of the traditional activities of a firm are outsourced, automated, or "heteromated" (automated through the help of third parties).[18] A good example is Uber, a ride-hailing platform that matches independent contractors (drivers) with end users (passengers), in which the management and control of the former is largely done through a combination of algorithms and user reviews. The corporate structure and size of the firm in terms of factors of production (capital and labour) is extremely small compared to the amount of transactions that the platform generates and profits from. For example, Uber has approximately 20,000 employees, but "employs" more than four million drivers.

The peculiar structure of platforms, their relatively small size, and the powerful network externalities that sustain their competitive position in the market contribute to strengthening their bargaining power vis à vis all categories of users. Such stronger market power increasingly contrasted with a regulatory approach that largely left these powerful intermediaries untouched, as a legacy of the early days of the "neutral" internet. The platformisation of the Internet had little to do with the early vision of a neutral, end-to-end "network of networks", open to all for permissionless innovation. Rather, it led to the rise of new gatekeepers, which occupy an almost unattackable position and continue to reap a large share of the value associated with the transactions they not-so-neutrally orchestrate. Not surprisingly, the need to govern the humongous amount of data their ecosystems generate also led these companies to increasingly invest gigantic sums in data-hungry machine learning systems, which came to dominate the digital environment as well as the AI landscape. From Netflix's recommendation system to Google's search engine, enormous investment has

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[15] Examples of de facto ICT industry standards in the pre-Internet age include Lotus 123, WordPerfect and other applications based on the original IBM PC architecture and the MS-DOS. Later, Windows 3.1 and Windows 95 (which ushered the Internet age) became widely diffused de facto industry standards. The case of Microsoft Windows is perhaps the most telling in the evolution that the ICT went through during the 1990s: the modular architecture of the personal computer entailed the existence of one layer (at the time, the OS layer), which would end up being essential in terms of connecting hardware with software and determining the compatibility and interoperability requirements of the whole system.

[16] See A Gawer, *Platforms, Markets and Innovation* (Edward Elgar, Cheltenham, 2009).

[17] See RH Coase, 'The Nature of the Firm' (1973) 4(16) *Economica*, New Series 386-405. OE Williamson, *The Economic Institutions of Capitalism* (New York, The Free Press, 1985). OE Williamson, 'Public and Private Bureaucracies: A Transaction Cost Economics Perspective' (1999) 15(1) *Journal of Law, Economics, & Organization* 306-342. OE Williamson, 'Transaction-Cost Economics: The Governance of Contractual Relations' (1979) 22(2) *The Journal of Law & Economics* 233-261.

[18] HR Ekbia and BA Nardi, *Heteromation, and Other Stories of Computing and Capitalism* (MIT Press, 2017).

reinforced and ringfenced the market positioning of these platforms, enabling them to personalise product offerings, prices and conditions to an extent that no competitor could even come close to attaining.

Virtualisation, servitisation and platformisation have been extremely important drivers of change of the Internet ecosystem in the past two decades and have led to a massive change in the economy, largely consisting in a re-intermediation, rather than a dis-intermediation, of previous market transactions. Where the new business models have preserved the original end-to-end nature of the Internet, new governance forms such as distributed ledger technologies have started to surface, thanks to technological advances, cost reductions and the possibility to rely on peer-to-peer computing and the power of direct network externalities. Where companies have departed from the original architecture, multi-sided markets have replicated the characteristics of one-to-many communications systems, such as television (eg Netflix), and have largely profited from indirect network externalities. The thirst for personal data, coupled with the users' relative lack of awareness of the value of the data they shared and contributed to the working of large-scale algorithms, led these digital intermediaries to prosper by shrinking their size compared to the traditional firm, externalising most functions, reaping advertising benefits and enjoying a largely unregulated space.

Not surprisingly, this first wave of digital transformation created important tensions among regulators, in particular in the European Union. The more digital transformation was permeating traditional markets, the more the differences in the regulatory treatment of incumbent players and digital firms started to tilt the market balance in favour of the latter. The greater the diffusion of data-driven business models, the greater the tensions in terms of data protection, and the loss of control of personal data for end users. The stronger the centripetal forces unleashed by network externalities and platformisation, the greater the polarisation of market power and profits in the hands of a fistful of companies.[19] The more multi-sided platforms conquered the market, the more precarious most workers' conditions became, the more obscure the algorithmic practices behind their selection and reward, and the weaker their access to social dialogue. The greater the imbalance between firm size and overall profits, the more evident the need for digital taxation based on the place where value is created and revenues are reaped, rather than the place where the digital company is headquartered.

The reaction of the European Union to this first wave of internet transformation was initially very slow, then gradually more assertive and determined. The General Data Protection Regulation, entered into force in May 2018, is the poster child of a generation of reforms that have attempted to restore balance in the digital ecosystem, by establishing principles such as "data minimisation" and "user control over data", which were echoed by legislation in many other legal systems, from Brazil to Japan and California. A regulation on the free flow of non-personal data tried to couple restrictive rules on personal data with expansive rules on non-personal data flows, so far with little impact. Besides antitrust investigations and fine against giants like Google, new regulations expanded the remit of competition rules in areas such as the relationship between platforms and businesses (P2B), echoing national rules on abuse of economic dependence and abuse of superior bargaining power. After interventions on the tax side to counter tax rebates for digital giants such as Apple (in Ireland), work on a web tax has started to take shape, alternating with international efforts in the context of the OECD. And the first attempts to attribute entitlements over data emerged in the field of agriculture, where a code of conduct seeks to empower farmers in reaping value from their data.[20] And the approach to promoting competition in regulated sectors started to move from traditional access obligation related to infrastructure, towards mandatory interoperability obligations, initially imposed on industry incumbents, rather than on tech giants: the case of the Second Payment Services Directive (PSD2) portrays the awakening of the EU institutions to the use of

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[19] See T Philippon, *The Great Reversal* (Harvard University Press, 2019).
[20] See A Renda, N Reynolds, M Laurer, G Cohen, 'Digitising Agrifood' (2019) *CEPS and BCFN Joint Monograph*.

Application Programming Interfaces as a powerful way to impose interoperability obligations, with the (hopefully meaningful) consent of the data subject whose credit data are now moved to third party providers.

