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The COVID-19 pandemic has further accelerated the digitalization of the transatlantic and global economies, even as it has upended the world's way of living, working and playing. Some industries have been devastated while others have grown more resilient by fast-tracking their digital transformation. Many digital pioneers experienced a gold rush as online spending surged and virtual conferencing, learning and gaming all skyrocketed. Analysts estimate the crisis has sped up the adoption of a wide range of digital technologies by at least two years.¹

Digital tools powered an unprecedented worldwide sharing of gene sequencing data to track and treat SARS-CoV-2, the virus that causes the COVID-19 disease. The first breakthrough vaccine was a triumph of transatlantic collaboration between Germany's BioNTech and U.S.-based Pfizer. The speed at which the vaccine was developed was an amazing feat of science that was reliant on barrier-breaking synergies between digital and medical advances, and not possible for any previous pandemic.²

When the pandemic subsides, more government services will be online and more people will work and learn more flexibly. Digital shopping, virtual fitness, and online courses are all likely to become regular fixtures of societies across the Atlantic and beyond. Digital companies will grow into new areas of business and play an even larger role in our lives than they do now. Between 2020 and 2023 companies are expected to spend \$6.8 trillion on digital transformation. By the end of 2021, 60% of global GDP will be digitized.³

The numbers continue to astound. This year, humans will generate 74 zettabytes of data – 840 million times the Internet's size in 1997.⁴ More than 5.22 billion people now use mobile phones. 4.66 billion are now online. We now spend almost as much time online as we do asleep. Nearly half a billion people began to use social media in 2020, taking the global total to

4.2 billion people who will spend a total of 3.7 trillion hours on social media in 2021 – equivalent to more than 420 million years of combined human existence.⁵

The digital economy is not just connecting billions of people to each other, it is connecting them to billions of things, and it is connecting those billions of things to each other as well.⁶ Cisco estimates that 500 billion devices will be connected to the Internet by 2030.⁷ This has prompted former Cisco Chairman John Chambers to predict that the globe is already moving beyond the Internet of Things (IoT) to what he calls "the Internet of Everything: the penetration of the World Wide Web into the everyday aspects of our lives."⁸

For the transatlantic economy a number of digital transformations bear watching.

First, as companies and countries in North America

Rise of
cyberattacks

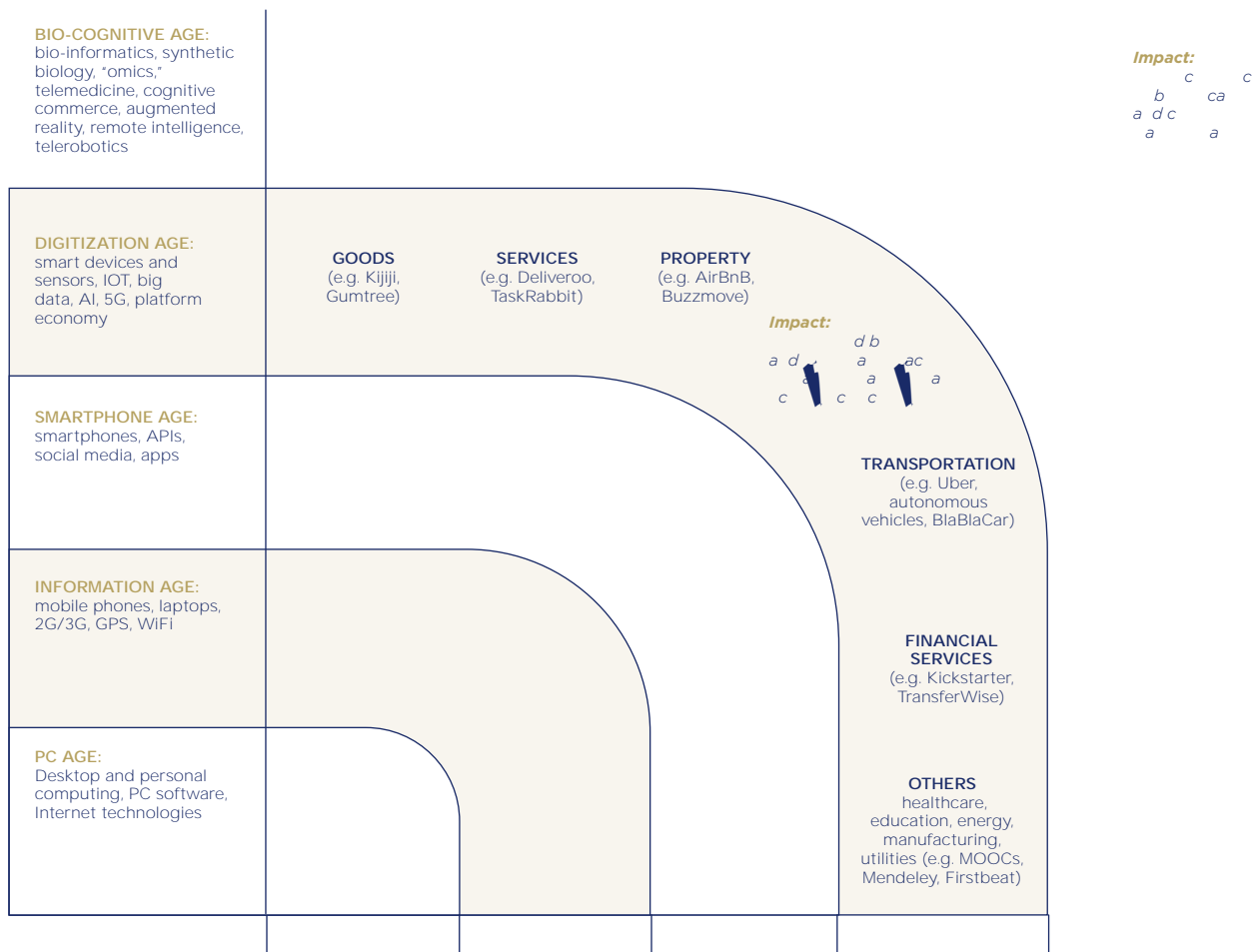
Digitization and
internationalization of SMEs

