

# Anticipated acquisition by Broadcom Inc. of VMware, Inc.

## Decision on relevant merger situation and substantial lessening of competition

ME7011/22

### SUMMARY

1. The Competition and Markets Authority (**CMA**) conducted a Phase 1 investigation into the anticipated acquisition by Broadcom Inc. (**Broadcom**) of VMware, Inc. (**VMware**) (the **Merger**). Broadcom and VMware are together referred to as the **Parties**, and for statements referring to the future (if the Merger was to proceed), as the **Merged Entity**.
2. Having examined a range of evidence, the CMA believes that the Merger meets the threshold for reference to an in-depth Phase 2 investigation, giving rise to a realistic prospect of a substantial lessening of competition (**SLC**) in relation to the supply of various server hardware components.
3. The CMA is therefore considering whether to accept undertakings under section 73 of the Enterprise Act 2002 (the **Act**). The Parties have until 29 March 2023 to offer an undertaking that might be accepted by the CMA. If no undertaking is offered to the CMA or the CMA does not accept any undertaking offered, then the CMA will refer the Merger pursuant to sections 33(1) and 34ZA(2) of the Act.
4. Broadcom is a technology company that designs, manufactures, and supplies a broad range of semiconductors and infrastructure software solutions. The following Broadcom hardware components that go into computer servers are relevant for the assessment of the Merger: Ethernet network-interface cards (**NICs**), fibre channel host-bus-adapters (**FC HBAs**), storage adapters, fibre channel (**FC**) switches, and top-of-rack (**TOR**) switching chips. Broadcom supplies these products globally to server manufacturers.
5. These components have different functions:
  - (a) Ethernet NICs provide an interface between the server and other computers and equipment on a network.

- (b) FC HBAs are used to connect servers to networked storage located outside the server on a storage-area network (**SAN**) using the Fibre Channel protocol.
  - (c) Storage adapters connect the server to storage directly, ie storage that is not located on a SAN.
  - (d) FC switches are used to connect the SAN to servers via FC HBAs.
  - (e) TOR switching chips are a component in TOR switches which forward network traffic from the broader datacentre to the appropriate server within a rack of servers and aggregate network traffic from the servers in that rack to send out to the broader datacentre.
6. VMware is active in IT software. The software relevant to the assessment of the Merger is VMware's server virtualisation software, which enables servers to be used more efficiently by aggregating their computing power to emulate multiple 'virtualised' servers. VMware sells this software globally to a range of enterprise customers (often large organisations such as government departments, financial institutions and telecoms companies) primarily for deployment in on- and off-premise datacentres and private clouds (hereafter referred to as **enterprise deployments**).
7. The CMA considered three main theories of harm (**TOH**) in relation to the Merger.

### **TOH1 – Foreclosure of hardware competitors through leveraging VMware's position in server virtualisation software**

8. The CMA considered whether the Merged Entity could foreclose Broadcom's hardware competitors and reduce competition in relation to each of the component types listed above by reducing or restricting the interoperability of their hardware with VMware's server virtualisation software.
9. Based on the available evidence, the CMA believes that VMware has a leading position globally in the supply of server virtualisation software in enterprise deployments. There are only few alternatives to VMware. While enterprises have increasingly turned to using 'public cloud' services offered by companies like Amazon and Microsoft as an alternative to enterprise deployments, the CMA found that these services currently constrain VMware's market power only to a limited extent.
10. The CMA also found that interoperability with VMware's server virtualisation software is very important for Broadcom and its hardware competitors. Maintaining effective interoperability of their hardware with widely-used software like VMware

takes time and effort by hardware manufacturers. VMware's virtualisation software interoperates with Ethernet NICs, FC HBAs, and storage adapters through device drivers that are certified by VMware (a driver is a programme developed by the hardware manufacturer that tells software how to communicate with a hardware device, providing an interface between the two), and with FC switches and TOR switching chips via application programming interfaces (**APIs**).

