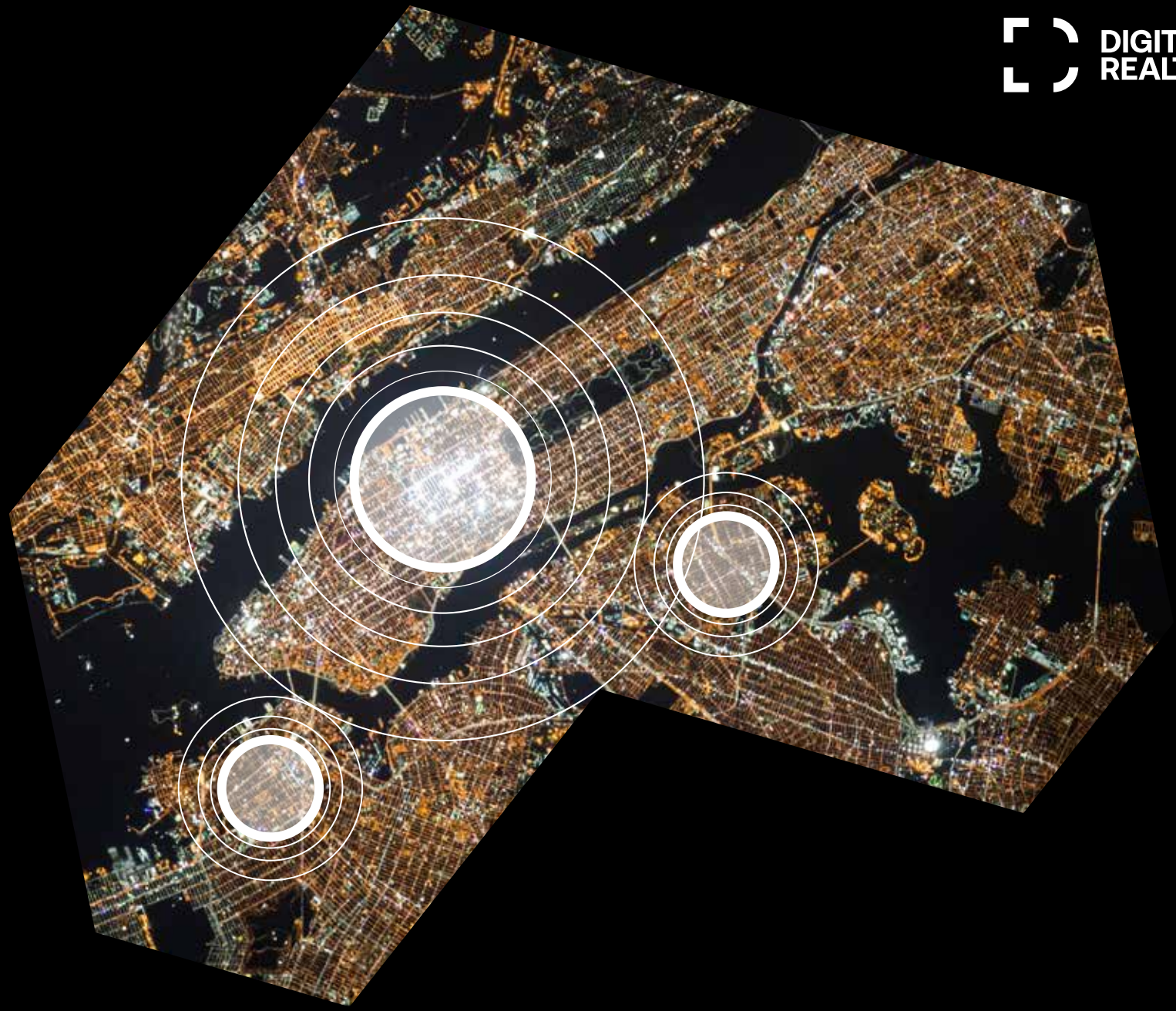
Data Gravity Index (DGx)™ 2.0



DIGITAL REALTY™

Measuring the effects of enterprise data creation and utilization across public cloud and private data centers

