Ofcom Cloud Services Market Study

AWS's response to Ofcom's consultation on its Interim Report, published on April 5, 2023

1. AWS appreciates the opportunity to comment on Ofcom's April 5, 2023 interim report in relation to what it refers to as "cloud infrastructure services" in the UK, a segment of the global market for IT services ("Interim Report"). AWS pioneered the on-demand delivery of IT services in 2006, providing customers with an additional option to on-premises hardware and software to meet their IT needs. These services became generally known as "cloud services". For the first time, any potential customer with a credit card and online access could instantly use IT services on a pay-as-you-go basis, without upfront investment in infrastructure. Since then, AWS has grown the quality and types of services on offer to enable our customers to effortlessly scale and innovate, and reduce the cost and burden of managing complex IT environments. Having started out with only 3 services, we today offer over 200 services which have opened the door to significant innovation and competition across a number of service areas, including databases, storage, networking, analytics and security. This has helped fuel an explosion of new business models that rely on on-demand IT services, such as ride sharing (e.g., Uber) and room rental (e.g., Airbnb).

2. New competition to offer on-demand IT services has grown rapidly while competition from on-premises providers continues to be fierce; according to leading industry analyst Gartner, less than 15% of IT spending is on the cloud nearly two decades after AWS launched.[1] As noted in Ofcom's press release that accompanied the publication of the Interim Report: "competitive market forces are delivering benefits to customers—especially where providers are competing to attract new customers—in the form of innovative products and discounts." We agree, and as a customer-obsessed company we welcome the benefits that this competition brings to customers. For example, we have reduced prices 129 times since launch, and other providers have similarly introduced price reductions over time. AWS has also been at the forefront of cloud innovation by introducing new services to meet customers' needs, often built on innovative technologies that underpin an extremely fast, secure and resilient global network for our customers to transfer data. AWS is not alone when it comes to innovation in response to competition and customers' needs; as the Interim Report recognizes, "[p]roviders are investing in their offerings to match product development by their rivals […]".[2]

3. Despite all of the advances in IT solutions and price reductions, the Interim Report expresses concern about cloud providers creating barriers for customers to switch or use multiple suppliers by (1) charging "egress fees" for data transfers out of a cloud service to the Internet; (2) having technical

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[1] According to Gartner, an estimated USD 4,400 billion was spent on IT in 2021 (https://www.gartner.com/en/newsroom/press-releases/2022-10-19-gartner-forecasts-worldwide-it-spending-to-grow-5-percent-in-2023) and of that amount, cloud spending constituted USD 413 billion (https://www.gartner.com/en/newsroom/press-releases/2022-10-31-gartner-forecasts-worldwide-public-cloud-end-user-spending-to-reach-nearly-600-billion-in-2023).

[2] Ofcom Interim Report, paragraph 1.15.

restrictions on interoperability that prevent some of their services from working effectively with services from other providers; and (3) offering volume discounts – or, as Ofcom refers to them, "committed spend discounts" – as an incentive for customers to use a single provider for most or all of their cloud needs. We believe that these concerns are based on fundamental misconceptions about the IT sector, global networking technology, the actual interoperability of IT services, and discounts on offer. Rather than inhibiting customer choice, the cloud has made switching between IT providers easier than ever before. Conversely, the potential interventions identified in the Interim Report would likely dampen competition and impede innovation to the detriment of IT customers. We therefore do not consider that the proposal put forward in the Interim Report to refer "cloud infrastructure services" to the UK's Competition and Markets Authority for potential regulatory intervention is merited or appropriate. Below, we provide AWS's views on competition for IT services and on the ability of customers to switch between and use multiple suppliers. We then address the misconceptions behind the specific concerns raised with regard to "egress fees", interoperability and "committed spend discounts".

<u>IT services are highly competitive and switching between them is easier than ever</u>

4. The overall IT sector continues to grow as customers look to reduce costs and connect online with their own customers as quickly and effectively as possible. Customers are typically looking to solve a specific IT problem; they are rarely, if ever, looking simply to use "the cloud" as an end in itself. Similarly, customers don't tend to think about "Infrastructure as a Service" or "Platform as a Service" choices. The solution for a particular IT problem may involve one or more different services, such as compute, storage and networking, working together in a specific way. Each of these components can be deployed on the customer's premises, in a co-located environment, online, and/or adopting a hybrid approach using multiple of these options. Within each of these environments, customers have scores of choice – as confirmed by Ofcom's market research, where the majority of customers noted that when choosing a specific provider, they had considered other providers and had a range of available options[3] – and often opt to use multiple providers and solutions for their various IT needs. For example, a company that wants to launch a web-based fitness application would begin by defining what they need to build the application and deliver it to end-customers, which would include (amongst other things) a development platform to build the application itself, processing, data storage, a database for fitness data, networking to allow the data to flow to users and back, and payment and security. Each of these could come from different technology providers – for example, the compute could come from Dell, the storage from EMC, the database from Oracle and the development platform from Atlassian.

