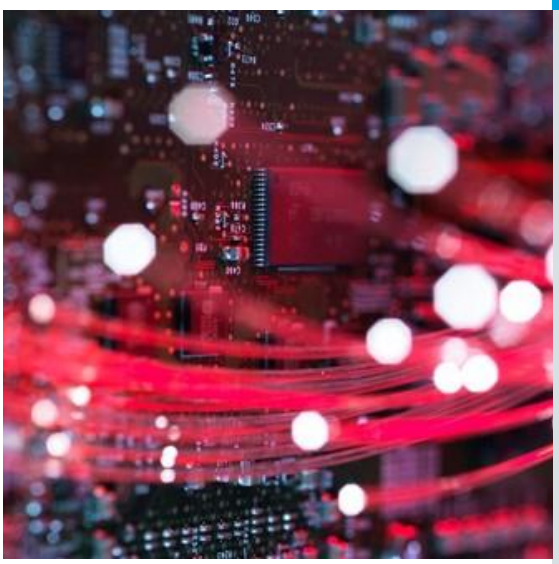

Study for the review of Commission Regulation 2019/424 (Ecodesign of servers and data storage products)

Task 2 Markets – DRAFT v2.1

June 2023

Submitted to:

Davide POLVERINI

Policy Officer, DG GROW

Avenue d'Auderghem 45, 1040 Brussels, Belgium

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A report submitted by ICF S.A.

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Eirini Passia
ICF S.A.
Avenue Marnix 17
Brussels
B-1000
Belgium
T +32 (0) 2 275 01 00
www.icf.com

Document Control

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Prepared by	Todd Leddy, Eirini Passia, Laurent Petithuguenin
Checked by	Tom Lock
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2 Introduction to Task 2 Markets

The prime objective of this report is to outline the economic, market and stock data of the products covered by the Ecodesign Regulation 2019/424 on servers and data storage products.

2.1 Generic Economic Data

The European Union's (EU) official source of statistics is PRODCOM and data are published annually by EUROSTAT[1]. PRODCOM data is based on manufactured goods whose definitions are standardised across the EU, therefore guaranteeing consistency and comparability between Member States. Although these statistics are often used and referenced in other EU policy documents when it comes to trade and economic policy, they have their limitations. Many data points are unreported, estimated, or confidential. There is also a lot of overlap of products with the same PRODCOM code. Thus, it can be difficult to get an accurate statistic for servers and data storage products. The study team has chosen the following PRODCOM codes which it feels best represent servers and data storage products.

There are seven categories defined by PRODCOM that cover servers and data storage products[2]. PRODCOM classifies servers and data storage products in the categories:

- NACE 26.20 "Manufacture of computers and peripheral equipment" and
- NACE 26.30 "Manufacture of communication equipment"[3].

The products covered under these categories which are relevant to this study are presented below separated out by product type:

2.1.1 Servers

- **26201400** – Digital data processing machines: presented in the form of systems;
- **26201500** – Other digital automatic data processing machines whether or not containing in the same housing one or two of the following units: storage units, input/output units;

2.1.2 Servers and storage-related network equipment

- **26302320** – Machines for the reception, conversion and transmission or regeneration of voice, images or other data, including switching and routing apparatus;
- **26302370** – Other apparatus for the transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network), other than transmission or reception apparatus of HS 84.43, 85.25, 85.27 or 85.28.

[1] https://ec.europa.eu/eurostat/web/prodcom

[2] https://ec.europa.eu/eurostat/web/main/home

[3] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R2119

2.1.3 Storage equipment

- **26202100** – Storage units;
- **26203000** – Other units of automatic data processing machines (excluding network communications equipment (e.g. hubs, routers, gateways) for LANs and WANs and sound, video, network and similar cards for automatic data processing machines);
- **26202200** - Solid-state, non-volatile data storage devices for recording data from an external source (flash memory cards or flash electronic storage cards), unrecorded

These categories include a wide range of products, and it is not clear exactly which devices each category covers, as the aggregation level of data remains relatively high. There are some concerns when using the PRODCOM data, where the codes and their scope are not completely clear:

- The scope of 26.20.14.00 code is not completely clear but this code is more likely to represent coding for computer mainframes.
- The scope of 26.20.15.00 code is not completely clear but it is more likely to represent coding for computer servers.
- 26.20.21.00 storage units may not apply to data storage devices as intended in the study. This is because it is possible the code is covering units such external hard drives, or USB keys.

Table 2.1 Market data for servers and data storage equipment in 2021 (EU-27)[4].

PRODCOM NACE Code	Quantity in 1000 units				Value in million €			
	Production	Import	Export	Apparent EU consumption[5]	Production	Import	Export	Apparent EU consumption
26201400	3,720	1,064	1,000	3,784	48,800	10,910	14,706	45,004
26201500	2,000	16,868	6,508	12,360	1,671	6,690	6,472	1,889
26202100	6,000	95,120	21,794	79,326	590	8,555	3,548	5,597
26203000	3,325	n/a*	n/a	n/a	428	n/a	n/a	n/a
26202200	390	5,187	640	4,937	144	2,616	574	2,186
26302320	53,625	n/a	n/a	n/a	3,558	27,958	14,075	17,441
26302370	13,735	n/a	n/a	n/a	1,408	640	654	1,394

**n/a – Data not available.*

The data presented in Table 2.1 represents the overall EU-27 production, trade, and apparent consumption in 2021 according to the seven PRODCOM categories. The 2021 data are the latest available at the time of writing this report. These values are compared below in Figure 2.1 and Figure 2.2.

