DATA AGE 2025

The Digitization of the World
From Edge to Core

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November 2018 (*Data refreshed May 2020*)

An IDC White Paper – #US44413318, Sponsored by SEAGATE

IDC
ANALYZE THE FUTURE

Executive Summary

Mankind is on a quest to digitize the world

The focus of this digitization is anything and everything that intersects our business workflows and personal streams of life.

This process of digitization is often referred to as digital transformation, and it is profoundly changing the shape of business today, impacting companies in every industry and consumers around the world. Digital transformation is not about the evolution of devices (though they will evolve), it is about the integration of intelligent data into everything that we do.

The data-driven world will be always on, always tracking, always monitoring, always listening, and always watching – because it will be always learning. What we perceive to be randomness will be bounded into patterns of normality by sophisticated artificial intelligence algorithms that will deliver the future in new and personalized ways. Artificial intelligence will drive even more automation into businesses and feed processes and engagements that will deliver new levels of efficiency and products that are tailored to business outcomes and individual customer preferences.

Traditional paradigms will be redefined (like vehicle or white goods ownership) and ethical, moral and societal norms will be challenged as genomics and advanced DNA profiling influence healthcare directives, insurance premiums, and spousal choices. Entertainment will literally be transformed before our eyes as virtual reality technologies transport us into new digital realities and augmented reality will dramatically change the service industry as we know it today.

The data-driven world will be **always on, always tracking, always monitoring, always listening** and **always watching – because it will be always learning**.

Data is at the heart of digital transformation, the lifeblood of this digitization process. Today, companies are leveraging data to improve customer experiences, open new markets, make employees and processes more productive, and create new sources of competitive advantage – working toward the future of tomorrow.

Global Datasphere expansion is never-ending

IDC has defined three primary locations where digitization is happening and where digital content is created: the core (traditional and cloud data centers), the edge (enterprise-hardened infrastructure like cell towers and branch offices), and the endpoints (PCs, smart phones, and IoT devices). The summation of all this data, whether it is created, captured, or replicated, is called the Global Datasphere, and it is experiencing tremendous growth. IDC predicts that the Global Datasphere will grow from 45 Zettabytes (ZB) in 2019 to 175ZB by 2025.

To keep up with the storage demands stemming from all this data creation, IDC forecasts that over 22ZB of storage capacity must ship across all media types from 2018 to 2025, with nearly 59% of that capacity supplied from the HDD industry.

An enterprise renaissance is on the horizon

The enterprise is fast becoming the world's data steward...again. In the recent past, consumers were responsible for much of their own data, but their reliance on and trust of today's cloud services, especially from connectivity, performance, and convenience perspectives, continues to increase while the need to store and manage data locally continues to decrease. Moreover, businesses are looking to centralize data management and delivery (e.g., online video streaming, data analytics, data security, and privacy) as well as to leverage data to control their businesses and the user experience (e.g., machine-to-machine communication, IoT, persistent personalization profiling). The responsibility to maintain and manage all this consumer and business data supports the growth in cloud provider data centers. As a result, the enterprise's role as a data steward continues to grow, and consumers are not just allowing this, but expecting it. Beginning in 2019, more data is stored in the enterprise core than in all the world's existing endpoints.

IDC predicts that the Global Datasphere will grow from **45 Zettabytes** in 2019 to **175 Zettabytes** by 2025

Cloud is the new core

One of the key drivers of growth in the core is the shift to the cloud from traditional data centers. As companies continue to pursue the cloud (both public and private) for data processing needs, cloud data centers are becoming the new enterprise data repository. In essence, the cloud is becoming the new core. In 2025 IDC predicts that 46% of the world's stored data will reside in public cloud environments.

China's Datasphere on pace to becoming the largest in the world

Every geographic region has its own Datasphere size and trajectories that are impacted by population, digital transformation progress, IT spend and maturity, and many other metrics. For example, China's Datasphere is expected to grow 26% on average over the next 5 years and will be the largest Datasphere of all regions by 2022 (compared to EMEA, APJxC, U.S., and Rest of World) as its connected population grows and its video surveillance infrastructure proliferates. (APJxC includes Asia-Pacific countries, including Japan, but not China.)

Consumers are addicted to data, and more of it in real-time

As companies increase the digitization of their business and drive consistent and better customer experiences, consumers are embracing these personalized real-time engagements and resetting their expectations for data delivery. As their digital world overlaps with their physical realities, they expect to access products and services wherever they are, over whatever connection

In 2025 IDC predicts that **46%** of the world's stored data will reside in public cloud environments

they have, and on any device. They want data in the moment, on the go, and personalized. This places greater demand on both the edge and the core to be able to produce the precise data consumers require, often in real-time. IDC predicts that due to the infusion of data into our business workflows and personal streams of life, that nearly 25% of the Global Datasphere will be real-time by 2025. Enterprises looking to provide superior customer experience and grow share must have data infrastructures that can meet this growth in real-time data.

Today, more than 5 billion consumers interact with data every day – by 2025, that number will be 6 billion, or 75% of the world's population. In 2025, each connected person will have at least one data interaction every 18 seconds. Many of these interactions are because of the billions of IoT devices connected across the globe, which are expected to create over 90ZB of data in 2025.

About this study

This study is based on IDC's ongoing Global DataSphere research and market sizing models. Industry and specific geographic Datasphere research was conducted in September 2018 by IDC and some data refreshed in May 2020. In addition, 2,400 enterprise decision makers were surveyed, and in-depth interviews were conducted with senior IT executives at a variety of industries to inform this study. The survey was with decision makers who had responsibility for or knowledge of their organization's use, management, and storage of data leveraging advanced technologies including Internet of Things, real-time analytics, and AI/machine learning. The survey spanned several countries and regions including the United States, China, EMEA, APJxC, and others.

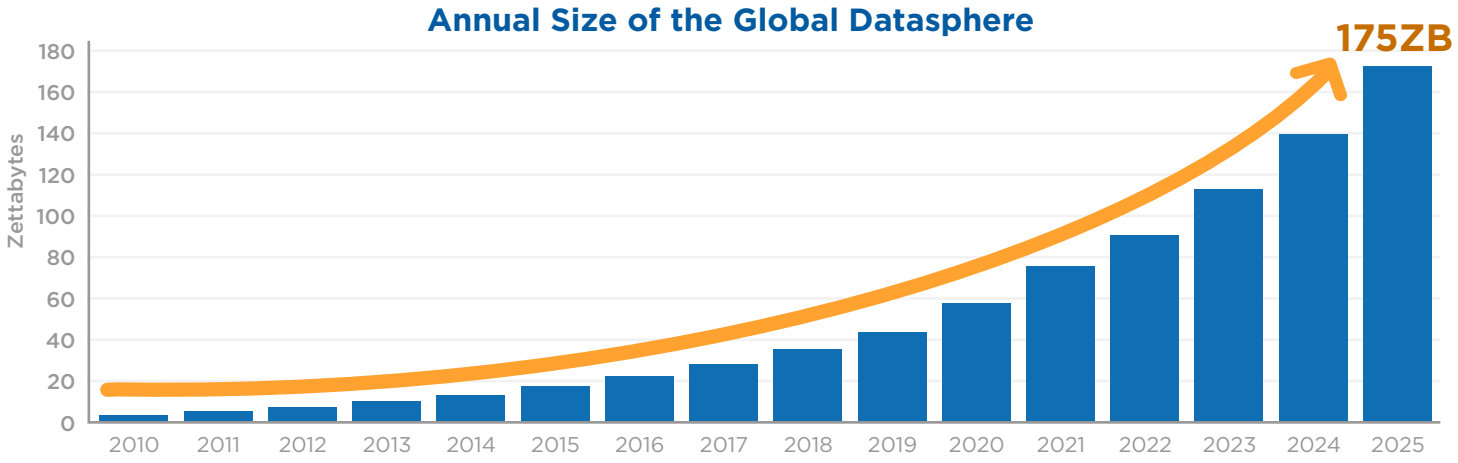
Global Datasphere Expansion is Never-ending

The use of data today is transforming the way we live, work, and play. Businesses in industries around the world are using data to transform themselves to become more agile, improve customer experience, introduce new business models, and develop new sources of competitive advantage. Consumers are living in an increasingly digital world, depending on online and mobile channels to connect with friends and family, access goods and services, and run nearly every aspect of their lives, even while asleep.

Much of today's economy relies on data, and this reliance will only increase in the future as companies capture, catalog, and cash in on data in every step of their supply chain; enterprises collect vast sums of customer data to provide greater levels of personalization; and consumers integrate social media, entertainment, cloud storage, and real-time personalized services into their streams of life.

The consequence of this increasing reliance on data will be a never-ending expansion in the size of the Global Datasphere. Estimated to be 45ZB in 2019, IDC forecasts the Global Datasphere to grow to 175ZB by 2025. (Figure 1). See Appendix for methodology and data/device categories.