5. As reflected by the fact that less than 15% of IT spending is in the cloud, the vast majority of customers continue to use on-premises IT solutions offered by major providers like IBM, Dell, HPE, and Cisco, or co-located or managed services offered by a broad range of providers, including Equinix, NetApp, and Digital Realty. At the same time, competition to provide cloud services as an additional, lower cost solution to meet customers' needs is only increasing. To name just a few, Google (2008), Microsoft (2010), Rackspace (2010), IBM (2011), Dell (2011), OVHcloud (2011), DigitalOcean (2012),

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[3] Ofcom Interim Report, paragraph 4.42.

UpCloud (2012), Aruba (2014), HPE (2015), Oracle (2016), Deutsche Telekom (2016), Cloudflare (2018), and Flexential (2019) have all begun offering cloud services, and the list is growing rapidly. According to IDC data, the number of cloud providers with half-year revenues in the UK above $20 million nearly tripled between 2017 and 2022, and the number of cloud providers with half-year revenues above $5 million more than doubled. Over the same period, 59 firms doubled their revenues in the UK to reach levels above $20 million and 191 firms doubled their revenues to reach levels exceeding $5 million in H1 2022.[4] In addition to cloud providers, there are also thousands of providers of software services that are delivered on-demand to meet customers' IT needs, including the competitors listed above, Salesforce, Adobe, SAP, and more. With these entrants, AWS represented less than 2% of global IT spend,[5] and – according to IDC – only 13.5% of the global public cloud segment in 2022, despite our significant head start as the original innovator in this space.[6] Amongst "infrastructure" cloud providers, AWS's share has fallen significantly between 2016 and 2021 according to Gartner,[7] and this remains dwarfed by the share of on-premises competitors.

6. This intense competition and innovation has driven lower prices. AWS has implemented significant price decreases for our primary compute product (Elastic Compute Cloud, or EC2), including in 2017, 2020, and 2022, and on Simple Storage Service (or S3), including in 2016 and 2021.[8] Other providers have implemented similar price decreases; the Interim Report recognizes that "list prices of IaaS services (such as compute) have generally decreased over time, reflecting improvements in performance and efficiency of underlying hardware".[9] In addition, we introduced the Free Tier in 2010, which today provides free usage of more than 100 AWS services up to specified limits. This includes the dramatic expansion of free data transfers out from our network from 1 gigabyte per month to 100 gigabytes per month as of November 2021.[10] Other providers have followed suit with their own "free tiers" to keep up, including Microsoft and Google following AWS's expansion of the data transfer free tier to 100 gigabytes in 2022.[11]

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4   IDC's "Worldwide Semiannual Public Cloud Services Tracker, H2 2022.
5   Based on Gartner reporting of worldwide IT spending in 2022: https://www.gartner.com/en/newsroom/press-releases/2023-04-06-gartner-forecasts-worldwide-it-spending-to-grow-5-percent-in-2023.
6   IDC's "Worldwide Semiannual Public Cloud Services Tracker, H2 2022.
7   See https://www.gartner.com/en/newsroom/press-releases/2017-09-27-gartner-says-worldwide-iaas-public-cloud-services-market-grew-31-percent-in-2016 and https://www.gartner.com/en/newsroom/press-releases/2022-06-02-gartner-says-worldwide-iaas-public-cloud-services-market-grew-41-percent-in-2021.
8   See https://aws.amazon.com/blogs/aws/ec2-price-reductions-reserved-instances-m4-instances/; https://aws.amazon.com/blogs/aws/ec2-price-reduction-for-ec2-instance-saving-plans-and-standard-reserved-instances/; https://aws.amazon.com/about-aws/whats-new/2022/06/price-reductions-amazon-ec2-instances-suse-linux-enterprise-server-sles-os/; https://aws.amazon.com/blogs/aws/amazon-s3-glacier-price-reduction/; https://aws.amazon.com/blogs/aws/aws-storage-update-s3-glacier-price-reductions/.
9   Ofcom Interim Report, paragraph 6.12(d).
10 See https://aws.amazon.com/blogs/aws/aws-free-tier-data-transfer-expansion-100-gb-from-regions-and-1-tb-from-amazon-cloudfront-per-month/. This also includes 1 terabyte per month of free data transfer from Amazon CloudFront to the Internet.
11 See https://azure.microsoft.com/en-us/pricing/details/bandwidth/ (showing Azure data transfer pricing to be free for first 100 gigabytes per month); https://www.oracle.com/a/ocom/docs/cloud/oci-vs-azure.pdf (Oracle document from March 2022 showing Azure to offer 5 gigabytes of free data transfer at the time);

7. Competition has also led to increased innovation. For example, AWS developed the AWS Nitro System, with specialized hardware that enables high speed networking, enhances security, and allows us to rapidly deliver Amazon EC2 instance types with an ever-broadening selection of compute, storage, memory, and networking options. We also developed AWS Graviton, AWS Trainium, and AWS Inferentia processors, which power Amazon EC2 instances with up to 40% better price and performance than comparable Amazon EC2 instances with significant improvements in energy efficiency. Each generation of this hardware offers increasing levels of performance, lower cost, and power efficiency for a diverse range of customer workloads. Additionally, for many years AWS has innovated in designing purpose-built hardware (e.g., for servers, motherboards, solid state drives and networking switches) that provides customers the lowest cost access to the entire hardware setup, instead of relying on generally available, costly, over-featured hardware that is not purpose-built for cloud workloads. Other IT providers are developing similar solutions, to the ultimate benefit of customers.