Contents

Photo courtesy of NASA/JPL-Caltech

Cover photo courtesy of NASA/JPL-Caltech

Introduction

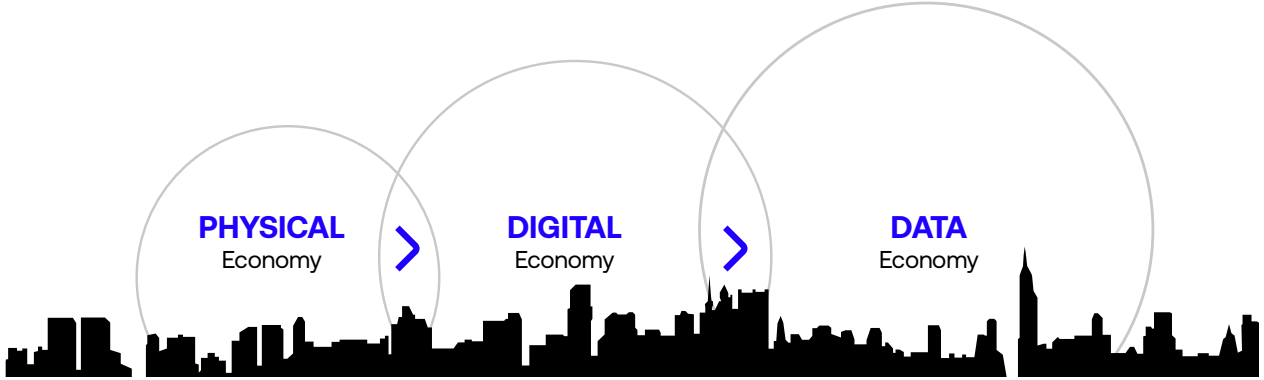
For as long as it has existed, the global economy has depended on the physical flows of people, goods, and services between trading centers and physical locations. These have evolved into financial and population centers.

The economy still rests on a network of physical locations, but these locations are now centers of data creation, processing, and exchange.

In these centers, the amount of data that enterprises and technology service providers use, consume, and exchange is growing exponentially. As companies digitize further and more data is created and exchanged, the intensity of use amplifies, which causes Data Gravity.

Business success relies on the secure and efficient exchange of these increased data sets to and from locations all over the world. To overcome the challenges of Data Gravity and facilitate these cross regional flows of data, businesses must plan strategically to manage impacts on customer experience and infrastructure.

In recent years, increased digitization* has shifted the physical economy to a digital economy, which is now entering a new form: **the data economy.**



*Accelerated by widespread use of technology, e.g. connectivity, internet, mobile, cloud, analytics, data, social, artificial intelligence and machine learning

About the Data Gravity Index™ 2.0

As the largest global provider of multi-tenant data center capacity,[1] Digital Realty has a unique vantage point on how technology infrastructure is built, deployed, and operated. For more than three years, we've witnessed the continued explosion of data growth globally and its effect on all businesses, irrespective of size.

We conducted research, cracked the code, built a global database, and in 2020, published the inaugural Data Gravity Index™ to share our findings. These unique insights have helped inform our customers as they shift their strategies to address complex Hybrid IT challenges underpinned by Data Gravity.

Today, we are continuing this mission with the Data Gravity Index™ 2.0, supported by refined data sets and calculations that correlate Data Gravity with Gross Domestic Product (GDP) growth. This reflects the increased importance of secure data exchange and our global economy shifting from physical to digital to data.

The 2.0 report is broadly applicable to large multi-national enterprises, technology service providers, and innovative fast-growing companies. It's designed to help them understand what's happening within the various locations they care about based on the capacity and connectivity needs of their businesses. It contains over 100 million unique data elements and over 1 billion calculations across more than 190 countries, 500 metros, and 10 industries.

The Data Gravity Index™ 2.0 quantifies and predicts the intensity of Data Gravity and the potential incremental capacity needed, so that businesses can make strategic decisions about where to place and connect infrastructure and data sets to enable performant, compliant, and resilient service delivery.