Figure 1 – Annual Size of the Global Datasphere



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

> MRI image creation is driving storage requirements significantly. The trend is more images with thinner slices and 3D capability. We've gone from 2,000 images to over 20,000 for an MRI of a human head, and stronger magnets and higher resolution pictures means more data stored.
>
> *– Senior Director in IT, Major Healthcare Provider*

How big is 175ZB?

Sometimes it can be difficult to get our minds around such a large number. Here are some illustrations of just how large 175ZB is.

- One zettabyte is equivalent to a trillion gigabytes
- If you were able to store the entire Global Datasphere on DVDs, then you would have a stack of single layer Blu-ray discs that could get you to the moon 23 times or circle Earth 222 times.
- If you could download the entire 2025 Global Datasphere at an average of 25Mb/s, today's average connection speed across the United States, then it would take one person 1.8 billion years to do it, or if every person in the world could help and never rest, then you could get it done in 81 days.

The Core is the Heart of the Datasphere

In this study we isolated three primary data location categories that make up the Datasphere:

1. Core

This consists of designated computing data centers in the enterprise and cloud providers. It includes all varieties of cloud computing, including public, private, and hybrid cloud. It also includes enterprise operational data centers, such as those running the electric grid and telephone networks.

2. Edge

Edge refers to enterprise-hardened servers and appliances that are not in core data centers. This includes server rooms, servers in the field, cell towers, and smaller data centers located regionally and remotely for faster response times.

3. Endpoint

Endpoints include all devices on the edge of the network, including PCs, phones, industrial sensors, connected cars, and wearables.

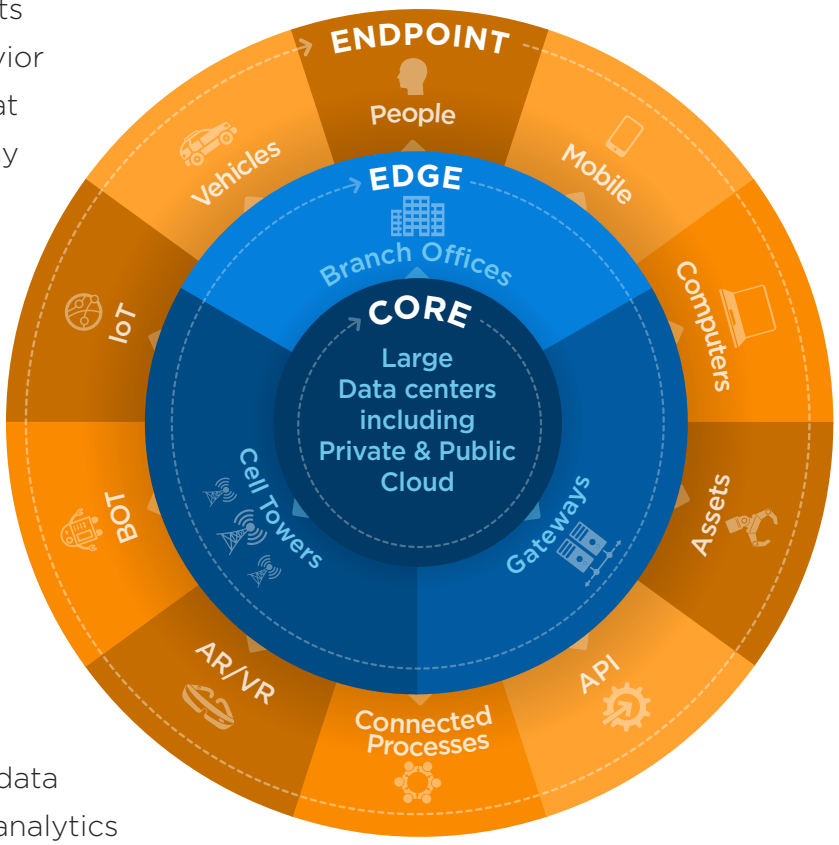
A key aspect characterizing the Datasphere today is the increasingly critical role of the endpoints and edge – which is where all the digital data about us or for us is delivered to us to help inform real-time decisions, personalized services, or other latency-sensitive actions. Data gathered from endpoints is collected at the edge, which is an important location for delivering the intelligence and analytics necessary to provide faster response and better end-user experience, as well as to accelerate and bring new levels of efficiency and quality to business.

Use cases at the edge and core that illustrate their criticality are growing aggressively, with entire categories yet to have even crossed our minds. One increasingly critical engagement between edge and endpoint is the connected car. Driven largely by the video captured and analyzed by numerous cameras integrated into the vehicle, IDC estimates that an autonomous vehicle can create over 3 TB of data per hour, and this doesn't include infotainment and GPS data. This data creation will continue to increase as vehicle-to-vehicle communication becomes commonplace, and as machine learning and AI continuously update pattern recognition integrated into vehicles' intelligent driving algorithms.

Manufacturers have long sensed and actuated on real-time data feeds within controlled manufacturing environments. This has led to better quality products at significantly lower prices. Companies are now looking to sense and actuate on data collected outside the factory walls, while products are being used. Manufacturers can extend product life and reduce product failures by understanding product performance in random environments used by customers with a multitude of behavior profiles. This is now possible with sensors that are embedded and connected in the everyday products that we use.

But the heart of the Datasphere is the core. The core plays a critical role by providing centralized storage and archiving, service delivery, deeper-level analytics, command and control, and regulatory compliance. As a result, data flows in a constant stream from endpoints and the edge to the core and back out to the edge and endpoints, with each location playing an important part in the overall Datasphere. This propagation of data drives data growth in the core and has ramifications for analytics and intelligence throughout the network, powering internal and external processes, as well as intelligent and predictive engagements between businesses and individuals across entire ecosystems (Figure 2). The net effect is the continued importance and growth in enterprise storage.

Figure 2
Data propagation from endpoints to core and back



Source: IDC's Data Age 2025 study, sponsored by Seagate

> We'll have more intelligence and more activity at the edge on data coming from the generators that we build and the IoT devices we have deployed...raw data will be analyzed on the edge first, and then the results will be sent back to the core for deeper analysis.
>
> *– CISO/CFO, Leading Manufacturing Firm*

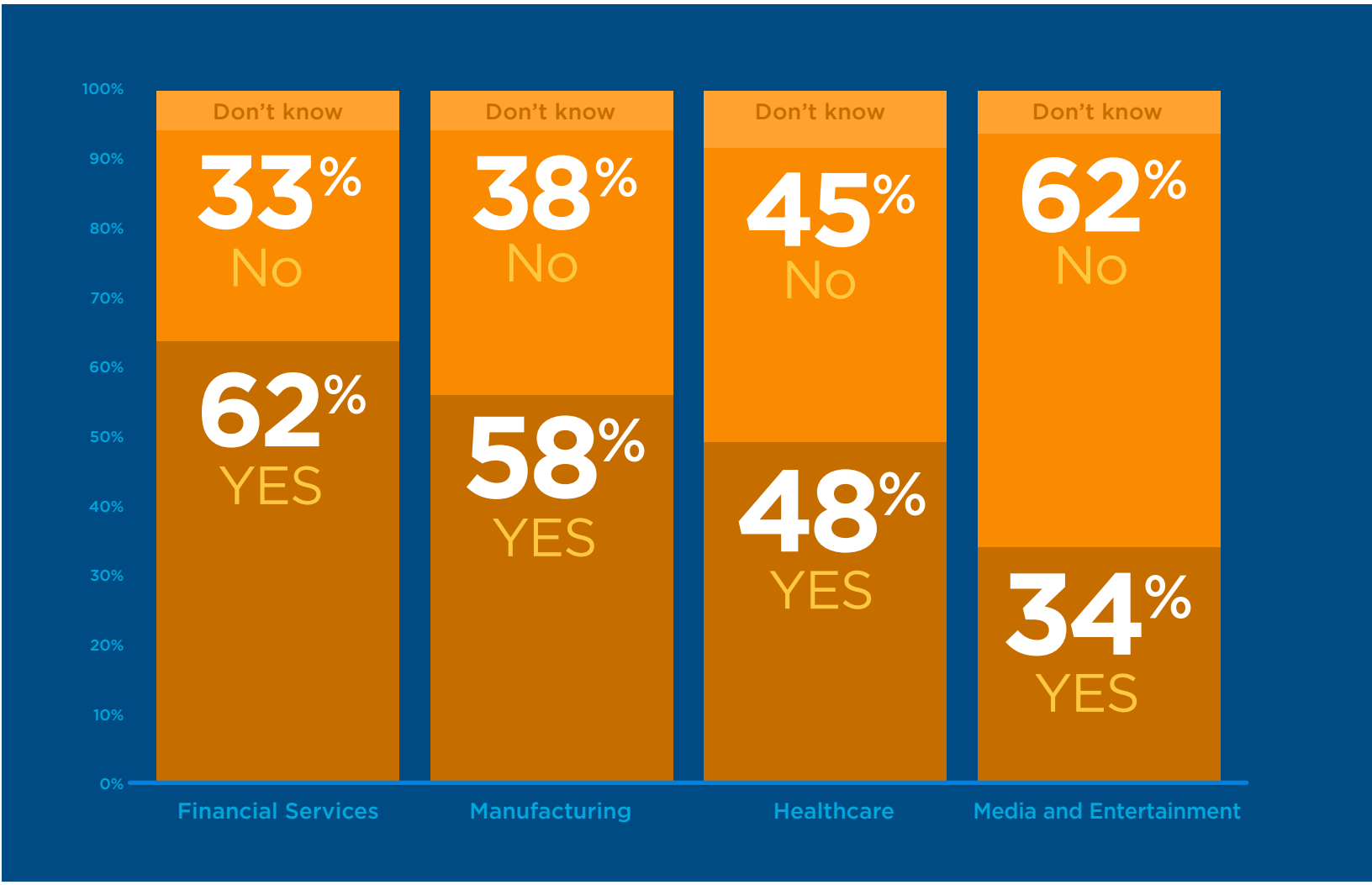
The Interplay Between Core, Edge, and Endpoint is Key in All Industries

