



## CCP Response to the CMA Cloud Services Market Investigation

23 June 2024

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*Please consider this response as public and citable.<sup>1</sup>*

This submission draws upon the economic and legal research of Sean Ennis and Ben Evans. It responds to the CMA Technical Barriers Working Paper and Primary Research undertaken by Jigsaw Research for the CMA and focusses on: (i.) insights from the empirical evidence on interoperability and switching; (ii.) potential remedies and unintended consequences arising therefrom; and (iii.) market-driven solutions.

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<sup>1</sup> **Suggested citation of this response:** Ennis, S. and Evans, B., 'CCP Response to the CMA Cloud Services Market Investigation', Centre for Competition Policy Consultation Response, 23 June 2024.

## Overview

The design and implementation of interventions in the cloud computing sector represents a complex challenge. We find that some seemingly simple solutions could have negative implications for competition and innovation and, ultimately, the availability of options to cloud customers in the UK. To the extent that problems are identified by the CMA, any proposed solutions would require careful consideration of dynamic implications.

Building on our prior work that is publicly available for citation, this submission responds to the CMA Technical Barriers Working Paper and Primary Research undertaken by Jigsaw Research for the CMA and focusses on: (i.) insights from the empirical evidence on interoperability and switching; (ii.) potential remedies and unintended consequences arising therefrom; and (iii.) market-driven solutions.

We refer to the CMA Technical Barriers Working Paper ('CMA Working Paper'),<sup>2</sup> the Primary Research undertaken by Jigsaw Research for the CMA ('CMA Primary Research'),<sup>3</sup> the CCP's Response to the Ofcom Consultation on its Cloud Services Market Study Interim Report ('CCP Ofcom Response')<sup>4</sup>, Ofcom's Cloud Services Market Study Interim Report ('Ofcom Interim Report')<sup>5</sup>, the Ofcom Market Research undertaken for Ofcom by Context Consulting ('Ofcom Market Research')<sup>6</sup>, the EU Data Act which includes a focus on portability and interoperability for cloud services,<sup>7</sup> the economic and legal research of Ennis and Evans,<sup>8</sup> and wider academic research concerning cloud computing.

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<sup>2</sup> Competition and Markets Authority, Cloud Services Market Investigation Technical Barriers Working Paper (6 June 2024) ('CMA Working Paper'). Available at: [https://assets.publishing.service.gov.uk/media/66618c942605fac482e67be6/Technical\\_barriers\\_.pdf](https://assets.publishing.service.gov.uk/media/66618c942605fac482e67be6/Technical_barriers_.pdf) (accessed 23 June 2024).

<sup>3</sup> Jigsaw Research, 'Cloud Services Market Investigation Qualitative Customer Research Final Report' (May 2024) ('CMA Primary Research'). Available at: [https://assets.publishing.service.gov.uk/media/664f02634f29e1d07fadcd56/Cloud\\_Services\\_Market\\_Investigation\\_Qualitative\\_Customer\\_Research\\_Final\\_Report\\_.pdf](https://assets.publishing.service.gov.uk/media/664f02634f29e1d07fadcd56/Cloud_Services_Market_Investigation_Qualitative_Customer_Research_Final_Report_.pdf) (accessed 23 June 2024).

<sup>4</sup> Ennis, S., Evans, B. and Mariuzzo, F., 'CCP Response to the Ofcom Consultation: Cloud Services Market Study (Interim Report)', Centre for Competition Policy Consultation Response, 16 May 2023. Available at: [https://research-portal.uea.ac.uk/files/206724111/CCP\\_Response\\_to\\_Cloud\\_Services\\_Consultation.pdf](https://research-portal.uea.ac.uk/files/206724111/CCP_Response_to_Cloud_Services_Consultation.pdf) (accessed 23 June 2024).