[4] Source: PRODCOM

[5] Apparent EU Consumption = EU production + EU imports – EU exports

Figure 2.1 Market size for servers and data storage products in the EU-27 in 2021[6]

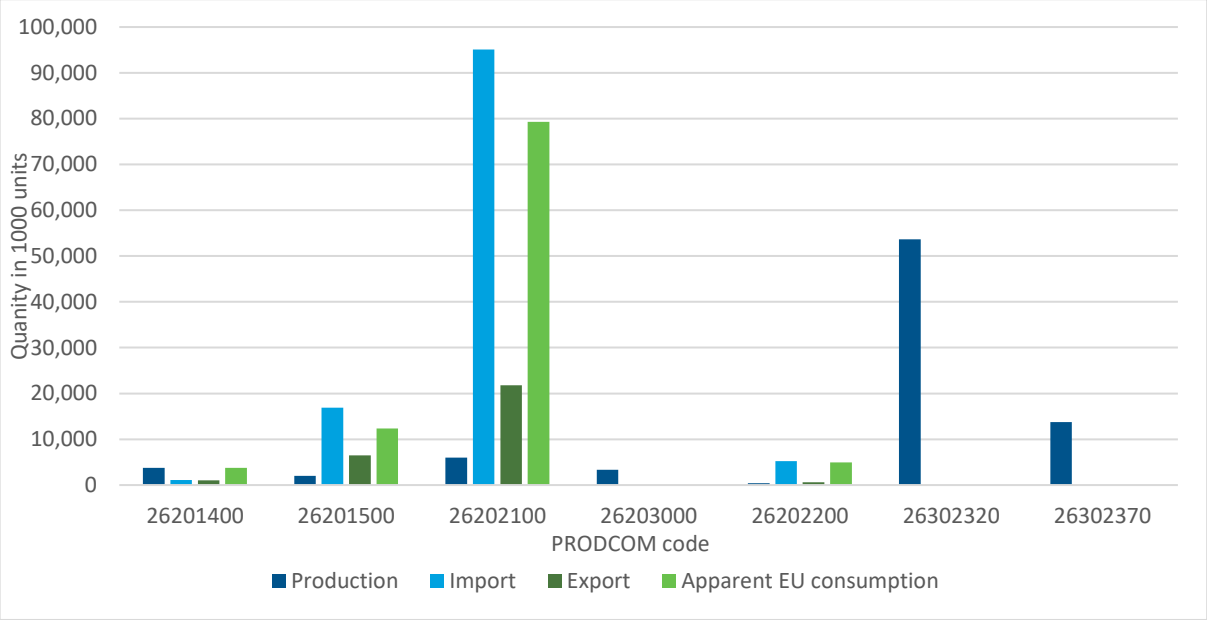


Figure 2.1 demonstrates that data storage products have the highest unit sales. However, due to the discrepancies in the PRODCOM code for 26202100 “Storage Units”, it is not clear what type of storage units are specifically included. It should also be noted that it is common practice to count storage products in terms of GB of storage, rather than number of devices as is presented by PRODCOM. Consequently, this may explain the order magnitude difference for this category. Hence, later on in this report we have analysed the capacity of data storage products as well as the number of shipments. This is displayed in **Error! Reference source not found.** and **Error! Reference source not found.**.

For servers, imports are greater than exports, which is expected, with most servers manufactured outside of the EU, as described in Section 2.4. Figure 2.1 demonstrates that production of servers and storage related network equipment is also one of the major markets for the EU regulation. However, there was no data on imports/ exports for these PRODCOM codes Thus, a full picture of the EU market is not available for servers and storage related network equipment.

[6] Source: PRODCOM

Figure 2.2 Market value for servers and data storage products in the EU-27 in 2021[7]