While the core will continue to be the heart of the DataSphere, the edge is expected to make up a larger portion of the DataSphere each year. All industries have examples of waves of data traversing the core, edge, and endpoints, in which data collected at the endpoints is processed at the edge, propagated at the core, then distributed back out to the endpoints. Yet, the degree at which various industries are analyzing and computing data at the edge are in different stages of adoption as shown in Figure 3.

Question

Does your organization utilize edge computing?

Figure 3 – Use of Edge Computing

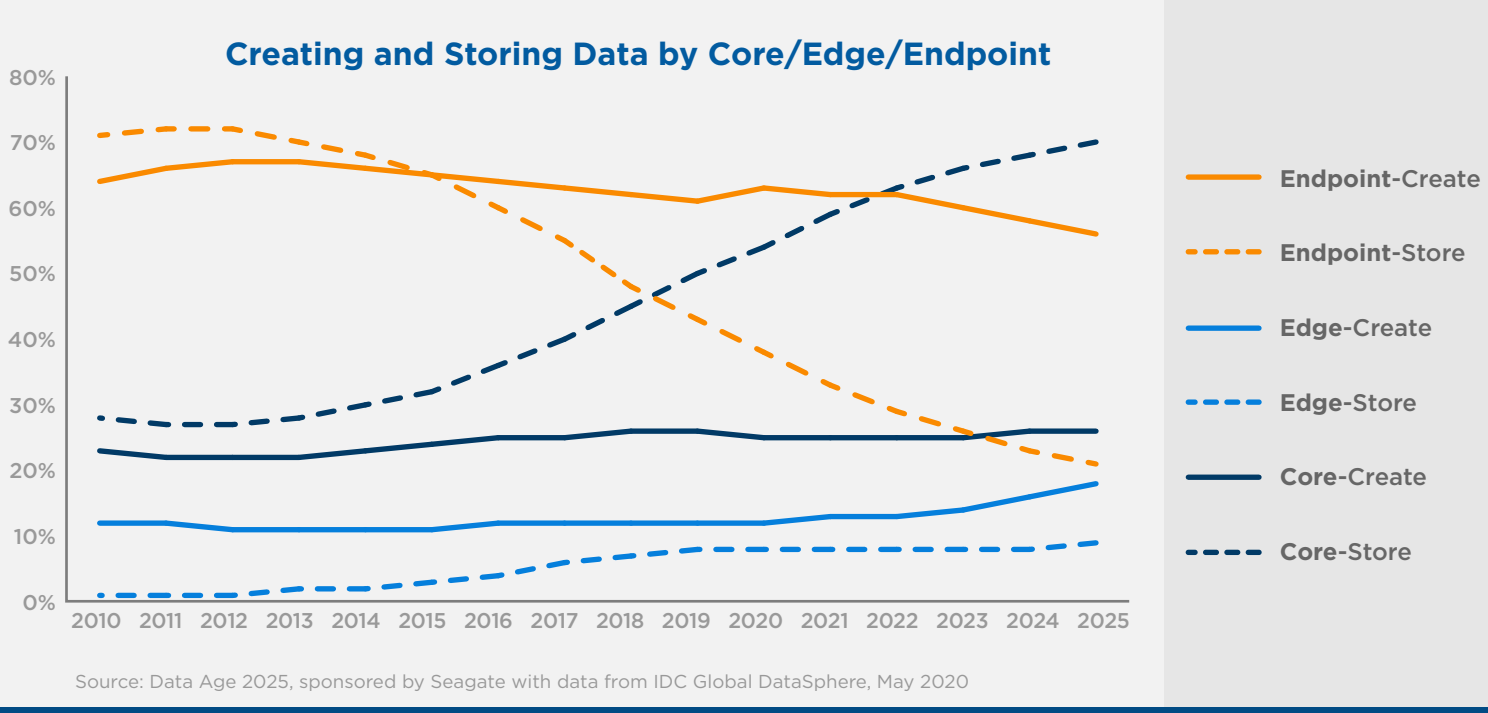


Source: Data Age 2025, sponsored by Seagate, Nov 2018, n=1,081

Data Created (Datasphere) is different than Data Stored

From a data creation perspective (solid lines in Figure 3), endpoints are declining as a percent while the core and edge continue to produce more. From a data storage perspective (dotted lines in Figure 4), the percentage share of data being stored in endpoints will plummet as the core becomes the repository of choice for data of all types. By 2024, we expect data stored in the core to be more than double the data stored in the endpoint, completely reversing the dynamic from 2015. Edge storage will also see significant growth as latency-sensitive services and applications proliferate throughout our world.

Figure 4 – Where data is created and stored



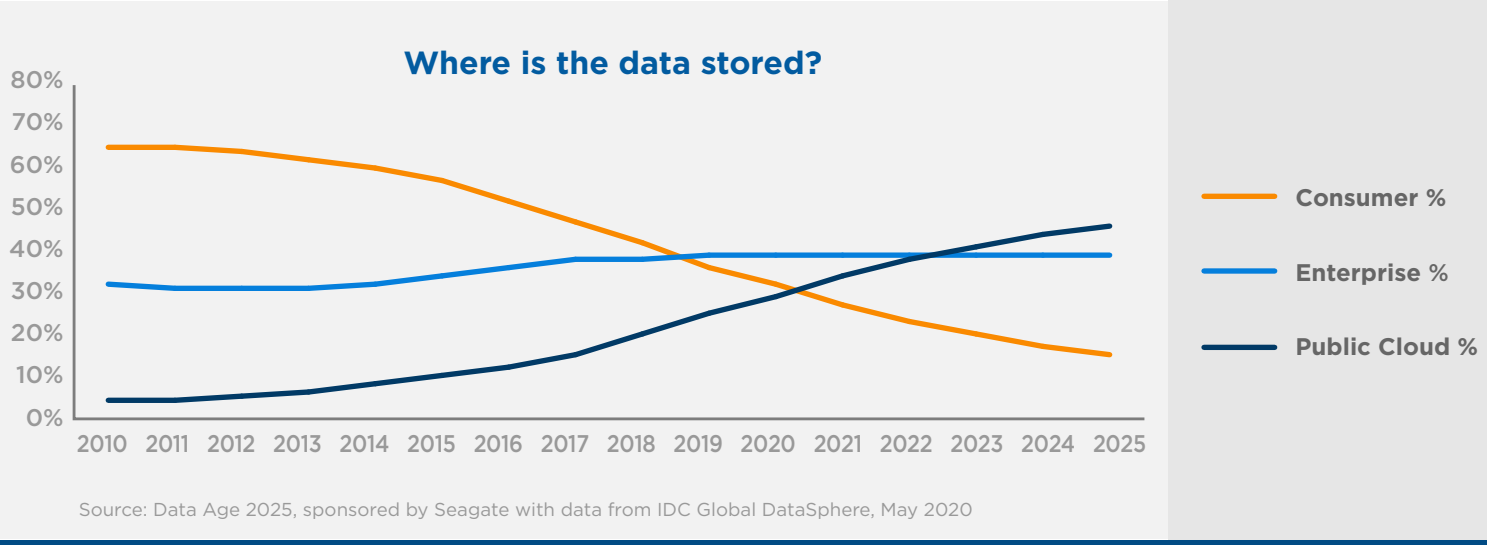
Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

> We are beginning to understand the value of data mining and being able to bring together disparate data and systems that create that data. We don't understand well enough how to do this in an efficient, cost-effective way. Right now, each system primarily creates its own data; each system manages its own data environment.
>
> *– CISO/CFO, Leading Manufacturing Firm*

Cloud is the New Core...and Much of it is Additive

Today, as greater numbers of devices with greater levels of intelligence are connected to various networks, businesses and consumers are finding the cloud to be an increasingly attractive option that enables fast, ubiquitous access to their data. Increasingly, consumers are fine with lower storage capacity on endpoint devices in favor of using the cloud. By 2020, we believe that more bytes will be stored in the public cloud than in consumer devices (Figure 5), and by 2022, there will be more data stored in the public cloud than in traditional data centers (Figure 6).