8. By reducing customers' costs and providing near instant access to sophisticated IT services at the scale customers need, cloud services generate savings that can be reinvested in customers' businesses for R&D, job creation, and other benefits. Cloud services reduce customers' IT infrastructure costs by an average of 20% relative to alternative IT solutions[12] and reduce the time to develop new software, speeding products to market and making it easier to experiment with new products. Public First has found that 84% of AWS customers in the UK report that cloud services have made it easier to innovate and launch new products. [13]

9. Customers using on-premises IT solutions have been and continue to be largely "locked-in" to costly infrastructure legacy hardware, as well as software that only runs on specific hardware. Before cloud services were on offer, switching IT providers was often a prohibitively expensive, multi-year process that required substantial up-front investment in duplicate hardware from the new provider, rewriting software to conform to that provider's operating system and other constraints, and then spending a great deal of time and money transitioning away from the old hardware. AWS was the first on-demand IT provider to offer pay-as-you-go pricing, creating an immediate reduction in the cost and burden of switching providers and solutions. Of course, even with cloud services, moving data and changing IT services still takes some time and resources. For example, to move an application (which could have many complex, inter-connected components, from databases to data warehouses, security, networking and many other elements and dependencies) between providers, a customer may need to train their employees on using the new services, decide whether code or configuration changes are needed, and make the necessary adjustments. Even replicating an application—and its data—from one data center to another can involve technical work and costs (e.g., data format changes and data transfer costs). While we're always working to reduce these inherent costs, they

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https://cloud.google.com/storage/pricing-announce (describing Google's expansion of free data transfer to 100 gigabytes).

12 Hackett Group, The Business Value of Migration to Amazon Web Services (Feb. 2022) at pp. 3-5 (demonstrating savings in infrastructure from migrating to cloud), https://pages.awscloud.com/rs/112-TZM-766/images/hackett-group-the-business-value-of-migration-to-aws-012022.pdf.

13 Public First, The Impact of AWS in the UK in 2020, available at: https://awsimpactreport.publicfirst.co.uk/.

still exist. However, they are lower than ever before and customers have never had more freedom or choice in their IT providers, particularly because of on-demand IT services which provide customers with the flexibility to design their solutions to be easily portable and interoperable between and across different IT environments.

10. As evident from Ofcom's own market research, multi-clouding and hybrid-clouding are popular – 52% of users of services categorized by Ofcom as "IaaS/PaaS" use more than one cloud services provider,[14] and 54% use both public and private cloud.[15] These figures likely underestimate the actual popularity of multi-clouding and existing competitive dynamics, because they exclude hybrid uses of on-premises and cloud services, as well as multi-cloud uses involving services categorized by Ofcom as "SaaS". In fact, the Flexera 2023 "State of the Cloud" Report found that 87% of its respondents used multi-cloud (this included organizations from across the world who purchased services categorized as "IaaS, PaaS and SaaS").[16] Similarly, 98% of respondents to Oracle's "Multi-Cloud in the Mainstream" report currently use or plan to use more than one cloud service provider.[17] According to Gartner, more than 80% of customers use multiple IT providers for different workloads and purposes.[18]

11. As evidenced by these figures, a customer that chooses a cloud provider for a particular workload need not choose the same provider for another workload. Both to respond to customer demands, as well as to compete for this business, AWS offers technical solutions that make it easier to transfer data and workloads to and from AWS, such as Database Migration Service, DataSync, and Snowball.[19] In recent years, we've also invested millions in customer migration programs to help lower the costs of switching. Our competitors also offer their own transfer services, such as Azure Migrate, Google Database Migration Service, and Oracle Cloud Migrations, as well as their own programs to help lower switching costs.[20] Finally, there are tens of thousands of other IT companies, including Accenture, BMC, Capgemini, and Deloitte, that partner with AWS to offer migration and other services directly to AWS customers. These partners often maintain relationships with other providers and facilitate customers switching away from AWS.[21]

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[14] Ofcom Interim Report, Paragraph 3.26; Ofcom Context Consulting Report, Slide 75.

[15] Ofcom Interim Report, Figure 3.7.

[16] See https://info.flexera.com/CM-REPORT-State-of-the-Cloud.

[17] See https://www.oracle.com/a/ocom/docs/gated/451-research-multicloud-in-the-mainstream.pdf.

[18] See https://www.gartner.com/smarterwithgartner/why-organizations-choose-a-multicloud-strategy.

[19] See https://docs.aws.amazon.com/dms/latest/userguide/CHAP_Introduction.Targets.html (showing that customers can select an on-premises database as the target when using Database Migration Service); https://aws.amazon.com/datasync/faqs/ (stating that DataSync "supports moving data to, from, or between" a number of AWS systems and confirming that DataSync can copy data off of S3 and to either on-premises or other cloud providers); https://docs.aws.amazon.com/snowball/latest/ug/transfer-export.html (describing the process of transferring data off of AWS with Snowball).

