Bjumper

Most common causes of outages in Data Centers

Setting the Context

We are aware that technology is advancing faster every day, and more people around the world are using technology in one way or another.

Each person has their own ‘technology circle’; sometimes for work, sometimes for fun, sometimes out of necessity, and in many cases, for all three reasons mentioned. The need for interconnection is becoming more evident every day, implying a need for more resources to absorb the demand generated by the globalized society in which we live.

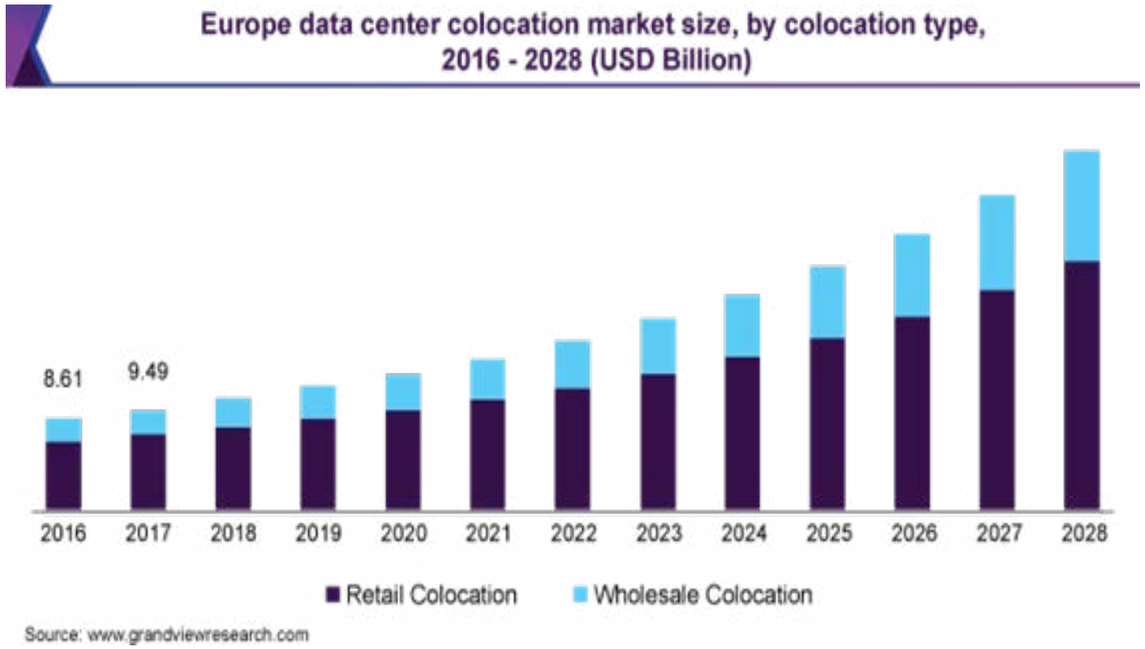
To put it in perspective, according to IDC, by 2025, it is expected that there will be more than 41 billion connected devices worldwide...

(More details in Annex - Setting the Context)

Market Size

Referring to the previously mentioned data and the Market Size Annex, along with many other sectoral indicators, it is common for investors to bet on the data center market and want to position themselves as soon as possible.

According to a study by GVR (Grand View Research), the data center colocation market in Europe was valued at USD 12.81 billion in 2020, and it is expected to expand with an annual growth rate (CAGR) of 13.1%, starting in 2021 and extending to 2028 according to the study.



As mentioned earlier, this market is driven by the high demand for colocation services from hyperscale data consumers, such as internet companies and public cloud service providers.

Facebook, Microsoft Azure, Google Cloud Platform have contracted large volumes of capacity in densely populated areas in Europe. Besides the significant advantages this brings them, they have also considered compliance with the European General Data Protection Regulation (GDPR) to ensure that data does not cross borders within each country.

One of the challenges faced by investors regarding the opening of more data centers is the limitation of space and the lack of power, so major competitors are exploring new locations such as Oslo, Berlin, Zurich, Reykjavik, Milan, Warsaw, Prague, Vienna, or Madrid.

These countries are considered potential critical points for the development of data centers throughout Europe. According to Cushman & Wakefield, data center capacity in these countries is expected to increase to **937 MW by 2024 from 492 MW in 2019**

(view more details.. in Market Size Appendix)

Outages in Data Centers

Focusing now on Outages in Data Centers, it is worth mentioning that two of the biggest challenges for Data Centers, and therefore for their managers, have always been outages and the consumption of their infrastructures.

According to a report from Uptime Institute and DCD, more than 50% of data centers have experienced an outage in the last 5 years.

Outages have always been a priority for critical infrastructure managers. As mentioned, although technology continues to bring improvements in these areas, outages remain a significant problem

We observe that the impact and costs of outages are still growing, although the causes of interruptions may be changing.

Network and software/IT configuration issues seem to be increasingly common, and energy-related problems can lead to a significant IT service disruption. Similarly, we observe that human error continues to cause problems, and many interruptions could be avoided by improving management processes and training personnel through new tools and operational management models.

While it is true, tracking interruptions is not straightforward. Not all outages or blackouts are perceived in the same way by people. Moreover, not all slowdowns or interruptions are accounted for in the same manner in these data centers.