Germany and other advanced manufacturing countries are likely to fare much better when it comes to another new frontier: the advent of the connected factory. It is estimated that smart factories will have delivered over \$500 billion in value, and increased overall manufacturing productivity by a factor of seven, over the past five years. Their potential is enhanced by 3D technologies such as 3D printing, 3D visualization and 3D configuration. These digital innovations are changing how products are designed, manufactured, used and serviced. Mass production is shifting to mass customization. Product-based manufacturing models are increasingly complemented by product-as-a-service models. Extended trade-in-task supply chains are evolving into smarter, connected and more resilient systems. Lower-cost countries, such as China, are no longer the automatic first choice for manufacturing facilities, as producers build capacities closer to their customers and seek to avoid bottlenecks and chokepoints.¹⁴

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Even as we grapple with the advances and challenges of the “Digital Age,” some pathfinders are already charting new revolutionary advances in quantum physics, biology, nanotechnology, behavioral and cognitive sciences and artific0.135 digw Op(t choic)nrh7\$.d).

Table 1 The Expanding Digital Frontier



Sources: GSMA Intelligence; McKinsey Global Institute; Author's own estimates

Many services sectors that were once non-tradable – because they had to be delivered face-to-face – have become highly tradable – because they can now be delivered over long distances.¹⁹ Digitalization even blurs the distinction between trade in goods and services. Automakers are now also services providers; online retailers are now also manufacturers. 3D-printing generates products that are a mix of goods and services.²⁰ Digitalization increases the importance of data flows and intellectual property. It has boosted trade in software design over trade in final products.

1. Introduction

The digital economy is dominated by services, which accounted for over 90% of total U.S. digital economy current-dollar value added in 2017.²⁶ Two metrics offer us a clearer picture of transatlantic connections in digital services. A narrow view can be had by looking at cross-border ICT services, or digital services as shorthand, which are services used to facilitate information processing and communication.²⁷ A broader view can be taken by looking at digitally-enabled services: services that can be, but not necessarily are, delivered remotely over ICT networks. These include digital services as well as “activities that can be specified, performed, delivered, evaluated and consumed electronically.”²⁸ Identifying potentially ICT-enabled services does not tell us with certainty whether the services are actually traded digitally.²⁹ But the U.S. Commerce Department notes that “these service categories are the ones in which digital technologies present the most opportunity to transform the relationship between buyer and seller from the traditional in-person delivery mode to a digital one,”³⁰ which means a digital transaction is likely and thus can offer a rough indication of the potential for digital trade.³¹