Against this background, the Juncker Commission worked also behind the curtains to speed up the reflection on AI rules, on the impact of the digital transformation on labour markets, as well as on the achievement of interoperability between administrations at the EU, national and local level. All these initiatives took the form of expert reflection (through *ad hoc* high-level groups) or voluntary frameworks (as in the case of ISA2); but had the merit to pave the way for an expected acceleration in the coming years, with more binding initiatives. The urgency of a reaction to the evolution of the digital ecosystem was felt more strongly by Member States, leading in some cases the European Commission to adopt initiatives in the attempt to stop the proliferation inconsistent rules at the national level (eg for web taxes, as well as for Artificial Intelligence).

Overall, the EU's reaction to the first wave of transformation of the Internet arrived too late, leaving the EU behind other superpowers in terms of preparedness and adaptation to the new paradigms of the digital economy. As acknowledged also by the European Commission, the United States and China have clearly taken the lead on the cloud-dominated, platform-dominated, machine-learning-led digital environment emerged in the past two decades, and only started to concretely react halfway through the Juncker years. The lack of anticipatory policymaking, for an inevitably cumbersome bloc of 28 states, created a significant lag between the digital transformation and the EU's policy response. That said, once the EU institutions managed to concretely respond, their ability to nest policy proposals into a concrete, solid and comprehensive set of principles led to the emergence of the first real *corpus* of legal rules aimed at creating a more socially and economically sustainable environment for the Internet age. The complete absence of similar rules in most other legal systems made the EU a real pioneer in this policy domain, despite the rather timid approach adopted in several areas. Anu Bradford even sees a magnified "Brussels effect" on global digital policy compared to the many other areas in which the EU already exerts a significant "normative power Europe".[21] This, in turn, encouraged the new European Commission to consider adopting a more assertive approach to digital policy, which culminates in a completely new stance on the Single Market.

B. The Second Transformation Wave: the Internet of Things, the Rise of Artificial Intelligence and the Emergence of Distributed Architectures

The von der Leyen Commission, already at the end of 2019, took stock of Europe's competition positioning in the digital environment with a degree of despair. Statements on Europe's lag compared to the increasingly battling United States and China proliferated: the world is dominated a fistful of cloud operators, most of which American, none of which European; there are no European companies among the top 20 global tech firms; the data train has left the station, as more than 90% of the data in the Western world are stored in the United States; China is going to dominate 5G, as the US rules the world on platforms and applications; Europe will never manage to match the level of AI investment of the United States and China. However, digital technology never stands still. As policymakers struggle to address the "pacing problem" and respond to the first wave of digital transformation, the evolution of technology is already paving the way for a transformation in the digital environment. And indeed, the next generation if Internet transformation may create new opportunities for Europe to regain its role in the global competition for digital solutions.

In particular, the next few years will mark the blossoming of the Internet of Things (IoT). The physical layer will indeed be enriched by the availability of smart, cyber-physical objects, which can enable decentralised data production, communication and processing, requiring

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[21] See Bradford, above n 2 and A Renda, 'Making sense of the "Geopolitical Commission" Insights from the TRIGGER project' (2020) *CEPS Policy Brief*.

storage and intelligence to be increasingly distributed. The projections of the Internet of Things are breath-taking, with the number of connected objected poised to skyrocket to one trillion by 2035.[22] More specifically, IoT systems are essentially organised around four main (sub-)layers: directly attached to the 'things' are sensors, antennas and actuators, which can take a wide variety of forms; these devices must be connected to a network layer, which allows the aggregation and basic control of data; above these layers (or, as commonly said, above the 'edge') are a first layer of intelligence (Edge IT), which provides analytics functions and pre-processing of data; and the cloud, in which data are stored, analysed, and processed for ultimate action and decision-making, mostly through Artificial Intelligence.

The IoT revolution will lead to an expansion of the possibility to automate complex processes, but will also require that both data and AI are kept as close as possible to the "things": for example, autonomous vehicles cannot rely on a basic "sensor-to-cloud-and-back" model of thinking, since the fact that data have to travel long distances would generate latency (for every 100 miles, an estimated 0.82 milliseconds). Looking at different network topologies, the immediate alternative to centralised IoT systems would be the implementation of intelligent solutions closer to things, and in particular 'at the edge'. While a fully decentralised system would entail 'embedded AI' in each of the connected objects, and would therefore be too costly using current technologies, most market analysts consider the so-called Edge/Cloud model to be the most interesting paradigm for the most sophisticated IoT use cases in the near future.[23] In an edge/cloud model, local computing, storage, and networking resources are provided close to IoT devices, and the data generated can be stored and pre-processed by the local edge cloud and only a small volume of processed data are eventually sent to central data centres.[24]

As already explained, the conventional cloud models will remain viable for a number of use cases. However, several emerging applications would strongly require an edge/cloud architecture: such a solution can offer important cost savings on top of a more distributed structure.[25] Performing computations at the network edge has several advantages: (i) the volume of data needed to be transferred to a central computing location is reduced because some of it is processed by edge devices; (ii) the physical proximity of edge devices to the data sources makes it possible to achieve lower latency which improves real-time data processing performance; (iii) for the case of data that still must be processed remotely, edge devices can be used to discard personally identifiable information (PII) prior to data transfer, thus enhancing user privacy and security; (iv) decentralisation can make systems more robust by providing

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[22] D Gros, 'Global Trends to 2035: Economy and Society, Report for the European Parliament' (2019) at http://www.europarl.europa.eu/RegData/etudes/STUD/2018/627126/EPRS_STU(2018)627126_EN.pdf.

[23] A related term, fog computing, describes an architecture where the 'cloud is extended' to be closer to the IoT end-devices, thereby improving latency and security by performing computations near the network edge. So fog and edge computing are related, the main difference being about where the data is processed: in edge computing, data is processed directly on the devices to which the sensors are attached (or on gateway devices physically very close to the sensors); in fog computing, data is processed further away from the edge, on devices connected using a LAN. See A Renda and M Laurer, 'IoT4SDGs. What can the Digital Transformation and IoT achieve for Agenda 2030?' (2020) *Joint CEPS-Hitachi Report*.

[24] Several attempts have been made at operationalising an edge/cloud model in the past few years. They include projects such as Cloudlet, Nebula, Femtocloud, HomeCloud and Fog Computing. Each of those alternatives has pros and cons, and as occurs for transmission protocols, different solutions may fit different use cases. For example, the implementation of Network Functions Virtualisation and Software-Defined Networking can provide numerous advantages to the dynamic management of edge/cloud systems, especially in the context of 5G deployment.