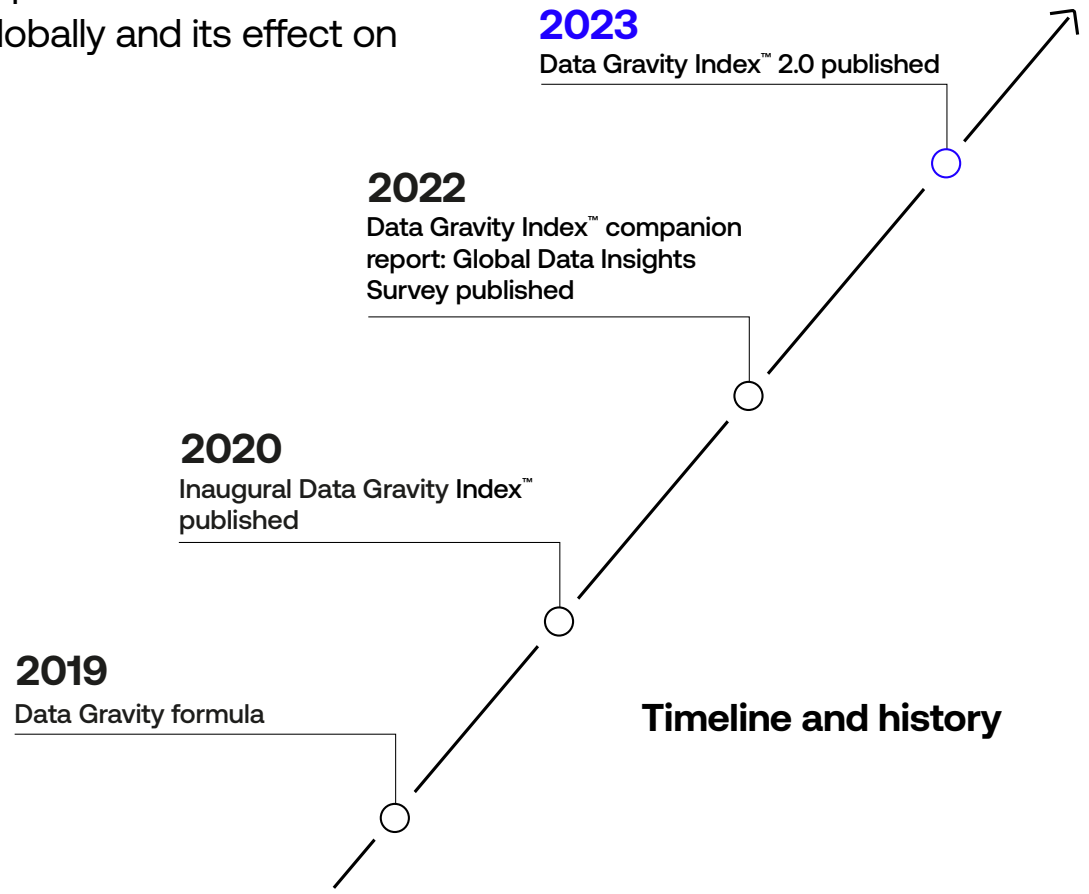


Fig. 1. *Data Gravity Index™ 2.0*, June 2023.

[1]451 Research, *Market Forecast, Leased Datacenter Global Providers*, 2023. Capacity measured in terms of operational square footage.

Macrotrends Influencing Data Gravity

	Digitally-Enabled Interactions	Data Localization	Mergers & Acquisitions (M&A)	Cyber–Physical	Enterprise Data Stewardship
What	Increasing digitization of enterprise workflows augmented by data and artificial intelligence	Expanding legal and regulatory policies requiring local data storage	Globalization is driving corporate M&A to achieve scale	Integration of physical and digital security systems to prevent intrusion of Internet of Things (IoT) systems	The enterprise is fast becoming the world's data steward
Why	70% **of new value created over the next 10 years will be based on digitally-enabled platform models**[1]	78% of IT leaders will maintain **local copies of customer and transaction data** for compliance[2]	63% of organizations are preparing for an **M&A deal in 2023**[3]	$12.6 trillion IoT could enable up to **$12.6 trillion** in value globally by **2030**[4]	80% By 2025, **80% of data worldwide** will reside in enterprises[5]
How	**Increases** enterprise data exchange volumes globally	**Increases** number of enterprise locations of data aggregation	**Increases** number of data sources participating in data exchange	**Increases** types and volumes of data creation and exchange	**Increases** the volume of data that needs to be aggregated and stored

[1] World Economic Forum, *Shaping the future of digital economy and new value creation*, June 2022.

[2] Digital Realty, *Global Data Insights Survey*, April 2022.

[3] Deloitte, *Could M&A Activity be a Springboard for Controllership Transformation*, December 2022.

[4] McKinsey, *The Internet of Things: Catching up to an accelerating opportunity*, November 2021.

[5] IDC #US44413318, *Data Age 2025, The Digitization of the World From Edge to Core*, November 2018

Photo courtesy of NASA/JPL-Caltech

Voice of the Enterprise

Key takeaways from Digital Realty's Global Data Insights Survey

Data-first strategy wins

75%

plan to use data to improve customer experience and build new digital products

Data distribution is increasing

72%

plan to add new business locations in the next two years

Data is localizing

78%

maintain local copies of customer data for business and compliance purposes

Data latency matters

77%

identified data latency specific performance requirements

The **Global Data Insights Survey** garnered responses from 7,295 C-level executives, business, and technology leaders, representing large multi-national enterprises across 23 countries and nine industries, with revenues ranging from $100 million to more than $1 billion.

Digital Realty, *Global Data Insights Survey*, April 2022.

