

Anticipated acquisition by Broadcom Inc. of VMware, Inc.

Decision on relevant merger situation and substantial lessening of competition

ME7011/22

The CMA's decision on reference under section 33(1) of the Enterprise Act 2002 given on 22 March 2023. Full text of the decision published on 5 May 2023.

Please note that [X] indicates figures or text which have been deleted for reasons of commercial confidentiality. In addition, some figures may have been replaced by ranges at the request of third parties for reasons of commercial confidentiality.

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 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.

ASSESSMENT

PARTIES

24. Broadcom is a technology company that designs, manufactures, and provides a broad range of semiconductors and infrastructure software solutions. Broadcom is headquartered in the United States and listed on NASDAQ. Broadcom generated worldwide revenues of approximately £26,961 million in the fiscal year ended 30 October 2022, with £[§<] generated in the UK.¹
25. VMware is active in IT software including virtualisation and related workload management technologies for datacentres and cloud computing environments, application development, and end-point management. VMware is headquartered in the United States and listed on the New York Stock Exchange. VMware was spun off from Dell Inc. in 2021, with entities affiliated with Michael Dell still owning approximately 40% of VMware's non-controlling shares.^{2,3} VMware generated worldwide revenues of approximately £9,499 million in the financial year 2022, with £[§<] generated in the UK.⁴

TRANSACTION AND RATIONALE

26. Pursuant to a merger agreement dated 26 May 2022, Broadcom will acquire all of the voting securities in VMware in exchange for Broadcom common stock and cash, valuing VMware at approximately \$61 billion. Broadcom will also assume \$8 billion of VMware's net debt.⁵
27. The Parties informed the CMA that the Merger has been reviewed by competition authorities in Canada, Brazil, and South Africa where no competition concerns were found by the relevant authorities.⁶ The Merger is subject to ongoing review by other competition authorities including in the United States, the European Union, and China.⁷

¹ Final Merger Notice submitted to the CMA on 24 January 2023 (**FMN**), paragraph 3.2.

² FMN, paragraph 2.19.

³ Post-Merger, current VMware shareholders will own approximately 12% of the Merged Entity on a fully diluted basis with the remaining 88% of shares being owned by current Broadcom shareholders. Broadcom will acquire all of the voting securities of VMware. FMN, paragraph 2.4.

⁴ FMN, paragraph 3.11.

⁵ This is based on the closing price of Broadcom's common stock on 25 May 2022. FMN, paragraphs 2.4 and 2.6.

⁶ FMN, paragraph 2.14.

⁷ FMN, paragraphs 2.12-2.13.

28. The Parties submitted that their offerings are mostly unrelated and serve different enterprise needs.⁸ Upon closing, Broadcom intends to rebrand and operate its IT infrastructure software solutions as 'VMware'. According to the Parties, combining their software offerings will create an improved software portfolio that will provide customers with greater choice and flexibility to build, run, manage, connect, and protect applications at scale across diversified, distributed environments, regardless of where these applications are deployed. Broadcom's aim is to compete more vigorously with larger software and cloud computing competitors such as Amazon, Alphabet, Microsoft, and IBM, by creating a more attractive software portfolio for datacentre managers.⁹
29. The CMA considers that Broadcom's internal documents are broadly consistent with the rationale stated above. For example:
- (a) A letter from Broadcom's CEO to VMware's board of directors in May 2022 proposing the Merger states that [§<]. Further, that the Merger will [§<].¹⁰
 - (b) A May 2022 report from external advisers to Broadcom management on the Merger rationale, indicates that [§<], specifically that the Merged Entity will be able to create '[§<]'. Further, the Merger brings '[§<]'.¹¹

PROCEDURE

30. The CMA's mergers intelligence function identified the Merger as warranting an investigation.¹²
31. The Merger was considered at a Case Review Meeting.¹³

JURISDICTION

32. A relevant merger situation exists where two or more enterprises have ceased to be distinct and either the turnover or the share of supply test is met.¹⁴

⁸ FMN, paragraph 2.12.

⁹ FMN, paragraph 2.12.

¹⁰ FMN, Annex RSLV_00008902, pages 1-2.

¹¹ FMN, Annex BCOM-CMA-00000057, pages 15, 17 and 18.

¹² [Mergers: Guidance on the CMA's jurisdiction and procedure \(CMA2revised\) \(Merger Assessment Guidelines\)](#), January 2021 (as amended on 4 January 2022), paragraphs 6.4-6.6.

¹³ See [Merger Assessment Guidelines](#), see paragraph 9.29 onwards.

¹⁴ [Merger Assessment Guidelines](#), chapter 4; section 23 of the Act.

33. Each of Broadcom and VMware is an enterprise within the meaning of section 129 of the Act, and as a result of the Merger, these enterprises will cease to be distinct.
34. The UK turnover of VMware exceeds £70 million, so the turnover test in section 23(1)(b) of the Act is satisfied.
35. The CMA therefore believes that it is or may be the case that arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation.
36. The initial period for consideration of the Merger under section 34ZA(3) of the Act started on 26 January 2023 and the statutory 40 working day deadline for a decision is therefore 22 March 2023.

COUNTERFACTUAL

37. The CMA assesses a merger's impact relative to the situation that would prevail absent the merger (the counterfactual). For anticipated mergers, the counterfactual may consist of the prevailing conditions of competition, or conditions of competition that involve stronger or weaker competition between the merger firms than under the prevailing conditions of competition.¹⁵
38. The CMA's conclusion on the counterfactual does not seek to ossify the market at a particular point in time, and an assessment based on the prevailing conditions of competition can reflect that, absent the merger, a merger firm would have continued making investments in improvements, innovations, or new products.¹⁶
39. The Parties submitted that the prevailing competitive conditions is the relevant counterfactual.¹⁷ The CMA has not received any evidence that indicates it should base its assessment on a counterfactual other than the prevailing conditions of competition. The CMA therefore considered the prevailing conditions of competition to be the relevant counterfactual.

¹⁵ Merger Assessment Guidelines, paragraph 3.2.

¹⁶ [Merger Assessment Guidelines](#), paragraph 3.3.

¹⁷ FMN, paragraph 11.1.

INDUSTRY BACKGROUND

Server virtualisation software

40. VMware supplies virtualisation software that is used to virtualise server computing capacity (termed '**compute**'), networking, and storage.¹⁸ VMware's server compute virtualisation software is vSphere and consists of two core components: ESXi (the hypervisor) and vCenter Server, which allows the deployment and management of virtual machines across clusters of ESXi servers. VMware also offers network virtualisation software (NSX) and storage virtualisation software (vSAN).¹⁹ According to the Parties, most providers supply server virtualisation software as part of a suite of virtualisation solutions.²⁰
41. Server virtualisation software enables a single server to be divided into multiple isolated virtual computers, known as 'virtual machines'. This is achieved through the use of a 'hypervisor'. A hypervisor is a specialised operating system (**OS**) that runs directly on server hardware (ie on 'bare metal'), pooling the physical computing resources of the server (processors, memory, storage, etc) and allocating them to the virtual machines. The virtual machines run their own 'guest' OS (such as Microsoft Windows) that communicates with the virtual resources presented to it by the hypervisor. Virtualisation enables multiple OSs and applications (or workloads) to make use of the same physical server, enabling enterprises to use fewer servers more efficiently.²¹
42. VMware sells server virtualisation software to a range of enterprise customers (often large organisations such as government departments, financial institutions and telecoms companies), either directly or via a range of distributors and resellers. Enterprise customers can deploy virtualisation software on physical infrastructure (servers or datacentres) that they own and operate themselves on their premises (**on-premise**) or that are hosted by a third party who owns the datacentre (**off-premise**).

¹⁸ FMN, paragraph 15.268.

¹⁹ FMN, paragraph 15.268.

²⁰ FMN, paragraph 15.340.

²¹ FMN, paragraphs 15.177-15.183.

Cloud computing

43. Virtual machines can also be deployed via cloud computing.²² Cloud computing refers to the provision of computing resources as a service on-demand over a network. A distinction is sometimes made between public and private cloud:
- (a) **Public cloud.** A public cloud is a service provided by a third-party provider (a cloud service provider or **CSP**) via the internet. Public cloud users only pay for the computing resources they use and can outsource their entire stack to CSPs (that pool these resources across multiple customers), eliminating the costs of purchasing and maintaining their own servers.²³ CSPs usually use their own proprietary virtualisation software for this purpose.
 - (b) **Private cloud.** Private cloud computing is more difficult to define and can overlap with other types of deployments. It generally refers to the provision of computing resources over a private network with hardware and software dedicated solely to the relevant enterprise. Private clouds can be either hosted by the enterprise for the benefit of its own users (on-premise), or hosted by a third party who owns a datacentre (off-premise). Off-premise private clouds are gated from other tenants using various isolation mechanisms, such as firewalls. This results in or is perceived as providing a higher level of control and privacy for sensitive data than in the public cloud.

Containerisation

44. Containerisation is a way of partitioning an OS to produce isolated workspaces within it.²⁴ Containers enable applications to share the same OS while remaining isolated from one another in a way that appears as though they are running in separate OSs. Workloads running in containers can only use the resources they are assigned and do not interact with workloads in other containers running on the same underlying OS.²⁵
45. The level at which abstraction takes place in server virtualisation and containerisation is different. Virtual machines are created through abstraction at the hardware level, whereas containers are created through abstraction at the OS level.²⁶

²² FMN, paragraph 15.187.

²³ FMN, paragraph 20.79.

²⁴ FMN, paragraph 15.236.

²⁵ FMN, paragraph 15.237.

²⁶ FMN, paragraph 15.238.

Server hardware components

46. Broadcom supplies a range of server hardware components to server original equipment manufacturers (**server OEMs**). The following components are relevant to the assessment of the Merger as they directly or indirectly interact with VMware's virtualisation software:
- (a) **Network-interface cards (NICs)**. NICs are server components that provide an interface between the server and other computers and equipment on a network. Most NICs communicate with other components of a network using one of two standard protocols: Ethernet and InfiniBand.²⁷ Broadcom only supplies Ethernet NICs.
 - (b) **SmartNICs**. SmartNICs are NICs that are capable of offloading network, storage, and security functions from the server's central processing unit (**CPU**) onto a separate dedicated CPU on the SmartNIC card. Broadcom terminated its SmartNIC business in 2021 and [REDACTED].²⁸
 - (c) **Fibre Channel host-bus-adapters (FC HBAs)**. 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.²⁹
 - (d) **Storage adapters**. Storage adapters connect the server to storage directly, ie storage that is not located on a SAN. This storage may be internal (located within the server) or external (located in a storage enclosure).³⁰ There are two main types of storage adapters, non-RAID and RAID.^{31, 32} A non-RAID adapter (also known as an input/output (IO) controller), is a basic chip for data transfer without any data protection capabilities, whereas a RAID adapter is a ready-made more advanced storage adapter, with data protection capabilities built into it.
 - (e) **Fibre Channel (FC) switches**. FC switches are used to connect the SAN to servers via FC HBAs. FC switches communicate with servers using the standardised FC protocol.³³

²⁷ FMN, paragraphs 15.446 and 14.447. InfiniBand is a network architecture with very low latency.

²⁸ FMN, paragraph 15.466.

²⁹ FMN, paragraphs 15.507-15.508.

³⁰ FMN, paragraph 15.514.

³¹ Note of a call with a third party [REDACTED] on [REDACTED].

³² RAID stands for redundant array of independent disks.

³³ FMN, paragraph 15.453.

- (f) **Top of rack (TOR) switches.** TOR switches are switches located closest to the server. TOR switches forward network traffic from the broader datacentre to the appropriate server within a rack of servers, and, in the other direction, aggregate network traffic from the servers in that rack to send out to the broader datacentre. Broadcom does not supply TOR switches, but does supply TOR switching chips, which are an input into TOR switches.³⁴
- (g) **SmartTOR switches.** SmartTOR switches have [X] that can handle more networking functionality compared to standard TOR switches. SmartTOR switches offload processing from the CPU. Broadcom does not supply SmartTOR switches, but does supply SmartTOR switching chips, which are an input into SmartTOR switches.³⁵ The market for SmartTOR switches is nascent, and Broadcom's SmartTOR switching chips are currently [X]. Broadcom only had [X].³⁶

Interoperability and certification

47. VMware's hypervisor communicates with underlying hardware through device drivers. A driver is a programme that tells software how to communicate with a device, providing an interface between the two. The purpose of the driver is to allow the OS's (hypervisor's) own API to be able to interoperate with hardware components supplied by hardware manufacturers.³⁷
48. Hardware manufacturers develop device drivers. Since each OS communicates with drivers in different ways, hardware manufacturers must create OS-specific drivers for their hardware.³⁸
49. VMware, like other OS vendors, publishes testing suites for hardware manufacturers to certify that their drivers work with its OS. VMware has a range of certification programmes designed to provide partners with the necessary tools and development resources to design, build, and integrate products with core VMware features and capabilities and facilitate interoperability with VMware software.³⁹
50. VMware's testing suites run a series of tests to determine whether a hardware product and driver works with VMware's products. The testing suites generate a log

³⁴ The Parties' response of 7 December 2022 to question 22 of the CMA's request for information (RFI), dated 25 November 2022.

³⁵ The Parties' response of 7 December 2022 to question 22 of the CMA's RFI, dated 25 November 2022.

³⁶ FMN, paragraph 15.596.

³⁷ FMN, paragraph 20.19.

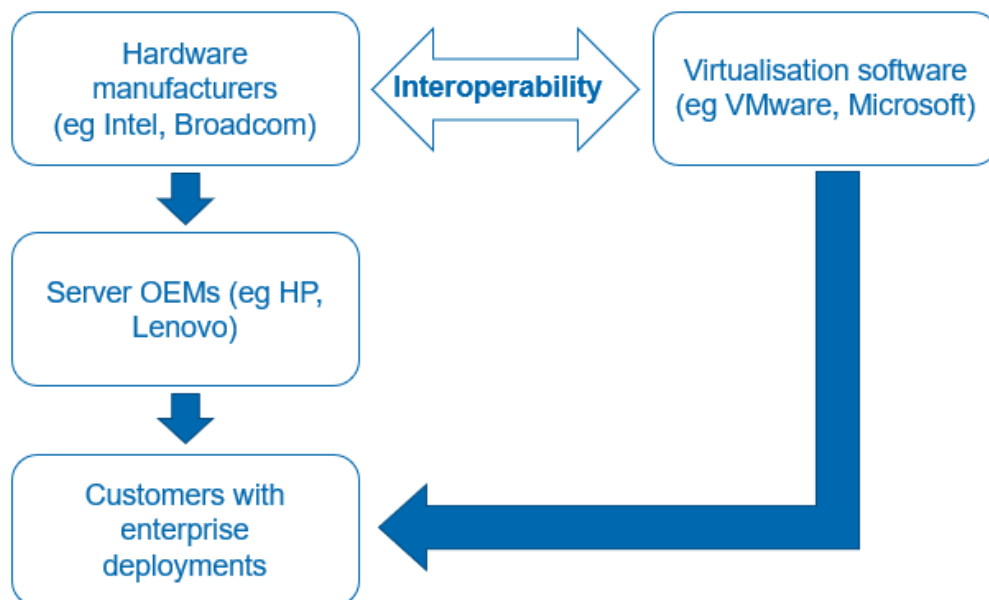
³⁸ FMN, paragraph 20.24.

³⁹ FMN, paragraph 20.38

that the hardware manufacturer submits to VMware for certification, which VMware then manually reviews. Hardware and software integration can also require some partners to work with VMware to troubleshoot issues that arise during testing.⁴⁰

51. Once VMware confirms that a driver has passed all tests, VMware certifies and lists the driver on its website. If the hardware manufacturer modifies the driver (eg to introduce new features or to maintain compatibility with new versions of VMware), the driver must be submitted for re-certification.⁴¹
52. Project Monterey is VMware's plan to build a version of its virtualisation software hypervisor (ESXi) that runs on SmartNICs. Project Monterey has been developed in collaboration with three SmartNICs suppliers: NVIDIA, Intel, and AMD Pensando.⁴² It has also included collaborations with server OEMs (Dell, HPE, and Lenovo), to ensure the new solutions work with their servers.⁴³
53. Figure 1 summarises the supply chain and the relationship between hardware manufacturers, server OEMs, virtualisation software providers, and customers with enterprise deployments described above.

Figure 1.1: Figure 1: Industry structure (excluding public cloud) (simplified)



Notes: The supply chain is simplified to focus on the key relationships relevant to the CMA assessment. For example, VMware often supplies virtualisation software to end customers through intermediaries. VMware

⁴⁰ FMN, paragraph 20.56.

⁴¹ FMN, paragraph 20.57.

⁴² FMN, paragraph 20.139.

⁴³ FMN, paragraph 20.141.

also sometimes sells to server OEMs who then resell to end customers, but such sales account for <10% of VMware's revenue.⁴⁴

FRAME OF REFERENCE

54. Market definition provides a framework for assessing the competitive effects of a merger and involves an element of judgement. The boundaries of the market do not determine the outcome of the analysis of the competitive effects of the merger, as there can be constraints on merging parties from outside the relevant market, segmentation within the relevant market, or other ways in which some constraints are more important than others. The CMA will take these factors into account in its competitive assessment.⁴⁵
55. The main products relevant for the assessment of the Merger are VMware's server virtualisation software and the following Broadcom server hardware components: Ethernet NICs, SmartNICs, FC HBAs, storage adapters, FC switches, and TOR switching chips.

Product scope

Server virtualisation software

56. The CMA considered whether server virtualisation software, public and private cloud computing and containerisation should constitute a single frame of reference. The CMA also considered whether the supply of software used to virtualise the server compute, network, storage and/or desktop hardware components should belong to the same frame of reference. In addition, the CMA also considered whether virtualisation software could be segmented by: (i) on-premise and off-premise virtualisation; (ii) type of virtualisation software; (iii) underlying hardware; or (iv) between open-source and proprietary software.

Private cloud

57. The Parties submitted that virtualisation software deployed in datacentres and in the private cloud belong to the same market, because the same virtualisation software can be used across both environments, and customers can run the same workloads in both environments.⁴⁶

⁴⁴ FMN, Table 4.

⁴⁵ [Merger Assessment Guidelines \(CMA129\)](#), March 2021, paragraph 9.4.

⁴⁶ FMN, paragraph 15.343 and footnote 526.

58. In line with the Parties' submission, the CMA considers that virtualisation software deployed in datacentres and in the private cloud belong to the same market (henceforth also referred to as **enterprise deployments**). The same suppliers tend to be active in relation to both virtualisation software used in private datacentres and in the private cloud, using the same software, and holding similar market positions in relation to each.⁴⁷ There is in fact no clear distinction between the two deployment types;⁴⁸ whether a specific deployment can be treated as private cloud largely depends on how the infrastructure is managed.

Public cloud

59. The Parties submitted that virtualisation software used in enterprise deployments belong to a wider market which also encompasses the public cloud.⁴⁹ According to the Parties, enterprises have increasingly migrated workloads from their own infrastructure or private clouds to the public cloud. In support of this the Parties refer to the following:

- (a) The number of virtualised servers and CPUs in the public cloud has increased by [40-50]% and [40-50]% respectively between 2019-2021, while the number in enterprise deployments has remained relatively stable.⁵⁰
- (b) Various recent examples of enterprises migrating existing workloads or deploying new workloads to the public cloud.⁵¹
- (c) A VMware internal survey from December 2021 focused on VMware's customers (the **Workloads Study**), which the Parties submitted demonstrates that [redacted].⁵²

60. The Parties nevertheless acknowledged that some workloads are less likely to be migrated to the public cloud.⁵³ This includes monolithic, legacy applications, which are sometimes more costly to rewrite for the cloud, and mission-critical applications that require zero risk of downtime or failure. As a result, enterprises may distribute

⁴⁷ See for example FMN, Table 51 and Table 53. The top 3 three competitors are the same across traditional and private cloud deployments on-premises with similar shares of supply.

⁴⁸ Industry analysts explain that 'a definition for private cloud is difficult, if not impossible' (FMN, footnote 359).

⁴⁹ FMN, paragraphs 15.327 and 15.343.

⁵⁰ FMN, paragraph 15.190, based on data from IDC.

⁵¹ FMN, paragraph 15.200.

⁵² FMN, paragraph 15.193.

⁵³ FMN, paragraph 15.220.

workloads across on-premise infrastructure and public and private clouds, as part of a 'hybrid cloud' strategy as discussed in paragraph 213.

61. The CMA considers that, while the public cloud may provide a constraint on virtualisation software, it is likely to be limited in several respects:
 - (a) As discussed in paragraphs 152-153, most customers of server virtualisation software either do not consider public cloud to be an alternative for on or off-premise virtualisation in the short run, or only for some of their workloads, or not at all.
 - (b) Contrary to the Parties' submission, the Workloads Study in fact shows that most workloads were more likely to stay with VMware than to migrate to the public cloud.⁵⁴ The Workloads Study also shows that the number of workloads deployed in datacentres is expected to decline [X] per year between 2021 and 2024.⁵⁵
 - (c) As explained in paragraph 156, other VMware internal documents indicate that the substitutability with the public cloud is limited.
62. The CMA therefore does not consider it appropriate to include the public cloud in the product frame of reference, but it has taken it into account as an out-of-market constraint in the competitive assessment.