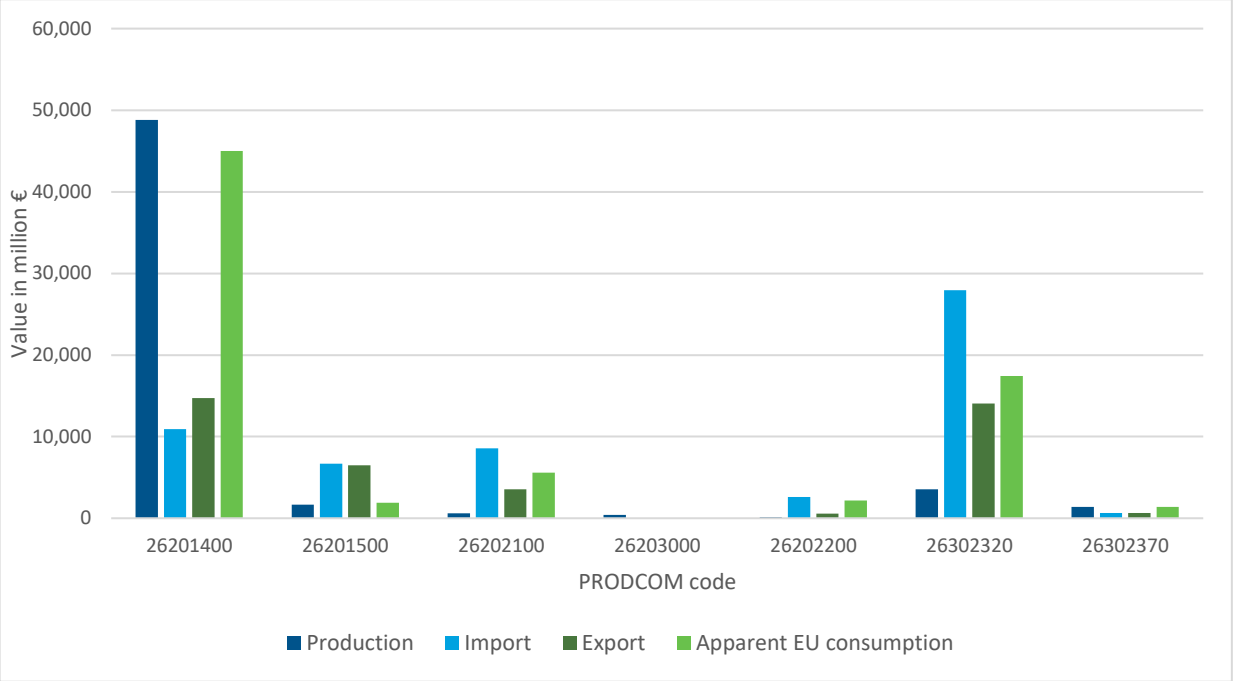


Figure 2.2 demonstrates the market value of imports, exports. From Figure 2.2 it is clear that the values of imports are far superior than exports for servers and storage-related network equipment. In addition, for the individual categories for servers and data storage products imports, imports appear to be greater. There is a significantly high production value for the "*Digital data processing machines: presented in the form of systems*". However, it is difficult to determine how servers impact this value, judging by the import values in Figure 2.1 it looks to be quite small, as imports are high in the EU.

Overall, due to this heterogenous nature of the data collected from PRODCOM this data does not present the best available source of sales, production, and trade. However, PRODCOM does provide a reference point to ensure that data utilised later on in the document is accurate. This breakdown limitation that the PRODCOM codes presented above will only serve for informational purposes. PRODCOM data will not be considered in the environmental and life cycle assessment analysis during this study.

2.2 Market and stock data

This section looks to provide the market analysis for servers and data storage products further than the PRODCOM data. Providing market and stock data for servers and data storage products covered by the Regulation 2019/424.

2.2.1 Manufacturer and Supplier Engagement

To collect data, we have circulated qualitative and quantitative questionnaires with over 150 stakeholders. Table 2.2 demonstrates the level of engagement received for both the questionnaires.

[7] Source: PRODCOM

Table 2.2 Number of responses to questionnaires circulated.

Type of Questionnaire	Number of responses
Qualitative Questionnaire	19
Quantitative Questionnaire	3

Off the back of this, we very much hope stakeholders will engage further with the study, in light of this information.

2.2.2 Sales data at global and EU level

2.2.2.1 Servers

Sources such as Statista, provide figures for the global and EU server market value and shipments. Table 2.3 below presents this data. Calculations have also complemented certain gaps in the data, such as by assuming that the EU percent share of the global market has continued to decrease at the same rate since 2019, and that the average price per unit has not changed significantly since 2020.

Table 2.3 Server market and Shipment data (Statista and ICF calculations)[8]

	2019	2020	2021	2022	2023	2024	2025	2026	2027
Global server market revenue ($bn)	87.18	91.02	*90.94*	*90.86*	90.78	96.04	101.60	107.48	113.70
Global server shipments (million units)	11,74	12,15	*12,14*	*12,13*	*12,12*	*12,82*	*13,56*	*14,35*	*15,18*
EU server market revenue ($bn)	*12,68*	*13,18*	*13,10*	*13,03*	12,95	13,63	14,35	15,10	15,9
EU server shipments (million units)	*1,71*	*1,76*	*1,75*	*1,74*	*1,73*	*1,82*	*1,92*	*2,02*	*2,12*
EU percent of global market share	*14,55%*	*14,48%*	*14,41%*	*14,34%*	*14,27%*	*14,19%*	*14,12%*	*14,05%*	*13,98%*

Figures in italics have been calculated from the statista data

The data shows how the server market is currently expected to grow until 2027. This has changed since 2020, as the covid-19 pandemic slowed sales between 2020 to 2022. The EU share of the global market is approximately 14%, but has been decreasing, despite continued growth of the EU revenue. This is due to the strong growth of the Asian market.

[8] Servers - EU-27 | Statista Market Forecast ; Servers - Worldwide | Statista Market Forecast ; Server shipments worldwide 2020 | Statista; Server market revenue worldwide 2020 | Statista ; End user server spend worldwide 2019-2024 | Statista

Information request

Sales data divided by the server's form factor has not been sourced, therefore further engagement from stakeholders is required.

2.2.2.2 Data Storage Products

Data storage units can either be host based or external controller based as displayed in Table 2.4.

Table 2.4 Storage options for data storage products

Host Based	External Controller Based
Internal	All External
External	iSCSI
SATA	Fibre Channel
SCSI	
JBOD Enclosures	

Table 2.5 Data storage product market revenue data (Statista and ICF calculations)[9]

	2020	2021	2022	2023	2024	2025	2026	2027
Global server market revenue ($bn)	41,15	*43,41*	*45,79*	47,92	50,59	53,41	56,38	59,52
EU server market revenue ($bn)	*6,04*	*6,32*	*6,61*	6,86	7,18	7,52	7,87	8,23
EU percent of global market share	*14,68%*	*14,56%*	*14,44%*	*14,32%*	*14,19%*	*14,07%*	*13,95%*	*13,83%*

Figures in italics have been calculated from the statista data

As with servers, the data storage market is expected to continue growing until 2027. However unlike for computer servers, the demand for storage did not decrease in 2021-2022 due to the covid-19 pandemic. The EU share of the global market is approximately 14%, but has been decreasing, despite continued growth of the EU revenue. This is due to the strong growth of the Asian market.