[25] In 2015, for example, David Floyer studied the data management and processing costs of a remote wind-farm using a cloud-only system versus a combined edge/cloud system. The wind-farm consisted of several data producing sensors and devices such as video surveillance cameras, security sensors, access sensors for all employees, and sensors on wind-turbines. The edge/cloud system turned out to be 36% less expensive and the volume of data required to be transferred was observed to be 96% less, compared to the cloud-only system. D Floyer, 'The Vital Role of Edge Computing in the Internet of Things' (2015) at https://wikibon.com/the-vital-role-of-edge-computing-in-the-internet-of-things.

transient services during a network failure or cyberattack; (v) edge computing increases scalability by expanding compute capacity through a combination of edge and IoT devices.

In non-technical terms, it is possible to state that while the AI revolution is the "brain" of the digital ecosystem, and the cloud governs its central nervous system, the IoT will represent the limbs and muscles, and the edge will act as the peripheral nervous system, requiring a degree of automation and fast-thinking already at the local level. This will require a number of important changes in the way the digital economy functions and is organised: small data become more important than big data; data storage occurs mostly at the edge and in devices; and ore distributed architectures are possible, with possible consequences also for competition.

While the edge/cloud architecture will become prominent in the next few years, the B2C world will also see a possible acceleration, in particular through the emergence of more distributed and decentralised architectures, enabling the possibility to store data locally, and in a more privacy-preserving way. The emergence of new paradigms for restoring user control over personal data, from the IHAN project proposed by the Finnish innovation agency SITRA to the approach proposed by the MyData movement and by Tim Berners Lee's Solid project, there is a wealth of ideas for enabling the creation of "data trusts" and other intermediaries, able to help end users easily manage their data by selectively sharing the information they need to share, without losing control of their diffusion in obscure secondary markets.

Most importantly, the new wave of digital transformation promises to achieve very substantial progress in the domain of public services, and more generally in the role of government. Governments that manage to collect good quality data will be able to develop APIs and share them with small and large corporations, researchers and other organisations for the development and provision of value-added services. The new age of "Government as a platform", which saw Estonia as a pioneer with its X-Road ecosystem (now available also in Finland), promises to revolutionise the relationship between public authorities and citizens, and places governments in the driving seat when it comes to securing trust in technology. The upcoming information-rich age will require a strong layer of trusted intermediaries, in charge of verifying the trustworthiness of data flows: suffice it to consider the fast development of "deepfakes", which contribute to an already rich repertoire of disinformation tools by making it almost impossible to distinguish between real and fake audiovisual content.

All these developments will determine the final departure of the Internet from its original design, and also away from its current architecture. As occurs in the evolution of complex organisms in biology, here too the Internet will have to accommodate increased complexity due to the co-existence of very different uses, including low-latency industry services enabling control through digital replicas (or "twins"), immersive holographic presence and so-called "multi-sense media", alongside with more traditional data flows. Inevitably, the giant technology companies of today may have an advantage in conquering also those spaces, which explains to a large extent why they continue investing huge sums in R&D. At the same time, the competitive space is open to new players, and even more to investment by private and public institutions that, from the "real economy", seek the achievement of a more balanced and sustainable internet architecture. This is where the European Union may have an advantage over other superpowers, and even vis à vis the current tech giants.

C. Wrapping up: an Evolving Ecosystem

The past few years have been characterized by the rise of a new wave of technological developments, which promise to revolutionize the digital economy, bringing it towards and era dominated by dramatically superior computing power and connectivity speeds; a skyrocketing number of cyber-physical objects connected to the Internet (the so-called Internet of Things, or IoT, powered by nano-technology and by 5G wireless broadband connectivity); and the pervasive spread of artificial intelligence into almost all aspects of personal and professional life. This new stack will be composed of powerful hardware, including faster processors (mostly a combination of CPUs, GPUs and TPUs); distributed computing capacity through edge (or fog) computing; new, distributed and decentralized platforms such as blockchain, able to keep

audit trails of transactions and other asset-backed values; and a pervasive presence of AI-enabled solutions, mostly in the form of data-hungry techniques such as smart analytics, deep learning and reinforcement learning.[26] Focusing on all layers of this emerging stack is extremely important when it comes to scaling up these technologies to the benefit of society: merely focusing on one element, such as AI or blockchain, would not harness the full potential of this emerging world.

Figure 1. The old v. new digital technology stack
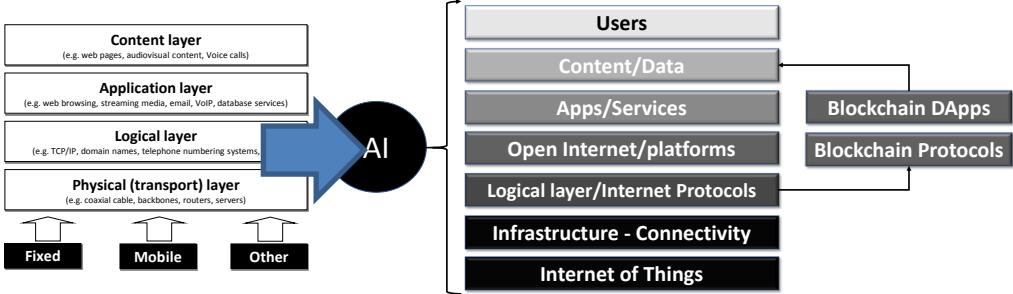
Source: Author's elaboration

Figure 1 above portrays the evolution of the technology stack. The Internet of Things (IoT) layer generates an unprecedented amount of data, requiring sensor technology, nano-tech, enhanced connectivity through 5G or satellite, and devices like drones or robots, able to generate live data remotely[27]. Regardless of the way in which data are generated, stored and exchanges, the use of AI will be ubiquitous in most supply chains. At the top of the supply chain, end users very often constitute the "weakest" link, which require the provision of adequate skills in using digital technologies (Renda 2019).

Although no real estimate of the combined impact of these technologies on the future economy exists, several studies have already been published on the economic impact of AI, as well as on the impact of IoT in specific sectors. For example, recent reports by Accenture/Frontier Economics, McKinsey and PWC conclude that AI will be a game changer for total factor productivity and growth, by gradually rising as a third pillar of production, together with labour and capital. PWC concluded that by 2030, global GDP will be 14% higher due to AI development and diffusion;[28] the Accenture study finds that growth rates will be doubled by 2035 thanks to AI.[29] The latter study also shows an industry-by-industry breakdown, which includes agriculture, forestry and fisheries: this sector is expected to more than double its growth rate by 2030, from 1.3% to 3.4% on a yearly basis thanks to AI. Distributed ledger technologies are expected to complement these developments by solving several market failures along supply chains, as well as empowering end users in their consumption choices; some commentators go beyond these expectations and foresee a revolutionary impact of blockchain in many sectors, but this chiefly depends on whether more decentralised architectures will prove scalable over time.