Containerisation software

63. The Parties exclude containerisation software from the product frame of reference but note that it is an important and growing constraint on virtualisation software and cannot be ignored in assessing competition.⁵⁶
64. The CMA considers that containerisation software should not be included in the same product market as server virtualisation software. As set out in paragraphs 165-167, evidence gathered by the CMA indicates that containerisation software provides a limited constraint on server virtualisation software. Most customers of server virtualisation software do not consider containerisation to be an alternative for all their workloads in the short run. Industry reports also indicate that containers are often used in conjunction with virtualisation software, rather than as an alternative.⁵⁷

⁵⁴ FMN, Annex Q15-011, slide 19.

⁵⁵ FMN, Annex Q15-011, slide 9.

⁵⁶ FMN, paragraph 15.345.

⁵⁷ See for example: FMN Annex Q15-009, page 3-4; VMware's response to s109 Notice 2, RSLV_00018714, page 23; FMN Annex Q20-010, page 3-4. FMN Annex Q15-009, page 2.

In addition, the costs of migrating virtualised workloads to containers can be significant for some customers.⁵⁸

Type of virtualisation software

65. As explained in paragraph 40, VMware has different software used to virtualise server compute, networking, and storage. The evidence received by the CMA indicates that from a demand-side perspective, server, storage, and network virtualisation software are not comparable in terms of product characteristics and intended use.⁵⁹ From a supply-side perspective, virtualisation software providers indicated that server, storage, and network virtualisation software are separate products.⁶⁰
66. Therefore, the CMA considers that other forms of virtualisation software (network or storage) should not be included in the same product market as server virtualisation (ie the virtualisation of server compute).

Underlying hardware components

67. The Parties submitted that the frame of reference for the supply of virtualisation software should not be segmented by the underlying hardware as providers often sell virtualisation software for installation on generally available servers rather than for particular hardware.⁶¹ The CMA agrees with the Parties' submission: virtualisation software is typically sold so that it can be installed across a range of underlying hardware.

Virtualisation software for on- and off-premise enterprise deployments

68. The Parties submitted that virtualisation software used for on- and off-premise servers belong to the same market because whether a server is located in a building owned or leased by an enterprise or by a third party is an issue of property ownership and has no bearing on an enterprise's choice of software.
69. The CMA agrees with the Parties' submission. The same server virtualisation software can be used for both on- and off-premise servers, while location and ownership of the server does not make a difference to the virtualisation software deployed. Most virtualisation customers responding to the CMA's investigation also

⁵⁸ Note of a call with a third party [X] on [X]; Note of a call with a third party [X] on [X]; Note of a call with a third party [X] on [X].

⁵⁹ Third-party responses to the CMA questionnaire.

⁶⁰ Note of a call with a third party [X] on [X]. Note of a call with a third party [X] on [X].

⁶¹ FMN, paragraph 15.399.

indicated that VMware's market position is similar across both on- and off-premise deployments.⁶²

Proprietary vs open-source software

70. The Parties submitted that there should be no segmentation of virtualisation software between open source and proprietary software. According to the Parties, there is no meaningful distinction as some vendors license proprietary tools with virtualisation software but continue to make the virtualisation software's source code freely available.⁶³
71. The CMA agrees with the Parties' submission. Some virtualisation customers and most virtualisation software competitors responding to the CMA's investigation indicated that both open-source and proprietary virtualisation software are alternatives to VMware. VMware's internal documents also list both open-source and proprietary virtualisation software providers as competitors.⁶⁴

CMA's conclusion

72. In view of the above, the CMA considers that the product frame of reference for virtualisation software includes the private cloud but excludes the public cloud and containerisation. The CMA also considers that server virtualisation software is distinct from other forms of virtualisation software (ie network and storage) and should not be further segmented by underlying hardware, on-premise and off-premise virtualisation, or between open-source and proprietary software.

Broadcom's server hardware components

Ethernet NICs and SmartNICs

73. Broadcom provides Ethernet NICs and Ethernet controllers, a NIC's on-board processor. Broadcom does not provide InfiniBand NICs. As noted above, Broadcom terminated its SmartNIC business in 2021, [REDACTED].⁶⁵
74. The Parties' submitted that it is appropriate to define separate product markets for NICs, without further segmentation by:

⁶² Third-party responses to the CMA's questionnaire.

⁶³ FMN, paragraph 15.341.

⁶⁴ See for example: VMware's response to s109 Notice 2, RSLV_00045456, page 34; and VMware's response to s109 Notice 2, RSLV_00020174, page 31.

⁶⁵ FMN, paragraph 15.466.

- (a) protocol, because Ethernet and InfiniBand protocols offer comparable performance to high-performance fabrics;⁶⁶
- (b) bandwidth, because there is no single use case that is served by a particular bandwidth and customers mix and match bandwidths to achieve similar results;⁶⁷ and
- (c) cards and controllers, because there is no difference in functionality between them.⁶⁸

75. The Parties also submitted that NICs should be distinguished from SmartNICs due to their differences in functionality, features, complexity, and price.⁶⁹

76. The CMA considered the above submissions:

- (a) **Segmentation by protocol.** The majority of customers that responded to the CMA's investigation considered that non-Ethernet NICs (such as InfiniBand NICs) do not constitute an alternative for Ethernet NICs.⁷⁰ Further, one hardware customer noted that InfiniBand is mostly used for high-performance computing, such as artificial intelligence and scientific computing.⁷¹ The CMA considers it appropriate therefore to define separate frames of reference for Ethernet NICs and non-Ethernet NICs.
- (b) **Segmentation by bandwidth.** Ethernet NICs are available on a continuum of price and performance. Customers and competitors noted that it is difficult to draw market-defining lines based on bandwidth or other performance characteristics, and there is a trade-off between higher bandwidths and price.⁷² Evidence from enterprise customers was mixed, with some considering they could use a range of different bandwidths while others considered some bandwidths did not meet their requirements. Therefore, the CMA considers it appropriate to group these together in the same frame of reference.
- (c) **Segmentation between cards and controllers.** Hardware competitors noted that there was no meaningful distinction between cards and controllers.⁷³ The

⁶⁶ FMN, paragraphs 15.494 and 15.495.

⁶⁷ FMN, paragraph 15.496.

⁶⁸ FMN, footnote 35.

⁶⁹ FMN, paragraph 15.493.

⁷⁰ Third-party responses to the CMA's questionnaire.

⁷¹ Third-party response to the CMA's questionnaire.

⁷² Third-party responses to the CMA's questionnaire.

⁷³ Third-party responses to the CMA's questionnaire.

CMA considers it appropriate therefore to group these products together in the same frame of reference.

- (d) **NICs and SmartNICs.** Some virtualisation customers noted that Ethernet NICs and SmartNICs are alternatives,⁷⁴ but most did not consider them to be viable alternatives.⁷⁵ Some hardware competitors noted that SmartNICs and NICs are not substitutable, as the functionality offered by each is different⁷⁶ and SmartNICs generally come at a much higher price.⁷⁷ Other hardware competitors noted that there is some demand-side substitutability between NICs and SmartNICs as SmartNICs contain the same features as NICs but with the addition of encryption and security features and are alternatives to certain bandwidth of NICs.⁷⁸ However, several customers and competitors also noted that over time traditional NICs will become less competitive with SmartNICs, as SmartNICs continue to develop.⁷⁹ Overall, therefore the CMA has not considered it appropriate to include NICs and SmartNICs in the same product frame of reference. In relation to SmartNICs, as there is some evidence indicating a degree of substitution with SmartTOR switches (as discussed in paragraphs 230-231), the CMA considered SmartTOR switches as an out-of-market constraint to SmartNICs in the competitive assessment.

77. For the reasons above, the CMA's considers that the product frame of reference for NICs should be segmented by protocol and distinguished from the supply of SmartNICs, but not segmented by bandwidth, or between cards and controllers.

FC HBAs

78. The Parties submitted that FC HBAs constitute a separate frame of reference, without requiring further segmentation by speed or generation.⁸⁰
79. The CMA agrees with the Parties' submission. The CMA's investigation indicated that all FC HBAs are designed to industry standards and that higher speed FC HBAs are substitutable for slower FC HBAs.⁸¹ The CMA therefore considers that there is a separate product frame of reference for the supply of all FC HBAs.

⁷⁴ Third-party responses to the CMA's questionnaire.

⁷⁵ Third-party responses to the CMA's questionnaire.

⁷⁶ Third-party responses to the CMA's questionnaire.

⁷⁷ Third-party response to the CMA's questionnaire.

⁷⁸ Third-party responses to the CMA's questionnaire.

⁷⁹ Third-party responses to the CMA's questionnaire.

⁸⁰ FMN, paragraphs 15.549 and 15.551.

⁸¹ Note of a call with a third party [X] on [X].

80. The CMA also considers that FC HBAs are constrained at a 'systems' level⁸² from Ethernet SANs (that use Ethernet NICs) and public cloud which does not require FC HBAs. The CMA considered these out-of-market constraints as part of its competition assessment in paragraphs 287-288.

Storage adapters

81. The Parties submitted that storage adapters constitute a separate frame of reference. According to the Parties, the market for storage adapters does not warrant segmentation by protocol, as consumers do not need to switch storage adapters to switch to a drive based on a different protocol.⁸³

82. The CMA agrees with the Parties' submission that storage adapters constitute a distinct market and that this market does not warrant segmentation by protocol.

83. The CMA also considered whether storage adapters can be segmented between their two main types: RAID and non-RAID storage adapters.

(a) Competitors responding to the CMA's investigation indicated that there is a trade-off between using RAID and non-RAID adapters. RAID adapters are more flexible and allow customers to back-up data in the event of a power outage. However, RAID adapters take processing power away from the CPU, reducing its performance, and are more expensive.⁸⁴

(b) In terms of supply-side substitutability, the two main suppliers of storage adapters both supply RAID and non-RAID adapters, and therefore the competitive assessment is not sensitive as to whether the product market is segmented between them.

84. The CMA therefore considers that RAID and non-RAID storage adapters belong to the same product frame of reference.

85. The CMA also considers that storage adapters are constrained at a 'systems level' from CPU-direct-attached storage (which does not require any storage adapters) and public cloud (which uses storage adapters less frequently). The CMA considered these out-of-market constraints as part of its competition assessment in paragraph 289.

⁸² Datacentres can be set up using different combinations of components (or systems) such as: Ethernet SANs (which use Ethernet NICs) instead of FC SANs (that use FC HBAs); and CPU-direct-attached storage instead of using storage adapters.

⁸³ FMN, paragraphs 15.548 and 15.551.

⁸⁴ Third-party responses to the CMA's questionnaire.

FC switches

86. The Parties have not submitted their views on the appropriate product frame of reference for FC switches. Nevertheless, the CMA considers that there is separate product frame of reference for the supply of FC switches. FC switches provide specific functionality, such as interconnecting different parts of a network to route and exchange data packets between the various sub-networks which cannot be directly replicated by another hardware device.

TOR switching chips

87. The Parties submitted that the narrowest candidate product market is the supply of TOR switching chips for TOR switches.⁸⁵
88. In line with the Parties' submission, the CMA considers that there is separate product frame of reference for the supply of TOR switching chips used for TOR switches.
89. The CMA also considers that the supply of TOR switching chips is distinct from the supply of SmartTOR switching chips, due to their different functionality. For example, Broadcom's SmartTOR switching chip has additional functionality, such as [X], compared to its other TOR switching chip products.⁸⁶

Conclusion on product scope

90. For the reasons set out above, the CMA considered the impact of the Merger in the following product frames of reference:
- (a) the supply of server virtualisation software (including the private cloud but excluding the public cloud and containerisation);
 - (b) the supply of Ethernet NICs;
 - (c) the supply of SmartNICs;
 - (d) the supply of FC HBAs;
 - (e) the supply of storage adapters;
 - (f) the supply of FC switches; and

⁸⁵ The Parties' response of 3 February 2023 to question 7 of the CMA's RFI, dated 27 January 2023.

⁸⁶ FMN, paragraph 15.575.

- (g) the supply of TOR switching chips.

Geographic scope

Server virtualisation software

91. The Parties submitted that the geographic scope of the server virtualisation software market is global.⁸⁷ The CMA agrees that the relevant geographic scope for the supply server virtualisation software is global.

Server hardware components

92. The Parties submitted that the geographic scope for the supply of Ethernet NICs, SmartNICs,⁸⁸ FC HBAs,⁸⁹ storage adapters,⁹⁰ and TOR switching chips⁹¹ is global. The Parties have not submitted any views on the appropriate geographic scope of the market for FC switches.
93. The CMA agrees that the relevant geographic frame of reference for the supply of Ethernet NICs, SmartNICs, FC HBAs, storage adapters, and TOR switching chips is global, and considers that this is also the case for FC switches.

Conclusion on frame of reference

94. For the reasons set out above, the CMA considered the impact of the Merger in the following frames of reference:
- (a) the global supply of server virtualisation software (including the private cloud but excluding the public cloud and containerisation);
 - (b) the global supply of Ethernet NICs;
 - (c) the global supply of SmartNICs;
 - (d) the global supply of FC HBAs;
 - (e) the global supply of storage adapters;
 - (f) the global supply of FC switches; and

⁸⁷ FMN, paragraph 15.350.

⁸⁸ FMN, paragraph 15.479.

⁸⁹ FMN, paragraph 15.553.

⁹⁰ FMN, paragraph 15.554.

⁹¹ The Parties' response of 3 February 2023 to question 7 of the CMA's RFI, dated 27 January 2023.

- (g) the global supply of TOR switching chips.

COMPETITIVE ASSESSMENT

Theories of harm

95. The CMA has assessed three theories of harm set out below:
- (a) Foreclosure of Broadcom's hardware competitors in the global supply of each of Ethernet NICs, SmartNICs, FC HBAs, storage adapters, FC switches and TOR switching chips by leveraging VMware's market power in the global supply of server virtualisation software (**TOH1**);
 - (b) Non-horizontal effects in the global supply of each of Ethernet NICs, SmartNICs, FC HBAs, and storage adapters as a result of the exchange of commercially sensitive information between Broadcom's competitors in these markets and VMware (**TOH2**); and
 - (c) Foreclosure of VMware's server virtualisation software rivals by leveraging Broadcom's market power in the global supply of FC HBAs and storage adapters (**TOH3**).

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

96. The CMA considered whether the Merged Entity would have the ability and incentive to leverage VMware's market power in server virtualisation software to foreclose Broadcom's competitors in relation to six types of component (Ethernet NICs, SmartNICs, FC HBAs, storage adapters, FC switches, and TOR switching chips), through reducing or restricting their ability to interoperate with VMware's server virtualisation software.
97. In relation to SmartNICs, the CMA acknowledges that Broadcom is no longer active in this market, having terminated its SmartNICs business in 2021. Nevertheless, the CMA considered whether the Merged Entity would have the ability and incentive to foreclose SmartNIC suppliers to protect Broadcom's presence in relation to NICs and SmartTOR switching chips and/or to support its re-entry into and growth in the SmartNICs market.
98. Foreclosure of competitors can occur where the Merged Entity could use its presence in one market to directly harm the competitiveness of its rivals in another, even if there is not a conventional supplier/customer relationship. The CMA

considers the ability, incentive, and effect framework to be appropriate to assess this theory of harm.⁹² Accordingly, in the sections below the CMA considers whether the Merged Entity would have: (i) the ability to foreclose its rivals active in the respective hardware markets; (ii) the incentive to do so (ie whether it would be profitable); and (iii) whether this would substantially lessen overall competition in the respective hardware markets.⁹³

Ability to foreclose hardware competitors

99. As regards ability to foreclose, the CMA considered the following:

- (a) whether the Merged Entity would have market power in the supply of server virtualisation software; and
- (b) the importance of interoperability with the Merged Entity's server virtualisation software for hardware competitors and whether the Merged Entity would have the technical ability to restrict or reduce their interoperability with VMware's server virtualisation software.

VMware's market power

- Parties' submissions

100. The Parties submitted that the Merged Entity would not have sufficient market power in virtualisation software to give rise to foreclosure concerns⁹⁴ and that this was supported by VMware's low share of supply for virtualisation software.

- (a) The Parties submitted shares based on revenue, showing that VMware had a [90-100]% of 'x86 server virtualisation infrastructure' globally in 2021 based on Gartner data, and [60-70]% of 'software-defined compute software' globally in 2021 based on International Data Corporation⁹⁵ data (Gartner and IDC are market intelligence providers).⁹⁶ However, the Parties submitted that these revenue shares overstate VMware's competitive significance, because they do not properly capture the constraint from vendors with alternative monetisation model, such as Microsoft's Hyper-V virtualisation software which is integrated

⁹² [Merger Assessment Guidelines](#), paragraph 7.11.

⁹³ [Merger Assessment Guidelines](#), paragraphs 7.9-7.10.

⁹⁴ FMN, paragraph 20.75.

⁹⁵ International Data Corporation (**IDC**) publishes third-party industry reports which Broadcom uses to monitor its competitors (FMN, paragraph 10.6).

⁹⁶ FMN, paragraphs 15.387-15.390 and Annex Q15-024.

into its broader Windows Server product or free open-source hypervisors, such as KVM and Xen.⁹⁷

- (b) The Parties also submitted volume shares commissioned from IDC based on the number of virtualised server CPUs installed globally. This showed that VMware had considerably lower shares, at [10-20]% in 2021 across all deployment types, including the public cloud, and [30-40]%⁹⁸ for traditional datacentre and private cloud deployments.⁹⁹ However, the Parties, also submitted that these shares based on CPUs installed do not accurately capture VMware's current and future position in the market.
- (c) Lastly, the Parties also submitted alternative shares of supply commissioned from IDC based on the number of new virtualised licenses shipped globally, which the Parties consider to be most appropriate.¹⁰⁰ According to this metric, the Parties submitted that VMware's share of supply in 2021 was only [10-20]% for all deployment types (including the public cloud) and [20-30]% for traditional datacentre and private cloud deployments.¹⁰¹

101. The Parties submitted that VMware's shares on both volume metrics above have followed a [X] over the last three years.

102. The Parties further submitted that VMware faces significant competitive constraints from a range of competitors, including:

- (a) proprietary hypervisors similar to VMware, most notably Microsoft's Hyper V offering;
- (b) paid open-source hypervisors, where the customer pays for technical support, such as IBM Red Hat's RHV, Nutanix and Citrix;
- (c) free open-source hypervisors, such as KVM and Xen, where the customer builds out their own virtualisation solutions;

⁹⁷ FMN, paragraphs 15.352-15.354.

⁹⁸ Based on aggregating Tables 51-55, and Tables 51-54 of the FMN respectively.

⁹⁹ FMN, paragraph 15.359. In relation to volume shares, the Parties noted that they do not currently track market shares systematically by volume and were not aware of any third-party data source that covers VMware's vSphere and competing virtualisation software. The Parties therefore commissioned share of supply estimates from IDC for the purposes of this merger investigation (FMN, paragraph 15.358).

¹⁰⁰ Parties' response to the CMA's Issues Letter of 28 March 2023 (**Issues Letter**) dated 3 March 2023 (**Issues Letter Response**), paragraph 2.6(b).

¹⁰¹ FMN, paragraph 15.364.

- (d) public cloud providers, where customers run virtualisation software on the cloud provider's infrastructure.¹⁰² The Parties note that the major cloud competitors are AWS (EC2), Google (Cloud), and Microsoft (Azure), but other providers include IBM, Oracle, and Alibaba.¹⁰³ According to the Parties, the constraint from public cloud providers has grown substantially in recent years. Specifically, the Parties submitted that the Workload Study showed that [X]% of respondents migrated all evaluated workloads to the cloud. Finally, the Parties submitted that the ability to move workloads to the public cloud on the margin still constrains the pricing of VMWare licences across the board, including with respect to workloads that are not easily moved, because VMware cannot discriminate pricing for those workloads; and
- (e) providers of containerisation software, which the Parties submit can be used instead of virtualisation software or in conjunction with it, make switching between virtualisation software and cloud providers easier.¹⁰⁴ According to the Parties, customers are increasingly writing applications for deployment in containers.¹⁰⁵

103. The Parties submitted that VMware has lost [X] worth of opportunities for new vSphere licences annually in recent years, and that this shows VMware [X].¹⁰⁶

104. The Parties submitted that switching costs for moving workloads from VMware to rival server virtualisation providers and to the public cloud are low, and switching workloads is quick and straightforward in many circumstances.¹⁰⁷ Further, the Parties submitted that the prevalence of multi-homing and the use of migration tools, third-party consultancies, and containers facilitates switching.¹⁰⁸

105. In response to the CMA's Issues Letter, the Parties submitted that the CMA misinterpreted internal document evidence by taking documents out of context, being selective about their content, and using documents from 2020 which they consider to be out of date.¹⁰⁹ Further, the Parties submitted additional documents, relating to the threat from public cloud providers.¹¹⁰

¹⁰² FMN, paragraph 20.79.