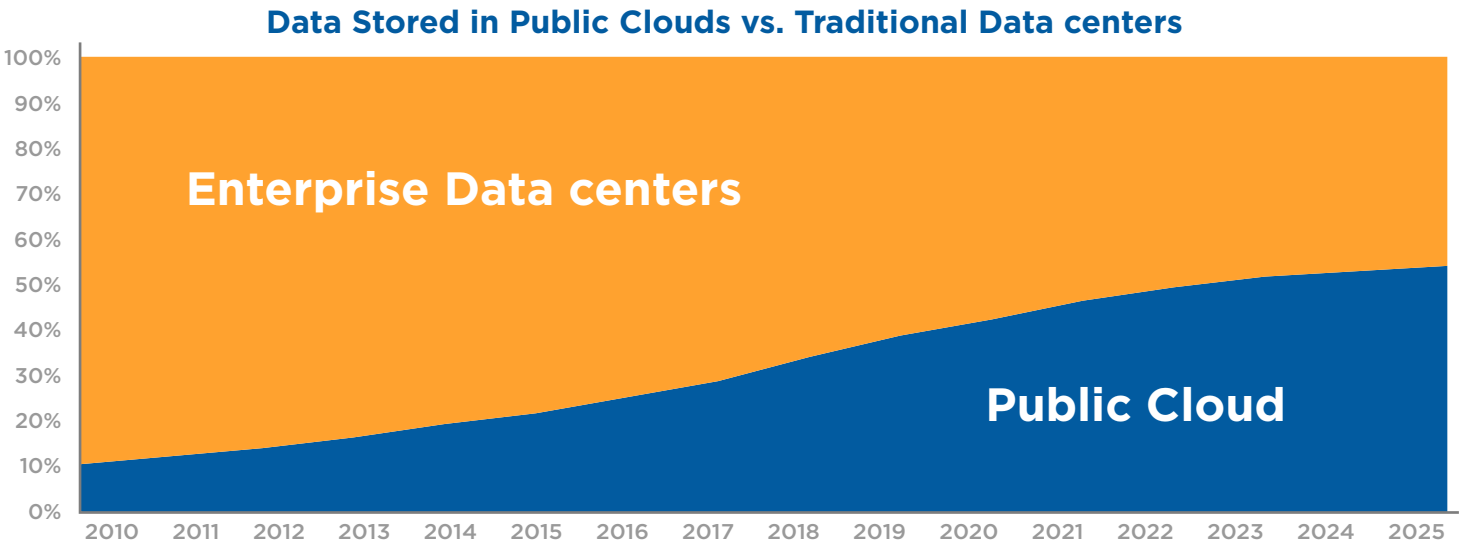
Figure 5 – Where is the data stored?



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

> There is definitely interest in an increase in utilization of public cloud for data stores as long as we're good with governance and identify suitable candidates. It's still not going to be customer data for the foreseeable future, but there are candidates...It's fair to say that public cloud utilization is going to double.
>
> *– VP of IT, Fortune 50 Financial Services Firm*

Figure 6 – Data Stored in Public Clouds Versus Traditional Data centers



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

Business models and the location of data management may be changing, but the technical requirements and challenges remain. Data must be archived and stored in ways that provide appropriate levels of performance and enable analytics and intelligence to be applied to them, but it must be done cost-effectively and securely.

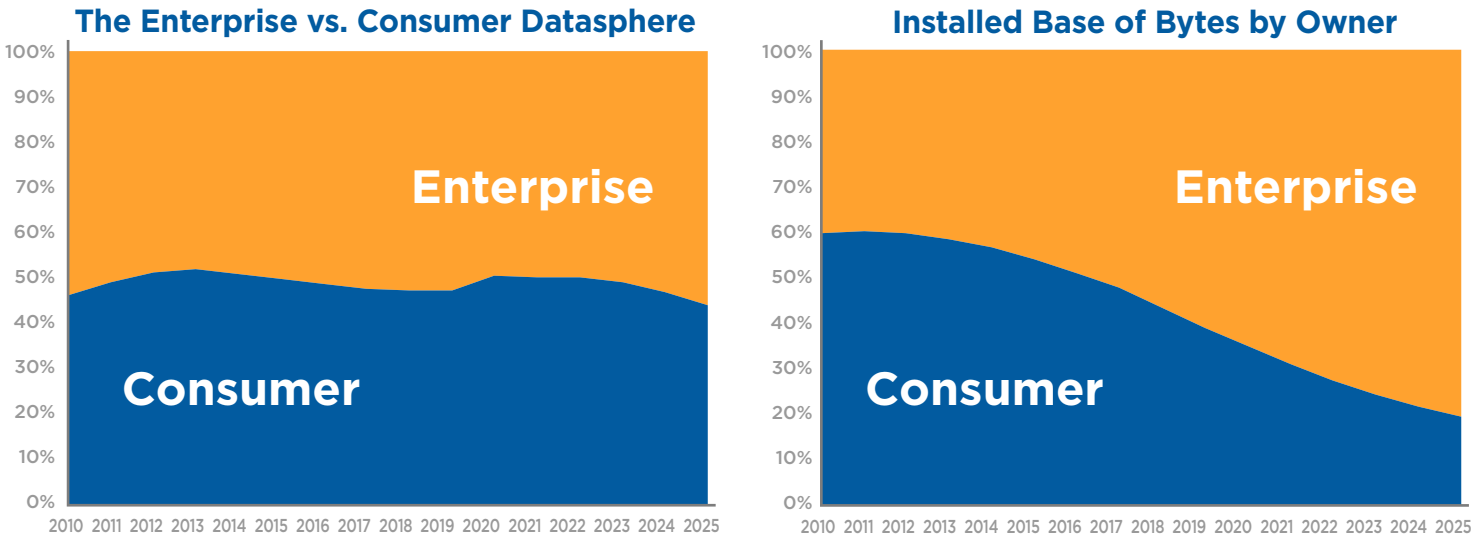
This is not necessarily an easy task given that some industries still have data in silos within the corporate walls, as well as outside the corporate walls residing in branch offices, contractor sites, or some other location where the data is not generally accessible.

> There is a lot of data that has been done by third parties, and there's a lot of data we own but it sits out with other people. A big part is trying to figure out how we might bring back that data and store it. We may not even know what we need it for, but we need it stored in one place so that others, like data scientists, can have access.
>
> *– CIO and SVP of Corporate IT, Major Media Firm*

The Enterprise Datasphere and Stewardship is Vital to Our Future

The amount of data created by consumers and enterprises is roughly divided equally at 50% per year (Figure 7). Yet, consumers are increasingly shifting the responsibility to maintain and manage their data to enterprise/cloud provider data centers. The enterprise is already the primary steward of data storage, and the trend continues to amplify these responsibilities (Figure 8).

Figure 7 and 8 – The Enterprise Datasphere Continues to Expand



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

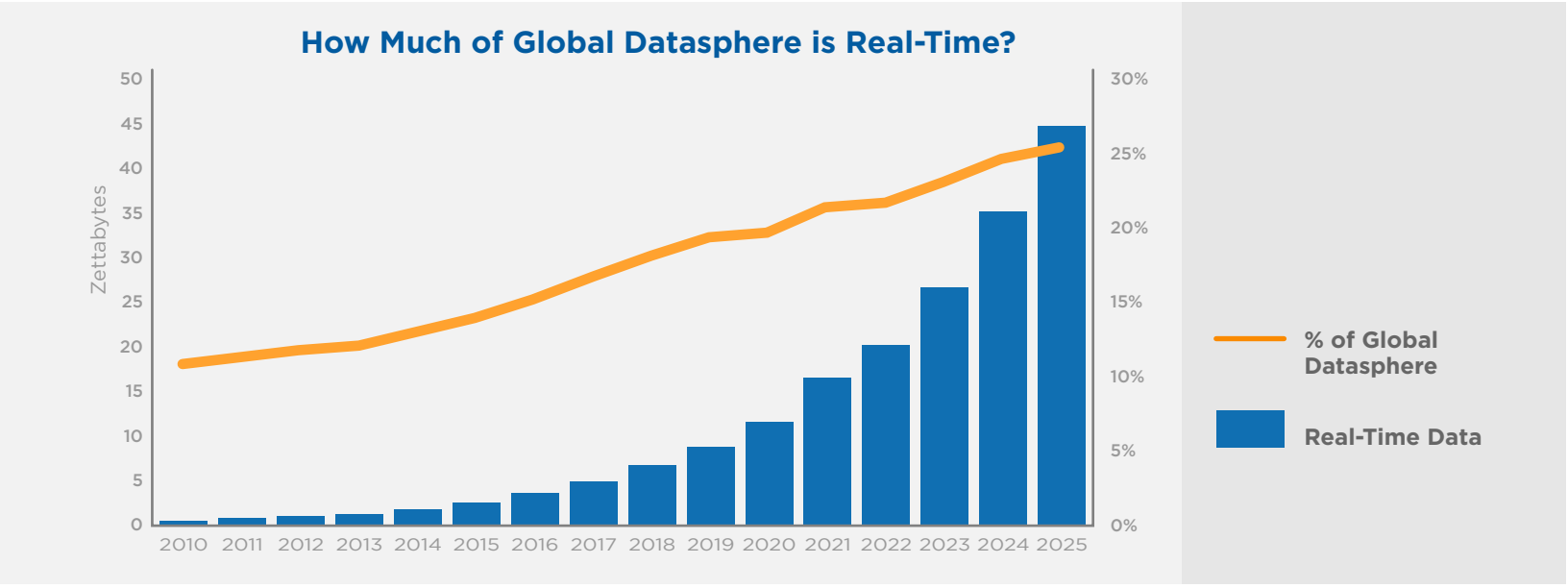
The installed bytes across the enterprise is expected to **grow to 12.6ZB**, representing **over 80% of the worldwide installed bytes in 2025**.

