

REFERENCE RELATING TO THE ANTICIPATED ACQUISITION BY BROADCOM INC. OF VMWARE, INC.

Summary of provisional findings

Notified: 19 July 2023

Overview of our provisional findings

1. The Competition and Markets Authority (**CMA**) has provisionally found that the anticipated acquisition (the **Merger**) of VMware, Inc. (**VMware**) by Broadcom Inc. (**Broadcom**) may not be expected to result in a substantial lessening of competition (**SLC**) in relation to the supply of various server hardware components in the United Kingdom (**UK**).
2. Broadcom and VMware are each a **Party** to the Merger; together they are referred to as the **Parties** and, for statements relating to the future, the **Merged Entity**.
3. This is not our final decision, and we invite any interested parties to make representations to us on these provisional findings by no later than 17.00 BST, on **Wednesday 9 August 2023**. Please make any response to these findings by email to Broadcom.VMware@cma.gov.uk. We will take all submissions received by this date into account in reaching our final decision.

About the server industry

4. Broadcom supplies hardware components for servers and VMware supplies virtualisation software that is primarily used either in data centres or in a private cloud. Both Parties have substantial sales in the UK, and their hardware and software are used by thousands of businesses that operate in the UK.
5. Data centres are owned by the company that uses the servers, while a private cloud is dedicated server capacity that can either be hosted by the company itself or by third parties. A public cloud is owned and operated by a company that supplies server capacity to other companies, enabling those other

companies to scale their computing resources on-demand and pay only for the server capacity which they use. Servers have traditionally been located in data centres at premises owned by the company using the server but in recent years there has been significant growth of Cloud Service Providers (**CSPs**) offering public cloud services. These include companies such as Google (Google Cloud Platform), Amazon (Amazon Web Services) and Microsoft (Azure).

6. Broadcom is a technology company that designs, manufactures, and supplies a broad range of hardware and infrastructure software solutions. The hardware Broadcom supplies for servers includes components that allow servers to connect and communicate with each other such as adapters and switches. Broadcom supplies these components globally, primarily to 'Original Equipment Manufacturers' (**OEMs**) such as Dell and Hewlett Packard, who in turn build and sell servers and related hardware components to companies and other institutions (**enterprise customers**). Servers are built using components from multiple suppliers. As such, it is necessary for different suppliers' components to interoperate with each other.
7. Server virtualisation software enables the processing power of a single server to be segmented into a number of 'virtual machines'. This means that separate computing environments can be created on a single server and the server's processing power can thereby be used more efficiently. VMware sells server virtualisation software globally to a range of enterprise customers (often large organisations such as government departments, financial institutions and telecoms companies) primarily for deployment on servers in data centres and private clouds (**enterprise deployments**).
8. The hardware components in a server must be compatible with the virtualisation software running on that server. In order to achieve interoperability, hardware suppliers will share information about new products such as product samples, product roadmaps, driver source code, and other technical information with suppliers of virtualisation software. VMware then 'certifies' hardware products as being compatible with its virtualisation software. This provides reassurance to customers that those hardware products have been tested to ensure that they interoperate correctly with VMware's server virtualisation software. In addition, VMware provides support (which includes troubleshooting and periodic updates) for certified hardware, which is important for enterprise customers.

9. Our investigation has focussed on those hardware components manufactured by Broadcom and its competitors that require interoperability with VMware's virtualisation software, and which are therefore relevant for our assessment of the Merger. These products are Ethernet network-interface cards (**NICs**), fibre channel host-bus-adapters (**FC HBAs**), storage adapters and fibre channel (**FC**) switches (together, **I/O hardware and switches**).

The Merger

10. Broadcom announced in May 2022 that it had agreed to acquire VMware for a purchase price of approximately USD61 billion (and Broadcom will assume VMware's net debt of USD8 billion). The Merger is subject to regulatory approval.

Our assessment

Why are we looking at this Merger?