11. The CMA considered that the Merged Entity would be able to leverage VMware's market power in server virtualisation software to weaken ('foreclose') Broadcom's hardware competitors, for example by impairing the certification of competitors' drivers for Ethernet NICs, FC HBAs, and storage adapters, and impairing access to VMware's API for competitors' FC switches. (The CMA considered that the Merged Entity would not have the technical ability to foreclose TOR switching chip competitors.)
12. The CMA considered that the Merged Entity would also have the incentive to foreclose competitors for Ethernet NICs, FC HBAs, storage adapters, and FC switches. The CMA took into account evidence that, if faced with interoperability issues using non-Broadcom hardware components in their servers, most VMware customers would find it easier to switch to using Broadcom hardware rather than to switch from using VMware to its rivals. While some customers would consider switching to the public cloud instead, the CMA considered that VMware would still be able to recapture enough of the resulting profits lost through its position as a hybrid cloud platform to make the foreclosure strategy profitable overall. The CMA also took into account that server hardware components are purchased by server manufacturers, generally on behalf of virtualisation software customers. The presence of server manufacturers in the supply chain may increase the incentive of the Merged Entity to foreclose hardware rivals, as the manufacturers may have a preference to sell VMware-compatible servers to all customers regardless of which virtualisation software these customers ultimately choose to use.
13. The CMA found that the competitors for Ethernet NICs, FC HBAs, storage adapters, and FC switches that could be targeted by the foreclosure strategy account for a significant share of supply of each component. The CMA therefore considered that the effect of the foreclosure strategy on competition in each market could be substantial.
14. Accordingly, the CMA believes that the Merger gives rise to a realistic prospect of an SLC in the UK as a result of foreclosure of hardware competitors in relation to each of the global markets for the supply of Ethernet NICs, FC HBAs, storage adapters, and FC switches.

15. The CMA also considered as part of TOH1 whether the Merged Entity would have the ability and incentive to reduce or restrict the interoperability of another hardware component, a 'SmartNIC'. SmartNICs are NICs that are capable of offloading network, storage, and security functions from the server's central processor onto a separate dedicated processor on the SmartNIC card. Broadcom previously developed and sold SmartNICs but closed its business in 2021. VMware is working with SmartNIC providers (of which there are several) to develop interoperability between their SmartNICs and VMware. The CMA considered that while the Merged Entity would have the ability to reduce or restrict SmartNIC manufacturers' interoperability with VMware's server virtualisation software, the Merged Entity is unlikely to re-enter the SmartNIC market in future. As such, the Merged Entity would not have an incentive to foreclose SmartNIC manufacturers in order to secure a competitive advantage.

## **TOH2 – Non-horizontal effects from commercially sensitive information sharing**

16. The CMA considered whether competition could be harmed by the flow of commercially sensitive information (**CSI**) from Broadcom's hardware competitors to VMware that occurs as part of the process by which VMware certifies the interoperability of their products with VMware's server virtualisation software. As noted, certification is a vital step in ensuring interoperability. The information passed to VMware includes product samples, product roadmaps, driver source code, and other technical information. This concern is relevant in relation to Broadcom's competitors in the supply of Ethernet NICs, FC HBAs, and storage adapters.
17. The CMA found that, post-Merger, there would be a risk that Broadcom would gain access to this CSI. This could harm competition in two ways. First, Broadcom may have a reduced incentive to innovate and compete because it could develop its products to be only marginally better than its competitors' products. Second, Broadcom's competitors may have a reduced incentive to innovate because they would anticipate that Broadcom would use their CSI to advance its own product improvements.
18. The CMA considered that the effect on competition could be substantial given that the relevant hardware markets are already relatively concentrated and interoperability with VMware's server virtualisation software is very important to server hardware manufacturers.
19. Accordingly, the CMA believes that the Merger gives rise to a realistic prospect of an SLC in the UK as a result of non-horizontal effects from the exchange of CSI in

each of the global markets for the supply of Ethernet NICs, FC HBAs, and storage adapters.

### **TOH3 – Foreclosure of server virtualisation software competitors through leveraging Broadcom’s position in FC HBAs and storage adapters**

20. The CMA considered whether the Merged Entity could foreclose VMware’s server virtualisation software competitors by reducing or restricting their interoperability with two of Broadcom’s server hardware products: FC HBAs and storage adapters, for which Broadcom is the leading supplier globally.
21. Server virtualisation software interoperates with both products through the device drivers that Broadcom releases. The CMA found that post-Merger, the Merged Entity would be able to reduce or restrict the interoperability of both products for rival virtualisation software providers through degrading the quality of its drivers and that doing so, as part of a joint strategy for both products, could harm rival virtualisation software providers.
22. However, as Broadcom uses the same drivers to interoperate with server virtualisation software as for operating systems on non-virtualised servers (known as ‘bare-metal’ servers), any foreclosure strategy would also have a negative impact on the interoperability of Broadcom’s products with bare-metal servers. In view of the significant costs this would incur with no associated benefits, the CMA considered that the Merged Entity ultimately would not have the incentive to engage in such a foreclosure strategy.
23. Accordingly, the CMA found that the Merger does not give rise to a realistic prospect of an SLC in the UK as a result of a foreclosure strategy in the global supply of server virtualisation software.