> We have initiatives partnering with facility management, micro payments, and car manufacturers. We currently have 25 properties, so we leverage IoT to have efficient optimization around data center and portfolio management. All of those are big sources of data ingest.
>
> *– VP of IT, Fortune 50 Financial Services Firm*

Real-Time Data Demand is Driving the Edge

IDC forecasts that more than 150B devices will be connected across the globe by 2025, most of which will be creating data in real time. For example, automated machines on a manufacturing floor rely on real-time data for process control and improvement. Real-time data represents 15% of the Datasphere in 2016, and nearly 25% by 2025 (Figure 9).

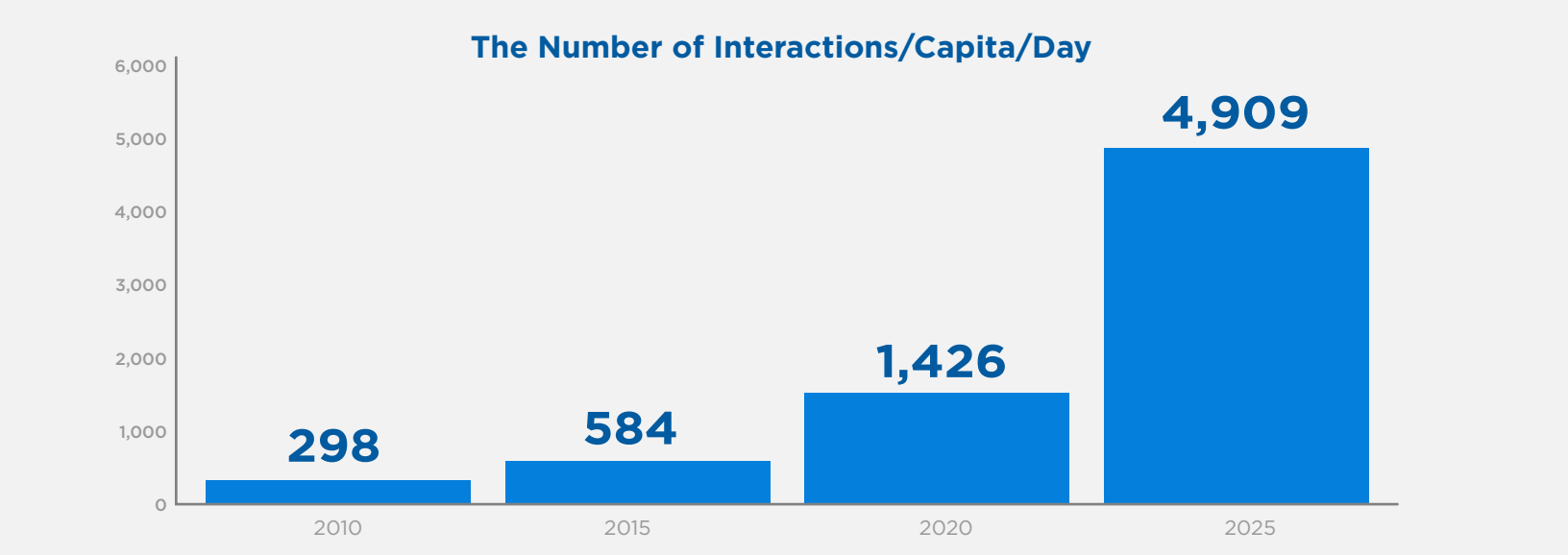
Figure 9 – Real-Time Data



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

But it's not just machines that are driving real-time data. IDC estimates that by 2025, every connected person in the world on average will have a digital data engagement over 4,900 times per day – that's about 1 digital interaction every 18 seconds (Figure 10).

Figure 10 – Data Interactions per Connected Person Per Day



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

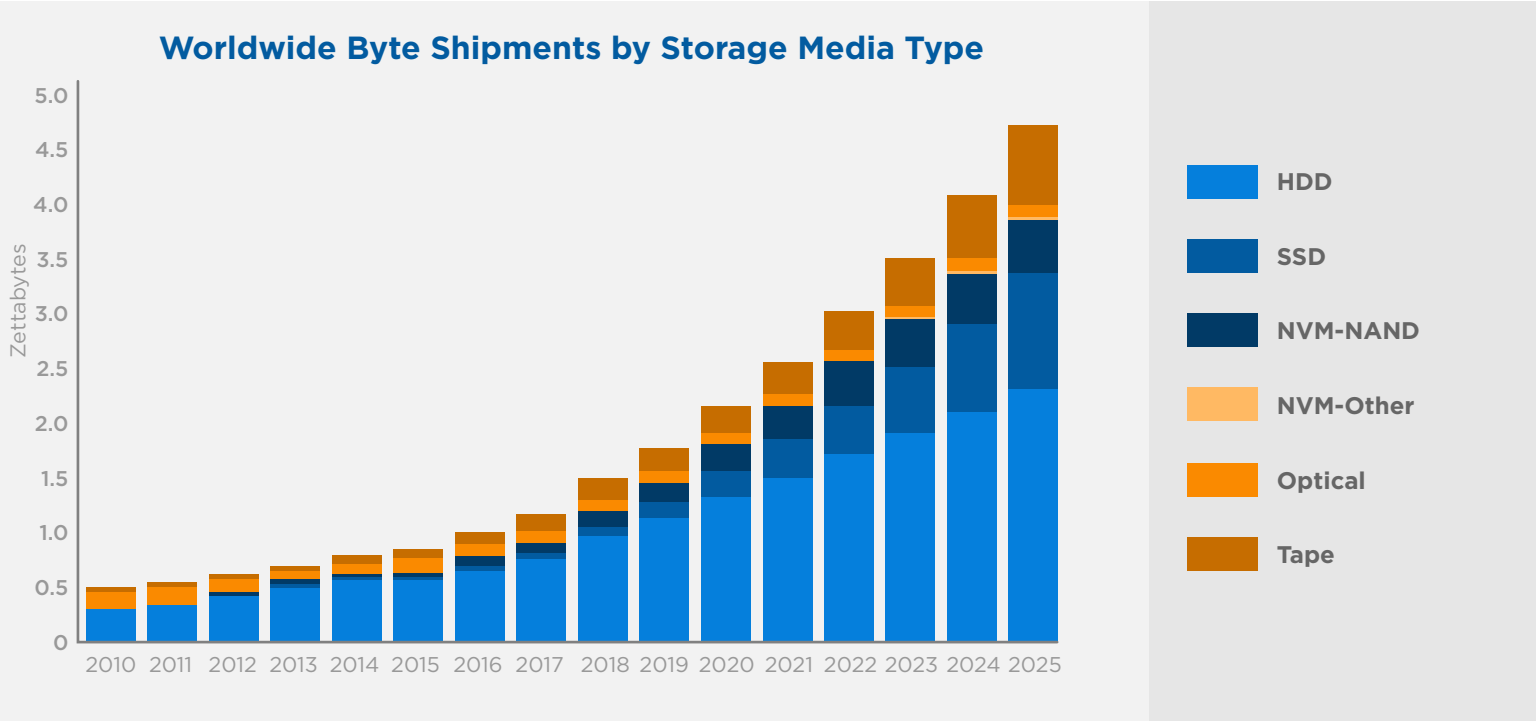
The Demand for Storage Remains Strong

The amount of data created in the Global Datasphere is, of course, the target for the storage industry. Even with the amount of data created that is discarded, overwritten, or sensed, but never stored longer than milliseconds, there still exists a growing demand for storage capacity across industries, governments, enterprises, and consumers.

To live in a digitized world where artificial intelligence drives business processes, customer engagements, and autonomous infrastructure or where consumers' lives are hyper-personalized in nearly every aspect of behavior – including what time we'll be awakened based on the previous day's activities, overnight sleep patterns, and the next day's calendar – will require creating and storing more data than ever before.