11. The CMA's primary duty is to seek to promote competition for the benefit of UK consumers. In this context, it investigates mergers that could raise competition concerns in the UK, provided it has jurisdiction to do so.
12. While both Broadcom and VMware are US-based entities, the question for the CMA is whether the Merger may have an impact on competition in the UK. In this case, we have provisionally concluded that the CMA has jurisdiction to review this Merger because the UK turnover of VMware is in excess of our legal threshold of £70 million for its last business year.

How have we examined this Merger?

13. In deciding whether a merger may be expected to result in an SLC, the question we are required to answer is whether it is more likely than not - a more than 50% chance - that the merger will result in an SLC within any market or markets in the UK.
14. To determine whether this is the case, we have gathered information from a wide variety of sources, using our statutory powers to ensure that we have as complete a picture as possible, under the constraints of the statutory

timetable, to understand the implications of this global Merger on competition in the UK.

15. Given VMware's importance in the supply of server virtualisation software, our investigation has focused on whether the Merged Entity might reduce the interoperability between VMware's virtualisation software and the I/O hardware and switches that are supplied by Broadcom's competitors, thereby encouraging customers to buy Broadcom's I/O hardware and switches rather than those of its competitors, and/or whether it could use any information provided to VMware by Broadcom's I/O hardware competitors to put those competitors at a significant competitive disadvantage.
16. We have focused on two ways, or 'theories of harm', in which the Merger could give rise to an SLC:
 - (a) We first considered whether the Merged Entity would be able to harm the competitiveness of competing manufacturers of I/O hardware and switches by reducing the interoperability between VMware's virtualisation software and competitors' I/O hardware and switches. In assessing this theory of harm, we have considered whether the Merged Entity would be able to reduce interoperability, whether the Merged Entity would have an incentive to do so, and what the impact would be on competition in each of these hardware markets.
 - (b) We also considered whether the Merged Entity (in particular the division of Broadcom which supplies Ethernet NICs, storage adapters and FC HBAs, **I/O hardware**) might have access to commercially sensitive information (**CSI**) from its I/O hardware competitors following the Merger, because these competitors may share such information with VMware when working to ensure their I/O hardware interoperates with VMware's virtualisation software. We considered whether, if Broadcom had access to such information, it could weaken either its incentives or those of its competitors to innovate in I/O hardware markets, thus harming competition now or in future, to the detriment of consumers. To assess this, we considered the CSI which is shared, how I/O hardware competitors are likely to respond post-Merger and the likely impact on innovation.

17. We have provisionally concluded that the Merger may not be expected to result in a substantial lessening of competition for either of these theories of harm. This is discussed in further detail below.

What evidence have we looked at?

18. In assessing this Merger, we looked at a wide range of evidence that we considered in the round to reach our provisional decision. We received a significant volume of evidence from the Parties, including internal business documents which were created in the ordinary course of business and set out each Party's views of the markets, as well as their future commercial strategies. We also held a site visit with each of the Parties, where the Parties' senior business staff provided an overview of the markets and products in question and explained the rationale for the Merger, and formal hearings with each of the Parties, in which we spoke to the Parties' senior management about topics that we were exploring in our investigation. In addition, the Parties made a number of other submissions setting out their views on our theories of harm and evidence base at different points in our investigation.
19. We gathered evidence from customers, other I/O hardware providers and virtualisation software providers. We sent out several requests for information, including to UK-based customers, holding calls with many respondents. These calls and information requests helped us to have a better understanding of the markets, the competitive landscape, likely future developments in these markets, and the likely responses of customers and competitors to any change in the Merged Entity's commercial strategies post-Merger, globally and in the UK.
20. The evidence we have gathered has been tested rigorously, and the context in which the evidence was produced has been considered when deciding how much weight to give it.
21. We have looked at how competition works currently (and each Party's current market position), but at the same time we have recognised that markets, and in particular markets for technological products such as those offered by the Parties, are constantly changing over time. Our assessment therefore includes a forward-looking aspect and considered how these specific markets are evolving and each Party's plans for their businesses in future.

What did the evidence tell us about our first concern: harm to the competitiveness of Broadcom's competitors due to a reduction in interoperability with VMware?

VMware's position in server virtualisation software and is VMware able to reduce interoperability?