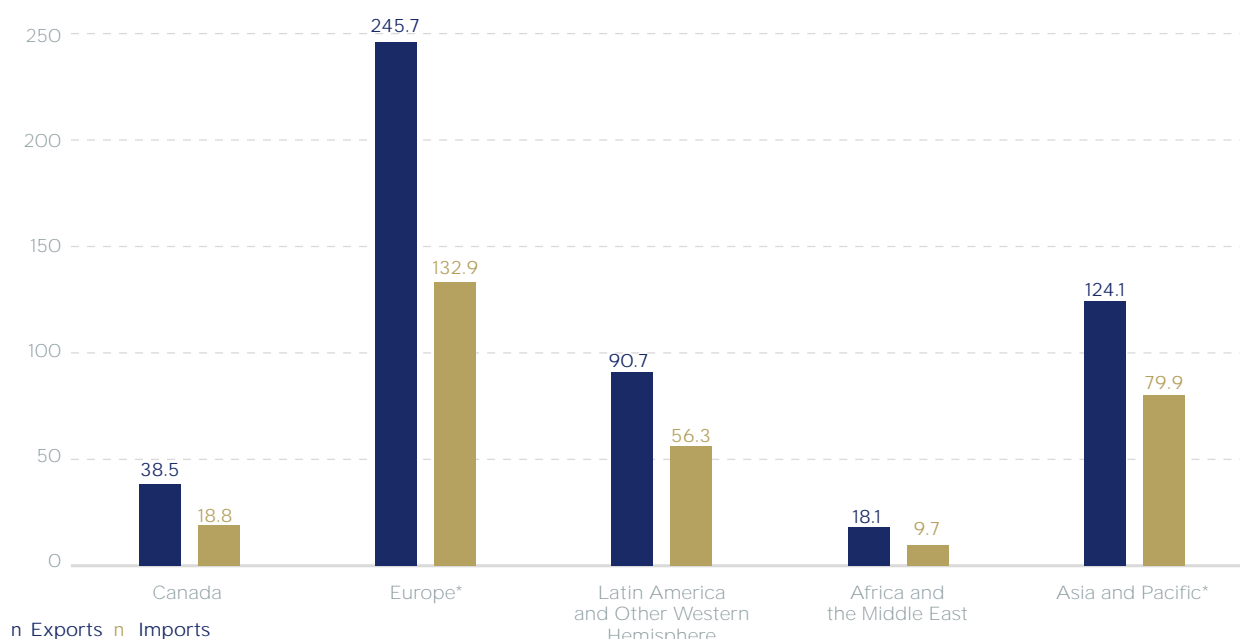
In 2018, the latest year of available data, digitally-enabled services exports amounted to \$2.9 trillion, half of total global services exports. Business services exports were by far the largest category, with a global value of \$1.2 trillion.³²

Digitally-enabled services are not just exported directly, they are used in manufacturing and to produce goods and services for export. Over half of digitally-enabled services imported by the United States from the European Union is used to produce U.S. products for export, and vice versa, thus generating an additional value-added effect on trade that is not easily captured in standard metrics.³³ According to the OECD, the top global hubs for imports and exports of digitally deliverable services are the United States, Germany, Ireland, the Netherlands, France and the UK.³⁴

In 2019, digitally-enabled services accounted for 59% of all U.S. services exports, 50% of all services imports, and 76% of the U.S. global surplus in trade in services (Table 7).

In 2019 the United States registered a \$219.9 billion trade surplus in digitally-enabled services with the world. Its main commercial partner was Europe, to which it exported over \$245 billion in digitally-enabled services and from which it imported an estimated \$133 billion, generating a trade surplus with Europe in this area of over \$112 billion. U.S. exports of digitally-enabled services to Europe were about 2.7 times greater than U.S. digitally-enabled services exports to Latin America, and roughly double U.S. digitally-enabled services exports to the entire Asia-Pacific region (Table 3).

Table 3 U.S. Trade in Digitally-Enabled Services by Major Area, 2019 (\$Billions)



*Europe imports of ICT are author's estimates. Actual data for ICT imports in 2019 have been suppressed to avoid disclosure of individual company data.

Source: Bureau of Economic Analysis, Trade in Potentially ICT-Enabled Services Database. Data as of July 2020.

The 27 EU member states collectively exported €1.1 trillion in digitally-enabled services to countries both inside and outside the EU in 2019.³⁵ EU27 imports of digitally-enabled services were also €1.1 trillion in 2019. Excluding intra-EU trade, EU member states exported €585 billion and imported €622 billion in digitally-enabled services, resulting in a deficit of €37 billion for these services (See Table 3 and Table 4).