IDC currently calculates Data Age 2025 storage capacity shipments across all media types (HDD, SSD, NVM-flash/other, tape, and optical) over the next 4 years (2018–2021) will need to exceed the 6.9ZB shipped across all media types over the past 20 years. IDC forecasts that over 22ZB of storage capacity must ship across all media types from 2018 to 2025 to keep up with storage demands. Around 59% of the capacity will need to come from the HDD industry and 26% from flash technology over that same time frame, with optical storage the only medium to show signs of fatigue as consumers continue to abandon DVDs in favor of streaming video and audio (Figure 11).

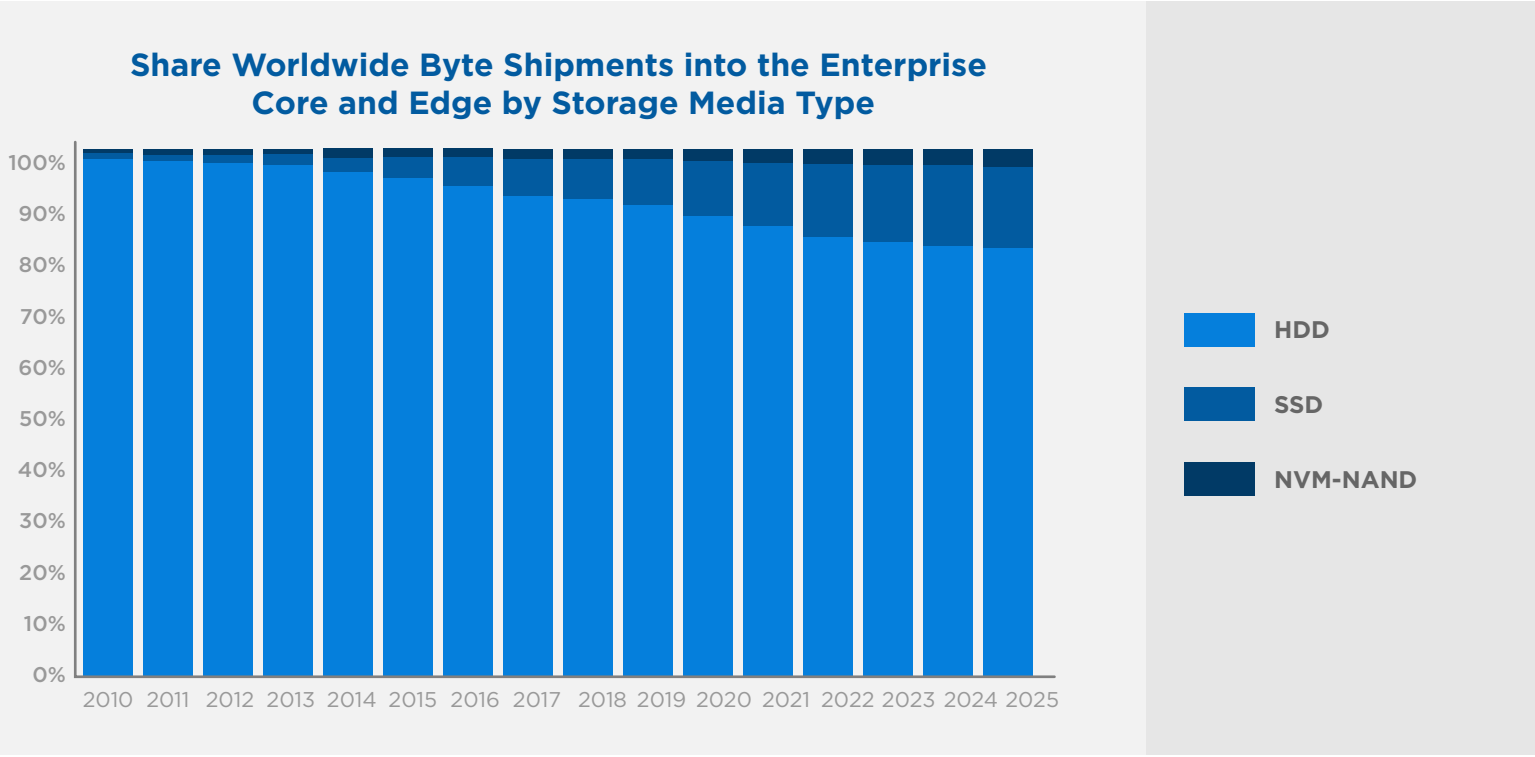
Figure 11 – Worldwide Byte Shipments by Storage Media Type



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

The growth in endpoint and edge storage will favor solid state, while the core continues to have a voracious appetite for the economical bytes that hard disk drives and tape provide. Enterprises will use a mix of disk drives, SSDs, flash, and tape to satisfy the performance, management, and archive demands being placed on them. By the end of 2025, over 80% of the enterprise bytes shipped into the core and edge will continue to be HDD bytes when compared to SSDs and other NVM technologies (Figure 12).

Figure 12 – Share Worldwide Byte Shipments into the Enterprise Core and Edge by Storage Media Type



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, Nov 2018

By the end of 2025, over **80%** of the enterprise bytes shipped into the core and edge will continue to be HDD bytes.

Regional Dataspheres have their own unique growth profile

Whether population driven, application driven (e.g., video surveillance), or digital transformation maturity driven, any given country or region will have a different Datasphere growth profile. Note that the calculations in regional Dataspheres are based on where the devices are located from a regional perspective, as opposed to who may actually own them. For example, if providers in the U.S. own and operate data centers in EMEA, the data created and stored are part of the EMEA Datasphere.

China

China has the fastest growing Datasphere of all the regions forecast in this study. The rapid deployment of video surveillance in China has catapulted the country's use of enterprise storage, as well as a large share of endpoint data creation. China is also one of the fastest growing regions when it comes to the deployment of cloud.

EMEA

Much of the growth in the EMEA Datasphere is a result of a massive population with associated endpoint devices used to create and consume massive amounts of data, an already established base of video surveillance infrastructure, and the initial impact of General Data Protection Regulation (GDPR) legislation that likely will result in a temporary increase of data until formal data management practices are implemented fully.

U.S.A.

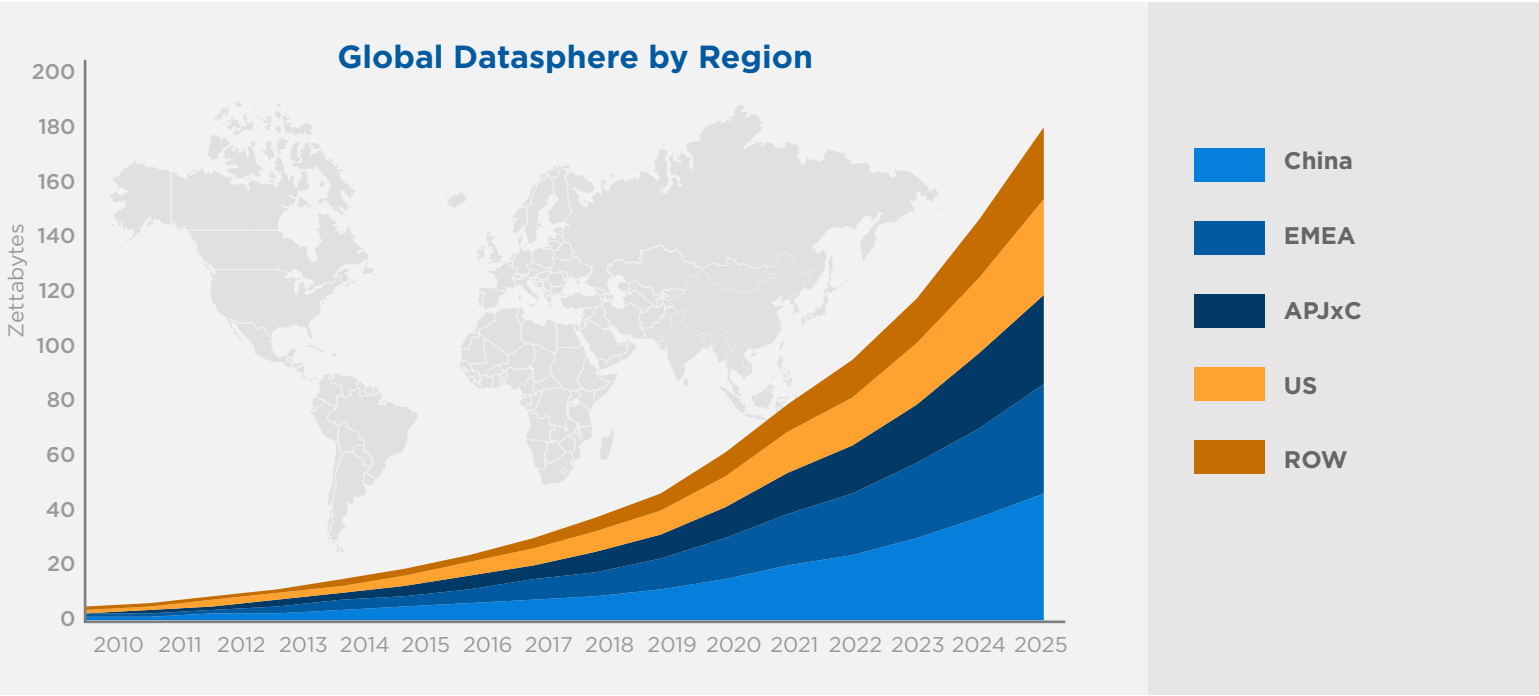
While the U.S. Datasphere continues to grow, it cedes share to the other regions due to its more mature state in cloud infrastructure and highly penetrated population from an endpoint perspective.