[20] See https://cloud.google.com/database-migration; https://cloud.google.com/storage-transfer-service; https://cloud.google.com/transfer-appliance/docs/4.0/overview; https://docs.oracle.com/en-us/iaas/Content/cloud-migration/cloud-migration-overview.htm.

[21] For example, Databricks Lakehouse runs on Azure, AWS, and GCP, and Accenture provides consulting services, including how to design a multi-cloud solution, and partners with AWS, Azure, and GCP.

12. As a result, customers regularly switch between IT providers. For example, Netflix migrated its streaming services away from its own data center to AWS to take advantage of the scalability of the cloud, reduce outages, use our global network and reduce costs.[22] On the other hand, Dropbox moved much of its data out of AWS to its own network of servers, in a switch from the cloud to a hybrid on-premises and cloud solution.[23] Walmart has also moved from the cloud to a hybrid solution by building its own network of servers to "switch seamlessly between cloud providers and its own servers."[24] Zynga, a mobile game developer, switched from AWS to its own private cloud, but ultimately brought workloads back to AWS when it found that keeping its own infrastructure was costlier over time than using AWS.[25] FirstGroup plc,[26] a provider of transport services in the UK and North America, migrated workloads to AWS from on-premises and from a competing cloud provider to improve performance and reliability.

Addressing misconceptions related to data transfer fees

13. The Interim Report suggests that AWS charges "egress fees" when customers transfer their data out of our network to discourage customers from switching or using multiple suppliers, and that these fees are only loosely related to our costs. This is not the case.

14. AWS does not charge "egress fees". We charge customers for data transfers using our proprietary global network based only on the amount of data a customer chooses to transfer and the location to and from which the data is being transferred.[27] Our fees are never based on the reason for the data transfer; indeed, our customers make hundreds of millions of data transfers each day, and we do not know if the data transferred out to the Internet is a normal part of a customer's business (e.g., a video streaming company sending a movie to one of its users) or a customer transferring data out to switch IT providers. Instead, our fees reflect the costs of transferring data across our network which, contrary to the assertions in the Interim Report, include more than just bandwidth connections. Unlike cloud providers that rely mainly on the public Internet to enable data transfers (in which case costs likely relate to bandwidth, i.e., the movement of data from A to B over the public Internet), AWS provides a more secure, reliable and available global network to support customers' needs, which often include transferring regulated and sensitive data. AWS has built a first in class global network by investing tens of billions of dollars in proprietary networking solutions such as custom semiconductors, equipment and software, and millions of miles of terrestrial and undersea cable.

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[22] See https://about.netflix.com/en/news/completing-the-netflix-cloud-migration (describing Netflix's migration to AWS).

[23] See https://dropbox.tech/infrastructure/magic-pocket-infrastructure; https://www.wired.com/2016/03/epic-story-dropboxs-exodus-amazon-cloud-empire/ (discussing Dropbox's transition from cloud to a hybrid solution).

[24] See https://www.wsj.com/articles/walmart-amps-up-cloud-capabilities-reducing-reliance-on-tech-giants-11656000000 (discussing Walmart's transition from cloud to a hybrid solution).

[25] See https://aws.amazon.com/solutions/case-studies/zynga/ (describing Zynga's migration away from and back to AWS).

[26] See https://aws.amazon.com/solutions/case-studies/firstgroup/.

[27] See, for example, https://aws.amazon.com/ec2/pricing/on-demand/ (showing data transfer pricing for AWS EC2).

Since 2019, we have offered enhanced security by ensuring that every link in this network that provides inter-site connectivity is fully encrypted, which adds to our network costs. This backbone enables customers to transfer their data within our proprietary network, as well as to their end-customers or other destinations outside of our network, with unrivaled security, efficiency, reliability and speed. We have built the network to withstand multiple overlapping, diverse failures to ensure 99.999%+ availability. This goes beyond the offerings of any traditional telecommunications provider. To protect the customer experience for the critical applications that they run on the AWS global network, we strive to keep network utilization low (below 30%) to ensure that when customers need the bandwidth it is always available. Our pricing reflects the costs of establishing and maintaining this network that our customers rely on. The Interim Report does not take appropriate account of the cost of these significant investments, and therefore presents an inaccurate picture of AWS's profits for data transfers.