¹⁰³ FMN, paragraph 15.300.

¹⁰⁴ FMN, paragraphs 15.247-15.263; Issues Letter Response, paragraphs 2.6c, 2.6f and 2.6j.

¹⁰⁵ FMN, paragraph 15.300.

¹⁰⁶ Issues Letter Response, paragraph 2.6a.

¹⁰⁷ Issues Letter Response, paragraphs 2.6e and 2.6g.

¹⁰⁸ Issues Letter Response, paragraphs 2.6d, 2.6i and 2.6h.

¹⁰⁹ Issues Letter Response, Annex 1, paragraphs 2, 3, 7, 10, 11, and 14.

¹¹⁰ Issues Letter Response, Annex 1, paragraph 4.

- CMA's assessment

106. In assessing VMware's market power, the CMA first considered share of supply estimates for VMware in the global supply of virtualisation software for traditional datacentres and private cloud deployments (the relevant frame of reference). The CMA also considered qualitative evidence regarding the strength of VMware's offer and competitive positioning and the strength of alternative suppliers, out-of-market constraints, as well as switching costs.
- Shares of supply
107. The CMA considered share of supply evidence from several different sources, including the Parties' estimates, shares of supply contained in the Parties' internal documents, and third-party share of supply estimates.
108. The CMA agrees with the Parties' submissions that revenue-based shares may lack reliability because they do not capture providers with alternative monetisation models. The CMA therefore has focused on volume shares of supply in the remainder of this section. Nevertheless, the CMA has seen VMware internal documents that [redacted] which indicates that they may carry at least some weight.
109. As regards volume shares of supply, the Parties provided the following three sets of volume estimates:
- (a) Initially, the Parties provided shares of the number of virtualised server CPUs installed globally, which the Parties created themselves based on VMware's internal data for VMware volumes and IDC data for third party volumes.¹¹¹
 - (b) The Parties subsequently provided revised shares on the same metric which the Parties commissioned from IDC, which solely use IDC data and do not use VMware internal data.
 - (c) The Parties also provided shares based on the number of new virtualised licenses shipped globally, commissioned from IDC and based solely on IDC data.
110. The CMA places greatest weight on the first of these estimates, for the following reasons:
- (a) The Parties have not provided a sufficiently detailed explanation underlying either of the estimates commissioned from IDC to enable the CMA to assess

¹¹¹ FMN, Table 43.

whether the approach adopted behind these estimates is robust and accurate. For example, the Parties have not provided any explanation of how IDC selected the sample of customers surveyed to inform the calculations, and whether it was biased towards customers most likely to use other suppliers.

- (b) Contrary to the Parties' submissions, shares based on the number of CPUs installed are likely to be more appropriate than the number of new virtualised licenses shipped. The former reflects the alternatives available to the entire VMware customer base rather than only new servers or customers, which is likely to be more relevant in the context of TOH1, given that any foreclosure strategy could affect both existing servers and/or new servers using existing VMware licences.
- (c) The Parties' initial estimates based on the number of CPUs installed are likely to be more reliable than the estimates regarding the same metric commissioned from IDC, because they combine VMware's actual internal data with IDC data.

111. The initial estimates provided by the Parties on the number of CPUs installed, subject to several adjustments,¹¹² are set out in Table 1 below. These shares cover traditional datacentre and private cloud deployments globally.

Table 1. Shares of supply in server virtualisation software based on number of CPUs installed, globally, 2019-2021 (traditional datacentre and private cloud deployments)

Supplier	2019		2020		2021	
	# of CPUs, million	Share	# of CPUs, million	Share	# of CPUs, million	Share
VMware	[>]	[40-50]%	[>]	[40-50]%	[>]	[40-50]%
Microsoft	[>]	[20-30]%	[>]	[20-30]%	[>]	[20-30]%
IBM	[>]	[5-10]%	[>]	[5-10]%	[>]	[10-20]%
Oracle	[>]	[0-5]%	[>]	[0-5]%	[>]	[0-5]%
SUSE	[>]	[0-5]%	[>]	[0-5]%	[>]	[0-5]%
Nutanix	[>]	[0-5]%	[>]	[0-5]%	[>]	[0-5]%
AWS	[>]	[0-5]%	[>]	[0-5]%	[>]	[0-5]%
Google	[>]	[0-5]%	[>]	[0-5]%	[>]	[0-5]%
Alibaba	[>]	[0-5]%	[>]	[0-5]%	[>]	[0-5]%
Others	[>]	[20-30]%	[>]	[10-20]%	[>]	[10-20]%
Total	28.5	100.0%	29.5	100.0%	30.6	100.0%

Source: CMA analysis of the Parties' data and third-party data.

¹¹² The CMA has taken the shares from Table 43 of the FMN and has made the following adjustments: (i) as the shares did not include estimates for VMware's competitors, the CMA has estimated these by using the competitor splits in the shares commissioned from IDC as a proxy; and (ii) where available, the CMA has used actual figures received from third parties.

112. These shares show that for traditional datacentre and private cloud deployments VMware has the largest share of supply at [40-50]% in 2021, which is almost twice the size of the next largest competitor, Microsoft at [20-30]%, followed by IBM at [10-20]%. All remaining competitors have less than 5% share and together account for around 25% of the market. VMware's share of supply is relatively constant across the three years and does not show a declining trend (in contrast to the Parties' submissions [redacted]).¹¹³
113. The CMA considers that these share estimates may understate VMware's actual share for the following reasons.
114. The estimates rely on IDC data to estimate the total market size. The CMA has not seen a sufficiently detailed methodology to assess the reliability of this estimate, and has reason to believe it may be overestimated since the 'Others' category accounts for around [20-30]% of the market. This is inconsistent with third-party feedback which did not indicate a significant number of alternative competitors, as well as third-party industry reports, which show that small competitors do not account for a significant share of the market (see paragraphs 139-149). If the share of the 'Others' category was smaller and, in turn, the true market size smaller, VMware's actual share of supply globally would be higher than [40-50]%.
115. The Parties' internal documents and third-party views consistently indicate that VMware's share is significantly higher than 40%.
- (a) In a document on the [redacted] and VMware cooperation dated June 2020, VMware estimates that it has a share of [60-70]% by number of virtualised instances, with the next closest competitor being [redacted] with a [20-30]% share. VMware has estimated this through [redacted].¹¹⁴
- (b) In VMware's 2021 multi-cloud strategy document, VMware estimates that it has a share of [60-70]% in the overall server virtualisation market. This rises to an estimate of [80-90]% in the paid-for market. The CMA understands that these shares are [redacted].¹¹⁵

¹¹³ In response to the Issues Letter, the Parties submitted that VMware's share of the net change in the installed base in Table 1 from 2020 to 2021 is [20-30]% (Issues Letter Response, footnote 5). The CMA considers that small fluctuations in the installed base can result in significant changes in shares based on net change do not reflect competition in the market as they are subject to significant fluctuations. For example, VMware's share based on the net change between 2019 and 2020 is [50-60]%, which is significantly higher than the [40-50]% figure based on the installed base.

¹¹⁴ FMN, Annex RSLV_00056380, page 7.

¹¹⁵ FMN, Annex RSLV_00028772, page 3; the Parties' response of 4 November 2022 to question 16 of the CMA's RFI, dated 28 October 2022.

(c) In a report commissioned by VMware in April 2022, it is estimated that VMware had market shares of [50-60]% for non-cloud server virtualisation infrastructure in terms of usage based on a [§<]. The same document estimates that in 2021 VMware's share of supply was [40-50]% for on-premise workloads based on the number of installed servers.¹¹⁶

116. As for third-party views, one third party indicated that VMware has a 60% share of the enterprise server OS market running fibre channel,¹¹⁷ while others indicated that VMware has a 70% share by number of servers.¹¹⁸

117. Taking the evidence in the round, the CMA considers that VMware's global share of supply for virtualisation software in traditional datacentre and private cloud deployments is likely to be higher than 40% and most likely around [60-70]%. That said, given the weaknesses of the market share data available, as well as the degree of product differentiation between suppliers (as discussed further below) which may result in market shares understating VMware's market position, the CMA also considers it is important to draw on other sources of evidence in assessing VMware's market power.

– VMware's offer and competitive positioning

118. Virtualisation customers told the CMA that VMware has a very strong offering in virtualisation software, with many customers describing VMware as having a market leading position¹¹⁹ and indicating that there are few alternatives.¹²⁰

119. VMware is an established supplier of virtualisation software and was a pioneer in the development of server virtualisation software. Third parties see VMware's incumbent position as one of its strengths. For example, when customers were asked why they chose to use VMware, several mentioned its long-standing position in the market.¹²¹

120. As well as being a well-established product, VMware's virtualisation customers identified VMware's strong position as resulting from having a stable product with

¹¹⁶ FMN, Annex RSLV_00017150.

¹¹⁷ A hardware competitor of Broadcom estimated that VMware has around a 60% share of the enterprise server OS market running fibre channel. Note of a call with a third party [§<] on [§<].

¹¹⁸ A virtualisation software competitor estimated that VMware has a 70% share by the number of virtualised on-premise servers (Note of a call with a third party [§<] on [§<]). A server OEM estimated that over 70% of their servers (ie volume shares) have ESXi through vSphere loaded (Note of a call with a third party [§<] on [§<]).

¹¹⁹ Third-party responses to the CMA's questionnaire.

¹²⁰ Third-party responses to the CMA's questionnaire.

¹²¹ Third-party responses to the CMA's questionnaire.

better features. For example, one virtualisation customer stated ‘We have been using VMware technology since 2006 and built our whole business on it. It was really the first mass market commercial virtualisation technology available. Whilst many have tried to follow, none are as feature rich, stable and considered business grade. In today[’s] market whilst there are other hypervisors, there are no alternatives that are as feature rich and mature.’¹²²

121. Some customers also consider VMware’s ability to offer a broad range of products related to server virtualisation software, such as network and storage virtualisation software, as an important part of VMware’s offering.¹²³ For example, one customer stated that ‘[i]t is the eco-system that makes VMware products attractive for our data centres and our customer-solutions. Most of them use additional VMware products on top of virtualization. Interoperability and service out of one hand are important to us’.¹²⁴
122. VMware’s internal documents also reflect the strength of its offering. For example, a 2021 strategy document concerning VMware’s multi-cloud strategy described VMware as ‘[redacted]’.¹²⁵ A VMware presentation to Broadcom dated July 2022 describes VMware’s market leading position as being enabled by a very broad customer base, a very large ecosystem of hardware and software technology partners, and a large ecosystem of vSphere admin and experts (with [redacted] experts worldwide).¹²⁶ In a CEO overview in May 2022, VMware considered itself to occupy an ‘[redacted]’.¹²⁷
123. In relation to the Parties’ submission that the CMA has relied on documents that are out of date in its assessment, the CMA does not consider that the internal documents identified by the Parties which date from 2020 are out of date, given that the Merger was first contemplated only shortly thereafter in March 2021.¹²⁸
124. Third-party reports confirm VMware’s strong market position. For example, a June 2021 report by IDC concluded that: ‘2020 saw VMware continue to hold a dominant position in the software-defined compute (SDC) software market.’¹²⁹ Deutsche Bank Research’s report dated November 2021 notes ‘VMware’s ubiquity across

¹²² Third-party response to the CMA’s questionnaire.

¹²³ Third-party responses to the CMA’s questionnaire.

¹²⁴ Third-party response to the CMA’s questionnaire.

¹²⁵ FMN, Annex RSLV_00028772, page 19.

¹²⁶ VMware’s response to s109 Notice 2, RSLV_00029833, page 8.

¹²⁷ FMN, Annex Q9(BM)–002, page 43.

¹²⁸ FMN, Annex BCOM-CMA-00000001, page 26.

¹²⁹ VMware’s response to s109 Notice 2, RSLV_00018230, page 2.

enterprise IT environments and compelling value proposition for multi-cloud computing'.¹³⁰

125. VMware's importance to end customers affects server OEMs' preferences, who ensure that the hardware components in the servers they sell interoperate with VMware's virtualisation software. Server OEMs responding to the CMA's investigation have explained that their customers have a preference or requirement for servers that perform well with VMware. For example, one server OEM said that 'Many customers use VMware as their hypervisor and express a preference for servers that perform well with or are certified by VMware'.¹³¹ Further, several server OEMs noted that a large proportion of their servers are currently being used to run VMware.¹³²
126. The CMA does not consider that the Parties' submission that in recent years VMware lost more than \$[redacted] million worth of opportunities for new vSphere licences annually suggests a significant change in its competitive positioning. First, it is unclear how the Parties conducted this analysis, including what assumptions were made as the Parties have not submitted the underlying methodology to the CMA. Second, the Parties' analysis in fact shows that VMware won a large proportion of the new opportunities that it quoted for in the last three years, [redacted].¹³³ The CMA considers that this figure is consistent with VMware having a high share of supply (as suggested by VMware's internal market share estimates) and a strong market position.
127. The CMA considers that the evidence points to VMware having a very strong position in the supply of virtualisation software on the basis of its mature, industry tested and full-feature product, with few alternatives in the view of many customers.
 - Alternative suppliers
128. Suppliers of virtualisation software that provide a viable alternative to VMware's virtualisation customers reduce VMware's ability to foreclose (by providing an option for customers to switch to in the event of any attempted foreclosure). The CMA has considered the strength and viability of the main two alternative suppliers of

¹³⁰ VMware's response to s109 Notice 1, RSLV_00008188, page 1.

¹³¹ Third-party response to the CMA's questionnaire.

¹³² Third-party responses to the CMA's questionnaire.

¹³³ The figures are based on data provided to the CMA in the graph labelled 'vSphere loses many opportunities each year' on page 5 of the Issues Letter response. The CMA has calculated the proportion of license bookings out of all opportunities (lost opportunities plus realised license bookings).

virtualisation software – Microsoft and IBM (including Red Hat) – as well as the tail of smaller competitors, such as Nutanix and Oracle.

129. **Microsoft.** Microsoft has a proprietary virtualisation software offering through its Hyper-V product, which is integrated into its Windows Server product.¹³⁴ As set out in Table 1 above, the share of supply data for virtualisation software in traditional datacentre and private cloud deployments indicates that Microsoft's share in 2021 was [20-30]%, a little over half the size of VMware's share.
130. VMware's internal documents indicate that VMware considers Microsoft a competitor in virtualisation software. A VMware presentation to Broadcom in July 2022 mentions [redacted].¹³⁵ However, the CMA has placed limited weight on this document given that it was prepared for the Merger. A VMware document prepared for its sales team dated November 2019 tracks [redacted].¹³⁶
131. VMware's customers consider Microsoft to be a good alternative to VMware and gave it an average rating of 3.9 out of 5 in terms of viability as an alternative.¹³⁷ However, some customers considered the dependency on Microsoft's operating system as limiting its strength as an alternative¹³⁸ and noted the lack of a competent on-premise offering suitable for network functions.¹³⁹
132. **IBM.** IBM offers virtualisation software through its Red Hat virtualisation product.¹⁴⁰ Red Hat provides a paid open-source solution where the hypervisor is available for free and IBM charges for technical support.¹⁴¹ As set out in Table 1 above, the share of supply data for virtualisation software in traditional datacentre and private cloud deployments indicates that IBM's share was [10-20]% in 2021.
133. A VMware internal document prepared for its sales team dated November 2019 considers Red Hat's virtualisation software as a primary competitor.¹⁴² However, other VMware internal documents note that Red Hat's virtualisation software does not have the same functionality:

¹³⁴ FMN, Table 39.

¹³⁵ VMware's response to s109 Notice 2, RSLV_00029833, page 8.

¹³⁶ VMware's response to s109 Notice 2, RSLV_00020174, page 31 and 94.

¹³⁷ This was given in response to the following question 'Please score the providers of virtualisation and containerisation for each deployment type. For each provider, please assign a score from 1 to 5, where 5 = a very suitable alternative to VMware and 1 = a provider that is not a suitable alternative to VMware'.

¹³⁸ Third-party response to the CMA's questionnaire.

¹³⁹ Third-party response to the CMA's questionnaire.

¹⁴⁰ IBM also offers another virtualisation software called PowerVM. The CMA understands that it is used with non-x86 IBM's servers.

¹⁴¹ FMN, paragraph 20.79.

¹⁴² VMware's response to s109 Notice 2, RSLV_00020174, page 31.

- (a) A VMware quarterly business review in September 2020 states that '[REDACTED]'. It is not clear if this quote refers to a comparison of functionality between VMware's vSphere and Red Hat's Virtualization software, rather than specific comments limited to Red Hat's 'recent major moves'. However, given the reference to the VMware's full platform solution it appears that VMware may have been making a broad comparison of functionality.¹⁴³
- (b) A VMware document [REDACTED].¹⁴⁴
134. VMware's customers gave IBM an average rating of 3.0 out of 5 as an alternative to VMware. While some customers considered IBM to be a viable alternative to VMware, others did not consider it to be a good alternative, with customers citing lack of certain features¹⁴⁵ and product maturity.¹⁴⁶
135. **Nutanix.** Nutanix offers virtualisation software through its open-source Nutanix AHV hypervisor.¹⁴⁷ As set out in Table 1 above, the share of supply data for virtualisation software in traditional datacentre and private cloud deployments indicates that Nutanix's share was [0-5]% in 2021.
136. VMware's internal documents note that Nutanix has a similar strategy to VMware, [REDACTED].¹⁴⁸ However, these documents also note that Nutanix has weaknesses, including in a 2022 document which notes that Nutanix mainly focusses on other products (such as storage virtualisation software) and does not yet have an established hypervisor.¹⁴⁹ Nutanix also uses a different approach to virtualisation compared to VMware that '[REDACTED]'.¹⁵⁰
137. VMware's customers gave Nutanix an average rating of 3.1 out of 5 as an alternative to VMware. While some customers considered VMware as a viable alternative to Nutanix, others did not consider it to be a good alternative, noting that it is not suitable for large-scale deployments¹⁵¹ and is not a fully functional replacement for VMware.¹⁵²

¹⁴³ VMware's response to s109 Notice 1, RSLV_00008337, page 32.

¹⁴⁴ VMware's response to s109 Notice 2, RSLV_00045456, pages 31 and 34.

¹⁴⁵ Third-party responses to the CMA's questionnaire.

¹⁴⁶ Third-party response to the CMA's questionnaire.

¹⁴⁷ FMN, paragraph 20.79.

¹⁴⁸ These documents include VMware's presentation to Broadcom in July 2022 (VMware's response to s109 Notice 2, RSLV_00029833, page 8), and a VMware internal document prepared for its sales team dated November 2019 (VMware's response to s109 Notice 2, RSLV_00020174, page 95).

¹⁴⁹ VMware's response to s109 Notice 2, RSLV_00029833, page 8.

¹⁵⁰ VMware's response to s109 Notice 2, RSLV_00020174, page 95.

¹⁵¹ Third-party responses to the CMA's questionnaire.

¹⁵² Third-party responses to the CMA's questionnaire.

138. Some virtualisation competitors also indicated that Nutanix’s hypervisor does not compete closely with VMware.¹⁵³ Nutanix’s AHV hypervisor is free while ESXI is paid for. Nutanix has a small presence in server virtualisation and mainly competes with VMware in storage virtualisation. Nutanix’s hypervisor is also not marketed in the same way.¹⁵⁴ Nutanix told the CMA that it does not consider itself as a hypervisor competitor, to VMware, mainly because its AHV hypervisor is free while ESXI is paid for, and Nutanix provides its hypervisor only when customers specifically request it. Instead Nutanix and VMware compete for the additional stacks that run on top of a hypervisor.¹⁵⁵
139. **Citrix.** Citrix offers virtualisation software through its paid open-source XenServer product.¹⁵⁶
140. A VMware internal document prepared for its sales team dated November 2019 lists Citrix Hypervisor as a primary competitor but notes that [redacted].¹⁵⁷
141. Third parties also responded that Citrix is not a strong competitor in server virtualisation software. VMware’s customers gave Citrix an average rating of 2.6 out of 5 as an alternative to VMware. Customers did not consider Citrix to be a good alternative because Citrix is not a fully functional replacement for VMware;¹⁵⁸ and it lacks features and functionalities.¹⁵⁹ Several customers also noted that Citrix is mainly used for desktop virtualisation.¹⁶⁰
142. Some virtualisation providers told the CMA that Citrix has legacy server virtualisation software, which has shrunk in market presence and is mainly used by Citrix’s existing virtual desktop infrastructure customers that have traditionally used it and do not want to move away.¹⁶¹
143. **Oracle.** Oracle offers virtualisation software through its paid open-source product VM Server for x86 and also offers private cloud through Oracle

¹⁵³ Third-party responses to the CMA’s questionnaire; Note of a call with a third party [redacted] of [redacted]; Note of a call with a third party [redacted] on [redacted].