When data centers experience outages, they typically do not immediately communicate the real reason. This information is often highly confidential and closely guarded by the data centers themselves to prevent it from being disclosed, at least until they thoroughly analyze what they are going to communicate (all logically based on the nature of the outage).

But we live in the world of communications, and we can extract certain information that helps us get an idea of what's going on through various channels, such as, for example lo:

- **Propia Empresa.** Own Company. When there are outages of a certain level, news and social media spread quickly, and we can obtain information from the company itself through press releases and statements or through relevant information that journalists gather from their sources Encuestas reconocidas y de prestigio.

- On the other hand, and perhaps more reliable, **are the surveys conducted** by major consulting companies in the sector, such as Uptime Institute, Gartner, Statist, DCD, or international organizations such as reports that can reach the European Union (JRC European Commission) or other U.S. international organizations, directly accessing their databases with relevant sector profiles.

- **Suppliers, Integrators, Manufacturers.** Information also comes through integrator companies, manufacturers, and other actors who, in one way or another, provide support and resources to data centers

Users, both businesses and individuals, are increasingly demanding and concerned about data center outages and the impact they have on their day-to-day activities

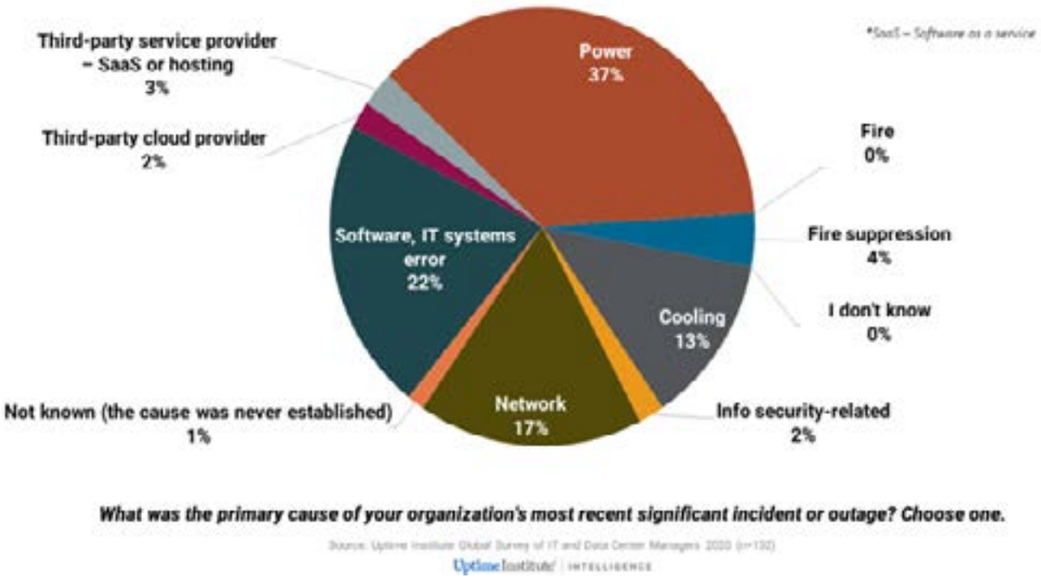
"According to UptimeInstitute in their latest data center resilience survey, nearly 44% of operators and 59% of providers believe that concern for the resilience of critical IT has increased in the last year. Only 5% believe it has decreased.

It is true that not all interruptions are equally important. For data centers, minor disruptions are nothing more than daily issues, sometimes annoying, but these interruptions should be addressed appropriately as they indicate that something is not right and requires the necessary attention to avoid consuming resources.

On the other hand, these minor interruptions also entail a cost that, in many cases, is not taken into account but, if analyzed over the year, amounts to a considerable figure.

In recent years, energy loss represented 80% of all IT load losses in consolidated data centers with good maintenance and operational service. However, nowadays, this is rare in such centers due to the work and investments made in this regard

But if we look at the overallity of data centers and surveys from various important sources in the sector, it shows that on-site power failure remains the leading cause of significant outages with 37%, followed by software/IT system issues with 22%, or network problems with 17%. Cooling is important but less significant at 13% according to the respondents. The rest of the outages are either unknown or of little significance.



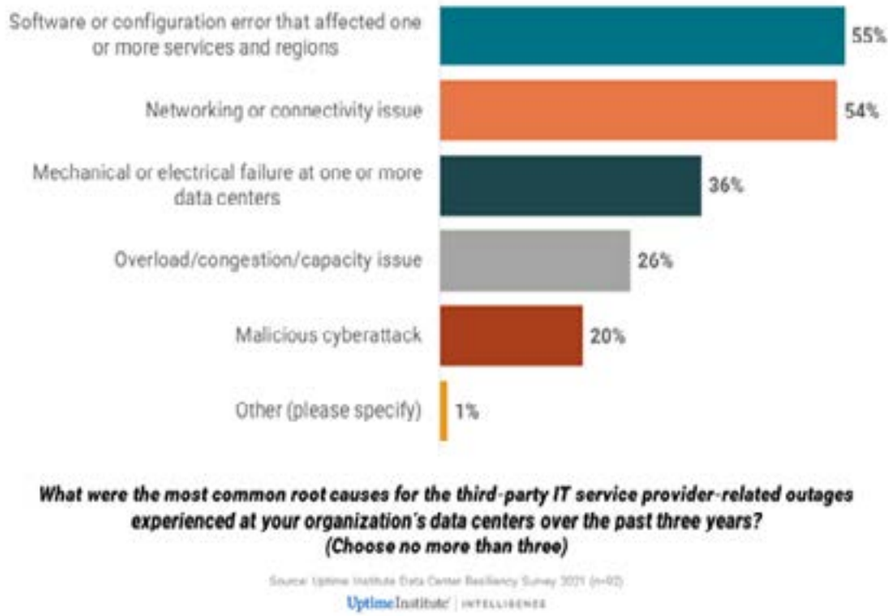
As we mentioned, many companies use service providers. This means that interruptions that occur in these centers should be or are notified to their hosted clients, as it involves them.