15. Just as AWS has innovated to reduce the cost of our services, we similarly work to reduce our data transfer costs and to pass these cost savings on to our customers. AWS data transfer costs decreased globally by 20% between 2019 and 2021, and we passed the vast majority of these savings directly on to our customers by reducing fees globally by 18% over the same period. Specifically, AWS's fees for transferring data out to the Internet fell over 50% globally between 2018 and 2022.[28] In addition, as mentioned above, we significantly expanded the free tier of data transfers out from our network from 1 gigabyte per month to 100 gigabytes per month in November 2021.[29]

16. The Interim Report suggests that the different approach taken by cloud providers with respect to data transfers into the cloud (i.e., a customer transferring data initially into AWS to begin using a service) – which are provided for free – supports the finding that "egress fees" are designed to discourage switching and multi-clouding. This is incorrect for AWS, as our pricing approach to data transfers into our network is driven by the associated costs, which are materially lower than data transfers out to the Internet. The costs described above of enabling data transfers across AWS's network are driven by the dominant direction of traffic which is outbound, not inbound, reflecting customers' use of AWS to send data to their own end-users. The cost for inbound data transfers is moreover a one-time cost that can be incorporated into the fees for storing the data. The same is not true for outbound data; some customers may not plan to transfer their data out, whereas some will transfer it millions of times daily. For example, a video streaming company transfers data out millions of times a day to provide content to its users. By charging for outbound data transfer instead of incorporating it into the fees for storage or other services, AWS can ensure that customers only pay for the services they use. This is a key component of AWS's pay-as-you-go pricing model, which enables customer flexibility and allocates costs based on actual customer use of AWS services, including our industry-leading networking services.

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[28] This figure includes data transfers out to the Internet from AWS Regions and from AWS Edge locations via Amazon CloudFront.

[29] See https://aws.amazon.com/blogs/aws/aws-free-tier-data-transfer-expansion-100-gb-from-regions-and-1-tb-from-amazon-cloudfront-per-month/. This also includes 1 terabyte per month of free data transfer from Amazon CloudFront to the Internet.

![aws](aws logo)

17. While many respondents to Ofcom's market research think "egress fees" should be reduced or removed (what customer wouldn't want to pay less for an extremely valuable, premium service?), the data transfer pricing model used by AWS and other cloud providers is efficient and pro-customer, and does not deter switching. Our pay-as-you-go model allows a business of any size to start using our services, and charging no fees for transferring data into AWS minimizes the costs of doing so. AWS offers the first 100 gigabytes per month of data transfer out to the Internet for free, which means that about 90% of our customers transferring data to the Internet pay no data transfer fees at all.[30] Once that free tier is exceeded, charges decrease with the amount of data that is being transferred. For example, data transferred to the Internet from our primary compute service costs nine cents per gigabyte for the first 10,000 gigabytes in a month, then decreases until it is five cents per gigabyte beyond 150,000 gigabytes.[31] A customer moving all of its data from AWS to another IT provider would likely pay a *lower* per-unit price than a customer sending a single file (once doing so outside of the free tier). This is the opposite of charging a premium for "egress" or switching. Using the AWS pricing calculator,[32] we estimate that the data transfer out fees incurred by switching customers represent less than 1% of their annual spend on AWS.[33] This relatively low one-time cost is unlikely to deter customers from switching, and is consistent with the fact that only 6% of respondents to Ofcom's market research identified 'data charges' as the main challenge of switching provider.[34] Furthermore, for smaller customers, there may be no cost due to the existence of the free tier.

18. The possible alternatives to the current pricing models proposed in the Interim Report would be substantially worse. The idea of equalizing the fees charged for transferring data out to the Internet with other data transfer charges ignores the inherent differences in the cost of transferring data out and within a cloud network. The vast majority of data transfers within AWS cover short distances within an AWS Region that do not require use of the costly global network backbone of optic fibre cables that provide connectivity between Amazon Regions and points of presence to third party networks and the public Internet. We incur less cost for these data transfers than for data transfers out to the Internet. The alternative of price controls would be costly to implement, and may not even be workable as the cost to the provider will depend on the specifics of the transfer, e.g. time of day, amount of data, start and end location, as well as the quality and associated costs of the provider's network. Moreover, banning the possibility to earn any profit on data transfers out to the Internet

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[30] See https://aws.amazon.com/blogs/aws/aws-free-tier-data-transfer-expansion-100-gb-from-regions-and-1-tb-from-amazon-cloudfront-per-month/ (showing that AWS offers 100 gigabytes per month of data transfer for free).

[31] See https://aws.amazon.com/ec2/pricing/on-demand/ (listing pricing for transferring data from AWS EC2 (in the Europe (London) Region, to the Internet).

[32] See https://calculator.aws/#/.

[33] The approach used to reach this estimate is similar to the one followed in the Final Report of the study "SMART 2016/0032 – Switching of Cloud Services Providers" entrusted by the European Commission to IDC and Arthur's Legal (available at https://op.europa.eu/en/publication-detail/-/publication/799e50ff-6480-11e8-ab9c-01aa75ed71a1/language-en). See, for example, section 3.1.3, which concludes that "even when run costs are optimized […], data egress cost remains less than 1% of the annual run cost". Results are further confirmed by analyses based on AWS real data.