¹⁵⁴ See for example: ‘AHV: Virtualisation Management for Enterprise’ <https://www.nutanix.com/uk/products/ahv>, last accessed 21 March 2023; and ‘VMware ESXi’ <https://www.vmware.com/uk/products/esxi-and-esx.html>, last accessed 21 March 2023

¹⁵⁵ Note of a call with a third party [redacted] on [redacted].

¹⁵⁶ FMN, Table 39.

¹⁵⁷ VMware’s response to s109 Notice 2, RSLV_00020174, pages 31 and 93.

¹⁵⁸ Third-party response to the CMA’s questionnaire.

¹⁵⁹ Third-party responses to the CMA’s questionnaire.

¹⁶⁰ Third-party responses to the CMA’s questionnaire.

¹⁶¹ Note of a call with a third party [redacted] on [redacted]; Third-party response to the CMA’s questionnaire.

Cloud@Customer.¹⁶² As set out in Table 1 above, the share of supply data for virtualisation software in traditional datacentre and private deployments indicates that Oracle's share was [0-5]% in 2021.

144. Oracle is not identified in VMware's internal documents as a competitor for server virtualisation software in traditional datacentre and private cloud deployments.¹⁶³
145. Third parties also indicated that Oracle is not a strong competitor in server virtualisation software. VMware's customers gave Oracle an average rating of 2.4 out of 5 as an alternative to VMware. While Oracle was considered a viable alternative to VMware by some customers, many did not consider it to be a good alternative, noting that it lacks capabilities¹⁶⁴ and is not customer friendly.¹⁶⁵
146. **Other virtualisation competitors.**¹⁶⁶ VMware's customers did not identify Linux KVM and Xen Project – both free open-source hypervisors – as suitable alternatives, giving both an average score of less than 2 out of 5. Lack of technical support was one of the main reasons why these products were not identified as suitable alternatives.¹⁶⁷
147. The Parties also identified Huawei (FusionCompute) as a competitor in server virtualisation software.¹⁶⁸ However, customers did not identify this supplier as a suitable alternative to VMware, giving it an average score of 1.4 out of 5 and the CMA has not seen evidence in VMware's internal documents that it considers Huawei as a competitor.
148. The CMA understands that AWS (with its Outposts product), Google (with its Anthos product), and Alibaba (with its Apsara Stack product) also have some offerings outside of public cloud that may be more comparable to the enterprise model. These products however have so far had very limited traction based on the shares of supply provided set out at Table 1 above. The CMA considers the competitive

¹⁶² FMN, Table 39. The CMA understands that VM VirtualBox is used for desktop virtualisation rather than server virtualisation.

¹⁶³ For instance, VMware's document on [X].

¹⁶⁴ Third-party responses to the CMA's questionnaire.

¹⁶⁵ Third-party responses to the CMA's questionnaire.

¹⁶⁶ The shares of supply estimated by IDC also list SUSE as virtualisation software but the CMA does not discuss it separately since the CMA understands that SUSE is an open-source OS that supports two open-source solutions Xen Project and KVM, which are discussed in paragraph 146 (FMN, Table 40).

¹⁶⁷ Third-party responses to the CMA's questionnaire.

¹⁶⁸ FMN, Table 39. In addition to the competitors listed by the Parties, a limited number of third parties also mentioned Canonical, Windriver and Ubuntu (with KVM) as alternatives to VMware (Third-party responses to the CMA's questionnaire.)

constraint imposed by public cloud providers (such as AWS and Google) in the section on out-of-market constraints below.

149. The CMA has not seen evidence in VMware's internal documents that it considers additional competitors not discussed above as competitors in server virtualisation software for traditional datacentre and private cloud deployments.
150. Overall, the CMA believes that no competitor currently provides a product comparable to VMware. Microsoft is a good alternative, albeit with some limitations. IBM is a viable alternative for some customers but also has limitations. The CMA considers that the remaining virtualisation competitors are all weak alternatives.
 - Out-of-market constraints – public cloud
151. Public cloud offers an alternative model that has been rapidly growing in recent years and cloud service providers such as Google, Amazon and Microsoft are active in this area.
152. While some customers responding to the CMA's investigation indicated that the public cloud is an alternative for using on- or off-premise servers,¹⁶⁹ the majority either only considered it as an alternative in the long run (more than 24 months), for some of their workloads, and/or not at all.¹⁷⁰ For customers that would consider moving some of their workloads to the public cloud, the majority indicated that barriers to switching to the public cloud are high. Those barriers include the need to rewrite older applications, increased cost, existing contracts, business risk and time to transition, changes to protocols and standards, and security considerations.¹⁷¹ Further, server virtualisation competitors and public cloud providers either did not consider public cloud to be an alternative to on- or off-premise servers, or if they did, only for some customer workloads or in the long run.¹⁷²
153. As one customer explained, some workloads are not suited to a public cloud environment for various reasons, including: they are old legacy applications that require dedicated infrastructure which is often uneconomical in a cloud model; a requirement for quick and efficient (ie low latency) access to network elements; the need to be able to easily transfer data to different areas of a business; and the cost to access large amounts data using public cloud providers compared to the cost of running the application on-premise.¹⁷³ One server OEM also noted that businesses

¹⁶⁹ Third-party responses to the CMA's questionnaire.

¹⁷⁰ Third-party responses to the CMA's questionnaire.

¹⁷¹ Third-party responses to the CMA's questionnaire.

¹⁷² Third-party responses to the CMA's questionnaire.

¹⁷³ Note of a call with a third party [X] on [X].

may prefer to use on-premise datacentres to keep confidential information and public cloud datacentres for non-confidential information.¹⁷⁴

154. The CMA understands that some systems may always remain on-premise due to regulatory requirements¹⁷⁵ and that certain groups of customers such as government entities, financial institutions, and healthcare providers wish to build their own datacentres or build their own private clouds at off-premise co-location facilities.¹⁷⁶
155. In response to the CMA's Issues Letter, the Parties' submitted emails sent between members of VMware's senior management from 2020. These emails support that public cloud is a growing presence and that some VMware customers shifting workloads to the public cloud is likely to pose some constraint on VMware's on-premise business. This includes an internal email in which the current VMware CEO, in 2021, stated that [REDACTED].^{177,178}
156. However, other VMware's internal documents show that it [REDACTED]:
 - (a) As discussed in paragraph 61(b), the Workloads Study shows that customers' willingness to switch to public cloud varies significantly by workload, and that most workloads were more likely to stay with VMware than to migrate to the public cloud.¹⁷⁹
 - (b) A VMware internal document dated June 2021 setting out its multi-cloud strategy notes that '[REDACTED]'.¹⁸⁰ The same document also notes that '[REDACTED]'.¹⁸¹
 - (c) In a VMware internal document from March 2020 assessing Google's threat, VMware notes that '[REDACTED]' and that '[REDACTED]'.¹⁸²
157. A number of internal documents also refer to VMware's strengths as a multi-cloud provider, and how it is differentiated from Amazon, Microsoft, and Google. In a VMware presentation to Broadcom in July 2022 (which was created in anticipation of the Merger, and therefore the weight that can be attached to it must be considered cautiously), VMware noted that it is [REDACTED].¹⁸³ VMware considers that the

¹⁷⁴ Note of a call with a third party [REDACTED] on [REDACTED].

¹⁷⁵ Note of a call with a third party [REDACTED] on [REDACTED].

¹⁷⁶ Note of a call with a third party [REDACTED] on [REDACTED].

¹⁷⁷ Issues Letter Response, Annex 1 appendix-003.

¹⁷⁸ Issues Letter Response, Annex 1 appendix-001.

¹⁷⁹ FMN, Annex Q15-011, page 20.

¹⁸⁰ VMware's response to s109 Notice 2, RSLV_00028772, page 4.

¹⁸¹ VMware's response to s109 Notice 2, RSLV_00028772, page 5.

¹⁸² VMware's response to s109 Notice 1, RSLV_00015886, page 11.

¹⁸³ VMware's response to s109 Notice 2, RSLV_00029833, page 8.

'[REDACTED]' with cloud providers is in local cloud deployments,¹⁸⁴ where VMware is '[REDACTED]'.¹⁸⁵

158. In relation to Amazon specifically, the VMware presentation to Broadcom notes that AWS does not provide services on other clouds other than AWS and [REDACTED].¹⁸⁶ Another document notes that [REDACTED].¹⁸⁷
159. In relation to Microsoft Azure specifically, the VMware presentation to Broadcom notes that it is typically sold with its own software. In one document from May 2022, VMware notes that '[REDACTED]' and '[REDACTED]'.¹⁸⁸ Further in another document from March 2020 VMware notes that [REDACTED].¹⁸⁹
160. In relation to Google specifically, a March 2020 VMware document notes that Google is '[REDACTED]' and that '[REDACTED]'.¹⁹⁰
161. The CMA places limited weight on the Parties' submission that [REDACTED]% of respondents to the Workload Study migrated all evaluated workloads to the cloud. The CMA notes that it is not clear what proportion of workloads were considered for migration and that respondents may have only migrated all of a limited number of workloads considered while keeping a large proportion of workloads on-premise.
162. The CMA understands that the Merged Entity may not have the ability to price discriminate between different workloads for the same customer and therefore this allows for a degree of constraint at the margin. However, the magnitude of this constraint is linked to the strength of the constraint imposed by public cloud and the evidence set out above overall shows that most workloads are likely to stay on-premise for the foreseeable future. The CMA also notes that (as shown by Table 1) the total number of virtualised servers has remained reasonably steady in recent years. Further, the evidence on migration away from VMware on-premise deployments does not necessarily imply that customers would switch to public cloud in response to Broadcom foreclosing hardware competitors. The CMA considers it relevant in this context that in relation to the threat from the public cloud, VMware's internal documents [REDACTED].

¹⁸⁴ VMware's response to s109 Notice 2, RSLV_00028772, page 24.

¹⁸⁵ VMware's response to s109 Notice 2, RSLV_00028772, page 3.

¹⁸⁶ VMware's response to s109 Notice 2, RSLV_00028772, page 24.

¹⁸⁷ VMware's response to s109 Notice 2, RSLV_00019480, page 34.

¹⁸⁸ VMware's response to s109 Notice 1, RSLV_00005518, pages 55 and 56.

¹⁸⁹ VMware's response to s109 Notice 1, RSLV_00015886, page 7.

¹⁹⁰ VMware's response to s109 Notice 1, RSLV_00015886, pages 7, 22 and 23.

163. Overall, the CMA considers that the presence of public cloud service providers is growing. However, the evidence in the round indicates that on-premise and off-premise enterprise deployments are likely to continue to be important to customers.

– Out-of-market constraints – containerisation

164. Evidence gathered by the CMA to date indicates that containerisation software provides a limited constraint on server virtualisation software.

165. Most customers responding to the CMA's investigation indicated that they do not consider containerisation to be an alternative for all their workloads in the short run.¹⁹¹

166. Industry reports also indicate that containers are often used in conjunction with virtualisation software, rather than as an alternative.¹⁹² Specifically, an IDC report dated November 2020 indicates that over [90-100]% of enterprise container instances are run on virtual machines, ie on top of virtualisation software.¹⁹³

167. In addition, the costs of migrating virtualised workloads to containers can be significant for some customers. One respondent explained that older applications are not written in a way that works well with containerisation and that the code needs to be updated to work with this technology.¹⁹⁴ Other customers considered that some software/applications are still not compatible with containers, for example because containers do not allow for the management of the physical infrastructure or the recoverability of legacy applications and data on another machine.¹⁹⁵

– Switching costs

168. The CMA considered whether the difficulty in switching and the costs associated with it for customers seeking to move away from using VMware's virtualisation software could further increase VMware's market power.

169. Most VMware customers responding to the CMA's investigation reported that there would be significant switching costs involved in moving workloads to another provider, particularly within a short time-horizon. Among other reasons, customers explained that switching is a complex task with significant challenges and time

¹⁹¹ Third-party responses to the CMA's questionnaire.

¹⁹² See for example: FMN Annex Q15–009, page 3-4; VMware's response to s109 Notice 2, RSLV_00018714, page 23; FMN Annex Q20–010, page 3-4.

¹⁹³ FMN, Annex Q15–009, page 2.

¹⁹⁴ Note of a call with a third party [X] on [X].

¹⁹⁵ Note of a call with a third party [X] on [X]. Note of a call with a third party [X] on [X].

investment,¹⁹⁶ might be risky or disruptive to the business,¹⁹⁷ and might be difficult due to IT infrastructure being tailored around VMware.¹⁹⁸ Some customers indicated that switching would be extremely difficult with one customer, for example, stating that even in the longer run ‘switching is not really a viable option’, since it requires significant cost to build a new platform, which would need to run in parallel until the customer was ready to switch.¹⁹⁹

170. Customers also identified significant financial costs related to switching: several customers mentioned migration costs of £5 million or above, with some noting it would be as high as £100 million,²⁰⁰ while other customers described migration costs as high or significant.²⁰¹
171. Some customers noted that the ease with which they are able to switch virtualisation depended on which workloads they chose to switch²⁰² and that complete switching would be more challenging than switching some of the workloads.²⁰³ For example, customers stated that it’s harder to switch legacy, network and customised workloads, and complex applications with a lot of dependencies.
172. The CMA considers that while the prevalence of multi-homing and the use of migration tools, third-party consultancies, and containers may reduce the cost of switching for some workloads and some customers to some degree, the customer responses to the CMA on the difficulty of switching and switching cost implicitly include the ability for customers to facilitate switching through all of these means.
173. The CMA considers that there are significant switching barriers and costs that may increase the Merged Entity’s market power in virtualisation software.
 - CMA’s conclusion on VMware’s market power
174. The CMA considers that VMware has significant market power in relation to server virtualisation software globally, given its high share of supply, strong product features, the limited number of alternative suppliers, the limited out-of-market constraint provided by the public cloud or containerisation, and significant switching costs.

¹⁹⁶ Third-party responses to the CMA’s questionnaire.

¹⁹⁷ Third-party responses to the CMA’s questionnaire.

¹⁹⁸ Third-party response to the CMA’s questionnaire

¹⁹⁹ Third-party response to the CMA’s questionnaire.

²⁰⁰ Third-party responses to the CMA’s questionnaire.

²⁰¹ Third-party responses to the CMA’s questionnaire.

²⁰² Third-party responses to the CMA’s questionnaire.

²⁰³ Third-party responses to the CMA’s questionnaire.

Foreclosure mechanisms

175. The CMA considered a range of mechanisms through which the Merged Entity could potentially harm its rival manufacturers of Ethernet NICs, SmartNICs, FC HBAs, storage adapters, FC switches, and TOR switching chips. The CMA's focus is on understanding if collectively these mechanisms would allow the Merged Entity to foreclose its rivals, not on predicting the precise actions it would take.²⁰⁴
176. The CMA considers that the main mechanism through which the Merged Entity would have the ability to foreclose hardware competitors is by restricting or reducing the interoperability of rival hardware products with VMware's virtualisation software. The CMA considers that there are several levers through which the Merged Entity can do this:
- (a) VMware's certification process and validation of drivers in respect of Ethernet NICs / FC HBAs / storage adapters;
 - (b) VMware's APIs in respect of FC switches and TOR switching chips; and
 - (c) VMware's support for Project Monterey in respect of SmartNICs.
177. The CMA also considered whether the Merged Entity can use the above levers to ensure that rivals' hardware products: (i) no longer interoperate with VMware (total foreclosure); and/or (ii) the quality of interoperability is reduced (partial foreclosure).
- Parties' submissions
178. In relation to hardware products that rely on their drivers being certified by VMware, (ie Ethernet NICs, FC HBAs, and storage adapters), the Parties have not disputed that the Merged Entity would have the technical ability to restrict or reduce their interoperability. Instead, the Parties submitted that the Merged Entity would lack the ability to target any particular group of: (i) customers with a preference for rival hardware; or (ii) customers which are more indifferent as to the choice of hardware.²⁰⁵
179. The Parties also submitted that any action that breaks compatibility with a driver would impact all devices using that driver, including those already installed and new sales, which would impose an enormous burden on customers though having to manually replace all affected products in their servers.²⁰⁶ The Parties further

²⁰⁴ [Merger Assessment Guidelines](#), paragraph 7.13.

²⁰⁵ FMN, paragraphs 20.89-20.92.

²⁰⁶ Issues Letter Response, paragraph 2.16.

submitted that any realistic foreclosure attempt could only impact new generations of devices that do not use previously certified drivers.²⁰⁷

180. Regarding FC switches, the Parties submitted that the Merged Entity would not be able to target rival FC switch providers. The Parties submitted that Broadcom's FC switch management software receives information from VMware's vCenter through publicly available APIs which are used by a range of different types of hardware manufacturers and applications to gather information.²⁰⁸ The Parties also submitted that its FC switches [X], and this is often the case in 'smaller customer environments' where there is only one or two FC switches in the SAN. In this case, its FC switches are managed using the software running the switch itself.²⁰⁹
181. The Parties also submitted that although Broadcom supplies its own FC switch management software (SANnav), the vast majority ([X]) of Broadcom's switches are managed by third-party software.²¹⁰ The Parties consider Cisco's FC switches could also be managed by third-party software.²¹¹
182. Regarding TOR switching chips, the Parties submitted that Broadcom's TOR switching chips have no interaction with VMware's virtualisation software whether through APIs or otherwise.²¹² Broadcom does not supply TOR switches nor the TOR switch management software.²¹³ The Parties submitted that this separation means that VMware has no visibility over whether a TOR switch has a Broadcom chip or a rival chip.²¹⁴
183. Regarding SmartNICs, the Parties have not disputed that VMware would have the technical ability to restrict or reduce the interoperability of SmartNICs via its involvement in Project Monterey. However, the Parties did submit that Project Monterey is not critical for the success of SmartNICs. SmartNICs were developed by CSPs for use in the public cloud and can also be used in bare-metal servers.²¹⁵
 - CMA's assessment

²⁰⁷ Issues Letter Response, paragraph 2.18.

²⁰⁸ The Parties' response of 3 February 2023 to question 3 of the CMA's RFI, dated 27 January 2023.

²⁰⁹ FMN, footnote 837.

²¹⁰ Issues Letter Response, paragraph 2.57.

²¹¹ Issues Letter Response, paragraph 2.60.

²¹² The Parties' response of 3 February 2023 to question 4 of the CMA's RFI, dated 27 January 2023.

²¹³ Issues Letter Response, paragraph 2.51.

²¹⁴ Issues Letter Response, paragraph 2.52.

²¹⁵ Issues Letter Response, paragraph 2.36.

- VMware’s certification process and validation of drivers – Ethernet NICs / FC HBAs / storage adapters

184. Third parties considered that it is very important for hardware manufacturers’ products to be certified with VMware’s virtualisation software in order to sell their products.²¹⁶ The majority of sales of Ethernet NICs, FC HBAs, and storage adapters are in relation to hardware compatible with VMware’s virtualisation software.²¹⁷
185. As explained in the Background section (paragraphs 47-53), VMware’s virtualisation software interoperates with underlying server hardware (including Ethernet NICs, FC HBAs, and storage adapters) through drivers. Drivers are developed by hardware manufacturers and (since each OS communicates with drivers in different ways) hardware manufacturers must make them OS-specific. Drivers for VMware’s virtualisation software are certified by VMware.²¹⁸
186. Hardware manufacturers receive technical support from VMware and work with VMware to ensure their products are supported by VMware. In doing so, VMware provides them with a range of information including roadmaps, technical information programming guides, API interfaces, architectural information, and technical standards.²¹⁹ Hardware manufacturers continue to cooperate with VMware after the product is released. Hardware manufacturers might need VMware’s input to release driver updates and resolve any issues that arise.²²⁰
187. The CMA considers that VMware could opt to refuse, delay, or hamper such information exchange, technical support, or certification of rival hardware’s interoperability.
188. In relation to the Parties’ submissions that they could not foreclose any products using a driver that has previously been certified, the CMA agrees that a complete breakdown in interoperability would cause undesirable disruption to customers. However, the CMA considers the Merger Entity could still partially foreclose rivals in relation to previously certified drivers by refusing, delaying, or hampering information exchange regarding driver updates or technical support.
189. The CMA considers that the Merged Entity could totally foreclose interoperability between new hardware products that have not yet had drivers developed and certified. As these new products are not currently installed in existing servers, it

²¹⁶ Third-party responses to the CMA questionnaire.

²¹⁷ Third-party responses to the CMA questionnaire.

²¹⁸ FMN, footnote 871.

²¹⁹ Third-party responses to the CMA questionnaire.

²²⁰ Note of a call with a third party [§<] on [§<]. Third-party response to the CMA questionnaire.

would not cause any disruption to customers' existing servers. Further, the Merged Entity could also partially foreclose new rival hardware products through refusing, delaying, or hampering information exchange in regard to driver updates or technical support.

190. The CMA does not consider that an inability to target specific customers would prevent the Merged Entity from pursuing a broader foreclosure strategy. The Merged Entity's incentives to foreclose are discussed in the incentive section (paragraph 201).