Information request

Feedback is requested from the stakeholders on shipment values and total GB capacity sales of storage for the data storage product categories:

- Storage Area Network (SAN)
- Direct Attached Storage (DAS)
- Network Attached Storage (NAS)
- Content Addressed Storage (CAS)

[9] Storage Report 2021 | Statista ; Storage - EU-27 | Statista Market Forecast

2.2.3 Sales growth rate

The global server market is estimated to grow by 5.79% Compound Annual Growth Rate (CAGR) from 2023 to 2027. For the EU, this growth is forecast to be 5.26% from 2023 to 2027, raising the market share from 12.95$bn to 15.9$bn.[10] It is noted that the growth rate of the EU market is lower than that of the global figure, as although the industry continues to develop, the Asian market is expected to grow at a faster rate, justifying the difference.

Similarly, the data storage market is expected to continue to grow by 5.57% CAGR globally, and by 4.67% in the EU, from the years 2023 to 2027. The EU market is expected to grow from 6.86$bn to 8.23$bn from 2023 to 2027.

2.2.4 Product Lifetimes

There are several different types of "lifetimes" that need to be clarified to avoid confusion:

- **The economic lifetime**: is the time after which equipment is renewed by the owner/operator for economic and business reasons; and
- **The technical lifetime**: is the time after which the product no longer functions and cannot be repaired. This is usually longer than the economic lifetime.

Servers and data storage equipment can have a technical lifetime of greater than 10 years for certain equipment. However, this can be impacted by the modularity of the equipment because this makes it difficult to determine the composition of the equipment. This can be caused by failing components (e.g., memory) which are replaced meaning after a several years in service the product could be composed of completely different components, while still being the same product.

There are several reasons why servers and data storage products may undergo early replacement before the end of the technical lifetime, and even before the end of their economic lifetime. This revolves around improving the energy efficiency of a data centre. It may become apparent that the latest technologies are significantly more efficient than current installations. Improvements include a new capacity, service contracts and operating system conversions. For example, technologies such as virtualisation and those arising from software defined hardware structures (e.g. Software Defined Data Centres, etc.) will reconfigure or accelerate retirement of older systems.

Table 2.6 provides an overview of the estimated lifetime for servers and data storage products. This data has been extracted from the previous Task 2 preparatory study conducted for this regulation. It is clear from Table 2.6 that there is a significant difference between the economic and average lifetime of these products.

[10] Source: Servers - EU-27 | Statista Market Forecast

Table 2.6 Average lifetime, by type of equipment[11]

Equipment type	Average economic lifetime (in years)	Average technical lifetime (in years)
Rack-blade, rack-mounted, tower/ standalone and multi-node servers	3 for lease 3 to 5 for primary users Up to 5 to 7 for secondary user	7 - 10
Mainframe servers	7 - 15	20
Data storage products (HDD, SSD and hybrid drives)	5 – 7	15 - 20

Following ICF's research into the lifetime of servers and data storage products. It was determined that the values for lifetime remain accurate in 2023. Therefore, these lifetime values have been presented again in this Task 2 report.

2.2.5 Replacement rates and new sales

Overall sales figures are determined by the new sales and replacement sales. It is important to distinguish between these two sale types:

- **New sales:** result from new service needs
- **Replacement sales**: involve replacing products that reach their economic lifetime

The previous preparatory study indicated that the sales growth rates would diminish due to increased utilisation rates through virtualisation. However, stakeholder feedback indicates that utilisation rates have not significantly increased, meaning that server sales have continued to increase at a similar pace to what was displayed in **Error! Reference source not found.**.

2.2.6 Installed base (stock)

The objective of this section is to present forecasts of the installed stock development of the different products in scope of Regulation 2019/424. The forecasted stocks are geographically limited to EU-27. It should be noted that that servers and data storage products undergo very fast technological changes. It is for this reason that the long estimations required by the MEErP tool must be considered with caution. These estimations are based on the current knowledge and perspectives of the market and new calculations based on updated data may result in variations to the outcome.

2.2.6.1 Installed stock for servers.

Information on the section for installed stock of servers.

The installed stock will be calculated by the study team in Task 5, when the modelling is undertaken. Therefore, Table 2.7 will remain blank until Task 5 is completed. This is due to a current lack of available data at the disposal of the study team.

[11] Source: Preparatory study for implementing measures of the Ecodesign Directive 2009/125/EC, DG ENTR Lot 9 - Enterprise servers and data equipment, Task 2: Markets, July 2015: Final report, bio by Deloitte & Fraunhofer IZM

Table 2.7 Servers Installed stock base (in thousand units)

Server Types	2015	2020	2022	2023	2025	2030	2040	2050
Rack-blade server								
Rack-mounted server								
Tower/standalone server								
Multi-node server								
Total units								

2.2.6.2 Installed stock for data storage products.

Information on the section for installed stock of data storage products.

The installed stock will be calculated by the study team in Task 5, when the modelling is undertaken. This is due to a current lack of available data at the disposal of the study team.