The Unrealized Opportunity for Multi-National Companies

As the shift from the physical to digital to data economy occurs, large multi-national companies are well-positioned to address the unrealized $100 trillion value opportunity driven by the rapid acceleration of digital technology adoption.[1] Not only is data growing, there is also a significant shift in how data is created, processed, stored, and exchanged. This is compounded by increasing data localization, regulation, and sovereignty needs, creating a critical Data Gravity challenge for the large multi-national companies that operate the most complex systems and serve millions of users and endpoints. By putting data first from both a business and technology standpoint, this segment can profit from the shift to data-driven workflows and address Data Gravity where it is the highest — in major population centers — to capture this opportunity.

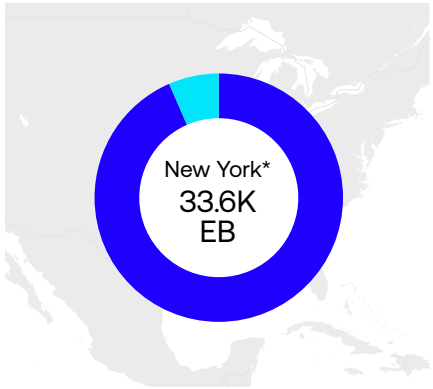


Fig. 2. *Data Gravity Index™ 2.0*, June 2023.

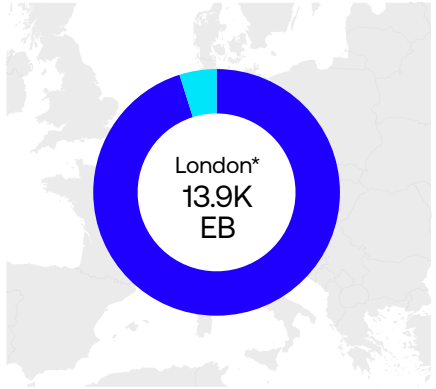


Fig. 3. *Data Gravity Index™ 2.0*, June 2023.

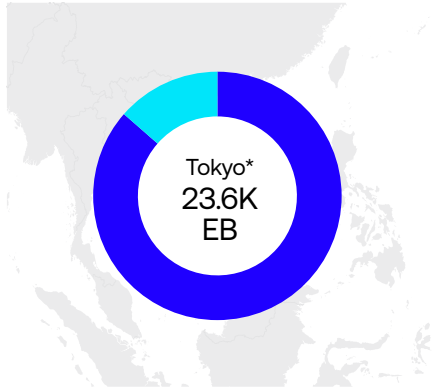


Fig. 4. *Data Gravity Index™ 2.0*, June 2023.

Enterprise Data Gravity	2025
Non-Cloud	●
Public cloud	●

*The Metro Forecast measures the enterprise data created and utilized within each metro, in exabytes (EB). For more information, see Methodology on pg. 17.

Large Multi-National Company Composite Profile[2,3,4,5,6,7,8]

13+	Countries with business presence (average per enterprise)
19K	Business units in 53 metros
36+	Points of presence (PoPs)
7K+	Data center PoPs
100M+	Employees
11M+	Applications
57K+	SAAS applications
$3T+	Annual IT and network spend
$18B+	Annual IAAS spend
$8B+	Annual PAAS spend
$40B+	Annual SAAS spend
$7B+	Annual colocation spend

[1]World Economic Forum. *$100 Trillion by 2025: the Digital Dividend for Society and Business*, January 2016.
[2] Gartner [3] HG Insights [4] Intricately [5] Synergy Research [6] IDC [7] Telegeography [8] Digital Realty Market Intelligence & Analytics

Key Takeaways*

As Trade Flows, Data Flows

01. **Data Gravity is increasing globally**. Its intensity has accelerated since we began measuring it three years ago.

02. **Enterprise data creation** and Data Gravity are **correlated with GDP**. As GDP of a location rises, so does its data.

03. **Trade flows** between countries and regions **increases Data Gravity**.

Secular Trends Drive Data Exchange

04. **Digital workflows driven by M&A** are localizing in large population centers due to Data Gravity.

05. **Increasing data regulations are amplifying Data Gravity** intensity relative to regional and country policies.

06. Maturity of digital technology adoption has a direct correlation to the intensity of Data Gravity. **As more combinations of technology are used, Data Gravity grows.**

As Data Grows, Infrastructure Capacity Grows

07. **Multi-cloud and hybrid cloud adoption** is becoming more common, which is contributing to the rise of Data Gravity.

08. **Cyber security and zero trust architectures** are increasing Data Gravity intensity.

09. **Artificial Intelligence (AI), predictive and generative,** will amplify Data Gravity as companies look to drive productivity and growth.