<sup>5</sup> Ofcom, 'Cloud Services Market Study: Interim Report' (April 2023) ('Ofcom Interim Report'). Available at: [https://www.ofcom.org.uk/\\_data/assets/pdf\\_file/0029/256457/cloud-services-market-study-interim-report.pdf](https://www.ofcom.org.uk/_data/assets/pdf_file/0029/256457/cloud-services-market-study-interim-report.pdf) (accessed 23 June 2024).

<sup>6</sup> Context Consulting, 'Cloud Services Market Research: Summary of Findings' (March 2023) ('Ofcom Market Research'). Available at: [https://www.ofcom.org.uk/\\_data/assets/pdf\\_file/0031/256459/context-consulting-cloud-services-market-research-summary-of-findings.pdf](https://www.ofcom.org.uk/_data/assets/pdf_file/0031/256459/context-consulting-cloud-services-market-research-summary-of-findings.pdf) (accessed 23 June 2024).

<sup>7</sup> Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data and amending Regulation (EU) 2017/2394 and Directive (EU) 2020/1828 (Data Act).

<sup>8</sup> S. Ennis and B. Evans, 'Cloud Portability and Interoperability under the EU Data Act: Dynamism versus Equivalence' (March 2023) CCP Perspectives Policy Paper 23-01. Available at: <https://competitionpolicy.ac.uk/publications/cloud-portability-and-interoperability-under-the-eu-data-act-dynamism-versus-equivalence/> (accessed 23 June 2024).

## 1. Insights from the empirical evidence on interoperability and switching

Empirical evidence of broad-based technical portability and interoperability problems and provider-induced barriers to switching should be considered a prerequisite for any policy recommendations that lead to legal and regulatory intervention in the cloud market. We, therefore, first address the findings of the CMA Primary Research, which is complemented by the Ofcom Market Research that preceded referral of the cloud market to the CMA for investigation.

We note that the CMA Primary Research finds that ‘specific technical barriers or instances of interoperability were not front of mind and often of a more general nature’ with ‘many participants’ citing ‘more high-level concerns about the perceived difficulty of multi-cloud or switching.’<sup>9</sup> Indeed, it is significant the research shows that ‘participants sometimes struggled to identify specific technical challenges that would have to be overcome to achieve a well-functioning multi-cloud infrastructure or a smooth switching experience’ since for many of the surveyed firms ‘multi-cloud or switching is not an active consideration.’<sup>10</sup> We observe that this finding aligns with the Ofcom Market Research, which concluded that ‘[t]he qualitative research process uncovered limited evidence of switching ... together with limited desire to do so’.<sup>11</sup> In that earlier research, we find it striking that while ‘most decision-makers acknowledge that a de facto lock-in exists ... this is primarily a function of internal factors rather than provider-imposed restrictions.’<sup>12</sup> And this position is compounded by the observations that ‘[f]ew, if any, firms, told us that they wished to switch providers but were impeded from doing so by the policies of their providers,’ and ‘nearly all [secondary barriers to switching] are internally driven rather than being ‘created’ by vendors.’<sup>13</sup> In fact, the CMA Primary Research confirms that ‘as some switchers or multi-cloud users in the sample demonstrate, these barriers can be overcome in practice, with enough time, effort and resources.’<sup>14</sup>

The problem is, hence, one of incentives and we note that the CMA Primary Research finds that presently ‘there doesn’t appear to be sufficient incentive for most participants to invest this time, effort and resources to switch provider or implement a multi-cloud architecture.’<sup>15</sup> Importantly, the research finds that ‘participants often have only a hypothetical view of potential benefits, while at the same time fearing both the anticipated and unforeseen challenges that would have to be overcome.’<sup>16</sup> Indeed, it is noteworthy that ‘most participants mentioned these barriers in the context of *hypothetical scenarios*.’<sup>17</sup> While ‘anticipated’ barriers may be perceived by firms, it reads as a substantial leap to conclude that ‘the expectation of these barriers alone acted as a deterrence to seriously entertain the prospect of switching cloud provider or embarking on an integrated multi-cloud journey.’<sup>18</sup> Firms would need to exhibit far more than a ‘more general fear of the “unknown”’ to warrant legal and regulatory intervention.<sup>19</sup>