22. In light of the evidence we have received from our investigation, we have provisionally found that VMware has market power in the supply of server virtualisation software in enterprise deployments. This is relevant to our assessment as the Merged Entity will only be able to have a substantial impact in the markets for I/O hardware and switches through a reduction of the interoperability with VMware server virtualisation software if it occupies an important position in virtualisation software and customers cannot easily switch away from VMware to a range of effective alternative suppliers. VMware has a high market share in the supply of server virtualisation software for enterprise deployments and evidence provided by customers consistently shows that, as a pioneer of virtualisation software, VMware holds a strong and established position in the market, offering a wide range of complementary services to enterprise customers. We have also seen evidence that there are few other effective alternative virtualisation software providers for VMware customers and that switching away from VMware software is complex, time consuming and has a high cost for customers.
23. In the past few years enterprise customers have migrated some of their existing workloads from enterprise deployments to the public cloud, and they will continue to do so in future, and CSPs exert a constraint on VMware for at least some customers and workloads. However, we have provisionally found that the constraint from CSPs is insufficient to prevent VMware from holding a position of market power as customers have diverse needs and specific requirements, several customers have strong preferences for some workloads to remain in enterprise deployments due to external factors and not all workloads may be suitable for the public cloud.
24. The evidence we have seen shows that interoperability with VMware is essential for providers wishing to offer I/O hardware components for use in servers running VMware server virtualisation software. Given VMware's market power, a lack of interoperability between VMware server virtualisation software and I/O hardware components manufactured by Broadcom's

competitors has the potential to weaken the offering of Broadcom's I/O hardware competitors. We consider that there are ways through which the Merged Entity could potentially reduce or eliminate interoperability between VMware software and competitors' I/O hardware products, for example, by refusing VMware certification for their I/O hardware, thereby disadvantaging Broadcom's I/O hardware competitors. Refusing to certify I/O hardware would reduce interoperability as uncertified I/O hardware can give rise to security risks and compatibility issues, and isn't supported by VMware, so would not benefit from any troubleshooting or updates provided by VMware.

25. On this basis, we have provisionally found that the Merged Entity would have the ability to reduce interoperability between VMware's virtualisation software and Broadcom's competitors' I/O hardware. We have provisionally found that the Merged Entity would not have the ability to reduce interoperability between VMware's server virtualisation software and FC switches.

The commercial benefits of reducing interoperability between competitors' I/O hardware and VMware's server virtualisation software

26. We then considered whether reducing interoperability between competitor I/O hardware and VMware software could lead customers to switch (i) to Broadcom I/O hardware when purchasing new servers or (ii) away from VMware software. We assessed whether this would be a profitable business strategy and, therefore, whether the Merged Entity would have an incentive to engage in such a strategy.
27. We considered the profits which would be gained by the Merged Entity from customers switching to Broadcom I/O hardware relative to the profits which would be lost from any customers who choose to switch away from VMware. Profits earned from sales of VMware's server virtualisation software are significantly higher than the profits earned by Broadcom from sales of I/O hardware. As a result, it would only be commercially beneficial for the Merged Entity to reduce interoperability between competitors' I/O hardware and VMware software if the vast majority of customers would switch to Broadcom I/O hardware when purchasing new servers, and only a very limited number of customers would choose to switch away from VMware.
28. Based on the evidence we have received from customers, including customers in the UK, we have provisionally found that the Merged Entity

would not have a commercial incentive to engage in this strategy. The evidence shows that it is likely that a sufficient number of VMware customers would move workloads away from VMware to mean that this strategy would be unprofitable for the Merged Entity.

29. On this basis, we have provisionally found that following the Merger, the Merged Entity would not have an incentive to reduce interoperability between competitors' I/O hardware and VMware's virtualisation software.

What did the evidence tell us about our second concern: a reduction in the incentives to innovate by Broadcom and its I/O hardware competitors?

The level and type of innovation taking place in I/O hardware

30. Innovation to develop new generations of higher speed Ethernet NICs, FC HBAs and storage adapters is motivated by the need to support increases in the speed of data processing in the server as new generations of central processing units are launched. The protocols for higher speed next generation products are agreed at industry-wide standards bodies and the timelines for introducing new standards are determined by the relevant standards body and made publicly available.
31. Innovation in I/O hardware can also take place on product features such as encryption or power usage. In FC HBAs, these features are set by industry standards, with suppliers choosing which features to prioritise in their products.