– APIs – FC switches and TOR switching chips

191. VMware publishes an API in its vCenter product which FC switch and TOR switch manufacturers use for the design of software used by customers to manage FC and TOR switches.²²¹ Access to the information that VMware makes available through this API allows users of FC and TOR switch management software to automate vCenter discovery, extract information from vCenter, and integrate the discovered Hosts/VMs/DataStores/Luns with SAN Fabrics managed by the management software.²²²

192. Regarding FC switches, the CMA considers that access to this API is important for suppliers to be able to develop the management software products used with their hardware. While there are other providers of management tools for FC switches, these contain more limited functionality that cannot be relied on to manage rival hardware products.²²³

193. In respect of the Parties' submission that FC switches can run without their respective switch management software products, the CMA considers that management software is needed to supply enterprise customers with FC switches.²²⁴

194. The CMA considers that although these APIs are currently public and not user-specific, rivals also rely on VMware to provide additional input and feedback in case there are issues or questions around the implementation of the APIs. This additional information is provided bilaterally and is not publicly available. Therefore, the Merged Entity could reduce VMware's engagement in these bilateral discussions with rivals. The Merged Entity could also avoid or delay making any new APIs

²²¹ Issues Letter Response, paragraph 2.53.

²²² Third-party [redacted] response to CMA request for information dated [redacted].

²²³ Third-party [redacted] response to CMA request for information dated [redacted].

²²⁴ Third-party [redacted] response to CMA request for information dated [redacted].

available to rivals supplying FC switches. Further, the Merged Entity could decide not to make these APIs public in the future.

195. Regarding TOR switching chips, the CMA considers that although TOR switch management software does access information via the vCenter API, the Merged Entity would not be able to degrade interoperability with this API specifically for TOR management software used with TOR switches that do not contain Broadcom's TOR switching chip. Broadcom does not supply TOR switch management software nor TOR switches and supplies its TOR switching chips to a range of TOR switch providers. The CMA, therefore, does not consider TOR switching chips further in TOH1.
 - Reducing/cutting VMware's support for Project Monterey in respect of SmartNICs
196. Project Monterey is VMware's plan to build a version of its virtualisation software hypervisor (ESXi) that runs on SmartNICs. Project Monterey has been developed in collaboration with three SmartNICs suppliers: NVIDIA, Intel, and AMD Pensando.²²⁵
197. The CMA considers that Project Monterey is important for the development of SmartNICs for use on-premise:
 - (a) VMware is providing the necessary resources for the design, development, and implementation of the project. The Parties submitted that it has [redacted] working on the project and has invested [redacted] into the programme.²²⁶
 - (b) A VMware internal document noted that VMware is needed '[redacted]'.²²⁷
 - (c) Third parties also responded that VMware's support is critical to be able to develop effective SmartNICs, to enable the introduction of additional features (eg on security and storage), to ensure compatibility with future versions of the OS/hypervisor, and to access the customer base.²²⁸
198. The CMA considers that the Merged Entity would have the ability to delay or prevent the development of SmartNICs via Project Monterey. SmartNIC suppliers that are part of Project Monterey require the continued support of VMware to be able to introduce additional features (in the next versions of its SmartNICs such as on

²²⁵ FMN, paragraph 20.139.

²²⁶ FMN, Annex Q20-002, page 7.

²²⁷ The Parties' response to question 1, Form CO – Conglomerate - Annex 48, of the CMA's RFI, dated 25 November 2022, page 24.

²²⁸ Third-party responses to the CMA's questionnaire.

security and storage), and to have access to the enterprise customers using VMware's software.²²⁹

199. Several third parties also expressed concerns that the Merged Entity may choose to stop supporting Project Monterey.²³⁰

CMA's conclusion on ability to foreclose hardware competitors

200. In view of the above, the CMA considers that the Merged Entity would have significant market power in relation to server virtualisation software and would have the technical ability to foreclose hardware competitors of Ethernet NICs, SmartNICs, FC HBAs, storage adapters, and FC switches.

Incentive to foreclose hardware competitors

Parties' submissions

201. The Parties submitted that the Merged Entity would not have the incentive to foreclose rivals for the following reasons:
- (a) VMware has adopted a hardware-agnostic approach to promote broad adoption of its product and is central to its product strategy. Engaging in foreclosure would undermine this strategy and VMware's reputation for openness.²³¹ In addition, foreclosure strategy would run contrary to Broadcom's business model of separate franchises [§<] and the general principle of interoperability in the datacentre environment.²³²
 - (b) VMware has previously been owned by providers of hardware that needs to interoperate with VMware's virtualisation software (most recently Dell, which provides servers, and before that, EMC, which provides storage arrays). VMware did not engage in any equivalent foreclosure strategy during their ownership despite Dell and EMC having, according to the Parties, plausibly a higher incentive to do so (due to servers and storage arrays having higher gross profits than Broadcom's gross profits on NICs, FC HBAs, and storage adapters).²³³

²²⁹ Third-party response to the CMA's questionnaire.

²³⁰ Third-party response to the CMA's questionnaire; Note of a call with a third party [§<] on [§<].

²³¹ FMN, paragraphs 20.94-20.103; Issues Letter Response, paragraphs 2.7-2.8 and 2.19a.

²³² Issues Letter Response, paragraph 2.12.

²³³ FMN, paragraphs 20.119-20.124; Issues Letter Response, paragraph 2.11.

- (c) The foreclosure strategy would not be profitable given that the margins in virtualisation software are significantly higher than in hardware.²³⁴
- (i) VMware on average earns a per server margin of \$[X] for vSphere and \$[X] when associated products are considered. The corresponding margins for hardware products per server are significantly lower: \$[X] for Ethernet NICs, \$[X] for FC HBAs, \$[X] for storage adapters, and \$[X] for FC switches.²³⁵
- (ii) These margins imply that at least 85%, 92%, 97%, and 82%²³⁶ of VMware's customers using non-Broadcom FC HBAs, storage adapters, Ethernet NICs, and FC switches respectively would need to switch to Broadcom's hardware for the foreclosure to be profitable.²³⁷ According to the Parties, such significant switching is highly unlikely given the numerous alternatives to VMware's virtualisation software.
- (iii) The Merged Entity would have to risk enormous losses for insubstantial gains. In response to the Issues Letter, the Parties submitted that the Merged Entity would gain only \$[X] per year in the long run (\$[X] in the first year) if 100% of affected customers switched to Broadcom hardware in response to the total foreclosure strategy. This strategy would already be unprofitable if VMware lost workloads equivalent to one of its top [X] customers.²³⁸ The potential upside from partial foreclosure would be even lower,²³⁹ and VMware would incur additional cost since support calls cost \$[X] per request on average.²⁴⁰
- (iv) In response to the CMA's Issues Letter, the Parties submitted that even if it could recapture some workloads moving to public cloud, VMware

²³⁴ FMN, paragraphs 20-104-20.118; Issues Letter Response, paragraph 2.20.

²³⁵ The Parties' response of 30 November 2022 to question 1 of the CMA's RFI, dated 25 November 2022, Annex RFI4Q1-002, Annex 55 (Conglomerate), Tables 2 and 3; The Parties' response of 7 December 2022 to question 26 of the CMA's RFI, dated 25 November 2022, Annex RFI4Q26-001.

²³⁶ The 82% figure is based on the average margin of \$[X] for FC switches and assumes that 10 servers are connected to each FC switch (The Parties' response of 7 December 2022 to question 26 of the CMA's RFI, dated 25 November 2022, Annex RFI4Q26-001 and the Parties' response of 17 February 2023 to the CMA's RFI, dated 14 February 2023).

²³⁷ The Parties' response of 30 November 2022 to question 1 of the CMA's RFI, dated 25 November 2022, Annex RFI4Q1-002, Annex 55 (Conglomerate), Table 2.

²³⁸ Issues Letter Response, paragraph 2.21.

²³⁹ Issues Letter Response, paragraph 2.19c.

²⁴⁰ Issues Letter Response, paragraph 2.19b.

makes [REDACTED] on VMware Cloud on AWS and customers use VMware on AWS [REDACTED].²⁴¹

- (d) Customers have countervailing buyer power. Broadcom's customers are primarily large and sophisticated server and device OEMs, while VMware's customers are primarily large enterprises with sophisticated IT organisations. Server OEMs would not contemplate single sourcing hardware and retaliate by no longer including Broadcom's hardware products in servers that do not use VMware, advising customers to no longer use VMware given the risk of lock-in, and disciplining Broadcom in other hardware markets.²⁴²
- (e) Some of Broadcom's rivals (Intel, NVIDIA, and AMD, which supply Ethernet NICs and SmartNICs) would retaliate by degrading compatibility with Broadcom's NICs and TOR switching chips or VMware' software.²⁴³
- (f) The Merged Entity would have no incentive to foreclose SmartNIC providers in the context of Project Monterey:
 - (i) Project Monterey aims to increase VMware's competitiveness with public cloud providers. Degrading Project Monterey would remove the opportunity for VMware to deploy on bare-metal servers via SmartNICs.²⁴⁴
 - (ii) Broadcom exited the SmartNICs market and [REDACTED].²⁴⁵
 - (iii) Seeking to foreclose SmartNIC providers in order to protect Broadcom's Ethernet NICs business would not be profitable since these products are not alternatives and Broadcom only accounts for [10-20]% of the market for Ethernet NICs.²⁴⁶ In addition, the Parties have submitted to the FTC that they project that VMware would generate an additional margin of \$[REDACTED] per server for customers using vSphere together with SmartNICs, driven by licensing VMware for bare metal servers, upselling server virtualisation software, and cross-selling network virtualisation software.

²⁴¹ Issues Letter Response, paragraphs 2.6k and 2.27.

²⁴² FMN, paragraphs 20.125-20.133; Issues Letter Response, paragraph 2.23a.

²⁴³ FMN, paragraphs 20.134-20.137; Issues Letter Response, paragraph 2.23b.

²⁴⁴ Issues Letter Response, paragraph 2.36.

²⁴⁵ FMN, paragraphs 20.14 and 20.145; Issues Letter Response; paragraphs 2.32-2.33.

²⁴⁶ Issues Letter Response; paragraph 2.37.

This vastly exceeds any margins Broadcom could earn on sales of additional Ethernet NICs.²⁴⁷

- (iv) Broadcom's activities in SmartTOR switching chips would not give the Merged Entity the incentive to foreclose SmartNIC providers because they are not substitutable with SmartNICs. SmartTOR switches would act as complements to SmartNICs rather than substitutes since SmartNICs have wider capabilities (eg have control over all networking traffic going to and from virtual machines).²⁴⁸

CMA's assessment

- 202. In assessing the incentive to foreclose, the CMA considered whether the benefit of additional hardware sales would exceed the potential cost of losing VMware's sales, taking into account the extent of expected customer switching as a result of the foreclosure strategies set out above.²⁴⁹
- 203. Merging firms' current positions and margins may not always be a good guide to the future, and strategic considerations may instead play a greater role.²⁵⁰ The CMA typically also focuses on the relative magnitude of the overall cost and benefit of foreclosure and not on predicting the exact size of each element.²⁵¹
- 204. The CMA therefore considered evidence on a range of factors that may influence the Merged Entity's incentive to foreclose, including strategic reasons for the Merged Entity to entrench its position in the relevant hardware markets. The CMA also evaluated any evidence on factors that may shape the Merged Entity's incentive to continue with its model of neutrality, including any reputational concerns and the likelihood of retaliation by rivals or customers.
- 205. As Broadcom exited the SmartNIC market in 2021, the CMA examined the Merged Entity's incentive to foreclose SmartNIC manufacturers separately (see paragraphs 226-232).
 - Incentive to foreclose competitors in Ethernet NICs, FC HBAs, storage adapters, and FC switches

²⁴⁷ FTC, Compass Lexecon White Paper, page 21; FTC, Responses to FTC Compass Lexecon White Paper Questions (Updated), pages 4-6. The Parties shared the White Paper with the CMA on 16 December 2022.

²⁴⁸ The Parties' response of 7 December 2022 to question 22b of the CMA's RFI, dated 25 November 2022; Issues Letter Response, paragraphs 2.38-2.43.

²⁴⁹ [Merger Assessment Guidelines](#), paragraph 7.16.

²⁵⁰ [Merger Assessment Guidelines](#), paragraph 7.18.

²⁵¹ [Merger Assessment Guidelines](#), paragraph 7.18.

206. At the outset, the CMA acknowledges that the Parties' critical switching rates calculated on the basis of absolute margins are high. However, the CMA considers that they may be overestimated to some extent even within the remits of the static analysis that the Parties conducted. This is because the Parties' analysis is based on the most popular but also the most expensive version of VMware's virtualisation software, vEnterprise+. ²⁵² As some customers use cheaper versions, critical switching rates would be lower if all versions of VMware's virtualisation software were taken into account. In addition, the CMA considers that the Parties' analysis underestimates potential upside since it does not take into account that a foreclosure strategy might also affect hardware for servers that do not run VMware or lead to higher prices in the hardware markets (see paragraphs 215-217 and 220).
207. The CMA nevertheless has taken into account the broad principle that VMware's virtualisation software margins are much higher than Broadcom's hardware margins. However, the CMA still considers that foreclosure may be profitable, for the reasons set out below.
208. First, when faced with the loss of interoperability, the CMA expects that the majority of VMware's customers would prefer to switch to Broadcom's hardware rather than: (i) switch to VMware's competitors' software; or (ii) move to an alternative model, such as public cloud. This is based on a range of evidence from different sources.
209. The Parties themselves have acknowledged that switching costs for hardware are 'limited', with switching 'made easier by standards and protocols (such as Ethernet or FC) that ensure interoperability'. ²⁵³
210. Many customers view VMware's product as market leading, with few alternatives available in the market (as discussed in paragraphs 118-126). Customers also face significant costs in switching virtualisation software (as discussed in paragraphs 168-173). VMware's customers have explained that switching hardware is easier and cheaper than switching virtualisation software, when describing how they would react if VMware no longer interoperated with their hardware:
- (a) One VMware customer said that 'for anything that is to be deployed on VMware, we tend to prefer it to be VMware verified which would mean we would be left with procurement of new hardware which is compatible with VMware'. ²⁵⁴

²⁵² FMN, paragraph 15.398 and footnote 1000; Responses to FTC Compass Lexecon White Paper Questions (Updated), Annex VMware backup for FTC Q36.

²⁵³ FMN, paragraph 20.131.

²⁵⁴ Third-party response to the CMA's questionnaire.

(b) Other VMware customers emphasised that switching hardware is the cheapest option, which requires the least amount of time or minimises disruption.²⁵⁵

211. Most VMware customers have indicated that in the event of a loss of interoperability with the following hardware products – Ethernet NICs,²⁵⁶ FC HBAs,²⁵⁷ storage adapters,²⁵⁸ and FC switches²⁵⁹ – they would switch or consider switching hardware. Only a minority of customers stated that they would consider switching virtualisation software or moving to the public cloud.

212. The views of hardware competitors are largely consistent with those of virtualisation customers. They consider it to be significantly easier to switch hardware than virtualisation software if their end customers faced the loss of interoperability between their hardware and VMware.²⁶⁰ For example, one competitor told the CMA that '[i]t is far easier to change NIC vendor than to change hypervisors',²⁶¹ while another competitor stated that '[s]witching to hardware which does support VMWare is by far the easiest choice for customers'.²⁶²

213. Second, even if some workloads are moved to public cloud, the CMA considers that VMware's position as a hybrid cloud platform means that it can recapture at least some of the profits lost. This is because: (i) customers who move some of their workloads to the public cloud while retaining other workloads on-premise may require a single hybrid cloud solution to operate both deployments to allow data and application workloads to move seamlessly between platforms;²⁶³ (ii) VMware has a strong hybrid cloud offering; and (iii) contrary to the Parties' submissions, VMware generated high revenues on VMware's hybrid cloud product. This is supported by a range of evidence. One third party submitted that virtualisation can act as a platform that supports an ecosystem, meaning that it is easier for an enterprise to use a single company's virtualisation products across its entire system while having a choice of multi-vendor offerings at the containerisation and software layer. The third party noted that VMware is especially good at this by offering greater enterprise capabilities than competitors and supporting a large ecosystem of third-party vendors.²⁶⁴ An IDC report in 2020 shows that using VMware on AWS results in significantly cheaper and faster migration compared to other public cloud

²⁵⁵ Third-party responses to the CMA's questionnaire.

²⁵⁶ Third-party responses to the CMA's questionnaire.

²⁵⁷ Third-party responses to the CMA's questionnaire.

²⁵⁸ Third-party responses to the CMA's questionnaire.

²⁵⁹ Third-party responses to the CMA's questionnaire.

²⁶⁰ Third-party responses to the CMA's questionnaire.

²⁶¹ Third-party response to the CMA's questionnaire.

²⁶² Third-party response to the CMA's questionnaire.

²⁶³ [What is Hybrid Cloud? Definition and Challenges | VMware](#), accessed on 27 February 2023.

²⁶⁴ Note of a call with a third party [X] on [X].

providers.²⁶⁵ The Workloads Study also shows the strength of VMware as a hybrid cloud platform: out of respondents who moved some workloads to the public cloud, VMware on AWS was [X] most popular choice as a primary platform.²⁶⁶ Contrary to the Parties' submission that VMware generates [X], a 2021 strategy document concerning VMware's multi-cloud strategy shows that VMware generates [X] on VMware Cloud on AWS than enterprise deployments.²⁶⁷

214. Third, the CMA considers that Broadcom is well-positioned to capture the profits from customers who decide to switch hardware:

- (a) **FC HBAs, storage adapters, and FC switches.** In the markets for FC HBAs, storage adapters, and FC switches, Broadcom already has a strong product offering and market position, with only one material competitor for each product, namely Marvell, Microchip, and Cisco, respectively.²⁶⁸ In addition, the CMA considers Broadcom's products in these markets to be direct substitutes to its competitors' products, which facilitates switching. By foreclosing just one rival in each market Broadcom would become the only viable supplier (in the case of total foreclosure) or the best-performing alternative (in the case of partial foreclosure) for VMware's customers. In addition, given that FC HBAs and FC switches are used together, the ability to gain sales for both hardware products simultaneously reinforces the Merged Entity's incentive to pursue a foreclosure strategy.
- (b) **Ethernet NICs.** Broadcom faces competition from a larger number of providers in Ethernet NICs, with Intel and Nvidia accounting for almost [80-90]% of the market.²⁶⁹ However, the CMA considers that following foreclosure it could become the only alternative (in the case of total foreclosure) or the best-performing alternative (in the case of partial foreclosure) for customers who prefer to use VMware which would mean that options outside of Broadcom would still be limited. The CMA also considers that Broadcom's Ethernet NICs are directly substitutable with its competitors' products.

215. Fourth, virtualisation customers usually purchase servers from OEMs that already contain hardware components.²⁷⁰ This feature of the supply chain means that any

²⁶⁵ VMware's response to s109 Notice 1, RSLV_00002636, page 1.

²⁶⁶ FMN, Annex Q15-011, page 41.

²⁶⁷ FMN, Annex RSLV_00028772, page 26.

²⁶⁸ In respect of FC HBAs and storage adapters, see further paragraphs 277-292. In respect of FC switches, see RF14, Annex RF14Q24-001.

²⁶⁹ FMN, Table 77.

²⁷⁰ FMN, paragraphs 15.532 and 15.470.

switching of hardware is technically done at the server OEM level in response to end-customer demand rather than by the end customers themselves.

216. Importantly, hardware currently used by server OEMs supports a large number of OSs and in particular interoperability with VMware is very important to server OEMs (see paragraph 125). Having different server configurations for different OSs would incur additional costs since server OEMs would need to test and qualify different products.²⁷¹ It would also limit customers' ability to switch to VMware in future. This may result in server OEMs choosing hardware compatible with VMware – ie Broadcom's hardware post-Merger – even in cases where the server is not ultimately used with VMware's virtualisation software. Therefore, the actual level of switching to Broadcom's hardware is likely to be higher than what the evidence on end-customer switching preferences would otherwise suggest. Notably, this factor is not taken into account in the Parties' critical switching analysis which instead assumes that the same customer takes the decision on which server hardware and software to use.
217. Based on the evidence available, the CMA considers that at least some server OEMs would adopt such an approach. For example and contrary to the Parties' submissions on multi-sourcing, one server OEM said that in response to a loss in interoperability between VMware's virtualisation software and Broadcom's rivals, it would stop or significantly reduce purchases from Broadcom's rivals in relation to all of its servers to ensure all customers have the option to use VMware.²⁷² One hardware competitor also told the CMA that they expect to lose all sales with server OEMs if its hardware was no longer interoperable with VMware.²⁷³ Another server OEM suggested that it might continue to use rival hardware, provided however that a sufficient number of customers request such servers.²⁷⁴
218. The CMA places limited weight on the Parties' submissions regarding server OEMs' buyer power, including their ability to retaliate for servers that do not use VMware or in other hardware markets:
- (a) Buyer power depends on the availability of good alternatives to which customers can switch.²⁷⁵ Third parties also emphasised the importance of multiple supplier options, with one server OEM stating that it is important to have multiple suppliers of the components in order to obtain the best pricing.²⁷⁶

²⁷¹ Note of a call with a third party [X] on [X]; Note of a call with a third party [X] on [X].