2.3 Market channels

2.3.1 Link to Phase 1 report

The Phase 1 report introduced the procurement practices for servers and data storage products in Section 2.7. This section of the Task 2 report will introduce the procurement practices for servers and data storage products. Section 2.4 and Section 2.4 and Section 2.7 of this Task 2 report will also provide information on the procurement practices of servers and data storage products.

2.3.2 Channels to market

Servers deliver a data service which can be delivered anywhere around the globe with an internet connection. However, despite the capability of delivering a service remotely, there are considerations for the market to be aware of around economic, political and security concerns.

- Servers are heavily tied to the financial sector, which relies on servers for processing financial information, and therefore regulations around servers may have impacts on the finance industry.
- On political matters, data privacy concerns, notably the development of GDPR, has led to the development of servers to host data domestically. For security reasons, countries may not only want servers to be hosted domestically but also manufactured domestically, as there may be concerns of the creation of backdoor access mechanisms created during the manufacturing process.

2.3.3 Direct sales to customers

There is mixed feedback from stakeholders on the route to market for servers and data storage products. The North American market is dominated by purchasing occurring directly from Original Equipment Manufacturers (OEM) to the end user client. These purchasing decisions are made primarily around the technical performance capabilities of the product. With regards to energy efficiency, the procurement metric in North American market is to ensure that devices meet the Energy Star criteria.

In Europe, purchasing decisions are similarly focused on technical performance. However, stakeholder feedback discussed in the Phase 1 report, provides a mixed picture that distributors may have a more active involvement in the sales of servers and data storage products, instead of sales coming directly from manufacturers.

2.3.4 Distribution routes

The product distribution channels of the products eligible for Regulation 2019/424 are mostly business-to-business. This is because servers and data storage products usually require experience and engineering knowledge for proper installation and configuration. Within the Phase 1 report, stakeholder feedback has indicated that the route to market in Europe is directly from manufacturers and through distributors.

2.3.5 Installation services

Servers are expensive to not only purchase, but also to install. Therefore, installation costs must also be considered when purchasing the product. Installation services are usually offered by the manufacturer selling the product at an additional fee. In addition, most manufacturers include warranties within their purchase prices for servers and data storage products. Usually, these warranties stand for three years from the date of purchase. However, this can be as low as one year for low-end models or as high as seven years, in some instances.

Installation costs are discussed in greater detail in Section 2.7.3 of this report.

2.4 General market trends

There are several market trends that can influence the sales and stock of IT equipment, these include:

- **Cloud services:** this includes software as a service such as productivity software. It also relates to media and data storage, video streaming, customised media services and gaming platforms. Cloud services demand high volumes of storage capacity.
- **Big data:** this incorporates ubiquitous and automatic sensor data acquisition, automatic filing and analysis, software-defined IT resource utilisation and increased data security provisioning. In recent years there has been an increased collection of sensor data, transportation, energy grids, environmental applications, customer relationships and other end-user data. The development of these data sources has seen servers and data storage products evolve to adapt to the increased storage needs.
- **Fixed-mobile conversion:** mobile computing and communication is an important market driver for servers and data storage products.

- **Security and encryption:** the secure communication and data handling will always drive evolution of the design and architecture of products. Encryption technology continues to grow, especially with the likes of Crypto currency becoming ever popular. This growing trend has led to both software and hardware-based solutions. The SPEC SERT test standard reflects the demand in encryption technology by testing a specific encryption workload (worklet).
- **Real time computing:** immediate communication (latency and bandwidth) is continuing to increase in demand, especially post Covid-19 with hybrid working practices still being popular.

2.5 General trends in product design and product features

The key drivers with respect to product features are expandability, reliability, energy efficiency and cost. There is significant recognition of the resource limitations within a data centre, therefore, most market segments will aim to maximise useful output.

Servers tend to be hosted in two types of locations: distributed IT (where servers are used in offices or other buildings which are not dedicated for servers), and datacentres (which are specialised locations for server usage, with dedicated power and HVAC services).

The bulk of servers are operated within datacentres. The trend has been to consolidate data operations in data centres as their operation is optimised, allowing for better tracking of energy usage across devices and support systems. These buildings can also be reinforced in terms of data connectivity and power availability.

Within the datacentre ecosystem, there are a few different models: Enterprise IT (which are locations which are owned by a single operator, with only their servers present), Colocation IT (which are datacentre spaces which provide a space with appropriate temperature, power, and internet connection for operators to rent for their servers).

The services provided by servers may be directly for owners or could be provided under the following cloud services: Infrastructure as a Service (IaaS) or Platform as a Service (PaaS). IaaS provision allows for a user to hire the control over a virtual machine, with a set storage and workload capabilities. PaaS is used for general software development and hosting the software after development, for example to host a website. The markets of IaaS and PaaS are globally dominated by AWS, Microsoft Azure, Alibaba cloud and Google cloud (GCP), with a combined forecasted revenue estimated at 167.3 billion US dollars.