Digitally-enabled services represented 55% of all EU services exports to non-EU countries and 63% of all EU services imports from non-EU countries.

In 2019 the United States accounted for 22% of the EU27's digitally-enabled services exports to non-EU countries, and 27% of EU digitally-enabled services imports from non-EU countries.³⁶ The United States

purchased €130 billion, according to Eurostat data for 2019, making it one of the largest consumers of EU digitally-enabled services exports.

European countries with the largest estimated value of digitally-enabled services exports were the UK (€261 billion), Ireland (€177 billion), Germany (€173 billion), and the Netherlands (€160 billion).

On the other side of the equation, EU27 member states imported €1.1 trillion in digitally-enabled services, according to 2019 data from Eurostat. 42% originated from other EU27 member states (See Table 4). Another 16% (€167 billion) came from the United States – making it the largest supplier of these services – and 11% came from the UK.

Table 4 Destination of EU27 Exports of Digitally-Enabled Services, 2019 (€Billions)

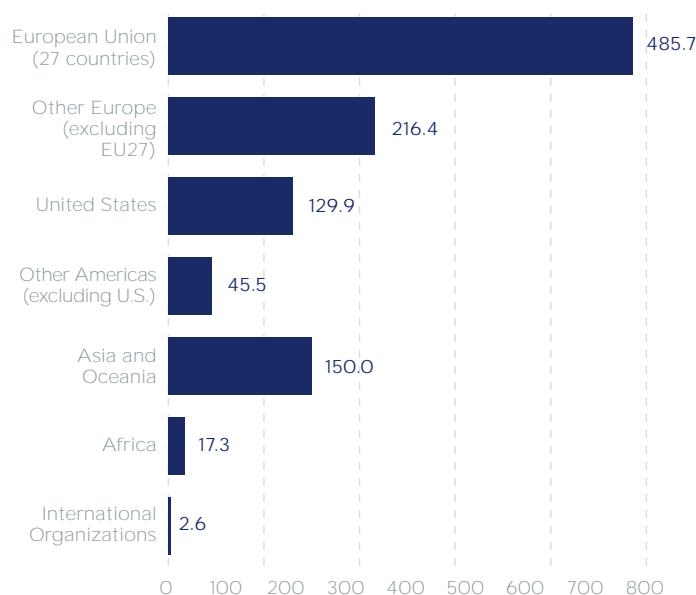
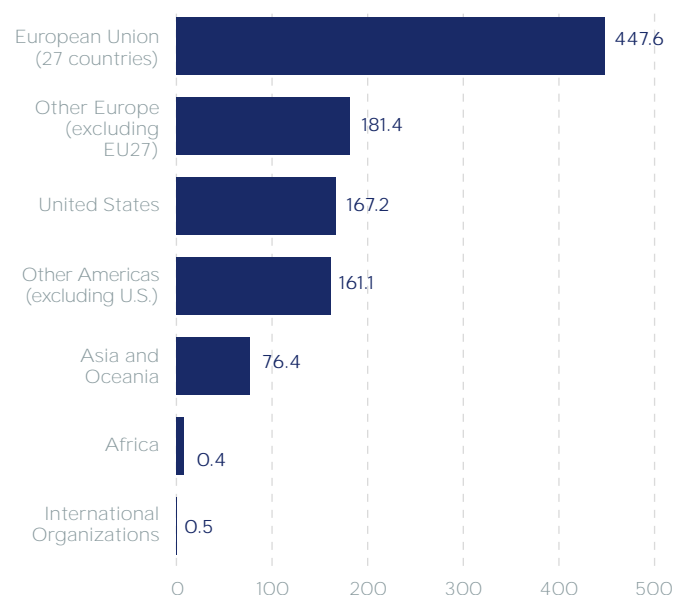


Table 5 Origin of EU27 Imports of Digitally-Enabled Services, 2019 (€Billions)



Note: Digitally-Enabled Services includes finance; insurance; IP charges; telecommunications, computer, information services; R&D services; professional and management services; architectural, engineering, scientific and other technical services; and select other business services. Asia includes Middle East countries. Data on EU28 exports and imports of services by product is not available from Eurostat for the year 2019.

Source: Eurostat. Data as of March 2021.

Table 6 categorizes U.S.-EU digitally-enabled services trade into five sectors. For both economies, the most important exports are represented by business, professional and technical services, which accounted for 43% of digitally-enabled services exports from the EU to the United States and 44% of digitally-enabled services exports from the United States to the EU in 2019. The second most important category consists of intellectual property, including royalties and license fees, most of which are paid on industrial processes and software, underscoring how integral such transatlantic inputs are to production processes in each economy.³⁷ Financial services comprise the third largest digitally-enabled services export category.