²⁷² Third-party response to the CMA's questionnaire.

²⁷³ Note of a call with a third party [X] on [X].

²⁷⁴ Third-party response to the CMA's questionnaire; Note of a call with a third party [X] on [X].

²⁷⁵ [Merger Assessment Guidelines](#), paragraph 4.20.

²⁷⁶ Note of a call with a third party [X] on [X].

Customers' options will however be reduced post-Merger as a result of the Merged Entity's foreclosure strategy, therefore their ability to exercise buyer power will be significantly weakened.

- (b) Contrary to the Parties' submissions, the CMA has not seen any evidence that server OEMs would retaliate in other hardware markets or stop including Broadcom's components in servers not using VMware.²⁷⁷ The CMA considers that such retaliation strategy would incur additional costs to server OEMs. The fact that server OEMs currently use Broadcom implies that they prefer Broadcom to its rivals. This means that in order to retaliate, server OEMs would have to switch to a less preferred hardware manufacturer.

219. Fifth, and related to the fourth point above, rivals' ability to effectively compete and stay in the market may be impacted if they are not able to maintain sufficient scale. The CMA considers that there are significant economies of scale in the relevant hardware markets given substantial R&D costs,²⁷⁸ which can exceed more than \$100 million.²⁷⁹
220. Sixth, foreclosure can lead to the Merged Entity being able to raise hardware margins, a further feature that is not captured in the Parties' static analysis of critical switching rates. As the foreclosure strategy might reduce the competitive constraint on the Merged Entity generally, the Merged Entity might be able to increase prices for both: (i) customers that already purchase Broadcom's hardware; and (ii) customers who would switch from Broadcom's rivals because of the foreclosure.
221. Seventh, on the Parties' arguments regarding Broadcom's model of independent franchises and VMware's model of neutrality and the absence of foreclosure attempts under Dell's or EMC's ownership, the CMA considers that VMware might not have been completely neutral under Dell's ownership. A VMware internal document from May 2021 noted that [§<].²⁸⁰ Further, in VMware's public announcement on the spin-off from Dell in 2021, one of the reasons given for the spin-off was that it would give VMware more freedom to execute its strategy 'to create a ubiquitous software and SaaS platform across all clouds and hardware infrastructure'.²⁸¹ VMware's strategy post spin-off was therefore based on neutrality

²⁷⁷ Third-party responses to the CMA's questionnaire.

²⁷⁸ Third-party responses to the CMA's questionnaire.

²⁷⁹ Third-party response to the CMA's questionnaire.

²⁸⁰ VMware's response to s109 Notice 1, RSLV_00012714, page 7.

²⁸¹ [VMware and Dell Technologies Reach Agreement Regarding Spin-Off - VMware News and Stories](#), accessed on 14 March 2023.

amongst others, and the inference is that under Dell's ownership, VMWare had less freedom to pursue this strategy.

222. Moreover, the Merger will create a new link between VMware and Broadcom, a hardware manufacturer, which did not exist previously. As a result of this relationship, the Merged Entity will have new foreclosure mechanisms that could affect its rivals directly. The Merged Entity's incentive to continue pursuing VMware's model of neutrality might therefore be different compared to the pre-Merger position. This is consistent with third-party concerns that the Merged Entity might engage in the foreclosure of hardware competitors post-Merger.²⁸² Broadcom's differing incentives may lead it to change VMware's business strategy in practice, which would be consistent with Broadcom's behaviour following previous acquisitions. This is supported by a significant number of third parties which expressed the concern that Broadcom may change VMware's business strategy following the Merger, citing significant price increases and changes in distribution practices following Broadcom's previous acquisitions as examples of Broadcom's strategy.²⁸³
223. Eighth, contrary to the Parties' submission in their response to the Issues Letter, in the case of partial foreclosure, the CMA does not consider that VMware would incur significant costs related to support calls from virtualisation customers because such customers tend to operate a large number of servers (some customers have more than [X]), while the costs per support request are small and amount to \$[X] only.²⁸⁴
224. Ninth, the CMA considers that Broadcom's rivals would only retaliate if such retaliation was profitable. The CMA has not seen any evidence that this would be the case. Additionally, according to the Parties' submissions, only a subset of the rivals that could be foreclosed may be in a position to retaliate, in particular certain rivals active in the supply of Ethernet NICs. Further, only one third party mentioned retaliation as a possible strategy.²⁸⁵ Therefore, the CMA places very limited weight on the possibility of retaliation occurring and frustrating the Merged Entity's ability or incentive to engage in foreclosure.
225. For the reasons set out above, the CMA believes that the Merged Entity would have the incentive to adopt a foreclosure strategy in relation to rival providers of Ethernet

²⁸² Third-party responses to the CMA's questionnaire.

²⁸³ Third-party responses to the CMA's questionnaire.

²⁸⁴ Issues Letter Response, paragraphs 2.16b and 2.19b.

²⁸⁵ Note of a call with a third party [X] on [X].

NICs, FC HBAs, storage adapters, and FC switches by restricting or reducing their interoperability with VMware's virtualisation software.

- Incentive to foreclose SmartNIC competitors

226. Broadcom exited the market for SmartNICs in 2021 and [REDACTED].²⁸⁶ The CMA considered whether Broadcom would have an incentive to foreclose SmartNIC competitors by using one of the following strategies (or a combination of them): (i) re-entering into SmartNICs and recapturing diverted sales from SmartNIC competitors; (ii) preventing the migration from Ethernet NICs to SmartNICs to protect Broadcom's position in Ethernet NICs; and/or (iii) encouraging customers to use SmartTOR switches instead of SmartNICs.
227. As a starting point, the CMA agrees with the Parties that Project Monterey would bring benefits to the Merged Entity. One server OEM submitted that it expects SmartNICs to become part of all servers in the future,²⁸⁷ while one hardware competitor told the CMA that Project Monterey will allow enterprise customers to take advantage of SmartNIC capabilities that are currently only offered in public cloud.²⁸⁸
228. With regards to re-entry, [REDACTED].²⁸⁹ The CMA understands that [REDACTED].²⁹⁰ While some third parties explained that Broadcom might be able to re-enter,²⁹¹ the CMA believes that circumstances have not changed materially since Broadcom's exit, and Broadcom would face the same challenges as before. Although Broadcom continues to be active in Ethernet NICs, SmartNICs require different manufacturing capabilities, in relation to processors and software, which makes it a distinct product, and unlike Intel, Nvidia, and AMD – the largest SmartNIC manufacturers – Broadcom is not active in the processor (CPU) space. [REDACTED].²⁹² Therefore, the CMA believes that the Merged Entity would not be able to re-enter the SmartNIC market and recapture diverted sales from SmartNIC competitors.
229. With regards to protecting Broadcom's position in Ethernet NICs, as highlighted already, SmartNICs and Ethernet NICs are two distinct products (see paragraph 76(d)).²⁹³ In addition, even if the Merged Entity could prevent migration from

²⁸⁶ FMN, paragraph 15.466.

²⁸⁷ Note of a call with a third party [REDACTED] on [REDACTED].

²⁸⁸ Note of a call with a third party [REDACTED] on [REDACTED].

²⁸⁹ Broadcom's response to s109 Notice 2, BCOM-CMA-00000169, page 2.

²⁹⁰ The Parties' response of 30 November 2022 to question 1 of the CMA's RFI, dated 25 November 2022, Annex RFI4Q1-002, Annex 31 (Conglomerate), paragraph 3.3.

²⁹¹ Third-party responses to the CMA's questionnaire.

²⁹² Issues Letter Response, paragraph 2.34.

²⁹³ Third-party responses to the CMA's questionnaire.

Ethernet NICs, Broadcom could recapture only a relatively small share of diverted sales since it only has a [10-20]% share in Ethernet NICs.²⁹⁴ The CMA also believes that the adoption of SmartNICs might allow the Merged Entity to generate additional margin through customers upgrading to VMware's products with a higher margin or deploying Project Monterey on bare-metal servers (although the CMA has not seen any evidence on the precise figures).²⁹⁵ Therefore, the CMA considers that Broadcom would not have an incentive to foreclose SmartNIC manufacturers in order to recapture sales in Ethernet NICs.

230. With regards to encouraging migration to SmartTOR switches, the CMA understands that Broadcom offers SmartTOR switching chips (a key component in SmartTOR switches) and was the first to enter the market.²⁹⁶ There is evidence indicating a degree of substitution between SmartNICs and SmartTOR switches. For example, a Broadcom board document from December 2020 discusses that one of the paths for growth is '[X]'.²⁹⁷ Another document from a meeting with [X] in December 2020 discusses migrating '[X]'.²⁹⁸ A Broadcom management update document from August 2021 on [X].²⁹⁹
231. The CMA interprets these documents together with the other evidence. While Broadcom [X] as set out in its internal documents, Broadcom's SmartTOR switching chips [X].³⁰⁰ Therefore, Broadcom could not immediately recapture any diverted sales from SmartNICs. Moreover, Broadcom's SmartTOR switching chips might not be suitable for SmartTOR switches. One hardware competitor explained that SmartTOR switches would include a SmartNIC processor that is similar to those included in SmartNICs rather than a switching chip.³⁰¹ Most virtualisation customers also explained that SmartTOR switches and SmartNICs are not substitutes or only substitutes in specific circumstances.³⁰² Therefore, the CMA considers that Broadcom could not recapture diverted rival SmartNICs sales by selling more SmartTOR switching chips.
232. The CMA therefore believes that the Merged Entity would not have an incentive to adopt a foreclosure strategy in relation to SmartNICs. In light of this, the CMA does

²⁹⁴ FMN, Table 77.

²⁹⁵ FTC, Compass Lexecon White Paper, page 21; FTC, Responses to FTC Compass Lexecon White Paper Questions (Updated), pages 4-6.

²⁹⁶ Broadcom's response to s109 Notice 3, BCOM-CMA-00000383, page 1.

²⁹⁷ FMN, Annex BCOM-CMA-00000007, page 143.

²⁹⁸ Broadcom's response to s109 Notice 3, BCOM-CMA-00000397, page 18.

²⁹⁹ Broadcom's response to s109 Notice 3, BCOM-CMA-00000395, page 16.

³⁰⁰ [X]. FMN, paragraph 15.596.

³⁰¹ Note of a call with a third party [X] on [X].

³⁰² Third-party responses to the CMA's questionnaire.

not consider it necessary to assess whether any foreclosure strategy would have an effect on competition in relation to SmartNICs.

Effect on competition

Parties' submissions

233. The Parties submitted that any foreclosure strategy would not have an effect on competition in the relevant hardware markets since any hypothetical degradation strategy would still allow hardware rivals to sell their products for the majority of servers that do not use VMware, including bare metal servers and servers with other hypervisors and in the public cloud.³⁰³
234. The Parties also submitted that the relevant I/O device markets are mature with slowing innovation rates and are not 'nascent and digital markets' where conglomerate concerns may be more likely.³⁰⁴

CMA's assessment

235. When it has been established that there will be harm to competitors this will often directly imply there will be harm to overall competition. Competition concerns may be particularly likely to arise if one of the merger firms has a degree of pre-existing market power in the affected markets and already faced limited competitive constraints pre-merger.³⁰⁵
236. The CMA believes that the competitors that could be targeted by foreclosure account for a significant share of supply of each hardware component:
- (a) Broadcom is a market leader in FC HBAs, FC switches, and storage adapters, with Marvell, Cisco, and Microchip being the only other material competitor to Broadcom in these markets respectively (see paragraph 214). Any weakening of these suppliers as competitors is likely to substantially weaken overall competition in each respective market.
 - (b) The CMA considers that Broadcom can affect a significant share of the markets for Ethernet NICs since it will be able to target all suppliers of Ethernet NICs that are used with VMware. The CMA considers that such a foreclosure strategy would weaken overall competition in Ethernet NICs.

³⁰³ FMN, paragraph 20.138. Issues Letter Response paragraph 2.25.

³⁰⁴ Issues Letter Response paragraph 2.29.

³⁰⁵ [Merger Assessment Guidelines](#), paragraph 7.21.

237. The CMA does not consider that the fact that hardware competitors also sell to cloud service providers is relevant for assessing the effect on competition in relation to enterprise servers as cloud server providers are a different set of customers to whom hardware components are largely sold directly rather than through server OEMs. The fact that hardware competitors may remain competitive when selling to cloud service providers does not preclude their offer to server OEMs being weakened compared to Broadcom. As discussed above in paragraph 125, VMware's virtualisation software is used in a substantial share of enterprise servers, and, these servers account for a significant proportion of servers sold by server OEMs. In addition, as described in paragraphs 216-217, at least some server OEMs may be unwilling to sell servers that are not fully interoperable with VMware, hence VMware's virtualisation software share of servers may underestimate the proportion of the servers that would be affected and ultimately the effect on competition that the foreclosure strategy would have.
238. In relation to the Parties' submission that hardware markets are mature with slowing innovation rates, the CMA understands that the products are regularly updated (as discussed in paragraph 265 in relation to TOH2) and that partial foreclosure could affect all new servers regardless of whether innovation rates were slowing.
- CMA's conclusion on the effect of foreclosure of hardware rivals
239. For the reasons set out above, the CMA believes that the Merged Entity's foreclosure strategies are likely to have a substantial negative effect on overall competition in the markets for Ethernet NICs, FC HBAs, storage adapters, and FC switches.

Conclusion on foreclosure of hardware competitors through leveraging VMware's position in virtualisation software

240. For the reasons set out above, the CMA believes that the Merged Entity may have the ability and incentive to foreclose hardware competitors in Ethernet NICs, FC HBAs, storage adapters, and FC switches by reducing or restricting their interoperability with VMware's server virtualisation software, and that this may significantly harm competition. Accordingly, the CMA found that the Merger raises significant competition concerns 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.³⁰⁶

241. The CMA believes that the Merged Entity would not have the ability to foreclose hardware rivals in TOR switching chips and it would not have the incentive to foreclose hardware rivals in SmartNICs. Accordingly, the CMA found that the Merger does not give rise to a realistic prospect of an SLC in relation to foreclosure of hardware competitors in each of the global markets for the supply of SmartNICs and TOR switching chips.

TOH2 – Non-horizontal effects from commercially sensitive information sharing

242. The CMA considered potential effects on competition related to the sharing of commercially sensitive information (**CSI**) with the Merged Entity.

243. The CMA assessed this concern as a separate theory of harm but has drawn on evidence set out in its assessment of TOH1.

244. Under this theory of harm, a concern would arise if following the Merger, the Merged Entity is able to gain access to CSI about the activities of its hardware competitors (in this case technical product specifications or innovation plans) in the supply of Ethernet NICs, FC HBAs, and storage adapters. Access to CSI could be used by the Merged Entity to compete less aggressively in the development and innovation of these products or otherwise put its rivals at a competitive disadvantage.³⁰⁷

245. The CMA considers that harm to competition could occur in several ways, such as:

- (a) the Merged Entity competing less aggressively, ie developing products that are only marginally better than its competitors' products and less innovative than what they otherwise would have been; and
- (b) hardware competitors facing a reduced incentive to innovate as they anticipate any changes they make to be quickly replicated by Broadcom.

246. The CMA's assessment focused on:

³⁰⁶ As regards the effect of foreclosure in the UK, VMware generated £473 million of revenue in the UK in the financial year 2022, and VMware's customers in the UK use Ethernet NICs, FC HBAs, storage adapters, and FC switches that are supplied by Broadcom's rivals and which would be affected by a foreclosure strategy.

³⁰⁷ [Merger Assessment Guidelines](#), paragraph 7.3.

- (a) whether VMware currently has access to CSI of Broadcom's hardware competitors;
- (b) whether Broadcom would have access to the same CSI absent the Merger;
- (c) the Merged Entity's behaviour post-Merger; and
- (d) whether the Merged Entity or its rivals would have the incentive to compete less aggressively and/or whether the Merged Entity would otherwise put its hardware rivals at a competitive disadvantage.

247. The CMA has not considered FC switches or TOR switching chips under this theory of harm, because these products do not directly interoperate with VMware's software and therefore rivals do not need to certify them with VMware, limiting the need to share CSI with VMware.

248. In relation to SmartNICs, third parties responding to the CMA's investigation stated that hardware manufacturers share CSI related to SmartNICs with VMware in the context of Project Monterey.³⁰⁸ Similarly with the other products discussed under this theory of harm, there is a risk that this information would be accessible to Broadcom post-Merger. However, as discussed in paragraph 228 of TOH1, the CMA does not consider it is realistic that Broadcom would re-enter the SmartNICs market post-Merger. As a result, the CMA does not believe that SmartNIC providers' incentives to share information with VMware through Project Monterey are likely to change post-Merger, nor would Broadcom seek to use this information in order to benefit its own product offering. The CMA has not therefore considered SmartNICs further in TOH2.³⁰⁹

VMware's access to CSI of hardware competitors

Parties' submissions

249. The Parties submitted that:

- (a) The only information that hardware manufacturers must provide to VMware is information relating to the driver certification process and that none of this information is competitively sensitive.³¹⁰

³⁰⁸ Third party responses to the CMA's questionnaire. See also FMN, Annex Q20-002, page 13.

³⁰⁹ This does not however exclude the possibility that competition concerns in relation to the sharing of CSI about SmartNICs could arise under the general application of UK competition law, in particular in the event circumstances were to change and Broadcom were to re-enter the SmartNICs market in future.

³¹⁰ Issues Letter Response, paragraphs 3.5 and 3.6.

- (b) Information provided to VMware as part of the driver development and certification process is mostly public. Hardware manufacturers typically develop drivers for Linux first, which are open-source drivers, followed by Windows, before doing so for VMware³¹¹ The differences between Broadcom's VMware and Linux drivers are not competitively significant.
- (c) For some new releases where the product has not been previously tested and certified with VMware, the Parties consider that product roadmaps may be shared but that they do not provide VMware with competitively sensitive information.³¹²

CMA's assessment

250. As explained in the Background section (paragraphs 47-53), VMware's virtualisation software interoperates with Ethernet NICs, FC HBAs, and storage adapters through drivers. Drivers are developed by hardware manufacturers and since each OS communicates with drivers in different ways, hardware manufacturers must make them OS-specific. VMware specific drivers are certified by VMware.³¹³
251. Information provided by the Parties during the CMA's investigation shows that VMware and hardware manufacturers share information with one another regarding new products in the context of driver certification and that this is important to VMware's partnership programmes. The Parties indicated that similar to other vendors, Broadcom provides VMware with 2-3 years' notice of major product changes that may impact VMware's product.³¹⁴ Without early notice of changes to VMware's products to ensure hardware is interoperable with VMware, new VMware products would be released without any guarantee that those products would interoperate with users' hardware, deterring adoption of the hardware. Likewise, without any guarantee of immediate interoperability with VMware server virtualisation software, potential VMware customers may be dissuaded from choosing servers with the manufacturer's hardware.³¹⁵
252. The Parties provided an outline of VMware's certification process for the most recent release of a new generation of Ethernet NICs, FC HBAs, and storage adapters.³¹⁶ This showed that VMware receives information about new products up to two years ahead of the driver for the respective product being released, including

³¹¹ Issues Letter Response, paragraphs 3.7 and 3.8.

³¹² Issues Letter Response, paragraphs 3.9-3.11.

³¹³ FMN, footnote 871.

³¹⁴ FMN, paragraph 20.60.

³¹⁵ FMN, paragraphs 20.62-20.64.

³¹⁶ The Parties' response of 7 December 2022 to question 34 of the CMA's RFI, dated 25 November 2022.

information about the product's roadmap, underlying driver code, and pre-release hardware.

253. Third parties responding to the CMA's investigation stated that VMware receives CSI that is not in the public domain relating to hardware manufacturers' Ethernet NICs, FC HBAs, and storage adapters. This includes information required for the driver certification process, such as driver source code, but also product samples, roadmaps, technical information programming guides, API interfaces, architectural information, technical standards, performance benchmarks, security features, performance features, configuration settings, and pricing.³¹⁷ Hardware competitors emphasised the importance of close coordination with VMware, including sharing information for effective interoperability with VMware.³¹⁸ Regarding the Parties' submission that the information that hardware manufacturers share with VMware is largely first shared with Linux and reflected in open-source drivers, the CMA notes that this would only relate to information contained in the driver, and not to other information, such as product roadmaps, that may be shared with VMware and will not be public.
254. In view of the above, the CMA considers that through its driver certification process, VMware currently has access to CSI regarding Broadcom competitors' products and innovations for their Ethernet NICs, FC HBAs, and storage adapters.
255. The CMA also considers that in the future VMware could change its certification process (which is already considered to be secretive³¹⁹) to require hardware manufacturers to provide additional information about their product and feature updates or to provide information at an earlier stage.

Broadcom's current access to CSI

256. The CMA understands that Broadcom supplies input components to rival Ethernet NICs, FC HBAs, and storage adapter manufacturers.