We also recall some of the core findings of the Ofcom Market Research. In that research, it is noteworthy that despite 52% of firms referring to a ‘lack of interoperability’ as one of ‘various aspects of the way the cloud market [IaaS / PaaS] works’ that cause concern, in the specific context of barriers

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<sup>9</sup> CMA Primary Research, p. 44

<sup>10</sup> CMA Primary Research, p. 44

<sup>11</sup> Ofcom Market Research, p. 110.

<sup>12</sup> Ofcom Market Research, p. 110.

<sup>13</sup> Ofcom Market Research, pp. 14, 120.

<sup>14</sup> CMA Primary Research, p. 65.

<sup>15</sup> CMA Primary Research, p. 65.

<sup>16</sup> CMA Primary Research, p. 65.

<sup>17</sup> CMA Primary Research, p. 65.

<sup>18</sup> CMA Primary Research, p. 44

<sup>19</sup> CMA Primary Research, p. 65.

to switching only 7% of firms surveyed perceive that ‘interoperability challenges’ are the main challenge of switching provider completely.<sup>20</sup> We draw attention to the conclusion that in fact the ‘[p]erceived time and cost of making the change are the main barriers to switching provider completely,’ and this barrier is found to be ‘more of a concern to those who have not considered switching (55% see it as a challenge) than to those who have switched (34%).’<sup>21</sup> Moreover, according to the Ofcom Market Research, when asked about concerns relating to the ‘technical difficulties in transferring data’ it is found that firms who had not considered switching were found to be ‘nearly twice as likely to see this as a challenge (39%) as those who have switched (22%).’<sup>22</sup> In addition, we would emphasise the nascency of the cloud sector, something that is reflected in the characterisation of the ‘relative immaturity of firms in their cloud journey’, more specifically ‘still on the way in, not out, of their IaaS / PaaS environments.’<sup>23</sup> It is arguably, therefore, premature to draw conclusions and design bold interventions.

Rather, the ‘skills gap’ identified by the CMA Primary Research appears to represent a potential barrier.<sup>24</sup> In the context of single-cloud, we would draw attention to the research finding that this ‘gap’ may effectively render certain cloud customers’ engineering teams as ‘stranded assets’, which describes the reality that firms ‘may have invested a lot of time and money into building a body of knowledge with one particular cloud provider which makes it even harder to justify a switch into another environment where a considerable amount of that knowledge is no longer applicable.’<sup>25</sup> In the context of multi-cloud, we note that firms responded that they ‘would have to hire two separate cloud teams and essentially run a distributed architecture team, which in turn, raises security concerns.’<sup>26</sup> It is also important to consider the ‘resource and opportunity costs’, and in particular the problem of ‘unknown effort.’<sup>27</sup> We find it particularly interesting that ‘without expert knowledge in both clouds (in case of a switch) users are unable to predict just how much effort in re-architecting would be required, and what the implications for the rest of the business would be, in terms of potential disruptions to the service.’<sup>28</sup>

Before considering any potential interventions, we would emphasise the responsibility that cloud customers have to undertake an appropriate level of due diligence at the point of service adoption. We find that sophisticated customers, in particular of IaaS and PaaS services, are likely to account for potential portability issues during the decision making process by, for example, testing *ex ante* whether applications can be ported as required.<sup>29</sup> We would also emphasise that inherent to the IaaS model is a heightened level of customer control over data, with customers likely to test whether their data can readily be ported either in-house or to another cloud provider.<sup>30</sup> While the Ofcom Market

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<sup>20</sup> Ofcom Market Research, pp. 116, 121.

<sup>21</sup> Ofcom Market Research, p. 121.