In these cases, the end customer is affected (immediately for a period of time), and in some cases, depending on the provider, they may not even be aware of when it happened or what it could mean for their business

These problems, whose approximate cost is often unknown, entail compensation or at least explanations that, in some cases, fail to convince hosted clients. That's why more and more end-user companies are demanding greater visibility, requesting DCiM-type tools that allow them to know or prevent possible service interruptions

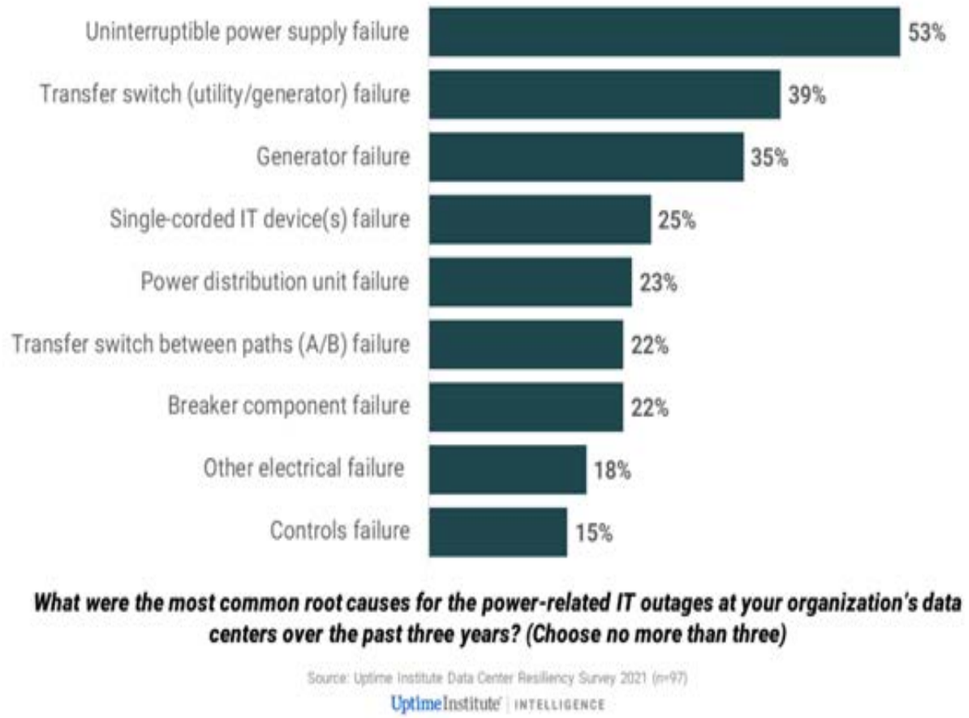
According to Uptime Institute a 2021 survey, more than 56% of organizations using hosting services have experienced some moderate or severe IT service outage in the last 3 years.

Common causes include software errors or configurations at 55%, followed by connectivity issues at 54%. Mechanical or electrical failures come next at 36%, while overloads or capacity issues account for 26%. Cyberattacks are of less impact, with 20%, according to the respondents."



"As mentioned, one of the causes of interruptions in data centers in general (and the most signiicant, although decreasing) is power-related outages.According to Uptime Institute this accounts f or around 45%, 40% according to surveys from DCD and 31% for Ponemon INSTITUTE

In this section, we find that half of the interruptions are caused by a lack of power supply, and both generator failures and transfer equipment are the next culprits of this type of failure. Other causes related to power supply interruption in data center areas are those produced by IT devices themselves or the distribution of power, such as A/B transfer switches or components/switches in power strips. Finally, controller failures .



What were the most common root causes for the power-related IT outages at your organization's data centers over the past three years? (Choose no more than three)

Source: Uptime Institute Data Center Resiliency Survey 2021 (n=97)

UptimeInstitute | INTELLIGENCE

Continuing with this section, it is worth mentioning that UPS, transfer switches, generators, PDUs are important components to consider, given the role they play in the infrastructure. However, in many cases, they do not receive proper maintenance, or their monitoring is nonexistent or inadequate. This also leads to unplanned interruptions..

It is important to consider that many i**nterruptions occur due to the wear and tear of capacitors or equipment fans,** as well as the batteries or UPS themselves. Maintenance and knowledge of their lifespan are very beneficial to prevent such interruptions and avoid adding costs associated with these disruptions. While it is true that, in many cases, they are not considered or are hidden.

Configuration errors or software update issues can be very dangerous, as evidenced by the impact on users during incidents such as the outages of Facebook, WhatsApp, and Instagram at some point agram en algún momento.

This is an error that large companies usually communicate to their audience (as mentioned at the beginning of this document). It may have a good deal of truth, but we may never know for sure.