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[26] See A Renda, 'Artificial Intelligence: Ethics, Governance and Policy Challenges' (2019) *CEPS Monograph*.

[27] Data can be stored in various ways, including through remotely accessible, cloud-enabled solutions; through distributed databases; or through distributed ledger technologies such as blockchain. Some of these technologies are key enablers of value chain integrity, monitoring and trust, since they produce "audit trails" that enhance the verifiability of transactions and contractual performance across the value chain.

[28] PWC, 'Sizing the Prize. What's the real value of AI for your business and how can you capitalise?' (2019) PWC Analysis at https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf.

[29] M Purdy and P Dougherty, 'Why Artificial Intelligence is the Future of Growth' (2017) *Accenture/Frontier Economics Report* at https://www.accenture.com/t20170927T080049Z__w__/usen/_acnmedia/PDF-33/Accenture-Why-AI-is-the-Future-of-Growth.PDFla=en).

II.   The Single Market 2.0 as a Layered Ecosystem

The previous section embarked into a short description of three decades of digital transformation, with a clear objective: to show that technological evolution often opens up new possibilities, which must be accounted for in the definition of public policies. In this context, the EU is faced with the herculean task of shifting gear towards a more assertive and enlightened policy for the Digital Single Market, in a way that preserves its values and at the same time boosts its competitiveness and sustainability over the coming years. This will require a thorough redefinition of the strategy for the Single Market, to preserve at once its role of "workhorse" of European integration, as well as driver of EU international actorness and competitiveness. The European Commission has acknowledged in many occasions that there can be no "geopolitical Commission" without a strong Single Market at home: even strategies aimed at orienting digital technology towards human rights and sustainability require a significant market positioning to be credible in internal fora.

As already mentioned, the "new" European Commission made a strong commitment to the digital transition, positioning the digital environment as a critical infrastructure, and postulating the need for digital sovereignty and the twin transition (green and digital) as cornerstones of its new geopolitical mission. The adoption of a comprehensive, ambitious data strategy and the White Paper on Artificial intelligence paved the way for new policy developments that aim, for the first time, at anticipating future market developments by achieving a first-mover advantage in the forthcoming second wave of digital transformation. As clearly stated by Commissioner Thierry Breton, the European Commission expects that the next years will mark a transition towards more distributed, localised data storage, at the edge and in devices as opposed to the cloud. While cloud operators will remain important, they will be part of a more complex architecture, as we described in Section I.B. This represents at once a challenge and an opportunity: on the one hand, it is clear that Europe has missed the first train (the B2C wave), and this may deprive it of the resources, the skills and the industrial base needed to jump into the second; on the other hand, the B2B sector is not (yet) dominated by the large tech giants, and requires the orchestration of resources from legacy industrial sectors, such as manufacturing, automotive, pharma, energy, in which European corporations are often market leaders. Similarly, the importance of data flows in (and for) government require action to avoid that public institutions end up relying on non-EU players for cloud and software solutions: digital sovereignty thus calls for new initiatives aimed at creating a full European technology stack. As explained by the European Commission, this assertive approach can and should be coupled with concrete commitments to use digital technology "for good", in particular in support of the Green transition: this requires, for example, that data centres become carbon neutral by 2030, and that the IT equipment used in Europe aligns with the requirements of the circular economy.[30]

The COVID-19 pandemic created a double challenge to the original commitments of the von der Leyen Commission. On the one hand, the need for concrete actions to strengthen Europe's digital economy has become even stronger, as most economic and social activities move online: an investment in the IoT and the Edge IT layers appears urgent to say the least, in the attempt to transform suffering economic sectors, facing an unprecedented nosedive in production and turnover. On the other hand, the upcoming depression may lead those sectors in dire straits, and thereby in the impossibility to embark in such an ambitious transformation. Despite the crisis situation, at the time of writing EU institutions have confirmed their intention to proceed as planned on the twin transition: the Council conclusions of 26 March 2020 urged the Commission to "get back to a normal functioning of our societies and economies and to

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[30] See the European Commission's Communication, Shaping Europe's Digital Future, 19 February 2020 at https://ec.europa.eu/info/sites/info/files/communication-shaping-europes-digital-future-feb2020_en_4.pdf.

sustainable growth, integrating inter alia the green transition and the digital transformation, and drawing all lessons from the crisis."[31]

The Commission's response on the twin transition placed the Single Market at the forefront, advocating the acceleration towards a "more circular, climate neutral and modernised economy". Current emphasis is however being placed on incremental measures such as reinforcing digital skills and making new tools and resources available to SMEs, on the reduction of red tape, the strengthening of enforcement in the traditional Single market. Only time will tell whether Breton's original ides of a more forward-looking approach to the Digital Single Market will survive the COVID-19 crisis. In order for Europe to realise its ambition to preserve and further nurture its actorness and competitiveness at the global level, it is important that the Commission realises that the "data train" has not left the station, and that Europe has a unique window of opportunity to rely on the new digital transition to boost its weight in global economy. This requires a number of initiatives, aimed at rebalancing (or restoring) competition in B2C digital markets; create and promote efficient data spaces in the B2B domain; pave the way for a distributed and reliable single market for services; enable a network of interoperable administrations and leverage eIdentity as a means to empower citizens and consumers; and lead the world on the responsible development and use of digital technologies.

Below, I briefly elaborate on each of those pillars.

A. Rebalancing Competition and Value Allocation in the B2C Domain: from Competition Policy to the Federated Cloud Infrastructure

It has become relatively uncontroversial that the "first wave" of digital transformation has created positions of excessive power, transforming a fistful of digital players in gatekeepers of the Internet, and leading to an excessive concentration of value generated by the digital economy.[32] There are many ways in which the EU institutions can try to rebalance this situation.

First, the Commission is likely to reform its competition rules to acknowledge the existence of specific situations in which digital players, regardless of market definition, occupy a position that grants them "intermediary" power, mostly fuelled by network effects and data availability. This move, which would echo the recent debate on the German draft Digitalisation Bill, might lead to considering specific remedies, such as the imposition of mandatory interoperability for specific datasets, to enable competitors to deploy similar services. This is likely at least for specific datasets which can be considered to be essential to develop services of general interest, and would be a re-proposition of the essential facilities doctrine, which dates back more than two decades in EU competition law, to cases like *Magill*, *IMS Health*, and *Microsoft*.[33]

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[31] See Joint Statement of the Members of the European Council, 26 March 2020 at https://www.consilium.europa.eu/media/43076/26-vc-euco-statement-en.pdf.