<sup>22</sup> Ofcom Market Research, p. 121.

<sup>23</sup> Ofcom Market Research, pp. 110, 119.

<sup>24</sup> CMA Primary Research, p. 55. This echoes the Ofcom Market Research, according to which ‘skills issues is a major barrier’ to switching.’ Ofcom Market Research, pp. 117, 143.

<sup>25</sup> CMA Primary Research, p. 55.

<sup>26</sup> CMA Primary Research, p. 55. We note that ‘second-order effects’ may ‘arise from the technical difficulties with multi-cloud and switching provider’, specifically in relation to security and ‘disruption to the IT service’, p. 51.

<sup>27</sup> CMA Primary Research, p. 56.

<sup>28</sup> CMA Primary Research, p. 56. We note, in particular, the response of one firm: ‘I think the thing here is we are so embedded into AWS. It’s almost a cultural thing, and our people know it. Our processes are built around it that there needs to be a big impetus for us to move. And I don’t see that being simply price.’

<sup>29</sup> W. Kuan Hon, C. Millard, and J. Singh, ‘Control, Security, and Risk in the Cloud’, in C. Millard (Ed.), *Cloud Computing Law* (OUP 2021), as cited in S. Ennis and B. Evans p. 7.

<sup>30</sup> N. Gleeson and I. Walden, ‘Cloud Computing, Standards, and the Law’, in C. Millard (Ed.), *Cloud Computing Law* (OUP 2021), as cited in S. Ennis and B. Evans, p. 7.

Research reveals that ‘[i]f the company has quickly adopted cloud in an expedited fashion, without really optimising how they’ve built their applications, then they find it really a challenge from to move,’ it does not follow that cloud providers should automatically shoulder an additional burden of responsibility.<sup>31</sup>

## 2. Potential remedies and unintended consequences

At the outset, we are encouraged by the engagement in the CMA Working Paper with the fundamental issue of (a)symmetric intervention. We are broadly critical of the EU Data Act’s symmetric and horizontal regulatory approach and would emphasise the importance of ‘considering whether to limit a potential remedy to the largest cloud providers or a subset of cloud providers (but not all)’ by ‘assess[ing] the extent to which the associated costs might have a disproportionate effect on smaller cloud providers.’<sup>32</sup> Further, we would question whether a *sui generis* regulatory approach that targets a ‘subset of cloud providers’ would be preferable to the application of existing competition law to remedy specific instances of firm conduct that exhibit clear anticompetitive effects. We would also question why cost is the only factor considered and underscore the potential negative impact of intervention, in particular where it is symmetric and horizontal, on both quality and innovation incentives.

Primarily, the CMA Working Paper proposes potential remedies that would require cloud providers to ‘follow common standards for some or all cloud services and interfaces.’<sup>33</sup> This potential remedy ‘could require cloud providers to contribute to the development of new standards or to adopt existing standards’, either on a mandatory or a voluntary basis.<sup>34</sup> We note that four types of intervention are considered, which can be conceived of as operating on a sliding-scale. At one end of the scale, the proposal for ‘[m]andating participation in existing industry schemes or adopting common practices, for example, requiring cloud providers to publish some or all of their APIs’ may yield some benefits. Crucially, however, only certain APIs may be important for facilitating a desirable minimum level of interoperability and switching, and it by no means apparent that all APIs should be captured.

The proposal for ‘equivalence of input’, which we note is derived from the Ofcom Interim Report, functions further along the scale and represents a significant incursion in the commercial liberty of firms.<sup>35</sup> By requiring cloud providers to ‘provide equivalent access to their cloud services’ this intervention is envisaged as enabling the CMA to, for example, ‘require cloud providers to standardise open APIs to support third party inputs.’<sup>36</sup> We find that the imposition of mandatory interoperability standards would inherently favour incumbents, impede existing competition by differentiation and limit the parameters for future innovation.<sup>37</sup> We would concur with the concerns raised by Ofcom that ‘mandating standards is likely to lead to significant implementation costs where they require re-engineering of cloud services and customer applications.’<sup>38</sup> And further, we also concur that standardisation ‘carries a risk to innovation in a dynamic market such as cloud, where any standards could become outdated if they are insufficiently flexible to adapt to industry developments.’<sup>39</sup> Rather, we would be far more optimistic about the emergence of market-driven solutions, such as the

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<sup>31</sup> Ofcom Market Research, p. 117.