[34] Ofcom Context Consulting Report, slide 121.

will act as a disincentive for cloud providers to innovate to improve this service for their customers. Finally, the proposal to require free data transfers out to the Internet is illogical because cloud providers could not operate, and would have no incentive to invest, if they were unable to charge customers for using their services. For example, data transfers out to the Internet would be a key service used by a video-streaming company sharing millions of movies per day to its end-customers, and it is only logical that it is charged for its use of that service. As noted above, there are significant costs involved in building and maintaining networks like the one AWS makes available to customers, and requiring cloud providers to provide costly services for free is not economically justified. When cloud providers are not allowed to charge for data transfers out according to usage, the cost of the data transfer will have to be recouped by charging other fees that are not based on data transfer usage. The result will be that customers transferring less data (which tend to be small businesses) will have to subsidize customers with larger data transfer volumes. Simply put, free data transfers out to the Internet would therefore lead to higher prices, underinvestment in innovation, and an uneven playing field that disadvantages small, innovative cloud providers with less efficient networks.

Addressing misconceptions related to interoperability

19. The Interim Report finds that there are technical barriers to switching and using multiple suppliers which have an adverse impact on customers, and that these barriers may be exacerbated by certain practices employed by AWS and other providers to limit interoperability. We explain below why we think these findings are misconceived.

20. Customers want the ability to use multiple clouds and to switch workloads among them and other IT environments. In fact, a key consideration for customers moving to the cloud is ensuring interoperability with existing IT solutions, and this factors into customers' decisions about which IT providers to use. AWS works to continually *increase* interoperability, not limit it, because that is what customers want. AWS offers a range of different services, enabling customers to choose the solutions that are right for them. AWS customers that choose to purchase an IT solution based on our compute, storage and networking services can build their own software in a manner that is completely cloud agnostic and transportable, as these services are based on a variety of open source projects (e.g. Linux, Xen, containers), open standards (e.g. storage formats like JPEG), and open APIs (e.g. the S3 API). If customers find that innovative AWS services that include proprietary technology better suit their business needs (including by reducing development and maintenance costs, and decreasing time to market), they are free to choose these AWS IT services – this decision is entirely up to them, and is no different from software-buying decisions that companies make every day when building new IT applications. We offer flexibility, and our customers make the choice.

21. For example, many customers choose to run their applications on EC2 virtual machines using widely available and supported operating systems such as Linux or Microsoft Windows. This enables customers to run identical or near-identical software in the AWS cloud, in their own data center, or in other clouds. The nature of IT means that making any configuration changes does incur some cost, but the costs of switching a virtual machine from one environment to another are relatively low. Other customers choose to instead use containers, which are another form of software packaging

that is lighter-weight than virtual machines and provides higher velocity for deploying software. Containers are built on open source standards and supported across on-premises and various cloud environments, and customers can run their containers everywhere they run their software (including in their own data centers, on AWS and on other cloud providers). Containers also often benefit from additional management and orchestration capabilities assisting customers in how to deploy and run the containers; for example, AWS has multiple services offering such capabilities, such as Elastic Container Service (ECS) and Elastic Kubernetes Service (EKS). Customers can also run their own open source-based services providing these capabilities on AWS, such as open source Kubernetes. We often see customers switching to/from these various options and even switching to/from their own data centers as they adapt their products and services to best serve their business needs.

22. AWS leads or supports hundreds of open source projects. [35] For example, AWS is now a top 4 contributor to PostgreSQL[36] and the largest external contributor to MariaDB. [37] We make many of our SDKs and APIs publicly available under open source licenses; use open protocols, interfaces, APIs, and data formats across services; and publish extensive documentation, including, where relevant, differences between the AWS services and the underlying open source. We also help customers design their IT processes for "reversibility" to easily adapt to another IT environment.[38] For example, we make our APIs for Amazon S3 publicly available under open source licenses. This approach has enabled the Amazon S3 APIs to be copied by many IT providers including Google, [39] IBM, [40] and Oracle,[41] and Microsoft recommends that customers use publicly available third-party code that implements the Amazon S3 APIs. [42] Each of these providers (as well as Linode Object Storage,[43] DigitalOcean Spaces, [44] Wasabi, [45] and Vultr [46]) actively markets these APIs to promote customer migration from AWS to their competing storage services. As another example, the AWS Encryption SDK, which makes it easy for customers to encrypt and decrypt their cloud-stored data, can also be used with other IT environments because it is distributed at no cost under an open source license. This allows customers to use the SDK to build encryption solutions that work both on AWS and other IT environments. We often provide our own alternatives alongside open source options, which simply provides more choice—customers are free to select from a menu of options based on what is most important to them.

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[35] See, for example, https://aws.amazon.com/opensource/?blog-posts-content-open-source.sort-by=item.additionalFields.createdDate&blog-posts-content-open-source.sort-order=desc.

[36] See https://www.enterprisedb.com/blog/importance-of-giving-back-to-postgresql.

[37] See https://mariadb.org/mariadb-contribution-statistics-march-2023/.

[38] AWS Whitepaper, Unpicking Vendor Lock-In, https://docs.aws.amazon.com/pdfs/whitepapers/latest/unpicking-vendor-lock-in/unpicking-vendor-lock-in.pdf.

[39] See https://cloud.google.com/storage/docs/migrating#overview.

[40] See https://cloud.ibm.com/docs/services/cloud-object-storage?topic=cloud-object-storage-compatibility-api.

[41] See https://docs.cloud.oracle.com/en-us/iaas/Content/Object/Tasks/s3compatibleapi.htm.