At times, these failures are due to i**ssues with the domain system (DNS)**. A continuous failure caused by a defective software chain update can lead to significant service interruptions

Cisco ThousandEyes identified a 6**1% increase in the number of network interruptions in ISP networks and a 44% increase** in cloud provider networks between February and March 2020 (Covid-19 impact).”

For many, the use **of a NetOps strategy (**with a focus on DevOps) is necessary to reduce, as much as possible, interruptions in the IT environment. Improving the deployment and updating of applications and addressing configuration errors is vital to mitigate failures in this regard.

In conclusion, using automation and optimization tools allows for better detection of problems and anomalies within critical infrastructures and networks. Having good reports and analyses helps network administrators understand and compare the performance of their network.

Continuing with the possible causes of interruptions, **we find those directly caused by human error.** 22% according to the Ponemon Institute and 20% according to DCD. It is true that talking about percentages in this context may be estimated from various perspectives and is not an easy topic to pinpoint.

We cannot provide specific figures, but we can share our experience in this regard. In Bjumper, we have noticed throughout our conversations with Data Center managers that there are certain possible causes that are supported and shared by them.

We mainly encounter errors caused by :

- Lack of rigor in following procedures .
- Incorrect or poorly planned procedures at certain critical points or less critical but troublesome points.
- Inadequate maintenance without having real, rigorous, and valuable information. Lifespans of equipment.
- Clear design errors or alarm programming errors; lack of valid thresholds.
- Insufficient preventive maintenance.
- Lack of tools and training for personnel to prevent potential failures.
- Lack of qualified or sufficient personnel. Multitasking individuals in repetitive processes can lead to exhaustion and lack of concentration.
- These errors can be significantly mitigated with a good operational framework and well-implemented tools that support and reinforce the personnel asset.

All these errors are easily detectable and can be largely mitigated through the implementation of tools that are part of a good operational framework, where process optimization and automation are significant

Costs of Interruptions

Difficult to evaluate the real cost. If we talk about service providers, it is likely that everything is reflected in the contracts, although in some cases it may be a bit complicated to understand all the possible scenarios that can occu

If we talk about proprietary data centers, the costs will depend on the analyses and tools they can have aligned with the business.

In any case, **visibility and transparency are increasingly necessar**y when evaluating these interruptions. The value of data is becoming more valuable each day and needs to be analyzed and aligned with the business..

Having good data can significantly help in making a closer estimate of the real costs. Therefore, at Bjumper, we advise, as far as possible, to use tools that provide more information related to **critical infrastructure,** such as operational movements management, comprehensive control of maintenance, systems that analyze and prevent possible failures by generating anticipation, or the proper planning of procedures or structural designs.

As examples, we can point out some outages that have had certain relevance in the market, such as:

Delta Airlines faced a loss of $150 million in 5 days due to the cancellation of 200 flights, with a total cost of $150 million in 2016. The outage was caused by an electrical component failure that led to the shutdown of the transformer supplying power.

Another well-known case is that of **British Airways in 2017,** which experienced an outage leading to the cancellation of 400 flights, affecting over 75,000 passengers. The incident cost approximately $200 million in 3 days. The cause was a power loss in its UK Data Center.

In 2021, the most significant disruptions were caused by infrastructure and service providers, impacting a large number of companies and consequently, users.

One of the early disruptions occurred on January 26, 2021, at Verizon, affecting users in the United States. Many users were left without service when Verizon's FIOS network went down. According to Verizon officials, the disruption was due to a software issue, not a fiber break, as initially mentioned

In March 2021, we learned about the severe fire at **OVH**, one of the world's major hosting companies, which caused a global outage for thousands of websites. A few months later, in October, there was another significant outage. In this case, after various investigations, the company's president, Octave Klaba, admitted that the outage was due to "human error"—specifically, a misconfiguration of the router that led to the network failure.

El On October 4, 2021, there was a significant outage affecting **Facebook, WhatsApp, and Instagram. I**t was an interruption that lasted about 7 hours and also impacted all companies using Facebook's authentication.

The outage occurred due to a routine maintenance task gone wrong. According to Facebook's Vice President of Infrastructure, Santosh Janardhan, an accidental command was executed that wiped out all connections on their backbone network, disconnecting all Facebook data centers.

It should be noted that not only did the services go down, but also the tools used to manage the services. An error in the use of those audit tools prevented the command from being stopped, leading to the deletion of systems that respond to DNS queries..

On December 15, **Azure AD** experienced an Active Directory outage. The service was down for 1.5 hours, and users were unable to log in to Microsoft Office 365 services.

Estos These are some examples of data center outages, but... **How much did this cost them in money? And how much did it cost their clients?**

It's challenging to determine the real cost and the implications of interruptions and downtime in data centers. Depending on who and how it's presented, we might draw different conclusions. However, what we do know is that these interruptions, to a greater or lesser extent, have direct and indirect costs that are entirely associated with the disruption.

That is very difficult to assess, isn't it? That's why it's better to be proactive and start incorporating tools that automate the management of critical infrastructure. At Bjumper, we can help you address specific focal points or critical areas that we already know can lead to disruptions of one level or another.

When we think and analyze, a multitude of costs associated with interruptions and downtime in data centers come to mind."

As an example, we can discuss the costs incurred by

- Loss of direct revenue
- Third-party costs
- Costs due to loss of productivity
- Recovery costs associated with downtime and time to return to availability.