APJxC

The Asia-Pacific region including Japan, but excluding China, has the second strongest Datasphere growth with respect to geographies analyzed in this study. Countries like Japan are spending aggressively on smart city initiatives, which are data-creation intense.

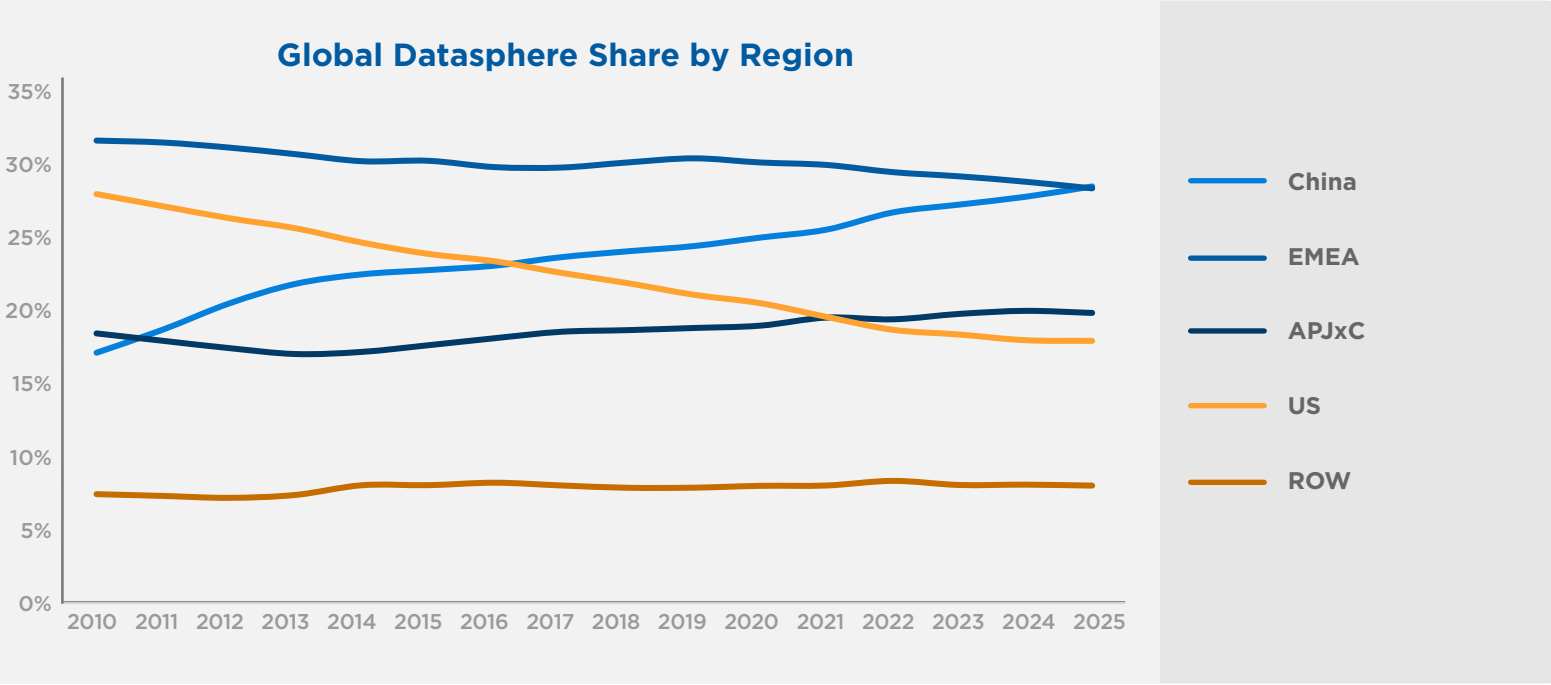
Figure 13 looks at the absolute size of each regional Datasphere while Figure 14 represents the Datasphere share of the U.S., EMEA, APJxC, China, and ROW in terms of the share of bytes generated.

Figure 13 – Size and Growth of the Global Datasphere by Region



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

Figure 14 – Global Datasphere Share by Region



Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

Cloud Growth Explodes Outside the United States

As the headquarters region for the leading global cloud providers, the United States has traditionally had the lion's share of cloud storage, followed by EMEA and APJxC. And while cloud storage in the United States will continue to grow, cloud storage in other regions will grow even faster, fueled both by the desire to reduce latency by locating data closer to the end consumer, as well as corporate and regulatory mandates requiring data to be housed locally within different regions. The U.S. share of public cloud storage will drop precipitously from 50% in 2019 to 39% by 2025, while China's share will more than double from 6% to 13% (Figure 15).

The U.S. share of public cloud storage will drop precipitously

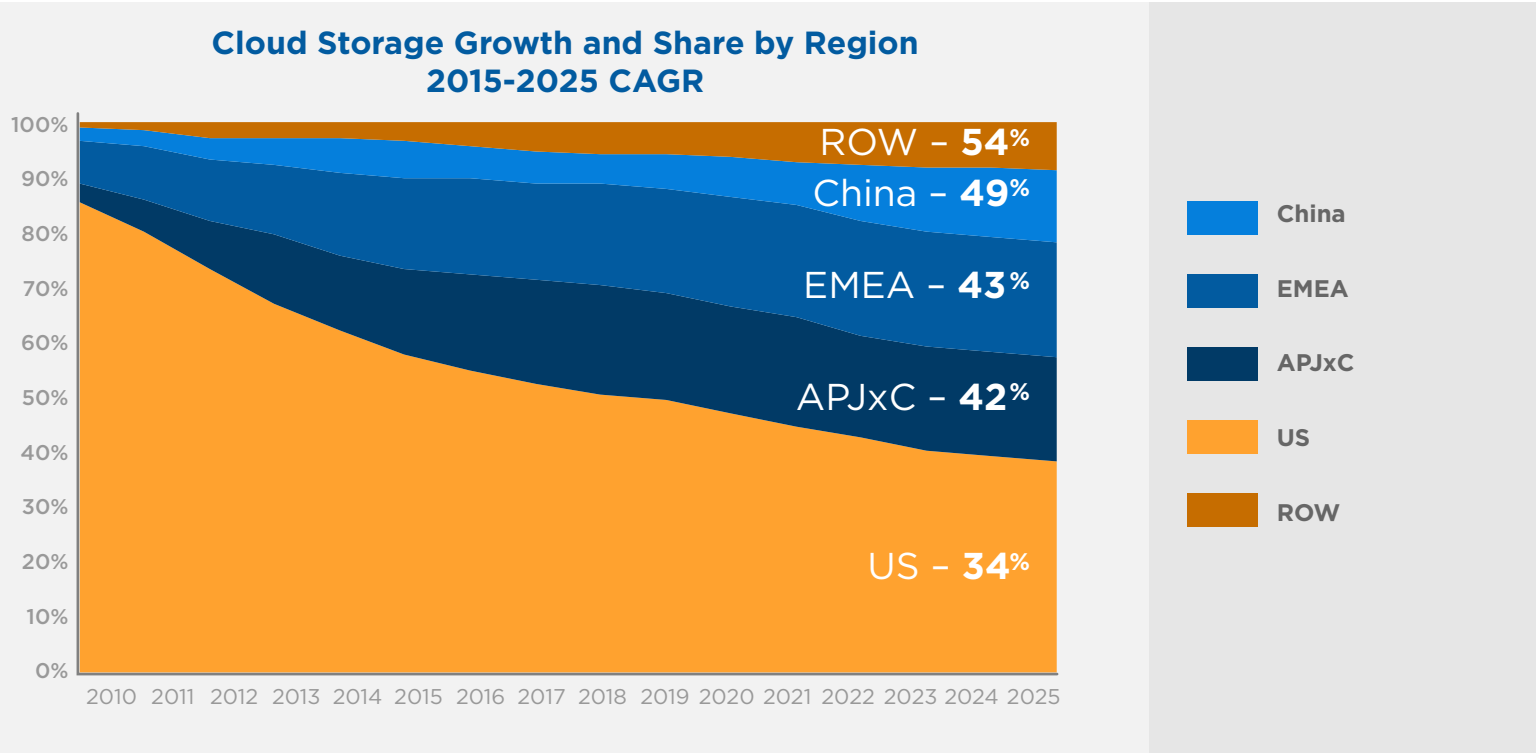
50% in 2019

39% in 2025

while China's share will more than double

6% to 13%

Figure 15 – Cloud Storage Growth and Share by Region

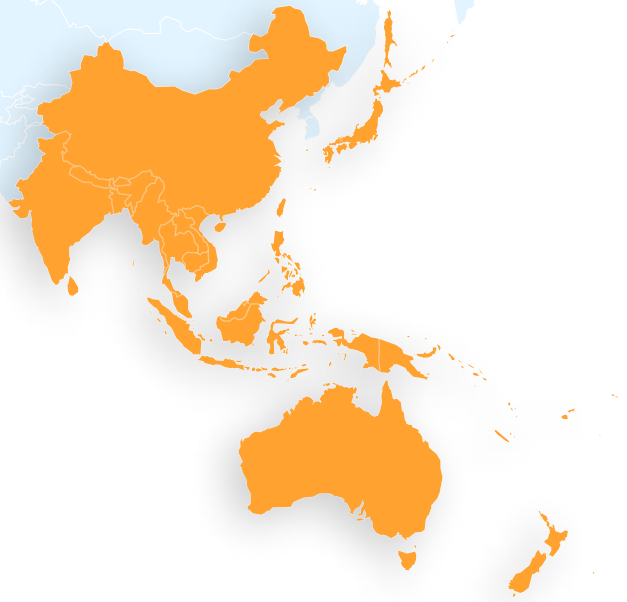


Source: Data Age 2025, sponsored by Seagate with data from IDC Global DataSphere, May 2020