[42] See https://devblogs.microsoft.com/cse/2016/05/22/access-azure-blob-storage-from-your-apps-using-s3-api/.

[43] See https://www.linode.com/blog/cloud-storage/s3-compatible-object-storage-for-your-business/.

[44] See https://docs.digitalocean.com/products/spaces/resources/s3-sdk-examples/.

[45] See https://wasabi.com/s3-compatible-cloud-storage/.

[46] See https://www.vultr.com/products/object-storage/.

23. One concern raised in the Interim Report is with regard to the mistaken conclusion that AWS increases technical barriers to switching and interoperability by tweaking services built on open source technology such that customers wanting to switch need to rewrite much of their code.[47] We do not do this. We offer managed services for popular open source software which provide customers with more options for running their open source workloads ("managed open source services"), such as Amazon OpenSearch Service, Amazon EMR, Amazon EKS and Amazon RDS. Customers use managed open source services because they don't want to focus on the administrative effort involved in running and maintaining secure, up-to-date open source software. While managed open source services include plug-ins that integrate with other AWS services, changes to the underlying open source are documented[48] and do not prevent customers from easily transitioning to their next solution. The open source portion of an application almost always requires various integrations and connections to other software that enable a full-featured application, regardless of where customers choose to run their open source software. In other words, nothing about our managed open source services raises technical barriers to switching. Our services built on open source, like OpenSearch,[49] add to, but do not supplant, the upstream open source projects. In fact, competitors like Oracle,[50] Instaclustr[51] and Aiven[52] have built managed open source services based on OpenSearch, further increasing the competition for customers who use this AWS-supported open source project.

24. Despite making broad statements regarding the interoperability of AWS services, the Interim Report only identifies interoperability limitations in a small subset of our 200+ services, focusing on 10 ancillary services for which there are competing software solutions available that customers can run on AWS (or elsewhere). [53] The features identified as limiting interoperability are described inaccurately, exist alongside features that ensure interoperability, or are the product of an objective technical limitation. We will engage with Ofcom to explain in detail, for each of the identified services, how they interoperate with third party services.

25. For example, the Interim Report incorrectly states that specific features of some of these services can only query or export/import data from Amazon S3. However, AWS services allow customers to connect to any data source using standard connectors or SDKs, which AWS makes available as open source. To illustrate, the Interim Report notes that Amazon Redshift ("Redshift") can only "bulk load" data from Amazon S3. Bulk upload between services is technically complex, which is why AWS has so far only developed this for Amazon S3. However, there are many other methods for loading data into Redshift which support ingestion from any source (such as other on-demand or on-premises data/file storage) via AWS Data Pipeline[54] or SSH (Secure Shell Protocol), or through industry-standard driver

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[47] Ofcom Interim Report, Paragraph 5.63.
[48] See for example: https://docs.aws.amazon.com/neptune/latest/userguide/feature-overview-standards-compliance.html; https://docs.aws.amazon.com/keyspaces/latest/devguide/keyspaces-vs-cassandra.html.
[49] See https://github.com/opensearch-project/OpenSearch.
[50] See https://docs.oracle.com/en-us/iaas/Content/search-opensearch/home.htm.
[51] See https://www.instaclustr.com/platform/managed-opensearch/.
[52] See https://aiven.io/opensearch.
[53] Ofcom Interim Report, Table 5.9.
[54] See https://aws.amazon.com/datapipeline/.

interfaces (e.g. JDBC or ODBC). These are the exact same methods that customers using any other AWS storage or database service use to upload data to Redshift. Redshift also provides a Data API that allows customers to access data from Redshift with any application, including on-premises, cloud-native, and containerized services.[55]

26. To take another example, the Interim Report incorrectly claims that a customer wishing to use Amazon SageMaker ("SageMaker") to manage data downloading as part of a training job can only do so using certain AWS services. However, this does not limit interoperability because customers can instruct SageMaker to pull data from any source, including third party solutions operating in other IT environments; we have published a blog post with instructions on how to do this.[56] The Interim Report also refers to a claim from one cloud provider that SageMaker's optimal functionality is dependent on customers using other AWS services.[57] This is simply not the case. In particular, SageMaker uses standard open source Docker containers for core machine learning tasks such as code authoring, training and hosting. Customers can use their own Docker containers for model building, training and hosting, and they can reuse the same containers outside of SageMaker with other cloud and on-premises providers. In addition, SageMaker supports popular open source resources such as PyTorch and TensorFlow, and models developed on SageMaker using these frameworks can be deployed elsewhere without any changes. Finally, customers can use a SageMaker SDK to integrate with third party systems and services; for example, customers that have built machine learning systems using open source Kubernetes clusters (whether self-managed or managed by another IT provider) can integrate with SageMaker by using Kubernetes operators that SageMaker offers.[58] This provides flexibility in switching services or having a multi-cloud architecture.