<sup>32</sup> CMA Working Paper, p. 84.

<sup>33</sup> CMA Working Paper, pp. 85-6.

<sup>34</sup> CMA Working Paper, p. 86.

<sup>35</sup> CMA Working Paper, p. 89.

<sup>36</sup> CMA Working Paper, p. 89.

<sup>37</sup> D. Schnurr, Centre on Regulation in Europe: Switching and Interoperability Between Data Processing Services in the Proposed Data Act Report (2022), pp. 19-20, as cited in S. Ennis and B. Evans, p. 10.

<sup>38</sup> Ofcom Interim Report, p. 207.

<sup>39</sup> Ofcom Interim Report, p. 207.

potential for innovative cloud providers to voluntarily join an open standardisation initiative in order to compete with incumbents operating closed systems in markets where cloud customers perceive a lack of interoperability as a substantial disadvantage.<sup>40</sup> However, to the extent that ‘equivalence of input’ could be established by a standard embodied within a limited number of APIs in order to ensure portability and interoperability between ‘plain vanilla’ services, we find it to be far more reasonable than the broad ‘equivalence’ requirement chosen in the EU. In this scenario, we would envisage that the services captured would extend only to those that are offered by all relevant cloud providers and rely less heavily upon novel intellectual property rights.<sup>41</sup>

Moreover, we would concur with concerns raised in the CMA Working Paper that ‘[t]here is a risk that by setting standards, we [the CMA] could impair innovation: (a) by restricting the cloud services that could be developed due to requirements to ensure standardisation; ... (b) in the development of standards themselves.’<sup>42</sup> While in theory it may be possible that ‘[d]ifferent independent bodies could be appointed to set and monitor standards for different types of cloud service’<sup>43</sup>, we would underscore the CMA Working Paper concern that there exists a risk that a standard-setting body ‘may not be sufficiently informed and that the standards set may not represent an optimal solution.’<sup>44</sup> While it is noted that such a risk may apply ‘more to mandatory standards and less to voluntary standards, as the market is less likely to adopt sub-optimal voluntary standards’, adoption incentives are complex and the considerable transaction costs associated should not be underestimated. Moreover, we concur that there exists a risk that standard-setting bodies may not be ‘sufficiently independent and, in particular, that one or more of the largest cloud providers has significant influence over the standards setting process.’<sup>45</sup> Indeed, the concern raised in the CMA Working Paper aligns with our concern that this process ‘could result in the standards benefitting certain cloud providers, to the detriment of others’ with incumbents most likely to benefit.<sup>46</sup>

Towards the farthest end of the scale of intervention is the CMA Working Paper proposal to require ‘[e]quivalence of output’, according to which ‘a cloud service may look and operate differently, but the output is comparable between cloud providers’ in a manner that is ‘consistent with the requirement for “functional equivalence” under the EU Data Act.’<sup>47</sup> We would concur with concerns raised by a respondent cloud customer that ‘if cloud providers are expected to facilitate customers achieving equivalence of outputs when they move cloud providers, it would delay or increase the cost of innovation, as cloud providers would need to take into account how the new development may impact on a customer’s ability to achieve equivalence of outcomes.’<sup>48</sup> We are deeply concerned by the potential unintended consequences of similar ‘equivalence’ provisions contained in the EU Data Act, which risk having a chilling effect on competition and innovation not only by smaller and new challenger cloud providers, but more broadly those cloud computing services that are competing most assiduously to meet customer needs.<sup>49</sup> We would emphasise that built-in variety seems to be the natural result of competition in the cloud sector, with firms frequently seeking to distinguish themselves from others with particular aspects of their offers.<sup>50</sup> Hence, we would expect that firms’ incentive to create purpose built, new solutions would be difficult to justify under far reaching

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<sup>40</sup> D. Schnurr, Centre on Regulation in Europe: Switching and Interoperability Between Data Processing Services in the Proposed Data Act Report (2022), pp. 19-20, as cited in S. Ennis and B. Evans, p. 10.