We must also take into account the inherent costs involved. On one hand, there are the costs of analyzing and discovering the reasons for such interruptions, and on the other hand, there are containment costs to prevent the interruption from escalating and to resolve it as quickly as possible.

Conclusion

Technology is advancing at an unprecedented pace, evolving much faster each year than in previous years. This leads to the user base, as discussed earlier, growing almost uncontrollably. The number of clicks is unimaginable, and as a result, Data Centers must reinforce and update themselves, at the very least, at the same rate demanded by demand and service quality.

Today, it is no longer acceptable for a Data Center to neglect investments in infrastructure management. It is a key asset/tool for its core operations. The delivery of service is vital, and consequently, Data Center Infrastructure Management (DCiM) tools are mandatory and valued by customers (both internal and external) of Data Centers.

It is clear that effective management of critical infrastructure significantly reduces interruptions, whether caused by power failures and devices or those resulting from human errors, thereby maximizing uptim

Activities as important as:

- The collection of data to prevent potential outages caused by power shortages
- Having comprehensive maintenance management to control the lifespan of equipment.
- Having visibility and traceability of all devices in real-time. I.
- Or having the appropriate operational processes....

Are some of the vital activities that must be ingrained in the DNA of any Data Center.

“ It is time to change. It is time to optimize and automate your critical infrastructure and prepare it for possible interruptions”

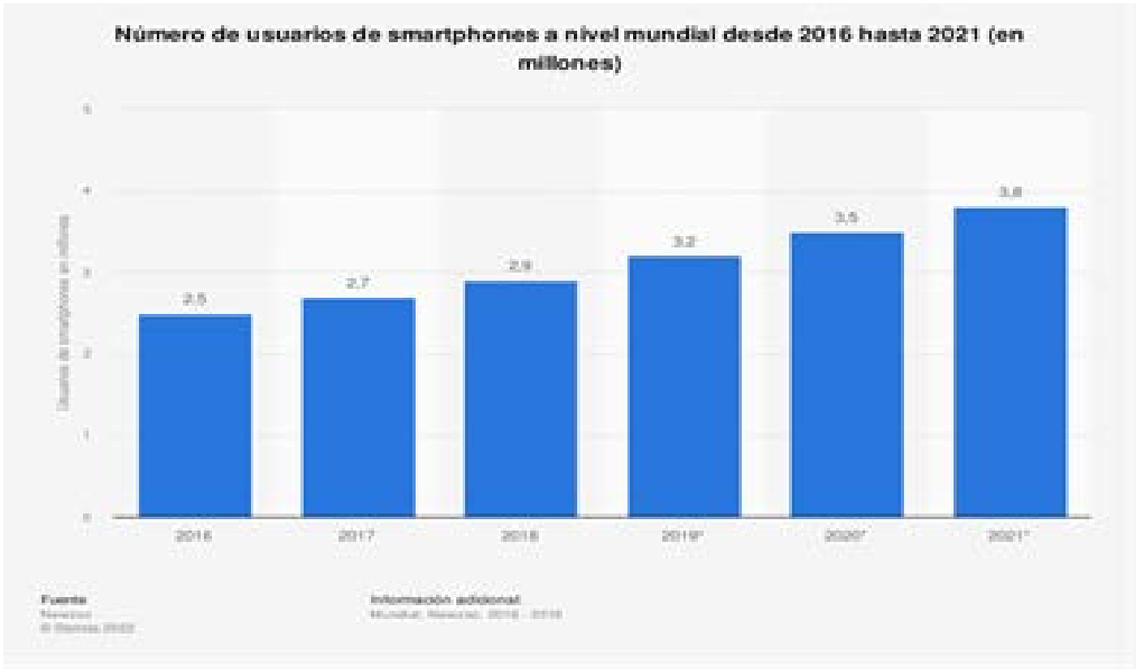
”Investing in this direction today can be the sustainability of your Data Center tomorrow.”

Bjumper

Annex.
Setting the Context

When we talk about users... televisions, washing machines, dryers, kitchen robots, thermostats, cameras, light bulbs, plugs, etc., etc., are already part of the ecosystem in many homes around the world, who would have thought just 5 years ago.

If we talk about mobile phones... Needless to say, the number of connected mobile phones worldwide and the amount of daily connections we make to the network as users.



All these connections (via mobile signal) will increase to very high figures with the incorporation of 5G and all the functionalities that this new technology brings with it.

When we talk about the business sector... what can we say? We see that the technology sector occupies the top positions in the global ranking of companies with the highest market capitalization, with Apple, Microsoft, and Alphabet leading the way. We can also see that among the top ten, 7 belong to the technology secto