[32] See M Mazzucato, *The Value of Everything. Making and Taking in the Global Economy* (Penguin Books, 2018).

[33] See A Renda, 'Competition-regulation Interface in Telecommunications. What's left of the Essential Facilities Doctrine' (2010) 34(1-2) *Telecommunications Policy* 23-35. Based on this approach, whenever a dominant market player holds an asset of information that is essential for competitors to viably compete in the relevant market, and refusal to provide access to this information is likely to either lead to the exit, or even prevent the growth of, 'as efficient' or even 'not yet as efficient' competitors, then competition law may provide for compulsory access remedies. Much in the same vein, the German government is now imposing compulsory access obligations to tech giants for specific datasets. In a recent paper for the European Commission's DG COMP, Jacques Crémer, Yves-Alexandre de Montjoye and Heike Schweitzer echo this view by observing that "the ability to use data to develop new, innovative services and products is a competitive parameter whose relevance will continue to increase"; and clarified that "in a number of settings, data access will not be indispensable to compete, and public authorities should then refrain from intervention. In other settings, however, duties to ensure data access – and possibly "data interoperability" – may have to be imposed". The paper correctly points out that a "broader diffusion of data is not always desirable, either from a social welfare or from a competition perspective" due to privacy concerns; and that

Second, in the B2C domain, EU institutions could decide to go beyond data access and interoperability obligations, and adopt policies aimed at returning control of their data to end users, or even treat data 'as labour' whenever possible, as advocated recently by the Report of the High Level Expert Group on the Impact of the Digital Transformation on EU Labour Markets.[34] This would lead to forms of remuneration from digital platforms to end users, which may take various forms, including the provision of free services, or most likely a web tax, which seems even more likely in the aftermath of the COVID-19 pandemic.[35] This approach, however, would not lead to the creation of more competition in the market, or possibly even the entry of European players in the B2C segment.

Another area that will prove important to rebalance the bargaining position of market players and users in the ecosystem is the effective implementation of recent EU rules on the unfair distribution of the contractual surplus among parties in the commercial relation. So-called "platform-to-business" (P2B) practices have been subject to specific regulation in the European Union, where a specific observatory on online platforms has been created in order to monitor the application of the regulation. The EU P2B regulation introduces a ban on certain unfair practices (eg no more sudden, unexplained account suspensions, plain and intelligible terms and advance notice for changes, greater transparency and mandatory disclosure for a range of business practices) and new dispute resolution possibilities.[36] P2B rules echo similar legislation that many countries have enacted in the domains of abuse of economic dependency, abuse of superior bargaining power, contract law, or unfair competition. In Germany, the draft Digitalisation Bill echoes existing provisions on "relative market power" vis-á-vis smaller enterprises, by removing any reference to the business size and adding that relative market power shall also be assumed for "undertakings acting as intermediaries on multi-sided markets insofar as undertakings are dependent on their intermediary services with regard to access to supply and sales markets in such a way that sufficient and reasonable alternatives do not exist" (Sec 20 para 1 GWB-Draft).[37]

Apart from reforming existing rules, the Commission will also act to restore digital sovereignty in the ecosystem, in particular by seeking the creation of a federated cloud infrastructure, operating under rules and protocols that embed strict data protection and governance requirements. This will most likely take inspiration from the GAIA-X project, initiated by France and Germany and already including more than 120 partners. GAIA-X can be seen as the quintessential pan-European approach to the future of the Single Market: rather than representing a single player competing with the US tech giants, GAIA-X is a federated data infrastructure, open to small and large companies, which attempts at once to level the playing field, and to embed in the cloud specifications the compatibility with key European provisions on security, data protection, openness and transparency, interoperability and trust.

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in addition to data interoperability, in some cases full protocol interoperability may be needed for competitors to be able to compete on an equal footing.

[34] See the Final report of the High-Level Expert Group on the Impact of the Digital Transformation on EU Labour Markets, April 2019 at https://ec.europa.eu/digital-single-market/en/news/final-report-high-level-expert-group-impact-digital-transformation-eu-labour-markets.

[35] In that case, the tax would be based on the consideration that the digital platforms derive (some would say, extract) value from the end users, who provide data in exchange for being part of the platform: the main theoretical argument in favour of such a form of redistribution is the 'collective action problem' faced by end users, who are structurally unable to place a price on the data they provide, while these data, once aggregated, become extremely valuable to the platform. This form of positive externality could be seen as the market failure that a web tax, or any other form of redistribution, would seek to remedy

[36] In Australia, similar concerns were expressed during the ACCC Digital Platforms Inquiry. Among those practice, some may also lead the digital platform to favour its own products, or anyway "preferred" customers on the business side, possibly through algorithmic ranking and product placement choices.

[37] Relative market power is to be assumed if undertakings depend on access to data to enter a market; in addition, hampering rivals' attainment of positive network effects can constitute an abuse if this is capable of triggering the tipping of a market: this includes case in which a platform adopts measures measures to disable data portability or interoperability along with exclusivity clauses or tying practices, to the extent that such measures create a "serious risk of a considerable restriction of competition on the merits."

In particular, interoperability is sought at three different infrastructure levels: network, data and service, in a way that resembles the approach to interoperability adopted by the European Commission to enhance exchanges between EU and national administrations (see below).

While still in its infancy, the GAIA-X project represents a gateway towards a next generation approach to technology-enabled policymaking at the EU level. It is, in particular, a clear response to the emerging edge-cloud infrastructure (as acknowledged in the GAIA-X White Paper);[38] and a sign of the increased awareness, in the European Commission, of the revolutionary potential of the second wave of digital transformation: centralized governance does not mean market concentration, especially if a common environment for cloud services is coupled with clear data interoperability and portability rules. In this respect, the emphasis on common standards and a thicker (three-level) interoperability framework embeds the key features of the Single Market 2.0 approach, in continuity with a long-standing approach of the European Commission.

B. Securing the B2B Domain: the End of Open Data

Based on our description of the EU strategy above, it is inevitable that the strongest effort of the new Commission will be concentrated in the B2B domain, where the emergence of the IoT and the edge/cloud infrastructure powered by 5G and other forms of connectivity call for a new approach to industrial policy. This seems to lead to a combination of data strategy and industrial policy, both adopted by the von der Leyen Commission under the auspices of Commissioner Breton in the first 100 days of the Commission's mandate.