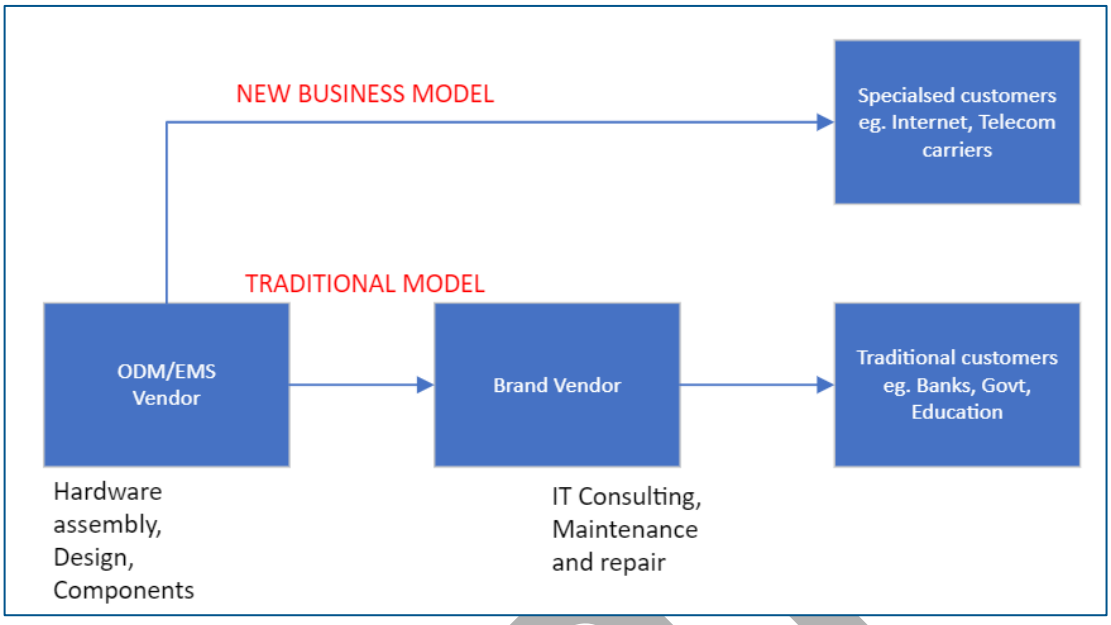
Lastly datacentres are crucial for the delivery of Software as a Service (SaaS), often called web services. SaaS makes applications available to the end user via the internet, such as Gmail, Microsoft 365, OneDrive, Netflix, etc.

It is important to note that nearly one third of the server market sales are comprised of white box original design manufacturers (ODM) servers which are customised by or for customers[12]. These products are produced by manufacturers including Quanta, Wistron, Inventec and shipped unbranded directly to customers. These products are not currently regulated due to their custom nature but make up a notable portion of the market and are often deployed in hyperscale data centre environments where the server is designed to maximise efficiency for a specific

[12] https://datacenters.lbl.gov/sites/default/files/EnergyUsageWebinar12062016.pdf

corporate or research workload at reduced cost (typically 25-30%)[13]. Figure 2.3 illustrates the divergent pathways that split the servers and data storage market.

Figure 2.3 OEM vs. ODM sales channels in computer server market[14]



In terms of product diversity, it is expected that this will continue to increase through the EU. This is being driven by the big data, fixed-mobile conversion, encryption and secure communications and cost considerations. It is common for vendors to introduce new products approximately every 18 to 24 months. These products are usually much more power than the previous generation and cost roughly the same.

On a technical level there are several emerging technologies that the project team has identified and that it believes should be considered when updating the regulation requirements. These technological, market and regulatory evolutions include:

- The emergence of storage “heavy” servers, or servers with an abnormally high capacity of storage devices which make it difficult to distinguish with storage products.
- Persistent memory, and how that creates a grey area between DRAM and traditional storage in both servers and storage products.
- Better defining and addressing hyperconverged servers which perform server, storage, and network functions in a single enclosure, presenting a very challenging testing case as testing all functions simultaneously is not currently possible.
- Updates in HPC, AI, and machine learning architecture, and how those updates may allow those products to be regulated more easily.
- Ebbs and flows in the adoption of virtualisation in server deployments.
- Impacts of broader data centre consolidation, along with the recent push back towards the edge particularly in telecom operations due to increased bandwidth

[13] https://www.ventureoutsource.com/contract-manufacturing/focus-odm-quanta-it-shift-cloud-infrastructure-leaving-dell-hp-traditional

[14] Source: ICF

needs and 5G infrastructure support. Particularly how increased rack density is impacting both deployment models as well as product design.

2.6 Market segmentation

2.6.1 Market share

The market for servers and data storage products in the EU is dominated by a few large manufacturers, who are key global players and produce their products outside of the EU-27. Meanwhile, small, and medium enterprises (SMEs) have a very low share of the EU market. Manufacturers of OEM servers and storage products are mostly based in the US (HPE, IBM, Oracle, Cisco, Dell, NetApp) and the Far East (Lenovo, Fujitsu, NEC, Inspur, Huawei). This correlates with the data in Table 2.1. This demonstrates how the EU is dependent on imports. Sales for servers and storage are mostly done directly as a business-to-business transaction by manufacturers themselves.

Many of the manufacturers are well represented by industry associations at the Member State level, mainly through DIGITALEUROPE[15] and The Green Grid[16] in the U.S. DIGITALEUROPE represents the European digital technology industry, which includes large and small companies in the Information and Communications Technology and Consumer Electronics Industry sectors, grouping more than 10,000 companies all over Europe. Some of the main equipment manufacturers are listed below in Table 2.8.

Table 2.8 List of manufacturers of servers and data storage products.