³¹⁷ Third-party responses to the CMA's questionnaire. In response to the CMA's Issues Letter, the Parties submitted that the only information that must be provided to VMware in relation to Ethernet NICs, FC HBAs, and storage adapters is information relating to the driver certification process, and that to the extent some hardware vendors provide additional information voluntarily in the past, this is not needed for the driver certification process (Issues Letter Response, paragraph 3.5). However, this submission is contradicted by the fact that the Parties elsewhere acknowledge that other information such as in relation to product roadmaps does at least sometimes need to be shared with VMWare.

³¹⁸ Third-party responses to the CMA's questionnaire.

³¹⁹ Note of a call with a third party [X] on [X].

257. The CMA understands that Broadcom does not currently receive any CSI in relation to storage adapters. Broadcom may currently receive some CSI in relation to Ethernet NICs and FC HBAs:
- (a) Regarding Ethernet NICs, Broadcom is a key supplier of silicon used to manufacture NICs, and NIC manufacturers that source silicon from Broadcom already share some CSI with Broadcom.³²⁰
 - (b) Regarding FC HBAs, Broadcom receives CSI about rivals' product updates and innovations as they are required to interoperate with Broadcom's FC switches. However, the CMA understands that it does not receive this information in the same timeframe as VMware.³²¹
258. Based on this the CMA understands that the Merger would give the Merged Entity access to additional CSI regarding these two products beyond the CSI that Broadcom already receives. This is because the CSI that VMware receives is different to what Broadcom can already access and/or is more sensitive.

The Merged Entity's behaviour post-Merger

Parties' submissions

259. The Parties submitted that to the extent the Merged Entity receives any CSI post-Merger, VMware will have no incentive to share it with Broadcom because its business model and reputation relies on working constructively with a wide range of hardware vendors. As such, VMware would not provide any CSI received from other hardware manufacturers with Broadcom post-Merger.³²² The Parties also submitted that doing so could result in litigation for breach of the non-disclosure agreements (**NDAs**) that VMware has with hardware manufacturers.³²³

CMA's assessment

260. The CMA does not place weight on the Parties' non-binding assurance that VMware would not share CSI with Broadcom post-Merger or on the protections afforded by NDAs. In practice, contractual protections such as NDAs may not completely remove a firm's ability to harm rivals, may be of limited duration, renegotiated or terminated, and firms may waive their rights to enforce any breaches in light of their

³²⁰ Third-party response to the CMA's questionnaire.

³²¹ Note of a call with a third party [§<] on [§<].

³²² Issues Letter Response, paragraph 3.13.

³²³ Issues Letter Response, paragraph 3.14.

overall bargaining position.³²⁴ The Parties have also not provided details of the terms of VMware's NDAs and how they would legally prevent information being shared within the same corporate group post-Merger. One hardware rival has also expressed doubts regarding whether NDAs could prevent Broadcom from accessing the information post-Merger.³²⁵

261. Moreover, as discussed in paragraph 268, some hardware competitors expressed reservations about sharing information with VMware post-Merger due to the risk that it would be made available to Broadcom. The CMA also notes that given it is hardware competitors' perception that would be the main driver of their behaviour, whether Broadcom ultimately has access to or uses the information to advance its own products may not necessarily be determinative as to whether rivals' behaviour and their incentives to innovate are affected post-Merger.

Incentive to compete less aggressively or otherwise disadvantage hardware competitors

Parties' submissions

262. The Parties submitted that innovation [§<]. Instead, innovation is [§<]. These innovations typically consist of [§<].³²⁶

263. The Parties argued that VMware's past ownership by Dell and EMC shows that information exchanged during driver development does not result in incentives to compete less aggressively. The Parties submitted that Dell and EMC's rivals in server OEMs and storage arrays continued to work with VMware and made no complaints.³²⁷

264. The Parties also submitted that only about [10-20]% of servers run on VMware. As a result, even if rivals did not want to provide any information to VMware under Broadcom's ownership, this would not stop them developing new products and innovating for the [90-100]% of demand for hardware components that comes from bare-metal servers running Linux or Windows or rival hypervisors.³²⁸ The Parties also submitted that if hardware competitors stopped providing information to

³²⁴ [Merger Assessment Guidelines](#), paragraph 7.15.

³²⁵ Note of a call with a third party [§<] on [§<].

³²⁶ Issues Letter Response, paragraph 3.18(b).

³²⁷ Issues Letter Response, paragraph 3.15.

³²⁸ Issues Letter Response, paragraph 3.2.

VMware, VMware would fall behind its competitors in supporting the latest technology.³²⁹

CMA's assessment

265. At the outset, and [§<], the CMA understands that innovation is an important parameter of competition in the relevant markets. Hardware competitors responding to the CMA's investigation confirmed that they do compete on new or additional features and improved functionality,³³⁰ while the Parties also submitted in the course of the CMA's investigation that there is constant innovation in the relevant hardware markets.³³¹
266. The CMA considers that there are two possible ways in which the exchange of CSI could result in a lessening of competition in the respective hardware markets post-Merger.
267. First, the Merged Entity may have a reduced incentive to innovate and compete because its products might need to be only marginally better than its rivals' products to compete with them effectively. If hardware rivals do not change their behaviour and continue providing CSI to the Merged Entity, the Merged Entity would have advance knowledge of its competitors' rollout of future products and their technical characteristics and could use this information to slow down its own innovation as a response to this rollout and to provide products that are only marginally better than its rivals' products to compete with them effectively. This may result in the Merged Entity offering less competitive and innovative products compared to the position absent the Merger.
268. Second, hardware rivals might have less incentive to innovate post-Merger or share less CSI in relation to their innovations post-Merger. In particular, hardware rivals might anticipate that Broadcom would use their CSI to respond more rapidly with its own product improvements. This would mean that rivals would lose their first-mover advantage, which in turn would reduce their incentives to innovate or share the CSI with the Merged Entity. Third-party evidence supports that such changes in rivals' behaviour could take place. Some hardware competitors expressed reservations about sharing information post-Merger.³³² The CMA does not attach weight to the Parties' submission that under VMware's previous ownership, Dell and EMC's rivals continued to work with VMware and made no complaints, given Dell and EMC were

³²⁹ Issues Letter Response, paragraph 3.18(d).

³³⁰ Third-party responses to the CMA's questionnaire.

³³¹ FMN, paragraph 21.11.

³³² Third-party responses to the CMA's questionnaire.

active in different markets, subject to different competitive conditions, and the Parties have not provided any evidence to support their submission.

269. The CMA considers that the effect on competition could be substantial taking into account the following:
- (a) The relevant hardware markets are already relatively concentrated. In relation to FC HBAs and storage adapters, there is only one other major supplier for each (see discussion in paragraphs 277-285). For Ethernet NICs, the Parties submitted that three providers accounted for nearly [90-100]% of sales in 2021.³³³
 - (b) VMware is a market leader in virtualisation software and interoperability with VMware is important to hardware manufacturers, as discussed in paragraphs 118-125 and 184.
 - (c) Given VMware's importance to hardware manufacturers' product offerings, if rivals' hardware could no longer be used with VMware they would have a reduced incentive to innovate as they would be faced with a smaller accessible customer base. This is because the costs of any new innovations may exceed the benefits if they can only be implemented with servers that do not use VMware products.
 - (d) The CMA places limited weight on the Parties' submission that even if rivals stopped providing information to VMware, this would not stop them continuing innovate for the c. [90-100]% demand for hardware components bare-metal servers and those running rival hypervisors. This is because competition could still be affected in relation to a large proportion of the market for the same reasons as explained in paragraphs 236-237.
270. The CMA considers that if hardware rivals decided to innovate less or share less CSI in relation to these innovations, this would result in lower-quality products and a loss in competition in the Ethernet NICs, FC HBAs, and storage adapters markets.
271. If hardware competitors decided to terminate their relationship with VMware for any new product innovations, this would have a similar effect as the total foreclosure strategy for new products in TOH1. The CMA considers that this scenario is unlikely given the importance of VMware (see paragraph 126).

³³³ FMN, Table 77.

CMA's conclusion

272. For the reasons set out above, the CMA believes that as a result of the exchange of CSI between the Merged Entity and hardware competitors for Ethernet NICs, FC HBAs, and storage adapters, post-Merger such hardware competitors may be disincentivised to innovate or to share CSI with the Merged Entity, to their competitive disadvantage. Even if they continue to provide CSI to the Merged Entity post-Merger, it could reduce Broadcom's incentive to innovate and compete. In both cases, the CMA considers that the Merger raises significant competition concerns resulting from the exchange of CSI in each of the global markets for the supply of Ethernet NICs, FC HBAs, and storage adapters.³³⁴

TOH3 – Foreclosure of virtualisation competitors through leveraging Broadcom's position in FC HBAs and storage adapters

273. Under this theory of harm, the CMA considered whether, post-Merger, the Merged Entity could foreclose rival virtualisation software providers by restricting or reducing the interoperability of their software with two of Broadcom's server hardware products: FC HBAs and storage adapters.

274. The CMA considered whether this theory of harm would satisfy the following cumulative conditions: (i) whether the Merged Entity would have the ability to foreclose its rivals active in the supply of virtualisation software; (ii) whether the Merged Entity would have the incentive to do so (ie whether it would be profitable); and (iii) whether this would substantially lessen overall competition in the global supply of virtualisation software.³³⁵

Ability to foreclose virtualisation software competitors

275. As regards ability to foreclose, the CMA considered the following:

- (a) whether the Merged Entity would have market power in the supply of FC HBAs and storage adapters; and
- (b) whether the Merged Entity would have the technical ability to restrict or reduce their interoperability with Broadcom's FC HBAs and storage adapters, and the importance of such interoperability for rival virtualisation providers.

³³⁴ These concerns also arise in the UK, for the same reasons as set out at footnote 306.

³³⁵ [Merger Assessment Guidelines](#), paragraphs 7.9-7.10.

Broadcom's market power in FC HBAs and storage adapters

- Parties' submissions

276. The Parties submitted that Broadcom does not have market power in FC HBAs or storage adapters for the following reasons:

- (a) Broadcom faces significant competition from Marvell in FC HBAs. In response to the CMA's Issues Letter, the Parties submitted that Broadcom only had a share of [40-50]% for FC HBAs used in servers (the Parties submitted that FC HBAs used in storage arrays should be excluded, as they do not use virtualisation software).³³⁶
- (b) Broadcom faces significant competition in storage adapters from Microchip, Marvell, and from third-party storage adapters that use Broadcom's or Microchip's controllers. In response to the CMA's Issues Letter, the Parties submitted that third-party adapters using Broadcom's controllers need to be excluded from Broadcom's market share calculation because Broadcom is [X], and therefore would not be able to degrade the drivers used in such adapters as part of any foreclosure strategy.³³⁷
- (c) The Parties submitted that Broadcom only had a [20-30]% share in 2021 based on volumes, when third-party adapters using Broadcom's controllers are excluded on this basis.
- (d) Broadcom's FC HBAs and storage adapters are subject to system-level competition from Ethernet SANs (that use Ethernet NICs) and CPU-direct-attached storage respectively, and both are also subject to competition from public cloud (that rarely uses storage adapters and almost never uses FC HBAs).³³⁸
- (e) Server OEMs have significant influence over their customers' hardware selection and can switch hardware manufacturers rapidly.³³⁹

- CMA's assessment

277. In assessing Broadcom's market power in FC HBAs and storage adapters, the CMA considered Broadcom's market position and out-of-market constraints.

³³⁶ FMN, paragraph 20.225; Issues Letter Response, paragraph 4.10b.

³³⁷ FMN, paragraph 20.225; Issues Letter Response, paragraph 4.10a.

³³⁸ FMN, paragraphs 20.227-20.229; Issues Letter Response, paragraph 4.10c.

³³⁹ FMN, paragraph 20.226.

- Broadcom’s market position

278. Table 2 sets out shares of supply for FC HBAs (by revenue) globally between 2019 and 2021, based on the Parties’ and third-party data.

Table 2. Revenue shares of supply for FC HBAs globally, 2019-2021

Supplier	2019		2020		2021	
	Revenue, \$m	Share	Revenue, \$m	Share	Revenue, \$m	Share
Broadcom	[<]	[50-60]%	[<]	[50-60]%	[<]	[50-60]%
Marvell	[<]	[40-50]%	[<]	[40-50]%	[<]	[40-50]%
Others	[<]	[0-5]%	[<]	[0-5]%	[<]	[0-5]%
Total	[<]	100.0%	[<]	100.0%	[<]	100.0%

Source: CMA analysis of the Parties’ and third-party data.

279. These shares show that Broadcom has the largest share of supply at [50-60]% in 2021, and only one material competitor, Marvell, with a share of [40-50]%. These shares are broadly consistent with the Parties’ own share estimates and shares of supply included in Broadcom’s internal documents. The Parties estimated Broadcom and Marvell to have shares of supply of [60-70]% and [30-40]% respectively in 2021.³⁴⁰ A Broadcom internal document ([<]) indicated that Broadcom had a market share of [60-70]% in Quarter 2 of 2021, while a similar update in July 2020 gave Broadcom a market share of [60-70]% in Quarter 1 of 2020.³⁴¹

280. The CMA does not place weight on the Parties’ submission that Broadcom only has a [40-50]% share in FC HBAs used in servers (as opposed to storage arrays), as the Parties have not sufficiently explained how they estimated the relevant market size or Marvell’s sales in this segment,³⁴² why a few large storage OEMs recently preferred Broadcom’s FC HBAs, or why Broadcom is weaker with server OEMs.³⁴³

281. Third-party views and internal documents also show that Broadcom has a strong market position. One respondent to the CMA’s investigation identified that Broadcom has been gaining market share since 2016/2017,³⁴⁴ while another respondent described Broadcom as a technology leader.³⁴⁵ Similarly, a presentation to Broadcom’s Board of Directors dated December 2021 describes [<].³⁴⁶

³⁴⁰ FMN, Table 82.

³⁴¹ Broadcom’s response to s109 Notice 2, BCOM-CMA-00000193, page 22; Broadcom’s response to s109 Notice 2, BCOM-CMA-00000186, page 4.

³⁴² Issues Letter Response, footnote 104.

³⁴³ Issues Letter Response, paragraph 4.10b.

³⁴⁴ Third-party response to the CMA’s questionnaire.

³⁴⁵ Third-party response to the CMA’s questionnaire.

³⁴⁶ FMN, BVM000000024, page 6.

282. Table 3 sets out shares of supply for storage adapters (by revenue) globally between 2019 and 2021, based on the Parties' and third-party data.³⁴⁷ These shares include storage adapter boards (the finished product) and controllers, which are the key component of the finished product.

Table 3. Revenue shares of supply in storage adapters globally, 2019-2021

Supplier	2019		2020		2021	
	Revenue, \$m	Share	Revenue, \$m	Share	Revenue, \$m	Share
Broadcom	[<]	[60-70]%	[<]	[60-70]%	[<]	[70-80]%
<i>Broadcom's Boards</i>	[<]	[20-30]%	[<]	[20-30]%	[<]	[20-30]%
<i>Broadcom-based Boards</i>	[<]	[40-50]%	[<]	[40-50]%	[<]	[40-50]%
Microchip	[<]	[20-30]%	[<]	[20-30]%	[<]	[20-30]%
<i>Microchip's Boards</i>	[<]	[0-5]%	[<]	[0-5]%	[<]	[0-5]%
<i>Microchip-based Boards</i>	[<]	[20-30]%	[<]	[20-30]%	[<]	[20-30]%
Marvell	[<]	[5-10]%	[<]	[5-10]%	[<]	[5-10]%
Total	[<]	100.0%	[<]	100.0%	[<]	100.0%

Source: CMA analysis of the Parties' and third-party data.

283. The shares show that Broadcom is the largest provider by a significant margin with a [70-80]% share in 2021, and that there are only two other suppliers, Microchip and Marvell, with shares of [20-30]% and [5-10]% respectively. The CMA's share of supply estimates are largely consistent with the Parties' estimates which show that Broadcom's and Microchip's shares of supply were [70-80]% and [20-30]% respectively in 2021.³⁴⁸

284. Contrary to the Parties' submission, the CMA does not consider it appropriate to exclude from the shares of supply third party storage adapters using Broadcom's controllers. While the relevant third party [<], they still [<] to enable the driver to be certified.³⁴⁹ Therefore, the Merged Entity would still have the ability to affect the interoperability of such storage adapters as part of a foreclosure strategy.

285. Third-party views and internal documents also show that Broadcom has a strong market position in storage adapters:

- (a) The CMA understands that Marvell is only present in some segments of the market (mainly non-RAID controllers) and does not compete directly with

³⁴⁷ The CMA estimated the value of Microchip-based storage adapters by multiplying the value of Microchip controller sales by four. This is in line with the Parties' approach used to estimate the sales of Broadcom-based storage adapters (see FMN, Annex Q15-016).

³⁴⁸ FMN, Table 83.

³⁴⁹ Issues Letter Response, paragraph 4.10a.

Broadcom's storage adapters.³⁵⁰ Another third party stated that Broadcom has 'a more modern product than Microchip.'³⁵¹

(b) A presentation to Broadcom's Board of Directors dated December 2021 describes [redacted].³⁵²

– Out-of-market constraints

286. The CMA understands that alternative storage strategies may involve the use of hardware other than FC HBAs and storage adapters and has assessed the extent to which they constrain Broadcom's market power.

287. **FC SANs/FC HBAs vs Ethernet SANs/Ethernet NICs.** The CMA considers that while virtualisation customers can, in principle, choose between Ethernet or FC protocols for their storage, once this choice has been made, it is difficult for customers to switch since servers and associated infrastructure procured from server OEMs would support either FC or Ethernet protocols. Hence, FC HBAs and Ethernet NICs are only indirectly substitutable for one another.

288. In addition, Ethernet or FC protocols themselves are differentiated offerings and not close substitutes. Broadcom's internal documents suggest that [redacted]³⁵³ and that [redacted].³⁵⁴ Most virtualisation customers³⁵⁵ and all hardware customers³⁵⁶ and competitors³⁵⁷ gave evidence to the CMA that is consistent with this finding (ie either that FC SANs and Ethernet SANs are not close alternatives to each other or that there are barriers to switching between the two).

289. **Storage adapters vs CPU-direct-attached storage.** The CMA considers that while some virtualisation customers may choose between storage adapters and CPU-direct-attached storage when purchasing servers from server OEMs, they are largely differentiated offerings. Most virtualisation customers³⁵⁸ and all hardware

³⁵⁰ Third-party [redacted] response to CMA request for information dated [redacted]. Third-party response to the CMA's questionnaire. See paragraph 46(d) for the distinction between RAID and non-RAID storage adapters.

³⁵¹ Third-party response to the CMA's questionnaire.

³⁵² FMN, BVM000000024, page 6.

³⁵³ Broadcom's presentation to [redacted] dated September 2019 (Broadcom's response to s109 Notice 3, BCOM-CMA-00000400, page 27).

³⁵⁴ [redacted] (Broadcom's response to s109 Notice 2, BCOM-CMA-00000189, page 22).

³⁵⁵ Third-party responses to the CMA's questionnaire.

³⁵⁶ Third-party responses to the CMA's questionnaire.

³⁵⁷ Third-party responses to the CMA's questionnaire.

³⁵⁸ Third-party responses to the CMA's questionnaire.

customers³⁵⁹ and competitors³⁶⁰ told the CMA that storage adapters and CPU-direct-attached storage are not close alternatives to each other.

290. **Public cloud.** As explained in paragraphs 151-163, the CMA considers that public cloud imposes only a limited out-of-market constraint on enterprise deployments. This in turn implies that any constraint from public cloud on Broadcom's supply of FC HBAs and storage adapters is also limited.

291. Overall, therefore, the CMA considers that system-level competition from Ethernet SANs/Ethernet NICs, CPU-direct-attached storage, and the public cloud is likely to provide only a limited constraint on Broadcom's market power in the supply of FC HBAs and storage adapters.

– CMA's conclusion on Broadcom's market power

292. In view of the above, the CMA considers that Broadcom has significant market power in the supply of FC HBAs and storage adapters. Broadcom has significant shares of supply (close to or exceeding [60-70]% for each product), faces only one significant competitor in each market, while out-of-market constraints are likely to be limited.

Foreclosure mechanisms and importance of interoperability to virtualisation software competitors

293. The CMA has considered: (i) whether the Merged Entity has the ability to affect interoperability with rival virtualisation software using drivers or by reducing technical support provided to rival virtualisation providers; and (ii) whether interoperability with Broadcom's FC HBAs and storage adapters is important to rival virtualisation providers, and therefore whether a loss of interoperability would be capable of harming them.

- Parties' submissions

294. The Parties do not dispute that Broadcom would have the technical ability to degrade the interoperability of its hardware with the virtualisation software of VMware's rivals by degrading the quality of its drivers. (The Parties submitted that this is unlikely to constitute a viable foreclosure mechanism because Broadcom's FC HBAs and storage adapters (including third-party adapters using Broadcom's controllers) are used only in [\times]% and [\times]% of affected virtualised servers

³⁵⁹ Third-party responses to the CMA's questionnaire.