The data strategy announces the objective to create a single European data space and couple it with measures aimed at ensuring that by 2030, the EU's share of the data economy corresponds to its economic weight ("not by *fiat* but by choice", the Commission adds). The idea of creating a "genuine single market for data" leads to an upgrade of the "free flow of non-personal data" approach that emerged during the Juncker Commission. Even if the Commission is very cautious not to venture into too assertive statements, it emerges clearly that in the B2B domain, the age of "open data", free-flowing information as a means to the promotion of innovation is definitely over. The need to avoid capture of industrial data by large tech giants, and imbalances in the distribution of revenues along the value chain, leads the Commission to propose the creation of a two-layer architecture, with an overarching single European data space and a number of domain- or mission-specific data spaces. The stated reasons for this move are the fragmentation between national data policies, and the persistence of significant constraints to all types of data flows; the existence of imbalances of market power; problems of data quality and interoperability; lack of adequate provisions for data governance; and a collection of other problems on both the supply and the demand side of data, including security aspects, regulatory certainty, and skills.

The result is the proposed creation of a series of large pools of data in specific domains, combined with the technical tools and infrastructures necessary to use and exchange data, as well as appropriate governance mechanisms. These pools (renamed "data spaces") require the adoption of a horizontal framework complemented by sectoral legislation for data access and use, and mechanisms for ensuring interoperability, and must be developed in full compliance with data protection rules and according to the highest available cyber-security standards. Such framework will be adopted by the end of 2020, and will need to be complemented by policies that stimulate the use of data and demand for services enriched with data.[39] Apart from the governance aspects of data space management, which are still unknown, it is clear that data spaces are a key component of the Commission's new vision for

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[38] See Project GAIA-X. 'A Federated Data Infrastructure as the Cradle of a Vibrant European Ecosystem' available at https://www.bmwi.de/Redaktion/EN/Publikationen/Digitale-Welt/project-gaia-x.pdf?__blob=publicationFile&v=4.

[39] See the Commission's Work Programme 2020 at https://ec.europa.eu/info/publications/2020-commission-work-programme-key-documents_en.

data-driven industrial policy, and aim at realising at once a rebalancing effect (keep entitlements over data in the hands of industrial players) and a repatriation effect (ensure that data are stored and managed according to European rules, and preferably in the territory of the EU).

The data spaces proposed by the Commission in its data strategy, as already mentioned, are in some cases cross-sectoral, in others more sector-specific. Among the cross-sectoral ones are a "Green Deal data space", which is expected to mobilise public and private data to help achieve Europe's environmental goals, even by creating a digital twin of the Earth; a Common European skills data space, aimed at reducing skills mismatches in the labour market; and European data spaces for the public administration, aimed at strengthening data exchanges, promoting transparency and accountability, fighting corruption, and enabling GovTech solutions. More sectoral solutions are devoted to manufacturing, mobility, health, finance, energy and agriculture.

The data spaces approach must be analysed in conjunction with the Industrial Strategy communications, adopted by the Commission in March 2020.[40] The strategy, though mostly focused on the real economy and on related topics such as innovation and entrepreneurship as well as industry alliances and the "analogue" Single Market, places strong emphasis on the concept of industrial ecosystems, which are not clearly defined in the Communication. One of the most crucial aspects of the new ecosystems approach is whether they will be defined as coinciding with industry sectors (eg aviation), or in a mission-oriented way (eg mobility). Data spaces have been defined according to the latter approach, but the COVID-19 crisis may call for a more sector-specific approach to industry support and aid. The new approach to the Single Market 2.0 would preferably preserve the mission-oriented approach, as well as its vocation towards sustainable development in a technology-neutral way.

C. A Distributed Single Market for Services

Above the infrastructure and data governance layers, the Single Market 2.0 will enable different forms of governance, from centralised to more distributed and decentralised. One interesting characteristic of the digital economy, in this respect, is that the traditional barriers to entry in the form of economies of scale are less likely to materialise, especially in the service economy. The servitisation of the economy describe in Section I above makes it possible for very small businesses to use powerful IT equipment, rent drones and even tractors or other costly machinery "as a service". The rise of 3D printing decentralises the production and assembling of products, drastically reducing costs. For example, in agriculture communities of farmers can then access modern technology at a fraction of the cost, and only for the time needed.[41] However, as already recalled these barriers to entry are being replaced by less tangible ones, notably represented by data access and management, as well as related skills.

The new technological frontier, coupled with interoperability rules, will make further servitization possible, alongside with the adoption of more distributed governance structures, thereby enabling greater market competition. Industrial economics will fundamentally change, unveiling the possibility to address issues in a centralised, distributed or decentralised way, as depicted in figure 2 below. In some cases, a centralised architecture (for example, exclusively cloud-based) may emerge, thereby triggering network externalities and winner-take-all competition; in other situations, a decentralised structure may lead to edge/cloud architectures and federated structures organised along a limited number of "supernodes"; and finally, with technological development even fully distributed structures, with service provision among peers, become increasingly possible.

[40] See Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, 'A New Industrial Strategy for Europe', COM(2020)102 final, 10 March 2020.
[41] See Renda et al, above n 20.

Figure 2 – Centralised, decentralised and distributed computing

Centralised (A)   Decentralised (B)   Distributed (C)
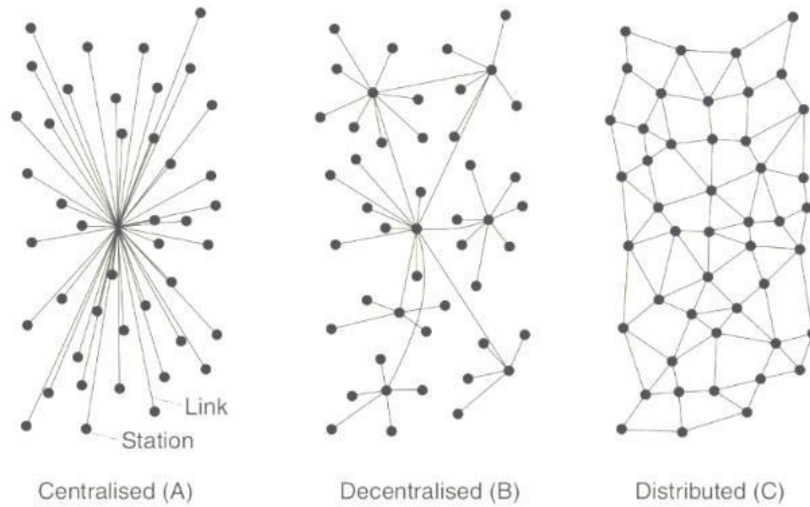
Source: Truong et al. (2016)[42]