Servers	Data storage equipment
• Cisco • Dell • Fujitsu • Hitachi • HP • IBM • Inventec • Lenovo • NEC • Oracle • Quanta • Supermicro • Wistron	• Dell • EMC • Fujitsu • HGST • Hitachi • HP • IBM • NEC • Netapp • Oracle • Seagate (Xyratex) • Western Digital

The product distribution channels of Regulation 2019/424 products are usually conducted via the business-to-business route. This is because these products usually require experience and engineering knowledge for proper installation and configuration.

2.6.2 Manufacturer product ranges

Overall, it is expected that product diversity of the market for servers and data storage products will continue to increase. This is driven by specialised applications

[15] https://www.digitaleurope.org/

[16] https://www.thegreengrid.org/

such as big data, fixed mobile conversion, encryption, and secure communication. Manufacturers introduce new products approximately every 18 to 24 months that are more powerful than the previous generation and at roughly the same price.

2.6.3 Market segmentation by technologies

2.6.3.1 Servers

The server's market is typically segmented by several factors such as its operating system (Windows, Linux, UNIX etc), server classification (high-end, mid-range, volume servers), server type (rack, blade, multi-blade and tower), end use (IT and telecommunications, retail, healthcare, media etc) and finally, geography[17].

The Regulation splits server types based on the form factor of the server. The form factor represents the size, configuration and physical arrangement of the server. Regulation 2019/424 covers the following four form factors for servers:

- Rack-blade servers
- Rack mounted servers
- Tower/ Standalone servers
- Multi-node servers.

2.6.3.2 Data storage products

Table 2.4 displayed the storage options that are present for data storage products, with storage options either host based, or external controller based. External based controller storage options are the focus of the Regulation, these are displayed below. External controller-based disk storages devices are a system that has one or more embedded controllers.

As discussed previously in Section 2.2.2.2, there are four dominant external controller-based storage units into the following four categories:

- Storage Area Network (SAN)
- Direct Attached Storage (DAS)
- Network Attached Storage (NAS)
- Content Addressed Storage (CAS)

2.6.4 SMEs

As discussed in Section 2.6.1 large manufacturers dominate the market, meaning that SMEs have a very small share of the EU market share of products. This was also confirmed by the manufacturer's responses in the questionnaires and is highlighted in the Phase 1 report.

[17] https://www.mordorintelligence.com/industry-reports/enterprise-servers-market

2.7 Consumer expenditure base data

2.7.1 Prices as sold

2.7.1.1 Servers

Server price ranges were separated by the four form factors displayed below, with the number of rackets being considered as well. This data was obtained from the previous preparatory study, inflated to the 2022 rates rounded to the nearest 100[18] after being compared and adjusted with current market prices as advertised on company websites.

Table 2.9 Purchase prices (excl. VAT) of typical server products in Euros (€) / unit[19]

Product Type		Range of purchase price (€/ unit)
Servers	Number of rackets	
Rack managed	1	800-1500
Rack managed	2	1500- 90500
Tower managed	2	900 -5500
Blade managed	4	4200-14000
Rack resilient	2	5900-8000
Rack resilient	4	4000-85700

Table 2.9 illustrates that there is a wide range of prices for servers, in particular servers with two or four rackets. This again relates to the fact that servers are highly customisable products. Since there are many configurations that a consumer can choose for the same product, prices vary greatly. On the manufacturers websites there are often starting prices presented for simple configurations, with the prices increasing based on the configurations which are chosen. The following types of configurations are likely to have the greatest influence on the price of a server:

- Number and speed of CPUs;
- Type, speed and capacity of the memory;
- Type, number and size of disk drives;
- Operating system;
- Years of warranty included.

2.7.1.2 Data storage products

Price ranges for storage systems are given in Table 2.10 for the four different types, namely CAS, DAS, NAS and SAN. This data was obtained from the previous preparatory study, compared with current prices online and inflated to the 2022 rates rounded to the nearest 100[20].

[18] Statistics | Eurostat (europa.eu)

[19] Source: Preparatory study for implementing measures of the Ecodesign Directive 2009/125/EC, DG ENTR Lot 9 - Enterprise servers and data equipment, Task 2: Markets, July 2015: Final report, bio by Deloitte & Fraunhofer IZM

[20] Statistics | Eurostat (europa.eu)

Table 2.10 Purchase prices (excl. VAT) of typical data storage products

Type of storage system	Range of purchase price (€/ unit)
CAS	118900-243800
DAS	4700-75600
NAS	3300-60600
SAN	5800-43000

Like servers the price ranges for data storage products are very broad. This is dependent on several features related to the maximum amount of storage of the storage system. Additionally, the maximum number of drives and hence the capacity impacts the price. The number of drives is characterised by their type (HDDs or SDDs). Drive features and read/ write intensity significantly impact the price of drives. For example, a storage system with a write-intensive drive, with the same speed and size costs twice as much as a drive without this[21]. This is because write drives are able to transfer large amounts of data to the drive.

Prices also vary because of the following two technical specifications: high performance tiering, which increases the array of input-output performance; and SSD cache, which accelerates application performance by utilising SSDs as extended controller read cache.

Table 2.10 illustrates that CAS are the most expensive storage products on the market. This is because CAS storage units have a high number of drives and hence, a large capacity. They are significantly more expensive than SAN and NAS storage products which have a smaller capacity.

2.7.2 Production costs

Manufacturers were invited to provide feedback on the production costs for servers and data storage products. This is commercially sensitive information, which most manufacturers did not report.