Digitally-Enabled Services Supplied Through Foreign Affiliates

The digital economy has transformed the way trade in both goods and services is conducted across the Atlantic and around the world. Even more important, however, is the delivery of digital services

The significant presence of leading U.S. service and technology leaders in Europe underscores Europe's position as the major market for U.S. digital goods and services. Table 8 underscores this dynamic. In 2018, Europe accounted for 69% of the \$289.6 billion in total global information services supplied abroad by U.S. multinational corporations through

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Electronic commerce offers a second window into transatlantic digital connections and complements our lens of digitally-enabled services. E-commerce, which had already been registering double-digit growth in recent years, simply skyrocketed during the pandemic, generating what The Economist called “the biggest shopping revolution in the West since malls and supermarkets conquered suburbia 50 years ago.”³⁹ Online shopping for food and personal care exceeded \$400 billion in revenues in 2020, up by more than 40% from 2019. Other sectors took a hit, however: online revenues for travel, mobility and accommodation slumped by more than 50%, a drop of well over half a trillion dollars in annual consumer spending.⁴⁰

When exploring the importance of e-commerce for the transatlantic economy, we again run into some definitional and data challenges. Most estimates of e-commerce do not distinguish whether such commerce is domestic or international. In addition, many metrics do not make it clear whether they cover all modes of e-commerce or only the leading indicators of business-to-business (B2B) and business-to-consumer (B2C) e-commerce. Finally, there are no official data on the value of cross-border

e-commerce sales broken down by mode; official statistics on e-commerce are sparse and usually based on surveys rather than on real data.⁴¹

Nonetheless, we can evaluate and compare many different estimates and surveys that have been conducted. According to UNCTAD, global e-commerce was worth \$25.6 trillion in 2018 – equivalent to 30% of global gross domestic product.⁴²

When most people hear the term “e-commerce,” they think of consumers buying things from businesses via websites, social networks, crowdsourcing platforms, or mobile apps. These business-to-consumer transactions (B2C), however, pale in comparison to business-to-business (B2B) e-commerce. In 2018 B2B e-commerce accounted for 83% (\$21 trillion) of the total value of global e-commerce, almost five times larger than business-to-consumer (B2C) transactions (\$4.4 trillion).⁴³

While B2B e-commerce accounts for the bulk of global e-commerce, most B2B e-commerce does not cross a border. Most B2B e-commerce users are



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Platform companies that connect individuals and companies directly to each other to trade products and



Online marketplaces generated 59% (\$94 billion) of the overall cross-border e-commerce market turnover of \$160 billion in the EU and UK in 2019. U.S. platform companies accounted for six of the top ten marketplaces in Europe; Amazon accounted for a quarter of the market. Marketplaces with European capital, led by Vinted, G2A, Farfetch and Zalando, represented 11% of the market (Table 12). In our 2020 report we offered examples of successful European cross-border marketplaces that show how companies can achieve success even from relatively small home economies. It is expected that in 2025, marketplaces will represent 65% of cross-border online sales in Europe.⁵⁰

Table 12 Top Ten Cross-Border Marketplaces Operating in Europe

1.	Amazon (US)
2.	eBay (US)
3.	AliExpress (China)
4.	Etsy (US)
5.	Discogs (US)
6.	Wish (US)
7.	Vinted (Lithuania)
8.	G2A (Poland)
9.	Farfetch (UK)
10.	Bandcamp (US)

Source: *Cross-Border Commerce Europe, "Top 100 Cross-Border Marketplaces Europe. An Annual Analysis of the Best Global Cross-Border Platforms Operating in Europe, EU 28 Including UK,"* September 24, 2020, <https://www.cbcommerce.eu/press-releases/press-release-top-100-cross-border-marketplaces-europe-an-annual-analysis-of-the-best-global-cross-border-platforms-operating-in-europe-eu-28-including-uk/>.