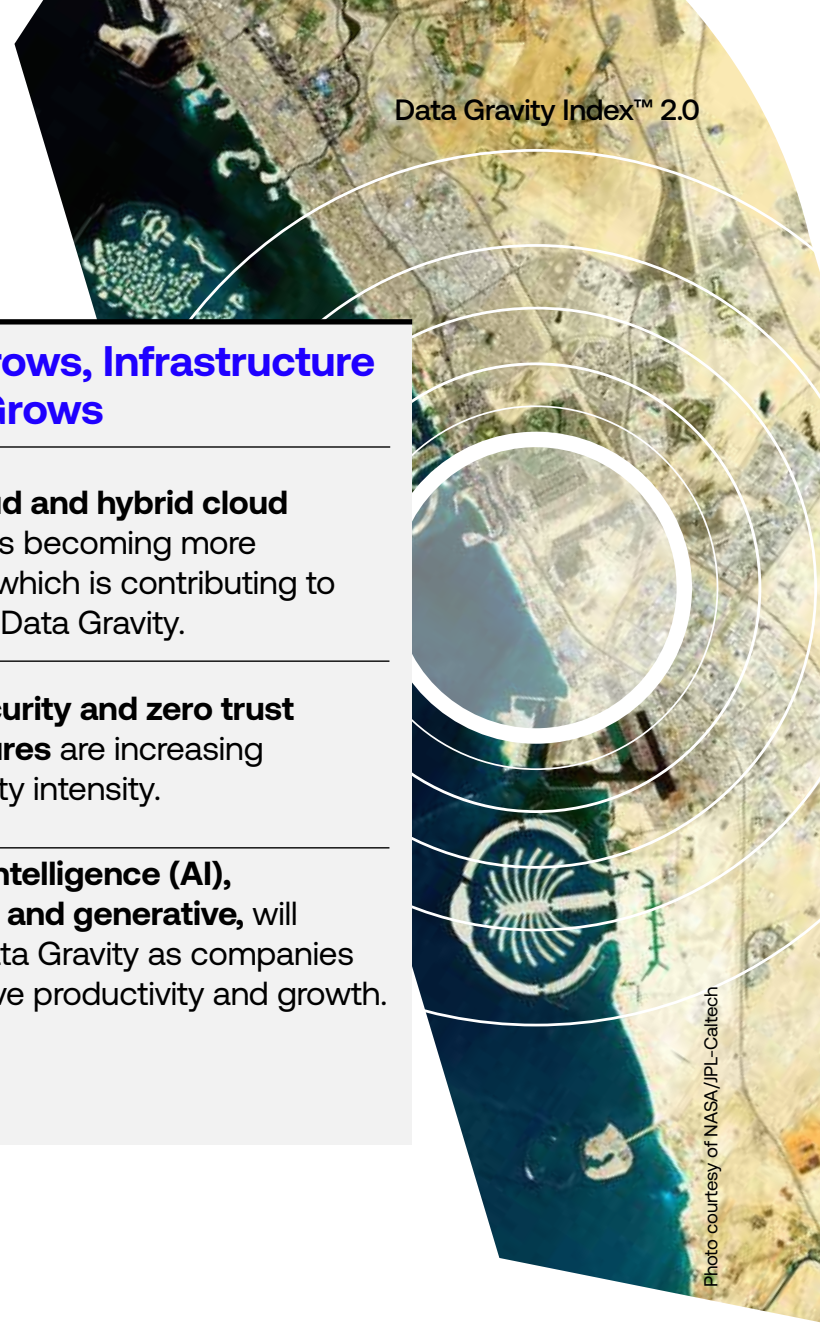


Photo courtesy of NASA/JPL-Caltech

*The Data Gravity Index™ 2.0 measures Data Gravity, correlated with the growth of Gross Domestic Product (GDP), and its impact on companies globally.
See Methodology on pg. 17 for more information.

Implications

	1. Cloud Providers	2. Network Providers	3. Enterprises
Implication	1. Data Gravity is cloud-adjacent 2. Traffic shift from north to south bound 3. Requires distributed cloud on-premise	1. Data Gravity is cloud-adjacent 2. Data flows across edge, core, cloud 3. Requires data-driven traffic management	1. Data Gravity is cloud-adjacent 2. Shift to data-driven workflows 3. Requires data-centric architecture
Recommendation	• Calibrate storage capacity across availability zones • Evolve cloud-to-cloud connectivity capabilities • Prioritize Hybrid IT colocation offerings	• Calibrate metro & regional capacity plans • Evolve SDN to data-centric traffic management • Become the middle mile orchestrator	• Calibrate capacity across employee centers • Place data & controls cloud-adjacent • Create centers of data exchange

Forecasts

Photo courtesy of NASA/JPL-Caltech

Data Gravity Index™ Evolution

The Data Gravity Index (DGx)™ 2.0 measures and quantifies the effects of enterprise data creation and utilization across public cloud and private data centers. The Data Gravity Index™ represents a multi-year data science program curating over 100 million data elements into the Data Gravity Index™ database and conducting over 1 billion calculations.