Ranking de empresas por valor en Bolsa

Capitalización En millones de euros

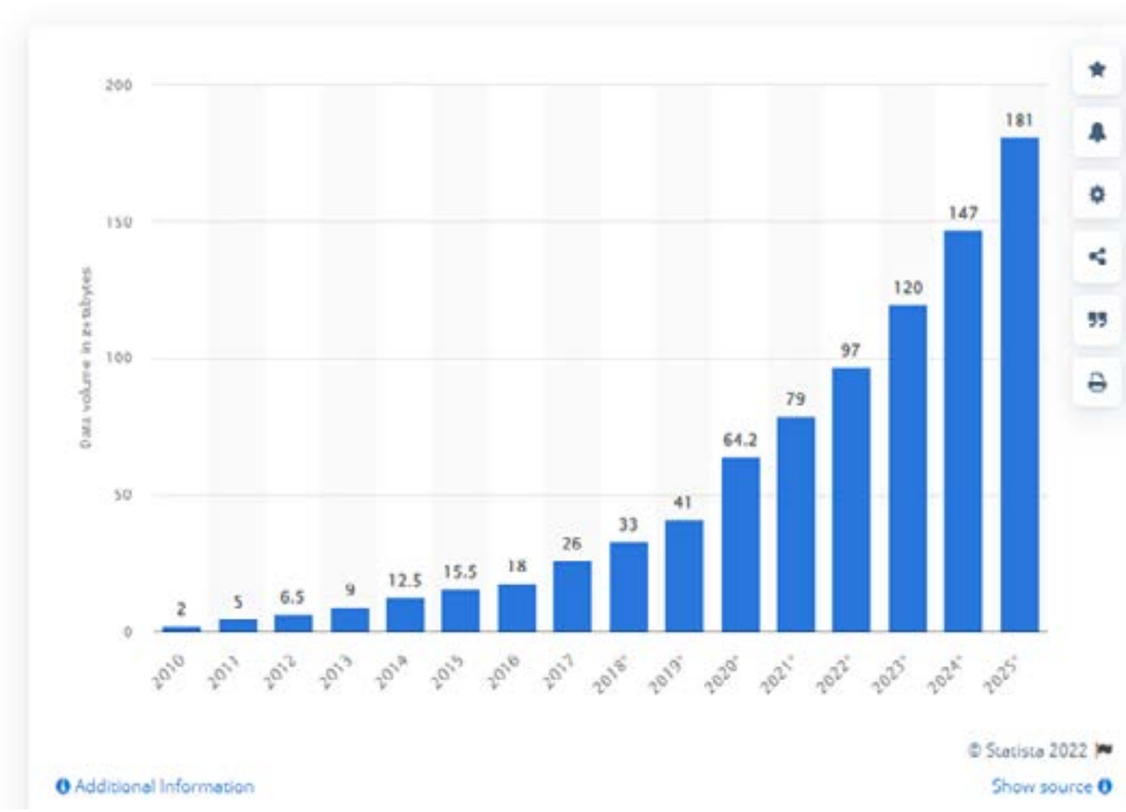
A 29 de diciembre de 2021

Nº	EMPRESA	Sector	País	CAPITALIZACIÓN	Var. anual en %	Dif. puesto s/2020
1	Apple	Tecnología	EE UU	2.603.715	36,0	0 =
2	Microsoft	Tecnología	EE UU	2.271.392	55,0	1 ▲
3	Alphabet	Tecnología	EE UU	1.721.545	67,4	2 ▲
4	Aramco	Petrolera	Arabia Saudí	1.659.235	4,7	-2 ▼
5	Amazon.com	Tecnología	EE UU	1.518.356	3,9	-1 ▼
6	Tesla	Automoción	EE UU	965.073	53,9	2 ▲
7	Meta (Facebook)	Tecnología	EE UU	844.003	25,5	-1 ▼
8	Nvidia	Tecnología	EE UU	663.563	130,0	15 ▲
9	Berkshire	Finanzas	EE UU	593.307	30,0	1 ▲
10	TSMC	Tecnología	Taiwán	510.577	18,1	2 ▲
11	Tencent	Tecnología	China	484.628	-21,2	-4 ▼
12	Unitedhealth	Salud	EE UU	421.287	46,2	9 ▲
13	Visa	Tecnología	EE UU	420.403	0,4	-2 ▼
14	JP Morgan	Finanzas	EE UU	414.569	27,9	2 ▲
15	Johnson & Johnson	Salud	EE UU	399.559	11,8	-1 ▼
16	Home Depot	Consumo	EE UU	379.559	57,9	10 ▲
17	LVMH	Consumo	Francia	367.868	45,4	7 ▲
18	Kweichow	Consumo	China	356.169	4,8	-1 ▼
19	Procter & Gamble	Salud	EE UU	351.527	21,0	0 =
20	Walmart	Consumo	EE UU	350.226	0,6	-7 ▼
21	Samsung	Tecnología	Corea	349.636	-2,0	-6 ▼
22	Nestle	Consumo	Suiza	348.560	26,5	-2 ▼
23	Bank of America	Finanzas	EE UU	323.149	50,0	6 ▲
24	Roche	Salud	Suiza	321.570	27,8	1 ▲
25	Mastercard	Tecnología	EE UU	314.065	1,7	-7 ▼

We can observe in this ranking that the top 10 companies closed with 13.35 trillion euros, which is a 11.6% increase compared to 2020.

The figures of these companies can already give us a very clear idea of the use of technology by users and businesses worldwide, and what it may mean for Data Centers.

In the following graph (Source: Statista 2022), we can see the estimated volume of data/information created, captured, copied, and consumed worldwide from 2010 to the estimated forecast for 2025 (in zettabits). We can see the significant growth expected over 10 years (2015 to 2025) and what it is currently and will continue to mean for providing the best service for Data Centers



Investments in the construction of Data Centers, both in terms of quantity and installed capacity, are a reality. The world is increasingly demanding more technology every day, and it needs to be closer to the user.