<sup>41</sup> Parliament text, Recital 72.

<sup>42</sup> CMA Working Paper, p. 90.

<sup>43</sup> CMA Working Paper, p. 90.

<sup>44</sup> CMA Working Paper, p. 91.

<sup>45</sup> CMA Working Paper, p. 91.

<sup>46</sup> CMA Working Paper, pp. 90-91.

<sup>47</sup> CMA Working Paper, p. 89.

<sup>48</sup> CMA Working Paper, pp. 86-7.

<sup>49</sup> S. Ennis and B. Evans, p. 1.

<sup>50</sup> S. Ennis and B. Evans, p. 10.

‘equivalence’ provisions.<sup>51</sup> Indeed, we would concur with the earlier concerns raised by Ofcom that ‘[i]f it leads to less control over the architectural and operational decisions relating to their first-party cloud services, this intervention may also dampen cloud providers’ incentives to innovate,’ and, further that ‘challenges with defining the exact scope, including whether they would apply to specific services or to specific cloud providers’ are likely to arise.<sup>52</sup> Ultimately, we are concerned that if the UK follows the EU approach, cloud service providers may respond to the proposed provisions by retrenching to a ‘lowest common denominator’ with diminished innovation.<sup>53</sup> The reality that many firms choose to customise their services already provides substantial information about the values and needs of such companies. Indeed, such customisation can represent an explicit decision by the user to make switching to another cloud provider less simple, or technically impossible without substantial re-customisation.<sup>54</sup>

Our conclusion is validated by the CMA Primary Research, according to which ‘some participants spoke about the potential loss of innovation inherent in avoiding vendor proprietary services,’ with firms expressing ‘the worry that by limiting themselves to vendor-agnostic solutions, they would risk forgoing access to cutting-edge innovation from the market leading cloud providers, potentially impeding their competitive edge within the digital sphere.’<sup>55</sup> Crucially, the report finds that ‘some participants talked about a perceived trade-off between standardization/increased interoperability on the one hand and performance optimization on the other’ and ‘cautioned that in striving towards greater interoperability between cloud services, companies (or regulators) risk targeting the “lowest common denominator” in terms of functionality of these services, potentially at the expense of innovative freedom from cloud providers.’<sup>56</sup> Indeed, we note that one firm responded to the CMA by explaining how ‘you’re in the lowest common denominator scenario. Which is you can’t take the innovations of any of the clouds if you do that because you’d have to do something that all the clouds could do.’<sup>57</sup> And, further, we would draw attention to that fact that another respondent firm remarked how ‘[i]f you want to be able to deploy into multi-cloud, you have to pick services that are common everywhere, at which point you are working with the lowest common denominator, as opposed to taking advantage of some of the specialist services that exist in a particular cloud.’<sup>58</sup>

Significantly, we note that a ‘small number’ of cloud customers responded to the CMA stating that ‘encouraging greater open-source standards may discourage cloud providers to innovate if they’re incentivised to prioritise the “lowest common denominator” over the most innovative solution.’<sup>59</sup> While the CMA Primary Research seems to emphasise that this represents ‘a minority opinion’, given that both that research and the Ofcom Market Research show that firms generally have not considered the issue of interoperability and switching, it is not unreasonable to suggest that the CMA

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<sup>51</sup> S. Ennis and B. Evans, p. 10.