In more concrete terms, this may mean that in some markets, a large number of small corporations may end up competing for services, by using data made available through widespread interoperability requirements. This comes very close to the IHAN model proposed by SITRA, which *de facto* re-proposes the PSD2 "open API" approach at a wider scale, commoditising data availability (hopefully, implementing privacy-preserving arrangements) and laying the foundations for a more competitive, pluralistic Single Market for services. Maximising data availability will also mean liberating all possible sources of data flow, including the use of public sector information by business (G2B); sharing and use of privately-held data by other companies (B2B); the use of privately-held data by government authorities when appropriate and desirable (B2G); and data-sharing between public authorities (G2G). In this respect, all other pillars of the proposed new framework for the Single Market 2.0 are essential to feed the new services market. For example, public administrations (as defined in more detail below) could enable innovation by acting as platforms and offering open APIs to citizens and businesses, thereby significantly lowering the data barrier to entry. Widespread, privacy-compatible data availability throughout the Union can also contribute to the environment by enabling more localised solutions. In a nutshell, the Single Market 2.0 would be more integrated (through data flows), competitive (through data interoperability), decentralised (through lower data barriers to entry) and environmentally sustainable (through lower transport costs, as well as carbon-neutral data centres).

Such a vision requires, inevitably, the support of modernised legal rules. In particular, the scope of most product liability regimes does not include intangible goods, implying that cases of inadequate services, careless advice, erroneous diagnostics and flawed information are as such not covered. A comparable situation exists in the field of product safety regulation, which so far has not been accompanied by a regulatory framework in the field of safety of services. In all these fields, the EU *acquis* appears far from complete, and will require more attention in the years to come. The upcoming Digital Service Act should fill this gap by clarifying the conditions for the liability of online service providers and intermediaries. The needed update of the Product Liability Directive will most certainly entail a revision of key definitions such as "product" and "producer", as well as rules on certain practices adopted by service providers vis à vis end users, such as price personalisation through automated decision-

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[42] N Truong, U Jayasinghe, T-W Um and M Gyu, 'A Survey on Trust Computation in the Internet of Things' (2016) 33 *The Journal of Korean Institute of Communications and Information Sciences* (J-KICS) 10-27.

making and profiling. In other words, the body of rules that supports the new vision of the Single Market should be able to generate sufficient trust among end users, as will be explained in more detail in Section II.E below.

D. Digital Government and eIdentity

Data availability and user-centric innovation in the future Single Market 2.0 would greatly benefit from a proactive role of government in the generation, collection, protection and provision of data. This can occur through *ad hoc* data trusts, or simply by public administrations acting as orchestrators of the data economy. The European Commission has gone a long way in creating the preconditions for the interoperability between administrations in Europe, in particular through its ISA2 programme, which led to the development of re-usable building blocks, available to national and local governments on a purely voluntary basis. However, that framework has led to a very low uptake, and would need to be converted into a much more concerted action for the development of digital government and "government as a platform" approaches in Europe: this includes measures included in the semester, in the InvestEU and Digital Europe programmes, and dedicated support through the newly created DG REFORM. The swift transition towards digital government solutions is even more urgent since the Ministerial Declaration on e-Government in Tallinn on 6 October 2017, in which the Ministers in charge of e-Government policy from 32 countries of the European Union (EU) and the European Free Trade Area (EFTA) unanimously committed to the vision laid out in the EU e-Government Action Plan 2016-2020 and in the new European Interoperability Framework that public administrations and public institutions in the EU should be open, efficient and inclusive, providing borderless, interoperable, personalised, user-friendly, end-to-end digital public services to all citizens and businesses – at all levels of public administration[43]. This includes, i.a., the development of more efficient and user-centric digital services; a call on the EU institutions to develop more interoperable, efficient, open and transparent administrative procedures to best serve their citizens and interoperate with all levels of government.[44] The ISA2 programme will leave, as important legacy, a layered approach aimed at building the foundations of the Single Market 2.0 by ensuring a high level of legal, organisational, semantic and technical interoperability between administrations.

EU institutions should take the timeline of the Tallinn declaration seriously: they have agreed at the end of 2017 to achieve six targets within five years: digital by default and inclusiveness; application of the "once only principle"; secure trusted electronic identification and trust services for electronic transactions in the internal market; enable the possibility for people and business to access personal data held by the public administrations; integrate instruments and a call to public authorities to oblige cross-border interoperable solution compatibles with European frameworks and standards; and improve the digital leadership skills and the IT education in every level of the public administrations.[45]

Among these commitments, as particularly important for the development of the whole Single European data space will be the area of digital verification, encompassing both digital identify (eID) and electronic trust services (eTS), altogether subsumed under an EU framework for authentication in digital transactions (eIDAS). eIDAS sets the standards and criteria for simple electronic signature, advanced electronic signature, qualified electronic signature, qualified certificates and online trust services. Furthermore, it rules electronic transactions and their management. Among other benefits, it fully recognizes digital means of verification that are considered to be equivalent to physical presence. In doing so, it lays the foundations for the creation of the Single European Data space. The system could in the future be updated to include other means of verification (eg fingerprint scan) and create a new system for

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[43] https://ec.europa.eu/digital-single-market/en/news/ministerial-declaration-egovernment-tallinn-declaration.
[44] ibid.
[45] https://joinup.ec.europa.eu/collection/nifo-national-interoperability-framework-observatory/news/tallinn-egov-declaration.

certification of digital ID in the Single Market 2.0. It should also be complemented by trustless (or better, trust-enhancing) mechanism for time-stamping, origin-stamping and other transaction authentication methods offered by Distributed Ledger Technologies (including fully privacy-preserving ways such as zero knowledge proofs).

E. Leading the World on Digital Technology "for good"

As already remarked in the previous section, a key pillar of the emerging Single Market 2.0 will necessarily have to be the trustworthiness of its infrastructure, protocols, rules, and services. In this respect, the EU has the responsibility and the opportunity to lead the world in the development of a trusted digital environment and has already started to do so in the domain of Artificial Intelligence. In the AI field, the European Commission (backed by an *ad hoc* High Level Expert Group (AI HLEG), advocated the transition towards "Trustworthy Artificial Intelligence", defined as AI that meets three cumulative requirements: legal compliance, ethical alignment, and socio-technical robustness. The AI HLEG identified four key principles (defined as ethical "imperatives") for Trustworthy AI: the respect for human autonomy, the prevention of harm, fairness and explicability.[46] These principles were further broken down into seven requirements, which were then operationalized into an Assessment List on Trustworthy AI (ALTAI). This strategy arrived at a turning point with the White Paper adopted on February 19, 2020 (together with the new EU strategy for data), in which the von der Leyen Commission announces the adoption of a flexible, agile regulatory framework limited to 'high-risk' applications, in sectors such as healthcare, transport, police and the judiciary; and focusing on provisions related to data quality and traceability, transparency and human oversight. A legislative initiative on AI is now expected by the end of 2020, as outlined in the Work Programme of the European Commission, which envisages a follow-up to the White Paper, including on safety, liability, fundamental rights and data.