The change in CSI available to Broadcom post-Merger

32. CSI is provided to VMware by I/O hardware suppliers as part of the process by which VMware certifies the interoperability of I/O hardware products with VMware's server virtualisation software. This includes product samples, product roadmaps, driver source code, and other technical information. In addition, Broadcom also receives CSI from suppliers of Ethernet NICs and FC HBAs (but not storage adapters) in its role as a supplier of (i) silicon used to manufacture Ethernet NICs; (ii) certain components used to manufacture FC HBAs; and (iii) FC switches (which need to interoperate with FC HBAs). We have therefore considered whether, as a result of the Merger, Broadcom

would have access to additional (or more timely) CSI through VMware's certification process. The evidence we have gathered shows that:

- (a) For FC HBAs, the CSI Broadcom receives is similar to the CSI VMware receives, although the timing of when it is shared can differ.
- (b) For Ethernet NICs, VMware receives additional CSI which is not available to Broadcom pre-Merger.

The likely impact on innovation

- 33. We have considered whether the sharing of information related to competitors' innovations with Broadcom (through VMware) could reduce the level of innovation and/or the incentive to innovate, undertaken either by Broadcom (eg as Broadcom could copy what its competitors are doing) and/or by competitors (as the commercial benefits from investing in innovation may be lower for competitors if Broadcom copies their innovation).
- 34. The evidence we have gathered for Ethernet NICs shows that there is limited innovation in lower speed products (which are predominantly used by OEMs). Innovation is focused on higher speed products, driven by demand from CSPs (who do not use VMware software). Evidence shows that OEMs adopt these higher speed products much later than CSPs. Accordingly, by the time information needs to be shared with VMware to achieve interoperability for hardware sales to OEMs, the higher speed product is already available on the market. We have therefore provisionally found that access by Broadcom after the Merger to CSI would be unlikely to impact significantly the incentives to innovate for Ethernet NICs.
- 35. For FC HBAs, the evidence shows that innovation takes place on product speeds and features which are set by industry standards bodies, and there is limited innovation which is driven by head-to-head competition. Further, Broadcom already receives CSI from hardware competitors which is similar to that which is shared with VMware. We have therefore provisionally found that access by Broadcom after the Merger to CSI would be unlikely to significantly impact the incentives to innovate for FC HBAs.
- 36. In storage adapters the evidence we have gathered shows that:

- (a) Developing new products is a multi-year endeavour and can take three to four years or more. The chip design is typically finalised first, followed by the firmware. Engagement with VMware takes place towards the end of the process, in the last year or two.
 - (b) Different suppliers have adopted different strategies for sharing CSI with VMware. These differences relate to both the type of information shared and the timing of when it is shared. We consider that this may reflect different attitudes towards risk, with some suppliers sharing information earlier to allow more time for interoperability to be ensured.
 - (c) While innovations may be contained in parts of the product that are not shared with VMware, the driver source code shared with VMware may reveal the new features which have been added to the product. However, these new features can also be revealed by the driver source code which is shared with Linux and is open-source, and the evidence indicates that the driver source code may be shared with Linux first (ie prior to any information being available to VMware). Further, the new features which are being planned may be advertised well in advance of product launch, and before any engagement with VMware, such that the information is publicly available by the time driver source code is shared with VMware.
37. Even if suppliers choose not to change their strategies post-Merger, such that Broadcom after the Merger has earlier access to CSI from hardware competitors, given the length of the innovation cycle and the involvement of industry standards bodies, we have provisionally found that this would be unlikely to impact significantly the incentives to innovate for storage adapters.

Provisional conclusion

38. As a result of our investigation and our assessment, we have provisionally concluded that the anticipated acquisition by Broadcom of VMware would result in the creation of a relevant merger situation.
39. We have also provisionally concluded that the anticipated acquisition of VMware by Broadcom may not be expected to result in an SLC in relation to the supply of I/O hardware and switches in the UK.