27. The IT sector is extremely dynamic and characterized by constant innovation and disruption from new and existing businesses. It is a sector marked by sophisticated customers who know what they want, and employ IT experts (or external IT expert consultants) to make decisions; this creates increased scrutiny of business offerings and competitive pressure. IT providers large and small are constantly developing new technologies to meet customer needs and solve novel problems, each offering a unique set of services, features, reliability, availability, scalability and price. This innovation is what drives competition in the IT sector, and customers rank quality and range of services as the number one reason for choosing their IT providers.[59] Cloud providers design many of their services to be interoperable with other solutions by using open technology and industry standards, as customers demand the ability to benefit from the innovative solutions offered by different providers. As recognized by Ofcom, open source technologies provide customers with more choice and can lower barriers to switching.[60] As a result, working with multiple cloud and other IT providers, and switching between them, is both prevalent and far easier than ever before. However, any regulatory

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[55] See https://docs.aws.amazon.com/redshift/latest/mgmt/data-api.html.
[56] See https://aws.amazon.com/blogs/machine-learning/use-snowflake-as-a-data-source-to-train-ml-models-with-amazon-sagemaker/.
[57] Ofcom Interim Report, paragraph 5.66(b).
[58] See https://docs.aws.amazon.com/sagemaker/latest/dg/kubernetes-sagemaker-operators.html.
[59] For example, Ofcom Interim Report, paragraph 4.36.
[60] Ofcom Interim Report, paragraph 6.12(c).

requirement for cloud services to be fully interoperable or to work with a predetermined set of standards will impede rather than improve competition in the IT sector. Such a requirement would, at the very least, increase the cost of innovation and reduce incentives to innovate, as acknowledged in the Interim Report.[61] This would ultimately not benefit customers, as they will find themselves choosing between undifferentiated services that compete on price alone, rather than innovation, quality, and capabilities of services. This type of intervention could be particularly harmful in a young and fast-growing sector like cloud services.

Addressing misconceptions about "committed spend discounts"

28. We do not agree with the concerns raised in the Interim Report that "committed spend discounts" can dampen competition by incentivizing customers to use a single provider for most or all of their cloud needs, or that we require customers to increase the amount of their committed spend upon renegotiation of their agreements.

29. AWS prices are listed publicly on our website, and any customer can use our services at these listed prices as much or as little as they need. To a tiny minority of customers that have business objectives that require AWS services over time and that can predict their minimum service needs, AWS provides the option to make a commitment to use a certain volume of AWS services in exchange for discounts to pay-as-you-go pricing. While the specific terms will depend on the customers' specific needs, in general, we offer discounts to reflect the commitment the customer makes with AWS. This gives customers the freedom to choose both how much of a commitment to make and how to meet it, much like our pay-as-you-go model that works for most customers.

30. For AWS customers that opt to renew their commitments, AWS partners with the customer to understand their business needs to jointly determine the right commitment and corresponding discounts. We do not decrease the discounts available at renewal; renewing customers are eligible for the same discounts based on usage levels without any differentiation. We do not require customers to commit to larger volumes to preserve existing discounts. Customers may decrease or increase their commitment to AWS upon renegotiation and their discounts will be adjusted accordingly.

31. Customer commitments to use a certain volume of AWS services helps us to better plan and acquire necessary capacity and infrastructure, and thereby provide a better customer experience at lower expense by, amongst other things, reducing our data center hardware costs, improving operational efficiencies, and lowering power consumption. These efficiencies benefit all customers regardless of whether they have a commitment, and we pass them along as price reductions whenever possible.

32. Discounts, savings and credits are a common business practice in most industries. Passing along efficiencies to customers helps all parties and enhances competition. As long recognized by regulatory agencies, volume discounts are generally pro-competitive, and Ofcom itself acknowledges in the Interim Report that discounts are a positive feature of markets, leading to lower prices and

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[61] Ofcom Interim Report, paragraphs 8.41-8.43.

promoting competition.[62] The Interim Report notes that there are efficiency reasons for discounting structures – for example to help providers achieve scale and to motivate investment – and that placing restrictions on discounting practices could lead to unintended consequences such as a weakening of the bargaining power of large customers or the dampening of incentives to invest as a result of the reduced certainty about their future demand.[63] This is exactly what would happen with regulatory intervention that would impact AWS's ability to provide these types of discounts to customers – reduced certainty in demand would considerably affect AWS's investment decisions, and would limit our ability to create efficiencies that benefit our customers. Regulatory intervention of how cloud providers offer discounts to customers would also adversely impact new entrants' ability to get the commercial certainty needed for them to build scale effectively.

<u>Conclusion</u>

33. Many companies, and the economy overall, have benefitted from robust competition among IT providers. The cloud has made switching between IT providers easier than ever before, which encourages vigorous competition to provide IT services at low cost and with high-quality, innovative services. Because the cloud industry is working well, access to IT services has been democratized and even the smallest companies are now able to quickly scale to compete with larger companies. This delivers benefits throughout the entire economy, as every industry experiences entry and expansion that access to the cloud makes possible. The regulatory intervention proposed in the Interim Report would be unwarranted, and could lead to significant unintended harm to customers and competition.

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[62] Ofcom Interim Report, Paragraph 8.46.
[63] Ofcom Interim Report, Paragraph 8.46.