The EU agenda on AI inspired many other countries and international organisations, including the OECD principles on AI, the G20 human-centred AI Principles, as well as the "AI for good" within the International Telecommunications Union. This revived the EU's actorness in the digital technology space, where it is now a recognized standard-setter, and perhaps the only superpower able to credible orchestrate a dialogue on responsible uses of digital technologies (starting with AI). In order to sustain high standards in this domain, as already recalled, the EU will need to rely on a vibrant Single Market, to be leveraged through extra-territorial rules to avoid that EU products are outcompeted by non-European, less sustainable standards.

## III.   Conclusion: towards a New Architecture for the Single Market 2.0

The five pillars of the Single Market 2.0 illustrated in Section II are certainly a non-exhaustive account of the possible future of Europe's "crown jewel". Compared to the architecture of the Internet shown in Figure 1 above, the new Single Market would look more articulate, but not necessarily more complex from an end user perspective. As shown in figure 3, the Single Market 2.0 would have an extensive infrastructure layer, composed of connected things, the edge IT layer, various connectivity protocols (including 5G and many others) and the federated cloud infrastructure. Above that layer, the traditional logical layer would be flanked by a legal, identity/trust and semantic interoperability layer, which will then support the emerging cross-cutting and sector-specific data spaces. These will cover most of the Single Market 2.0 from a B2B perspective, whereas the B2C will be more similar to the current Internet ecosystem. An

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[46] Importantly, contrary to what typically occurs in similar documents, the list did not include an imperative to "do good", or the so-called "beneficence" principle, which had been included in earlier drafts of the Guidelines See A Jobin, M Ienca, E Vayena, 'The global landscape of AI ethics guidelines. Nature Machine Intelligence' (2019) (ISSN 2522-5839).

important role could be played by G2C and G2B services with public administration becoming real catalysts of social innovation.[47]

Figure 3 – A sketched architecture of Single Market 2.0
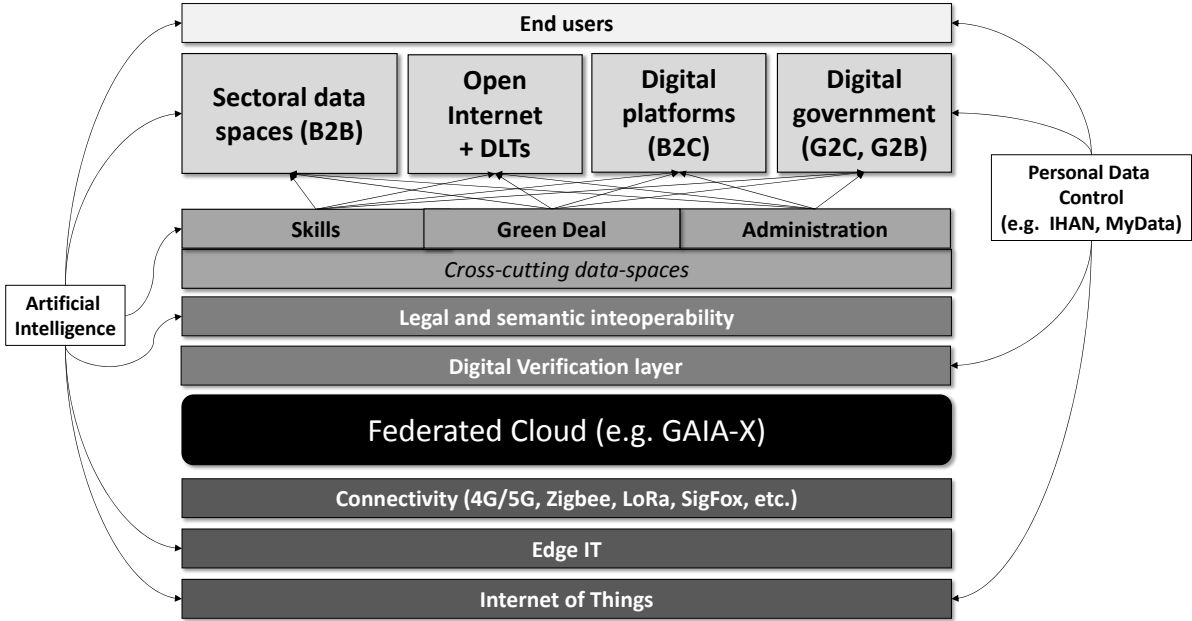
Source: Author's elaboration

This, inevitably, is only a sketch of the main components of the future Single Market 2.0, which will certainly be even more complex. The role of technologies such as blockchain and other DLTs in enabling transactions and fostering the so-called token economy is one of many aspects that will emerge over the next few years, and which are difficult to fully anticipate at the time of writing. The digital environment, as I have tried to explain throughout these pages, is an ever-changing multi-layered ecosystem, which becomes thicker as time goes by, and where the technological evolution defines the frontier of what is possible in a constantly evolving way.

The EU finds itself in a relatively favourable position at least in some of the layers portrayed in Figure 3. This is the case for 5G connectivity, an area in which EU companies like Nokia and Ericsson are rivalled (and complemented) by Chinese and South Korean players, and are way ahead of their North American counterparts; in the development of a federated cloud, thanks to the initiative of Member States; in the availability of a pan-European framework for digital verification, an soon also in the development of a governance framework for data spaces. The EU is also leading the world in responsible AI, in trusted blockchain applications and in a number of industrial B2B applications, from manufacturing to healthcare. Against this background, the looming economic recession, the oscillating trust and commitment of Member States and the lack of agility of EU institutions may stand in the way of a rapid shift towards a more vibrant, future-proof Single Market. Absent political commitment and a good dose of enlightened policymaking, the European Union risks missing also the second wave of digital transformation: afterwards, new waves will certainly come, yet catching up may prove increasingly challenging for the ones that lag two (or more) generations behind.

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[47] See also AI HLEG, Policy and Investment Recommendations, June 2019.

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