<sup>52</sup> Ofcom Interim Report, p. 206.

<sup>53</sup> S. Ennis and B. Evans, p. 10.

<sup>54</sup> S. Ennis and B. Evans, p. 18.

<sup>55</sup> CMA Primary Research, p. 62. See also: ‘Specifically, participants said that they have a choice between accepting lack of code portability (and hence greater vendor lock-in) or not taking advantage of vendor-specific PaaS solutions’ CMA Primary Research, p. 47.

<sup>56</sup> CMA Primary Research, p. 62.

<sup>57</sup> CMA Primary Research, p. 63.

<sup>58</sup> CMA Primary Research, p. 64. Further: ‘So, for example, if you were to look at the high throughput, high availability database stuff in Azure, it doesn’t exist and replicate into GCP. So you couldn’t use that service if you want to be multicloud. Suddenly you’re losing the advantage of something that’s really key for you as a business. You’d have to start building that yourself that you can then deploy in multiple places to keep that commonality. And then you’ve added another layer of cost onto that and something that isn’t going to be as good as something that they’ve invested massive amount of R&D in. And so you’re making compromises as well as adding layers of complexity, layers of testing, layers of cost.’

<sup>59</sup> CMA Primary Research, p. 64.

may find most informative, accurate and relevant, for the interoperability and switching policy discussion advanced in the CMA Working Paper, the views of the cognisant ‘minority’ that are seriously considering or have engaged in either multi-cloud or switching.

Further, the CMA Working Paper proposal for ‘standardisation of functionality’, which would require cloud providers to ‘ensure that the services are functionally the same (ie the input, the way the service operates, and the output is the same)’ function at the extreme end of the scale of intervention.<sup>60</sup> Although the CMA Working Paper concludes that ‘[w]hile there are risks with this approach, there may be some circumstances where it merits further consideration, for example billing services’ we would be profoundly concerned should this requirement extend to core elements of cloud product offerings.

Framed as a ‘less intrusive form of regulation’, the CMA Working Paper proposes potential remedies that use ‘principles-based requirements’, effectively ‘setting the direction or outcome, but giving cloud providers scope to decide how they comply.’<sup>61</sup> We are encouraged that the CMA Working Paper recognises that a ‘potential drawback of a principles-based approach is that unless the principles are well defined there is a greater risk of misunderstanding and/or circumvention compared to more tightly defined requirements.’<sup>62</sup> While on the one hand, it ‘may be possible to mitigate this risk by issuing detailed guidance or by iterating the principle or using a rule,’ we find that this approach may risk a substantial negative impact on dynamic competition and innovation, at least in the short-run, and would necessarily give rise to substantial transaction and compliance costs which would inherently disadvantage smaller and challenger firms.<sup>63</sup>

Finally, we are encouraged that the CMA Working Paper does not appear to pursue one of the main interventions considered in the Ofcom Interim Report, which would have ‘set outcomes rather than define any aspects of the technical design of hyperscalers’ services’ by a process that would ‘effectively separate or ‘unbundle’ cloud providers’ own first-party services into their respective elements’.<sup>64</sup> We would reiterate our concerns that a concept of modularity may not be applicable to highly heterogeneous cloud computing services, and we would emphasise that, despite the prevalence of a ‘building-blocks’ metaphor across many different kinds of technical products and services, the practical implementation of a ‘building-blocks’ approach could be very challenging to achieve for highly complex and interconnected cloud services.<sup>65</sup> And we would emphasise Ofcom’s concern that ‘quality of experience is reduced when using first-party and third-party services in combination, by comparison to using an integrated service’.<sup>66</sup>

### **3. Market-driven solutions**

We are encouraged that the CMA Primary Research highlights the existence of ‘enablers’ for interoperability and portability that are already being used by firms. In particular, it is found that ‘[t]he main potential enablers include using vendor-agnostic services instead of proprietary PaaS to reduce lock-in, containerization and orchestration tools to improve portability, and Infrastructure-as-Code solutions like Terraform.’<sup>67</sup> Moreover, we note that ‘many participants reported usage of orchestration tools such as Kubernetes to manage containerised applications’ suggesting that ‘many

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<sup>60</sup> CMA Working Paper, p. 89.