Data Gravity Index™ 1.5

Leveraged as foundation

$$(DM \times DA \times BW) / L^2$$

DATA MASS | DATA ACTIVITY | BANDWIDTH | LATENCY

New data, new dimensions

Adds new viewpoints

DATA SETS & GDP

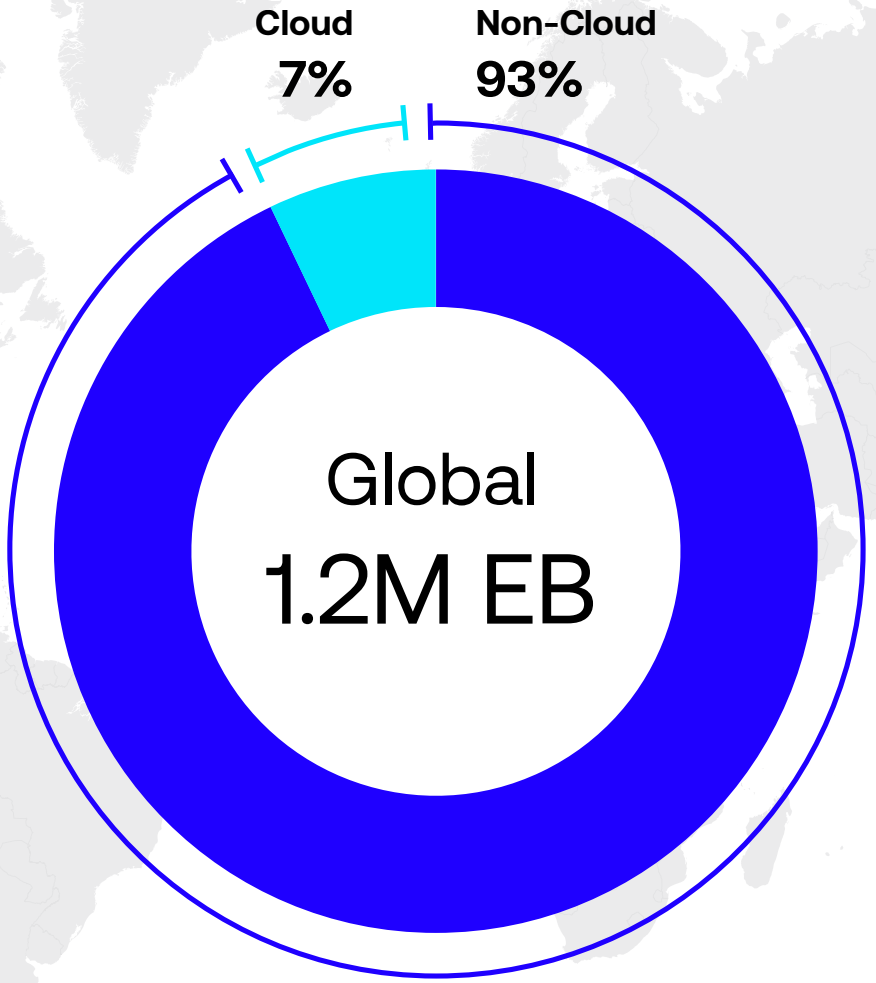
Data Gravity Index™ 2.0

New insights derived

2025 FORECAST of ENTERPRISE DATA CREATED & UTILIZED

Global Forecast*

Exponential growth globally
By 2025, approximately 1.2 million exabytes of incremental enterprise data are expected to be created and utilized across public cloud and private data centers.



Enterprise Data Gravity	2025
Non-Cloud	●
Public cloud	●

Fig. 5. *Data Gravity Index™ 2.0*, June 2023.