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Another way to understand transatlantic digital connections is to appreciate the role of cross-border data flows, which not only contribute more to global growth than global trade in goods, they underpin and enable virtually every other kind of cross-border flow. By the end of this year, cross-border bandwidth is slated to be 400 times what it was in 2005. By that time, global Internet Protocol (IP) traffic, a proxy for data flows, is projected to reach 150,700 gigabytes (GB) per second, over 3 times more than three years ago.⁵¹

For most of the history of the Internet, transatlantic flows of data were the fastest and largest in the world.⁵² That dominance is dissipating, however, as data flows diffuse and as companies face significant and growing legal uncertainty in transferring personal information out of the European Union. In July 2020 the Court of Justice of the European Union invalidated the Privacy Shield framework that enabled over 5,000 mostly small- and medium-sized enterprises to transfer personal data for commercial purposes. The Court and European privacy regulators have raised concerning questions about other data transfer tools, including standard contractual clauses, which are used by the majority of companies sending personal information out of Europe.⁵³ This re-opened transatlantic disputes over privacy protections, disrupted transatlantic data flows, and further chilled the transatlantic economy, as prominent European officials called explicitly for data localization.⁵⁴

According to Nikkei, the Chinese mainland and Hong Kong, the telecommunications gateway to the mainland, together account for 23% of the world's data.⁵⁵ That is almost double that of the United States (Table 13). In part because of China's burgeoning mobile payments platforms and its Belt and Road infrastructure initiatives, Chinese data flows are growing substantially with other Asian countries, which accounted for more than half of data flows in and out of China in 2019. The U.S. share of data flows in and out of China fell from 45% in 2001 to 25% in 2019.

Table 13 Countries with the Most Cross-Border Data, 2001-2019

2001	Rank	2019
United States	1	China/Hong Kong
United Kingdom	2	United States
Germany	3	United Kingdom
France	4	India
Japan	5	Singapore
China/Hong Kong	6	Brazil
Brazil	7	Vietnam
Russia	8	Russia
Singapore	9	Germany
India	10	France

Source: *Nikkei Asia*, November 25, 2020, <https://vdata.nikkei.com/en/newsgraphics/splinternet/>.



three times greater than that of Los Angeles and almost five times greater than that of Singapore, the Asian leader. Marseille, France has become a major hub for traffic between Europe, Africa and the Middle East. The United States accounts for about 40% and Europe for an additional 35% of so-called colocation data centers. Each hosts more data centers than Asia, Africa, the Middle East and Latin America combined.⁶³

Table 15 Highest Capacity International Internet Hub Cities

City	2020 Bandwidth (Tbps)
Frankfurt, Germany	110.6
London, UK	74.8
Amsterdam, Netherlands	71.2
Paris, France	67.9
Singapore, Singapore	56.3
Hong Kong, China	33.8
Stockholm, Sweden	32.0
Miami, U.S.	30.9
Marseille, France	28.8
Los Angeles, U.S.	25.2

Domestic routes omitted.

Source: Telegeography, *The State of the Network 2021*, <https://www2.telegeography.com/hubfs/assets/Ebooks/state-of-the-network-2021.pdf>.

These digital hubs are connected to digital spokes – the undersea fiber optic cables that transmit 95% of all intercontinental telecommunication traffic.⁶⁴ These cables serve as an additional proxy for the ties that bind continents. They show clearly that the transatlantic data seaway is the busiest in the world. Submarine cables in the Atlantic already carry 55% more data than transpacific routes, and 40% more data than between the United States and Latin America. Telegeography estimates a compound annual growth rate of 38% in transatlantic capacity until 2025. 8 new transatlantic cables will be needed by 2027 just to keep up with expected increases in demand, compared to 4 for intra-Asian routes, 3 for transpacific routes, and just one for U.S.-Latin American routes.⁶⁵ Military agencies also build submarine cables, yet those do not appear on public maps. Suffice it to say that if such connections are also considered, transatlantic submarine cables are even more dense than commonly depicted.⁶⁶

This move is exponentially increasing demand for “interconnection” – private digital data exchange between businesses – and is another fundamental driver behind the proliferation of transatlantic cable systems.⁷¹

Private interconnection bandwidth is not only distinct from public internet traffic, it is slated to grow much more quickly and become much larger. Equinix projects that interconnection traffic – direct, private connections that bypass the public Internet –

will see a three-year compound annual growth rate (CAGR) of 45%. This far exceeds the expected CAGR of global Internet traffic.⁷²

It is unlikely that the public Internet is doomed, since it is such a pervasive force in most people’s lives and a key to digitally-delivered services, e-commerce and the platform economy. Yet private interconnection is rising alongside the public Internet as a powerful vehicle for business. And as we have shown here, its deepest links are across the Atlantic.⁷³

Endnotes