New players, such as hyperscale data centers with the latest technologies and the need to bring Data Centers as close as possible to where computing is needed (EDGE), are essential for this growth and expected demand.

On the other hand, we can see that the use of cloud solutions and services continues to grow. Companies like AWS and other industry giants are highly focused on providing the significant advantages that the cloud offers to the vast majority of businesses. This involves delivering a service that ensures continuity (flexibility, availability, scalability, security, and innovation) at sustainable and adaptable costs based on each company's strategy. This, too, will increasingly contribute to the growth of Data Centers."

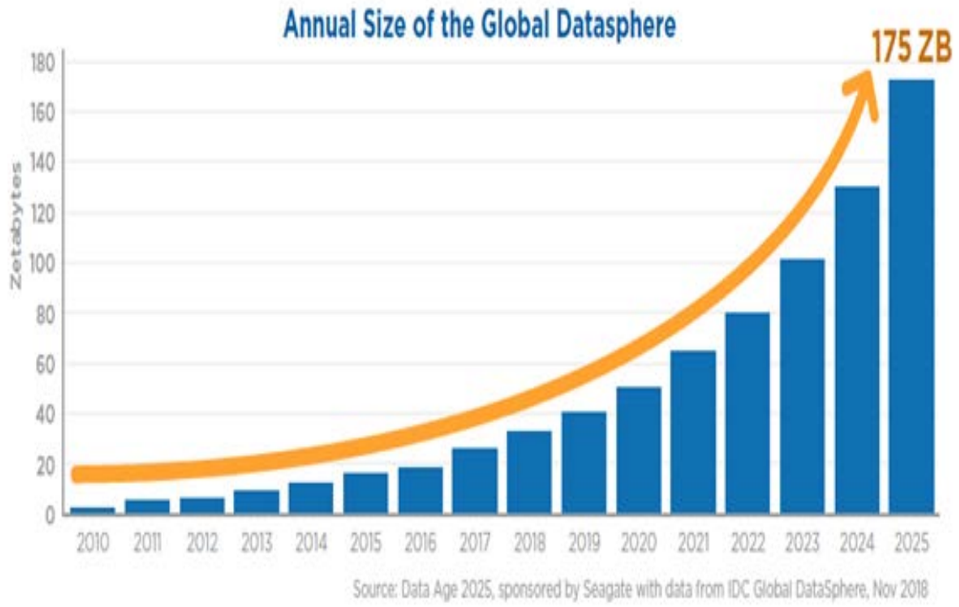
Digital transformation inevitably goes hand in hand with technology, and therefore, it has no other option but to move forward. Digital transformation is imperative if companies want to compete in a globalized and increasingly competitive world

" For companies, containing costs (as much as possible) and providing a better service or product will be vital for their continuity. This requires greater efficiency and effectiveness in their entire technological and IT system."

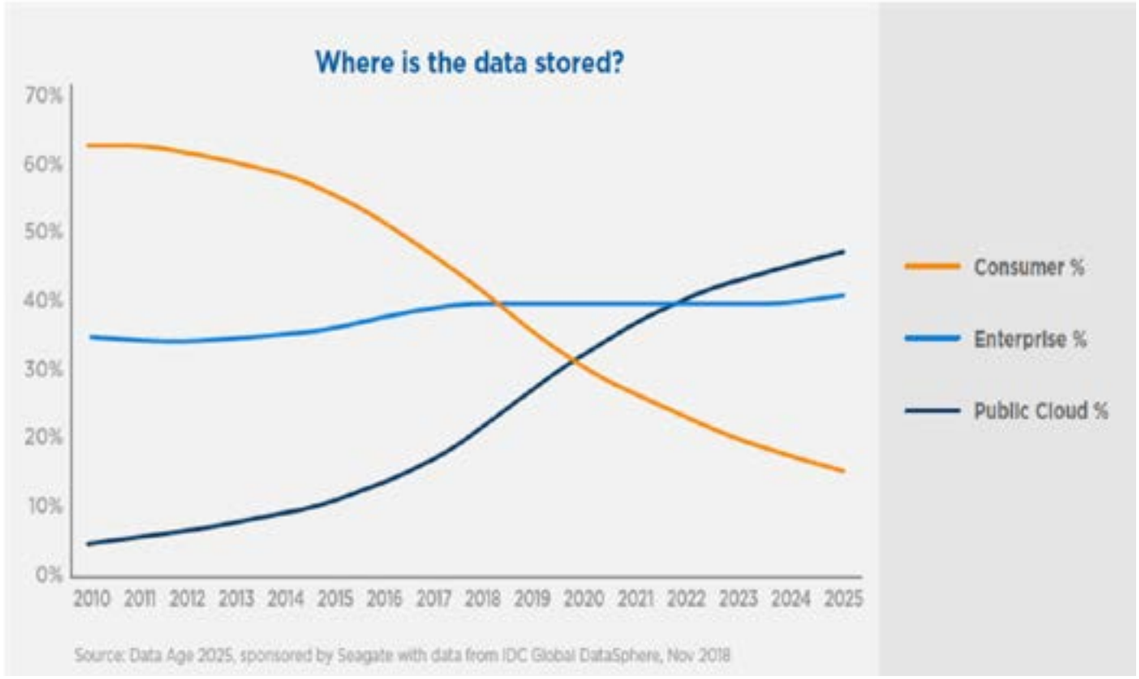
As we can see, every day companies are moving more processes to the cloud, every day there are more connected devices, every day there is a growing need for real-time information through mobile connections, and every day technology advances faster and becomes more affordable. All these factors will contribute significantly to the growth of Data Centers, regardless of their size and location.