³⁶⁰ Third-party responses to the CMA's questionnaire.

respectively and therefore interoperability with these products is of limited importance to them – a point that is relevant to the question of the Merged Entity’s ability to affect virtualisation competitors (see paragraph 299).³⁶¹

295. The Parties submitted that the Merged Entity would not have the ability to partially foreclose rival virtualisation software providers (and Linux-based providers in particular) by reducing technical support. According to the Parties, Broadcom [redacted].³⁶²

- CMA’s assessment

296. As discussed in TOH1 (paragraphs 185-186), hardware manufacturers develop drivers to enable FC HBAs and storage adapters to interoperate with virtualisation software. The CMA understands that both hardware manufacturers and virtualisation software providers work together to ensure the interoperability of their products, and therefore both are technically capable of compromising the interoperability of their products. This is consistent with third-party evidence. All virtualisation competitors who responded to the CMA’s question on Broadcom’s technical ability to foreclose stated that Broadcom could modify its products, so that they interoperate less well with rival virtualisation software as compared to VMware.³⁶³ Broadcom’s internal documents also indicate that the [redacted] and that [redacted].³⁶⁴ Therefore, the CMA considers that Broadcom would have the technical ability to partially or totally degrade the interoperability of its FC HBAs and storage adapters with rival virtualisation software through degrading the quality of its drivers.

297. However, Broadcom’s hardware and associated drivers are also used not just with virtualisation software but also with general-purpose OSs in bare-metal servers, which account for around [40-50]% of all enterprise servers.³⁶⁵ The CMA considers that Broadcom does not have the ability to target interoperability at rival virtualisation software in isolation, and hence any foreclosure strategy would also have much wider consequences and costs with no additional benefit. The CMA considered this point in more detail in the incentives section in paragraphs 305-310.

298. As for technical support (eg declining or delaying cooperation to resolve any interoperability issues), contrary to the Parties’ submissions, some third parties

³⁶¹ Issues Letter Response, paragraph 4.12 and Figure 6.

³⁶² Issues Letter Response, paragraph 4.7.

³⁶³ Third-party responses to the CMA’s questionnaire.

³⁶⁴ Updates to Broadcom’s management from [redacted] (Broadcom’s response to s109 Notice 2, BCOM-CMA-00000080 ([redacted]), dated September 2019), page 20; Broadcom’s response to s109 Notice 2, BCOM-CMA-00000189 ([redacted]), page 25).

³⁶⁵ FMN, Table 29.

submitted that Broadcom does provide some technical support to rival virtualisation providers.³⁶⁶ However, the third parties did not indicate that the technical support was particularly important. One third party told the CMA that implementation and testing of drivers could be done independently without Broadcom's assistance,³⁶⁷ while another third party mentioned that virtualisation providers in some cases interact with the wider Linux community instead of hardware manufacturers.³⁶⁸ Furthermore, none of the virtualisation providers responding to the CMA's investigation raised concerns that the Merged Entity would stop providing technical support.³⁶⁹ In light of this, the CMA does not consider that reducing technical support is likely to significantly impact the interoperability of Broadcom's FC HBAs and storage adapters for rival virtualisation providers.

299. As regards the importance of interoperability with Broadcom's FC HBAs and storage adapters to rival virtualisation providers, the CMA has considered the share of virtualised servers that use these two products. The CMA has not relied on the Parties' analysis of such shares as they inappropriately include servers using the public cloud, which does not form part of the relevant frame of reference. On the basis of virtualised servers used in enterprise deployments (ie excluding the public cloud), the CMA estimates that Broadcom's FC HBAs and storage adapters (including third-party adapters using Broadcom's controllers) are used in around [10-20]% and [50-60]% of such servers respectively.³⁷⁰ The high share for Broadcom's storage adapters indicates that interoperability is likely to be important for rival virtualisation providers, and therefore that a reduction in interoperability could harm them. The low share of enterprise servers for Broadcom's FC HBAs indicates that this may be less likely the case for this product. However, the CMA considers, that provided any foreclosure strategy leverages the Merged Entity's position in both products, a significant share of servers would still be affected, and in turn that virtualisation providers would likely be harmed.

CMA's conclusion on ability to foreclose virtualisation software competitors

300. The CMA considers that Broadcom has market power in both FC HBAs and storage adapters and that the effects of reduced interoperability of both products as part of a joint strategy could harm rival virtualisation software providers. However, while

³⁶⁶ Third-party responses to the CMA's questionnaire.

³⁶⁷ Third-party [redacted] response to CMA request for information dated [redacted].

³⁶⁸ Note of a call with a third party [redacted] on [redacted].

³⁶⁹ Third-party responses to the CMA's questionnaire.

³⁷⁰ The CMA estimated these shares based on: (i) Broadcom's share of supply in FC HBAs and storage adapters (see Tables 2 and 3 above); and (ii) the Parties' estimate on the share of enterprise servers that contain FC HBAs and storage adapters – [10-20]% and [70-80]% respectively (Issues Letter Response, Annex 3).

Broadcom has the technical ability to reduce the interoperability of both products for rival virtualisation software providers by degrading its drivers, any foreclosure strategy would also have a negative impact on bare-metal servers, which the CMA has assessed further in the incentive section.

Incentive to foreclose virtualisation software competitors

Parties' submissions

301. The Parties submitted that Broadcom would not have the incentive to degrade the interoperability of its FC HBAs and storage adapters to foreclose rival providers of virtualisation software for the following reasons:

- (a) The vast majority of rival virtualisation software is built on either Windows or the KVM component of Linux OS. Each virtualisation software provider relies on its parent OS to manage hardware device drivers.³⁷¹
- (b) There are generally no separate device drivers required to support these hypervisors. Once Broadcom has released a device driver for Microsoft Windows, Broadcom hardware supports Microsoft's Hyper-V; and once Broadcom has released a device driver for Linux, Broadcom hardware supports any KVM-based hypervisor. Broadcom only produces specific drivers for [redacted] for FC HBAs. Even if Broadcom decided to refuse to support a small Linux provider, that provider could simply download Broadcom's open-source driver.³⁷²
- (c) If the Merged Entity attempted to foreclose its rivals, Broadcom's hardware interoperability with Windows and Linux OS would be affected more broadly. Given that most servers – including all bare-metal and cloud servers – run these OSs, doing so would be disastrous for Broadcom's hardware business.³⁷³
- (d) If Broadcom tried to undermine interoperability with Linux, server OEMs would stop purchasing Broadcom's hardware and/or retaliate in other markets. The

³⁷¹ FMN, paragraph 20.232. VMware uses its own specialised proprietary OS, which is based neither on Linux, nor Windows.

³⁷² FMN, paragraph 20.232; Issues Letter Response, paragraph 4.6 and footnote 99. The same hardware can be used with different OSs. However, hardware manufacturers create OS-specific drivers (see paragraph 48 above).

³⁷³ FMN, paragraphs 20.232 and 20.236; Issues Letter Response, paragraphs 4.3 and 4.5.

Linux community could also retaliate by refusing certification of Broadcom's hardware.³⁷⁴

CMA's assessment

302. In assessing whether the Merged Entity would have the incentive to degrade the interoperability of its FC HBAs and storage adapters to foreclose rival virtualisation providers, the CMA considered whether the potential benefit of additional virtualisation sales would exceed the potential cost of losing hardware sales as a result of the foreclosure strategy.³⁷⁵
303. On the one hand, the Parties' analysis, discussed in TOH1 (paragraph 206) indicated that the margins associated with VMware's virtualisation software are much higher than for Broadcom's hardware products. This would imply that only a small proportion of rival virtualisation customers would need to switch to VMware to make the foreclosure strategy under TOH3 profitable.³⁷⁶
304. On the other hand, the evidence collected in relation to TOH1 indicates that the majority of VMware customers would prefer to switch hardware rather than to pursue other options (see paragraphs 208-212). This evidence focused on customers willingness to switch away from VMware rather than switch to VMware, and there are a number of reasons why switching to VMware might nevertheless be easier, including its VMware's leading market position, very extensive product offering,³⁷⁷ and superior migration tools compared to rivals.³⁷⁸ However, even taking this consideration into account, the CMA still considers that barriers to switching to any new virtualisation product are likely to be significantly higher than switching hardware.
305. In addition, any attempted foreclosure strategy would have a number of unintended impacts and associated costs.
306. First, some rival virtualisation providers are integrated into general-purpose OSs (eg Hyper V is integrated into Windows and the KVM hypervisor is integrated into Oracle Linux and Red Hat). In line with the Parties' submissions, third parties confirmed that the driver used for such virtualisation software is the same as that

³⁷⁴ Issues Letter Response, paragraphs 4.9 and 4.13.

³⁷⁵ [Merger Assessment Guidelines](#), paragraph 7.16.

³⁷⁶ Critical switching rate in relation to TOH3 can be calculated as 100% minus critical switching rate in relation to TOH1. The Parties submissions imply that 15% and 8% for FC HBAs and storage adapters customers would need to switch to VMware (or 6% and 3% respectively if associated software sold with vSphere is taken into account) to make foreclosure profitable.

³⁷⁷ Third-party responses to the CMA's questionnaire.

³⁷⁸ Third-party response to the CMA's questionnaire.

used for the underlying general-purpose OS.³⁷⁹ If the Merged Entity engaged in a foreclosure strategy which targeted such Microsoft or Linux-based virtualisation providers, it would incur significant costs since: (i) its hardware would no longer be compatible with bare-metal servers, which account for around [40-50]% of all servers, using these OSs;³⁸⁰ and (ii) server OEMs might switch away from Broadcom even for servers using VMware since server OEMs want to support a wide range of OSs (see paragraph 216).³⁸¹

307. Second, some Linux-based virtualisation providers, including those that are not integrated into general-purpose OSs (eg Nutanix), in any event cannot be targeted because they use open-source generic drivers³⁸² and changes to those drivers would have wider effects that go beyond users of that virtualisation product. One virtualisation provider explained that any attempt to affect interoperability with one provider would also likely affect other Linux-based virtualisation software providers.³⁸³
308. While some hardware manufacturers create specific drivers at least for certain Linux-based virtualisation providers (eg Citrix),³⁸⁴ those providers could still use open-source drivers available from the Linux community to avoid foreclosure.
309. Third, no rival virtualisation provider raised concerns regarding this theory of harm. Although some rivals specifically submitted that foreclosure was technically possible, one respondent to the CMA's investigation explained that the Merged Entity would not have the incentive to engage in it.³⁸⁵
310. In view of the above, and in particular the costs associated with being unable to target the foreclosure strategy at specific virtualisation rivals, the CMA does not consider that the Merged Entity would have the incentive to engage in the foreclosure strategy. In light of this, the CMA did not consider it necessary to assess whether the foreclosure strategy would have an effect on competition.

Conclusion on foreclosure of virtualisation software competitors

311. For the reasons set out above, the CMA considers that while the Merged Entity may have the ability to engage in a foreclosure strategy of rival virtualisation software, it

³⁷⁹ Third-party [redacted] response to CMA request for information dated [redacted], paragraph 15; Third-party responses to the CMA's questionnaire.

³⁸⁰ Annex RFI4Q1-002, Annex 55 (Conglomerate), Table 4; Issues Letter Response, footnote 98.

³⁸¹ Note of a call with a third party [redacted] on [redacted].

³⁸² Third-party responses to the CMA's questionnaire.

³⁸³ Third-party [redacted] response to CMA request for information dated [redacted].

³⁸⁴ Third-party responses to the CMA's questionnaire.

³⁸⁵ Third-party responses to the CMA's questionnaire.

would not have the incentive to do so. Accordingly, the CMA found that the Merger does not give rise to a realistic prospect of an SLC as a result of a foreclosure strategy in the global supply of server virtualisation software.

Other theories of harm

312. In addition to server hardware components, Broadcom is also active in the supply of software, including security software, IT management software, delivery automation software, and mainframe software. The CMA considered the following theories of harm involving Broadcom's software.
313. The CMA considered whether the Merger gives rise to competition concerns in relation to horizontal unilateral effects. The Parties overlap in the supply of security software, IT management software, and delivery automation software. In light of the range of alternative providers for these software and the absence of third-party concerns, the CMA has not identified competition issues regarding these overlaps.
314. The CMA also considered whether the Merged Entity could leverage VMware's market power in server virtualisation software to foreclose Broadcom's competitors by bundling Broadcom's software with VMware's virtualisation software. The CMA considers that such bundles might not be commercially feasible since: (i) most VMware customers indicated that Broadcom's and VMware's software tend to be purchased at different points in time and at different frequency;³⁸⁶ and (ii) at least some of Broadcom's software is not used in servers running VMware.³⁸⁷ In addition, it is unlikely that the Merged Entity will be able to deprive competitors of substantial volumes of sales, since Broadcom's rivals are likely to have effective counter-strategies by already being in a position to offer similar software bundles (eg Microsoft, IBM, AWS and Google).³⁸⁸ While a small number of third parties raised concerns in relation to a bundling strategy,³⁸⁹ these concerns were either not merger-specific or were not supported by the rest of the CMA's evidence. Therefore, the CMA has not identified competition issues regarding bundling.

³⁸⁶ Third-party responses to the CMA's questionnaire.

³⁸⁷ FMN, paragraphs 15.55 and 20.196.

³⁸⁸ FMN, paragraphs 20.202-20.206.

³⁸⁹ Third-party responses to the CMA's questionnaire.

COUNTERVAILING FACTORS

Barriers to entry and expansion

315. Entry, or expansion of existing firms, can mitigate the initial effect of a merger on competition, and in some cases may mean that there is no SLC. In assessing whether entry or expansion might prevent an SLC, the CMA considers whether such entry or expansion would be timely, likely and sufficient.³⁹⁰ In terms of timeliness, the CMA's guidelines indicate that the CMA will look for entry to occur within two years.³⁹¹
316. The evidence received by the CMA from the Parties and third parties at this stage in the investigation does not indicate that entry or expansion will be timely, likely, or sufficient to mitigate any SLC arising in any of the markets in which the CMA has identified competition concerns.

Server virtualisation software

Parties' submissions

317. The Parties submitted that entry based around existing open-source projects would be low cost. According to the Parties, virtualisation software is available to any interested market competitor in source-code form to develop, improve, and distribute free-of-charge to customers worldwide. There are already open-source suppliers in the market and there is a constant threat of entry in virtualisation software.³⁹²
318. The Parties did not identify any examples of entry of virtualisation software providers over the past five years but submitted that use of public cloud providers has grown rapidly and that CSPs have focused on developing cloud-based control planes that can manage both private and public cloud server virtualisation. The Parties also submitted that containerisation is an increasingly popular alternative for virtualisation customers.

CMA's assessment

319. Third parties indicated that there are several barriers to entry and expansion for suppliers, including: the need to continually evolve and advance their technology, the ability to adapt open-source technology to fit with their own technology, winning

³⁹⁰ [Merger Assessment Guidelines](#), from paragraph 8.40.

³⁹¹ [Merger Assessment Guidelines](#), paragraph 8.33

³⁹² FMN, paragraphs 21.3 and 21.4.

customers as the decision-making cycle of customers is long and complicated, and the need to ensure compatibility with server, storage, and networking hardware over time.³⁹³

320. As for the growth of the public cloud and containerisation, the CMA has already taken into account the out-of-market constraint provided by these alternatives in its competitive assessment, where relevant.

321. In view of this and the barriers to entry third parties have identified, the CMA does not consider that entry or expansion by virtualisation software providers, or public cloud and containerisation providers, is likely to alleviate the competition concerns identified arising from VMware's market power in server virtualisation software.

Server hardware

Parties' submissions

322. The Parties submitted that there are no legal or regulatory barriers to enter the NIC, FC HBA, and storage adapter markets. While vendors try to build strong relationships with their OEM customers, server OEMs' multi-sourcing strategies and constant innovation help ensure opportunities for new entrants.³⁹⁴

323. The Parties did not identify any entry in FC HBAs and storage adapters in the last five years but did identify several Chinese entrants in Ethernet NICs.³⁹⁵

324. The Parties have not made any submissions on barriers to entry and expansion for FC switches.

CMA's assessment

325. The majority of hardware manufacturers considered that there are significant barriers to entry and expansion in Ethernet NICs, storage adapters, and FC HBAs. These barriers include: R&D, which can be very expensive (exceeding USD100m), the time necessary to develop and design the products, certification of the hardware with VMware and other OSs, receiving the backing of server OEMs, and reputation as the products are central to the functioning of a server.³⁹⁶ Third parties indicated that entry would likely take more than two years.³⁹⁷

³⁹³ Third-party responses to the CMA's questionnaire.

³⁹⁴ FMN, paragraph 21.11.

³⁹⁵ FMN, paragraph 22.6.

³⁹⁶ Third-party responses to the CMA's questionnaire.

³⁹⁷ Third-party responses to the CMA's questionnaire.

326. Regarding the new Chinese entrants identified by the Parties in Ethernet NICs, no third party that responded to the CMA's investigation identified these providers as either an alternative or a new entrant.
327. The CMA has not seen evidence that new entry in FC switches is likely in the near future.
328. In light of the above, the CMA considers that barriers to entry and expansion into the supply of the relevant server hardware products are high and that entry or expansion in these markets is unlikely to alleviate the competition concerns identified.
329. For the reasons set out above, the evidence received by the CMA does not indicate that entry or expansion will be timely, likely or sufficient to mitigate any of the SLCs arising as a result of the Merger.

Efficiencies

330. Efficiencies arising from a merger may enhance rivalry, with the result that the merger does not give rise to an SLC where an SLC may otherwise arise. In order to consider efficiencies, the CMA must receive compelling evidence to be satisfied that efficiencies will enhance rivalry so that a merger does not result in an SLC. More specifically, the CMA must be satisfied that the efficiencies will:³⁹⁸
- (a) enhance rivalry in the supply of those products where an SLC may otherwise arise;
 - (b) be timely, likely and sufficient to prevent an SLC from arising;
 - (c) be merger-specific; and
 - (d) benefit customers in the UK.
331. The Parties submitted that the Merger will entail synergies and efficiencies, including [redacted].³⁹⁹ The Parties have not however explained how, nor have they provided compelling evidence, that the Merger would give rise to efficiencies meeting all of the conditions set out above. The CMA therefore does not consider that there are efficiencies that would enhance rivalry such that the Merger would not result in an SLC.

³⁹⁸ [Merger Assessment Guidelines](#), paragraph 8.8.

³⁹⁹ FMN, paragraphs 24.1-24.5.

THIRD PARTY VIEWS

332. The CMA contacted customers and competitors of the Parties. Some competitors and customers raised concerns regarding: (i) Broadcom degrading interoperability between VMware's virtualisation software and the hardware and software of competitors; and/or (ii) the ability of Broadcom to obtain confidential information through VMware's certification processes; and/or potential self-preferencing by Broadcom. Third party comments have been taken into account where appropriate in the competitive assessment above.
333. A few customers further raised non-competition concerns related Broadcom potential commercial strategies for the Merged Entity.

CONCLUSION ON SUBSTANTIAL LESSENING OF COMPETITION

334. Based on the evidence set out above, the CMA believes that it is or may be the case that the Merger may be expected to result in an SLC as a result of:
- (a) the foreclosure of Broadcom's hardware competitors in relation to the global markets for the supply of Ethernet NICs, FC HBAs, storage adapters, and FC switches arising from the Merged Entity leveraging VMware's market position in the global market for the supply of server virtualisation software; and
 - (b) non-horizontal effects in the global markets for the supply of Ethernet NICs, FC HBAs, and storage adapters arising from the exchange of commercially sensitive information.

DECISION

335. Consequently, the CMA believes that it is or may be the case that: (i) arrangements are in progress or in contemplation which, if carried into effect, will result in the creation of a relevant merger situation; and (ii) the creation of that situation may be expected to result in an SLC within a market or markets in the United Kingdom.
336. The CMA therefore believes that it is under a duty to refer under section 33(1) of the Act. However, the duty to refer is not exercised whilst the CMA is considering whether to accept undertakings under section 73 of the Act instead of making such a reference.⁴⁰⁰ The Parties have until 29 March 2023⁴⁰¹ to offer an undertaking to the CMA.⁴⁰² The CMA will refer the Merger for a phase 2 investigation⁴⁰³ if the Parties do not offer an undertaking by this date; if the Parties indicate before this date that they do not wish to offer an undertaking; or if the CMA decides⁴⁰⁴ by 5 April 2023 that there are no reasonable grounds for believing that it might accept the undertaking offered by the Parties, or a modified version of it.

David Stewart
Executive Director, Markets and Merger
Competition and Markets Authority
22 March 2023

⁴⁰⁰ Section 33(3)(b) of the Act.

⁴⁰¹ Section 73A(1) of the Act.

⁴⁰² Section 73(2) of the Act.

⁴⁰³ Sections 33(1) and 34ZA(2) of the Act.

⁴⁰⁴ Section 73A(2) of the Act.