China and Asia Pacific/Japan Have Edge in Data Maturity

IDC's global survey in support of this project indicates that other regions are beginning to eclipse the U.S. in certain measures of data maturity. In particular, China and APJ show better metrics in several areas.

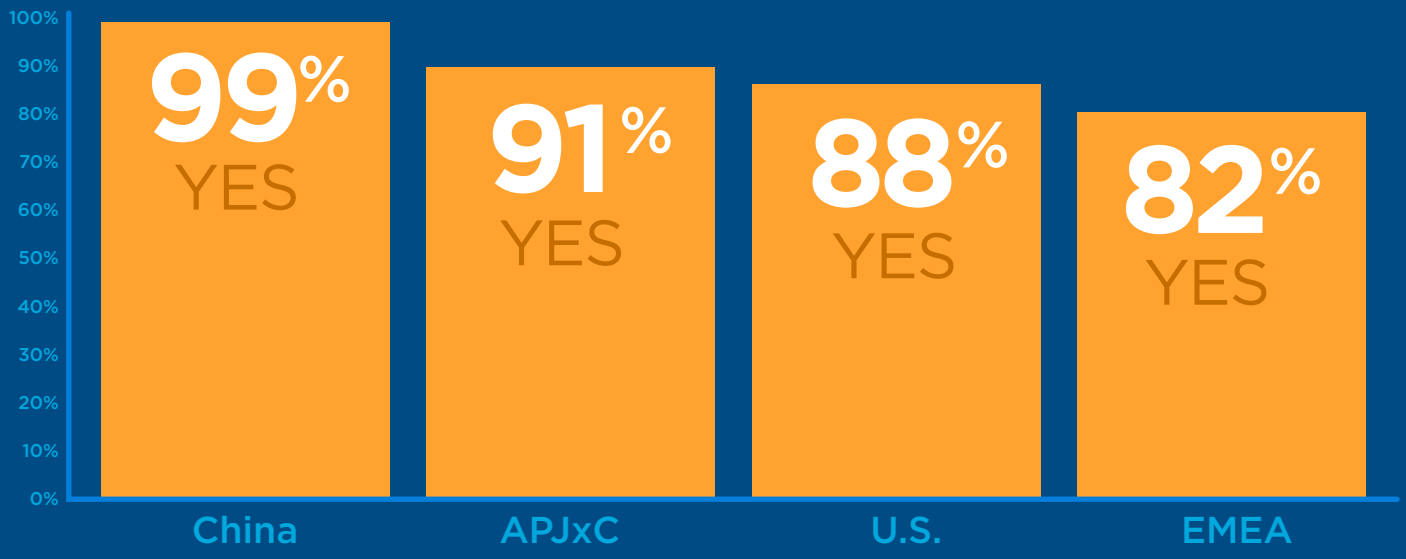
China and APJ are more likely to have corporate-driven digital transformation initiatives, to be able to quantify the value of their data, and to increase their usage of edge computing (Figure 16). This is helped in emerging markets by a lower level of investment in older legacy IT.



Question

Do you expect your organization's utilization of edge computing to increase in the next 2 years?

Figure 16 – Increased Use of Edge Computing



Source: IDC's Data Age 2025 study, sponsored by Seagate, n=959

Chapter 4

IDC Guidance

Enterprises must rise to the data guardianship challenge

As data is shifting from a consumer-centric model to an enterprise-centric model, this increases the burden on enterprises to provide an excellent experience. Enterprises are responsible for providing correct insights and excellent customer experience, even storing customers' digital lives. Ensure your data model provides secure, ubiquitous, real-time access to services and data. As consumers become more demanding of the experience in their digital lives, companies must ensure that they are providing data and services that are real-time, on the go via any network, and are personalized.

Cloud migration is strategic

Cloud providers have emerged as a serious contender for enterprise data storage and services. The largest providers have resources, scale, security, and performance that few enterprises can match. Their global reach enables businesses to provide services to global geographies, and their centralized access enables company resources to tap into all of a company's data to drive analytics today and artificial intelligence in the future.

Take a global approach to your data

It is increasingly important for companies to take a global approach to their data to provide low-latency, better customer experience and to address regulatory and compliance pressures requiring operators to locate data in regions in which customers are located. Whether in their own data centers or via cloud providers, companies need to consider which data needs to be located as close as possible to their customers and where in the network it should be located (core vs. edge, cloud vs. own data centers).

Invest in the edge

Intelligent data is being sought to drive our businesses and lives in real time and on-the-go. Many times, data has no time to travel from an endpoint to the core and back when informing real-time decisions. The enterprise edge helps to bridge this gap. Whether taking on data analytics or simply storing analyzed and intelligent data, the edge will play an increasing role in enabling a real-time world.

Ready your IT organization for digital transformation

Organizations born of the days when IT departments dealt with back office file-and-record processing are now facing a deluge of real-time, interrupt-driven bits and bytes from field organizations. Many IT organizations are finding themselves being given responsibility for physical security as well as data security, for operational data that was once sequestered on the factory floor, the grid, or the operating room, and for integrating data repositories previously kept in separate silos. Dealing with digital transformation will require not just new technology, but also new skills, political savvy, and relationships with top management.

Data is Changing the World

As consumers, data is helping us build more and deeper connections, and to access products and services more quickly and easily, at the time and place of our choosing. We can now walk into a store and walk out with our purchases, leaving our transaction record (and perhaps facial image) as a digital trail, but never having to pull out a credit card or cash.

As businesses, data is helping us reach new markets, better serve existing customers, streamline operations, and monetize raw and analyzed data. If reported global intangible assets of companies are more than $200 trillion dollars*, what must – and will – the value of unreported data assets be? Data is an intangible asset and underpins most other intangible assets like patents and goodwill. Bytes can be made more valuable by surrounding them with security, leveraging them in AI, or using them to cure diseases. Nevertheless, there is a cost associated with data: purchasing, maintaining, and protecting storage, as well as the cost of losing data or having sensitive data fall into the hands of a competitor or hacker. The real value of data is out there, and companies are just finding out that data has real worth. Those businesses first through the gateway of digital transformation will be the first to find out just how valuable their data is.

The Global Datasphere is large and complex, with key interdependencies between core, edge, and endpoints. While the edge and endpoints will continue to play a critical role as the place where the Datasphere meets the physical world, the core remains the heart of the Datasphere gathering data from the edges and endpoints, processing and archiving it, and promulgating it back for consumption by end users, including machines and things – and the cloud is a vital part of this core.

Companies looking to be relevant between now and 2025 will need to understand the role data plays in their organization and how the Datasphere will evolve during that period. They will need to embrace their role as data guardians, leverage the cloud, and take a global approach to their data.

Data is **helping** us reach new markets, **better** serve existing customers, streamline operations, and monetize raw and **analyzed data**.

* Source: IDC's Intangible Asset Market Value Study, 2018

Methodology

The Measure of the Global Datasphere

The Global Datasphere is a measure of all **new** data that is captured, created, and replicated in any given year across the globe.

An installed base of over 70 categories of content creation/capture devices, including embedded systems in devices like automobiles, gasoline pumps, vending machines, and kiosks, were sized by geography and industry. Content creation and capture and replication and consumption calculations were applied to this installed base of devices.

The aggregation of all these calculations is called **our Global Datasphere.**

The broad category of devices includes:

1. **Non-entertainment imaging**
   e.g., medical imaging, MFPs, surveillance cameras, etc.
2. **Entertainment**
   e.g., digital TV/radio, movies, video games, etc.
3. **Productivity**
   e.g. PCs, servers, supercomputers, metadata, embedded systems
4. **Voice**
   e.g. mobile phones, VoIP, etc.

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