Annex.
Market Size

To further provide context, I must mention that according to IDC, 175 zettabytes will be generated by 2025 (in 2018, we were at 33 ZB), and by 2025, 49% of the data stored worldwide will reside in the cloud

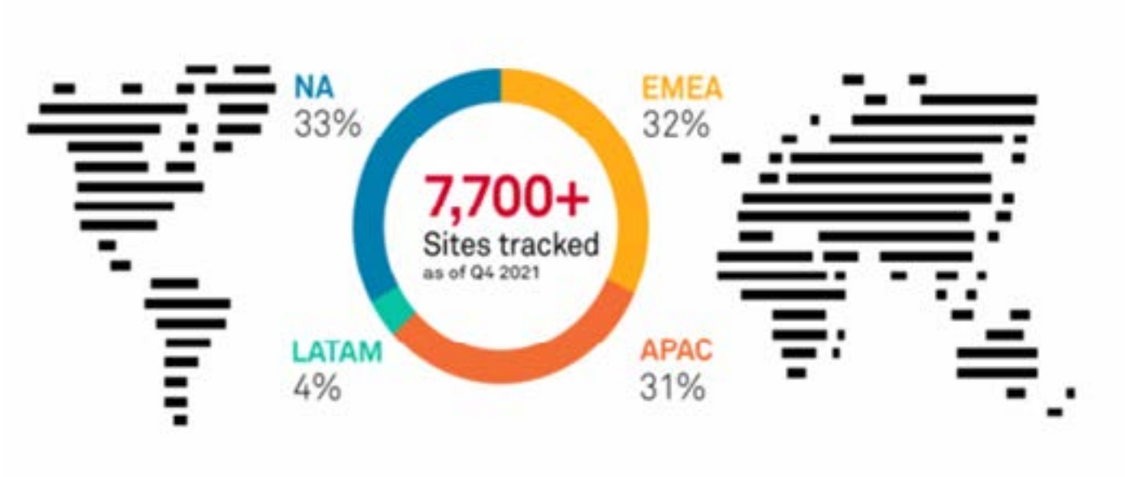


Other data provided by IDC that highlights the growth of data centers is that by 2025, an estimated 90 ZB will be generated by IoT devices, and 30% of the generated data will be consumed in real-time

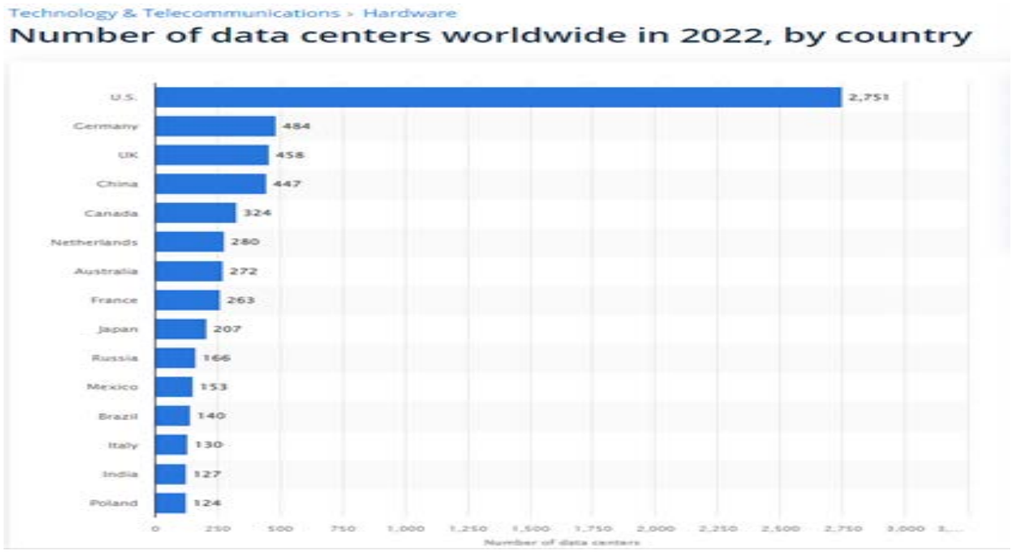


Lastly, a staggering prediction from IDC is that we will reach almost 5000 digital interactions per person per day on average, driven in part by IoT devices and the exchange of real-time data.

As we can see in 451 Research Datacenter, we are close to 8,000 data centers worldwide, with the U.S. significantly leading in numbers



By countries, we can see the information provided by the Statista consultancy..



We can observe that the United States significantly leads the ranking of Data Centers by countries with 2,751 centers, creating a considerable gap with the second-ranked Germany with around 484 and the UK in third place with 458... Data Centers

With this information and the forecast for the coming years, it becomes imperative for data center managers to seek more resources every day to develop their infrastructures and provide high-quality services to their clients.

All this volume of information poses a significant challenge for critical infrastructures, and the downtime of data centers will increasingly result in a higher volume of business loss.

Having real-time infrastructure management tools will be as necessary for everyone as having sufficient energy to provide service to that infrastructure.