2.7.3 Installation costs

An estimate can be made from the fact that the cost of an IT professional is on average €90-100 per hour[22]. However, this is an estimate and not a certain total.

Installation costs for servers and data storage products are usually available via the manufacturer for an additional fee. Costs can vary dramatically depending on the size of the installation, while some manufacturers do not perform installations for certain types of servers. For example, Dell charges around €340 for the installation of a blade server, but they do no offer installations for rack and tower servers. It should also be noted that different labour requirements may be required depending on the product category.

Data storage product installation is a little more expensive than server installation, costing around €425 for installation of remote onsite hardware installation with

[21] https://www.dell.com/nl-be

[22] https://www.serverpronto.com/spu/2019/04/how-much-does-a-server-cost-for-a-small-business/#:~:text=Cost%20of%20Installation&text=The%20average%20cost%20for%20an,talking%20about%20%24400-%24500.

remote configuration. The costs really depend on the type of size of the storage product being installed.

2.7.4 Energy & water costs

Electricity and water prices are presented in Table 2.11, this data has been extracted from the MEErP methodology. These values will be used during the modelling that is conducted in Task 5.

Table 2.11 Electricity and water prices in the EU-27, 2022 (Source: MEErP[23])

	Unit	Domestic incl. VAT	Long term growth p/a	Non-domestic excl.VAT
Electricity	€/ kWh	0.18	5%	0.11
Water	€/ m^3	3.70	2.50%	
Energy escalation rate	%		4%	
VAT	%		20%	

Servers and data storage products require a lot of energy in order to maintain their functionality. Therefore, this section will describe how they consume large amounts of energy and what can be done to combat this soaring energy consumption. This is especially important given the increased energy security vulnerability that have arisen from the Ukraine War. With the EU's energy prices having been heavily impacted, saving energy in data centres is vital to ensure running a facility remains economically viable in the EU.

Current practice is that heat from servers in a data centre is not normally reused and is instead released externally into the atmosphere surrounding the exterior of the data centre, an action that increases the local and surrounding temperature. Sustainable or green IT is increasing in popularity and therefore the waste heat recovery is an aspect worth exploring within this study along current applications, possibilities and practice. This is more relevant to a building level requirement and less of a product consideration.

This niche application is being put in practice in certain situations such as at city/campus level. One of the innovators in this area, constructor of data centres, combines the locations of the centres to the surroundings, with the aim to utilise surplus heat[24]. Preference is integration with existing CHP plants or other electricity plants that enables energy recovery in combination with renewable energy. An existing example is the Main Site of EcoData centre in Falun, Sweden.

One of the most recent practices on waste heat from data centres is an initiative from Microsoft to build a new data centre region in Finland, which will support the digital transformation and at the same time enable large scale district heating. It is expected that the waste heat produced in the data centres will be converted to district heating, serving Finland's second largest city Espoo and neighbouring Kauniainen, and the municipality of Kirkkonumm. Microsoft plans to create the world's largest scheme to recycle waste heat from data centres[25]

[23] MEErP Methodology Part 1 Final (2).pdf

[24] https://ecodatacenter.se/sustainability/

[25] Microsoft announces intent to build a new datacenter region in Finland, accelerating sustainable digital transformation and enabling large scale carbon-free district heating - Microsoft News Centre Europe

Liquid cooling of servers typically provides higher energy efficiency when compared to air cooled systems and could enable the driving of data centre industry forward. Manufacturers state that liquid cooling allows optimum energy use within the IT suite so that more power drives the applications on the servers rather than the cooling systems[26]. At the same time there are free air-cooled data centres in the US and adoption of free air cooling (at least part time) is preferred at Government data centres where possible.

Proposing requirements around proper deployment or quality of water-cooled solutions could be the way forward, however as these systems are still at their infancy, comprising of less than 5% of the server market, to impose requirements on water cooled solutions in a regulatory setting requires further review and analysis. In addition, liquid cooling introduces several new considerations including safety, proper fluid handling and maintenance (to avoid mould and/or corrosion etc.) and proper system design to minimise long term problems that specifically arise with the complications of liquid cooled solutions. Liquid cooling recommendations for this review study have been put forward in Section 2.11 of the Phase 1 report.

2.7.5 Repair and Maintenance costs (€/product life);

Servers and data storage products not only have a high CAPEX but are also expensive to operate and maintain. Therefore, the cost of ownership is one of the top criteria in purchasing decisions. Often manufacturers offer a three-year repair warranty with servers, however, for the low-end products this can be as low as one year. An estimate can be made from the fact that the cost of an IT professional is on average €90-100 per hour[27]. However, the exact price of repair will be unique to each product.

Repair and maintenance costs data

The study team has not yet been able to accurately determine the repair and maintenance costs for servers and data storage products.

2.7.6 Disposal tariffs/ taxes (€/product);

Electricity, fossil fuel, water, interest, inflation, and discount rates will use the values for Jan. 2011 in MEErP Chapter 2, including the average annual price increases mentioned there. For regional differentiation of consumer prices (for sensitivity analysis) also see Chapter 2 of the MEErP.

2.8 Recommendations

The recommendations section will be finalised in the second iteration of this report once further data have been obtained.

[26] Solving Data Center hunger, EiBi, issue June 2022

[27] https://www.serverpronto.com/spu/2019/04/how-much-does-a-server-cost-for-a-small-business/#:~:text=Cost%20of%20Installation&text=The%20average%20cost%20for%20an,talking%20about%20%24400-%24500.