<sup>61</sup> CMA Working Paper, p. 92.

<sup>62</sup> CMA Working Paper, pp. 92-93.

<sup>63</sup> CMA Working Paper, pp. 92-93.

<sup>64</sup> Ofcom Interim Report, p. 205.

<sup>65</sup> S. Ennis and B. Evans, p. 14.

<sup>66</sup> Ofcom Interim Report, p. 205.

<sup>67</sup> CMA Primary Research, p. 58.

users of cloud services are aware of potential dependency and “lock-in” to a specific cloud provider, with some using such solutions to improve portability.<sup>68</sup> Ultimately, it is evident that some firms may be more sophisticated than others. We note that one respondent explains: ‘[t]here are ways of writing particular database queries that are cloud specific. We try and keep that level of abstraction high enough that it would work on all cloud providers and don't use anything proprietary and use all of our coordinations as the services based on APIs and Infrastructure-as-Code. So we could take that code and change those APIs to any other provider.’<sup>69</sup> Moreover, we are aware that advances in technology may be facilitating new solutions to perceived problems. In this regard, we would underscore the broad relevance of the response of one cloud customer that: ‘I think it’s easier than it has been to do multi-cloud and that I think there’s quite a lot of tooling out there now that helps with multi-cloud, and I think that it’s a more advantageous environment than it was.’<sup>70</sup>

While abstraction layers clearly have a role to play, they are by no means a panacea. We would concur with the CMA Working Paper finding that potential unintended consequences of introducing a ‘remedy to improve the interoperability of cloud services through the use of abstraction layers’ include potential ‘reduced innovation, as it would reduce perceived differences between cloud provider services.’<sup>71</sup> Indeed, we would emphasise the concern raised that ‘the underlying difference in functionality may be beneficial to customers, if that difference leads to better performing products/services, as providers are better able to introduce new functionality that has nonequivalent outputs’, and we would question the CMA’s qualification that this may somehow be limited to the short-term.<sup>72</sup> The further well-reasoned risk raised is that ‘requiring cloud providers to offer solutions that assist customers in using multiple public clouds could allow cloud providers to extend the reach of their ecosystems’, potentially exacerbating any lock-in that may exist.<sup>73</sup> And from a financial perspective, it follows that ‘[i]f cloud providers were required to provide or support abstraction layers for free, they may look to recoup the cost of the abstraction layer by increasing the prices of other cloud services.’<sup>74</sup>

Furthermore, the CMA Primary Research confirms the role of ‘service-based enablers like third party consultants and training from the cloud service provider.’<sup>75</sup> As outlined in that research, two types of ‘service-based enablers’ typically exist: first, ‘[t]hird party consultants providing support during the migration’ which ‘may come recommended by the “new” cloud provider,’ and second, ‘[s]upport offered by the “new” cloud provider, mainly in the form of training.’<sup>76</sup> While it is noted by the CMA to be a disadvantage that both solutions require a certain level of cloud customer ‘effort’, we would suggest that it is unclear under what circumstances limited or no effort on the part of cloud customers would be justified.

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<sup>68</sup> CMA Primary Research, p. 59.

<sup>69</sup> CMA Primary Research, p. 48.

<sup>70</sup> CMA Primary Research, p. 60.

<sup>71</sup> CMA Working Paper, p. 95.

<sup>72</sup> CMA Working Paper, p. 95.

<sup>73</sup> CMA Working Paper, p. 95.

<sup>74</sup> CMA Working Paper, p. 95.

<sup>75</sup> CMA Primary Research, p. 58.

<sup>76</sup> CMA Primary Research, p. 61.