Highlights

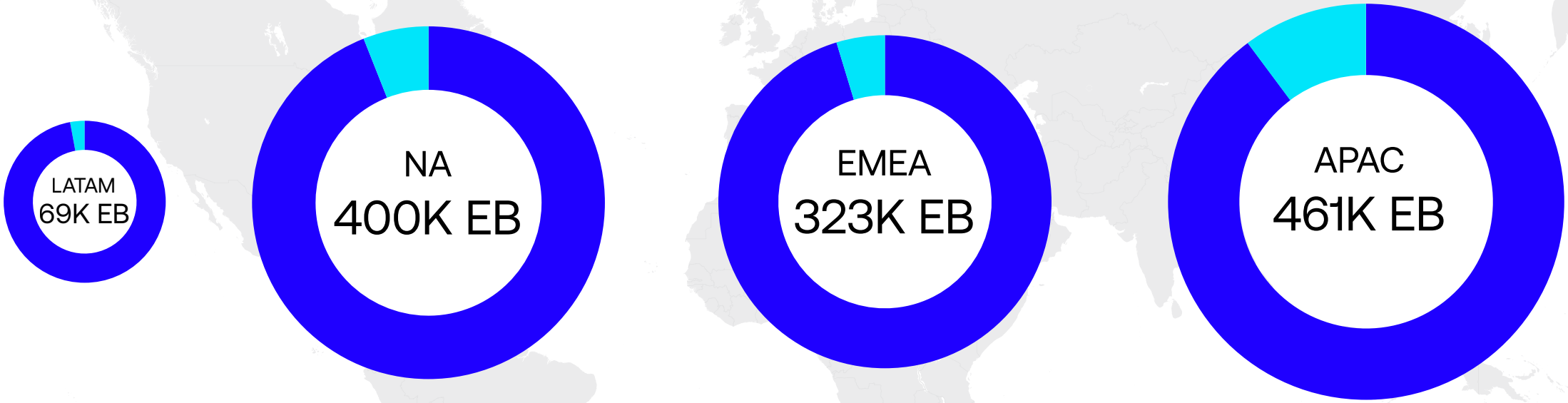
- Majority of enterprise data is created and utilized outside the public cloud
- Enterprises located in major population centers experience the highest Data Gravity intensity
- Enterprises implementing analytics, AI, and Big Data initiatives increase their Data Gravity intensity

*The Global Forecast measures the combined enterprise data created and utilized globally, in exabytes (EB).
For more information, see Methodology on pg. 17.

Regional Forecast*

Accelerating growth across all regions

By 2025, APAC is expected to be the region with the greatest incremental enterprise data created and utilized.



Enterprise Data Gravity	2025
Non-Cloud	
Public cloud	

Fig. 6. *Data Gravity Index™ 2.0*, June 2023.

NA Highlights

- 94% outside the public cloud
- Data localization is increasing Data Gravity
- NA enterprises lead global AI adoption

EMEA Highlights

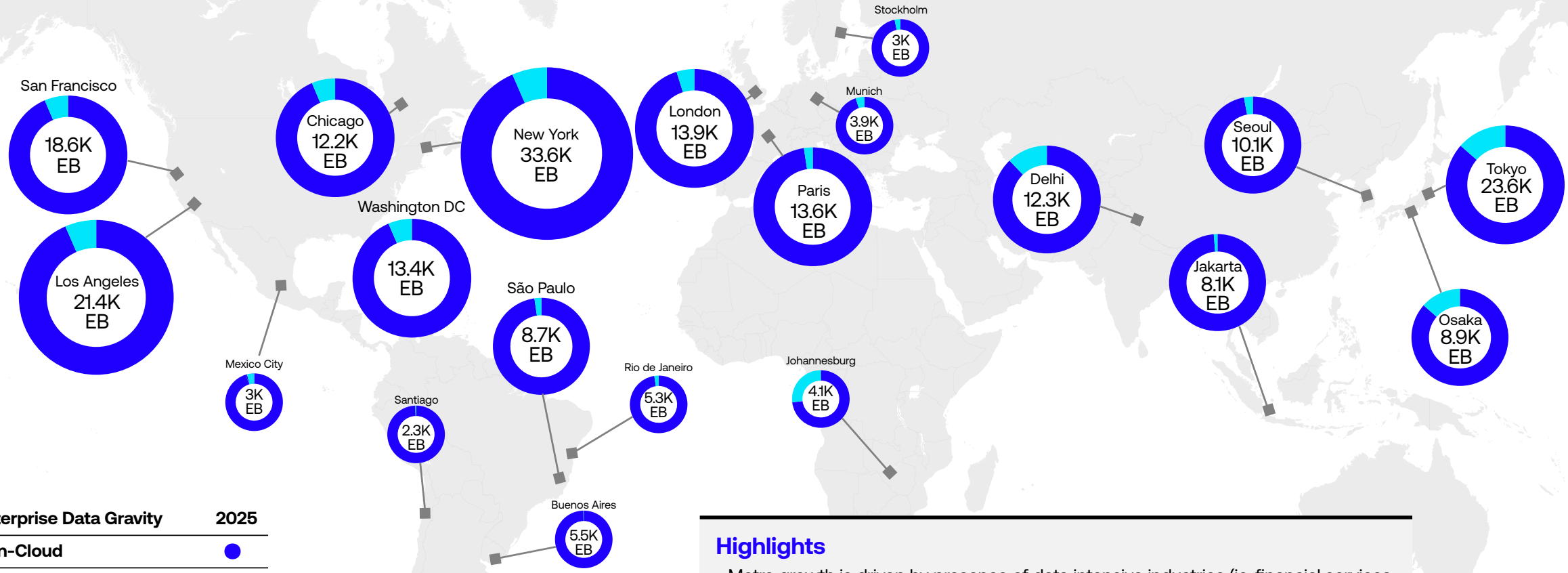
- 95% outside the public cloud
- Data regulations are increasing Data Gravity
- Pockets of strong enterprise AI use (France, Germany, UK)

APAC Highlights

- 90% outside the public cloud
- Data sovereignty is increasing Data Gravity
- Rapid growth of enterprise AI adoption (India, Japan, Singapore, South Korea)

*The Regional Forecast measures the enterprise data created and utilized within each region, in exabytes (EB).
For more information, see Methodology on pg. 17.

Metro Forecast*



Enterprise Data Gravity	2025
Non-Cloud	●
Public cloud	●

Fig. 7. *Data Gravity Index™ 2.0*, June 2023.

*The Metro Forecast measures the enterprise data created and utilized within each metro, measured in exabytes (EB). For more information, see Methodology on pg. 17.

Highlights

- Metro growth is driven by presence of data intensive industries (ie. financial services, manufacturing, pharmaceutical, logistics, healthcare, media and entertainment)
- Metro growth is influenced by region/country specific data regulations
- Metros with advanced IoT adoption encounter higher Data Gravity

Enterprise Storage*

Global

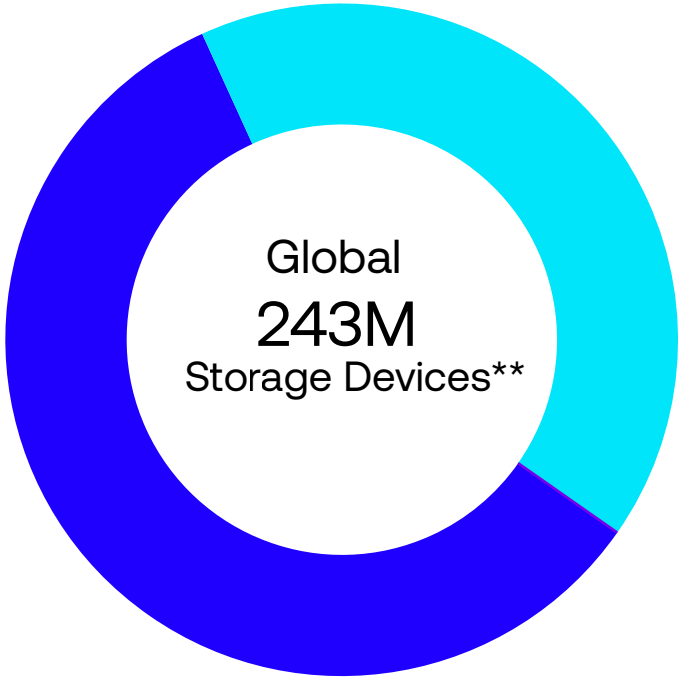


Fig. 9. *Data Gravity Index™ 2.0*, June 2023.

Enterprise Storage	2025
Non-Cloud	●
Public cloud	●

Regional

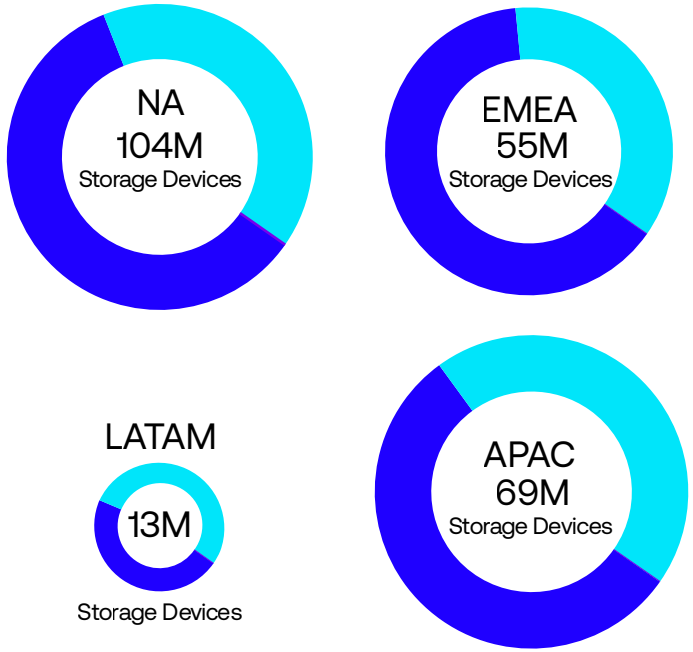


Fig. 10. *Data Gravity Index™ 2.0*, June 2023.

Metros

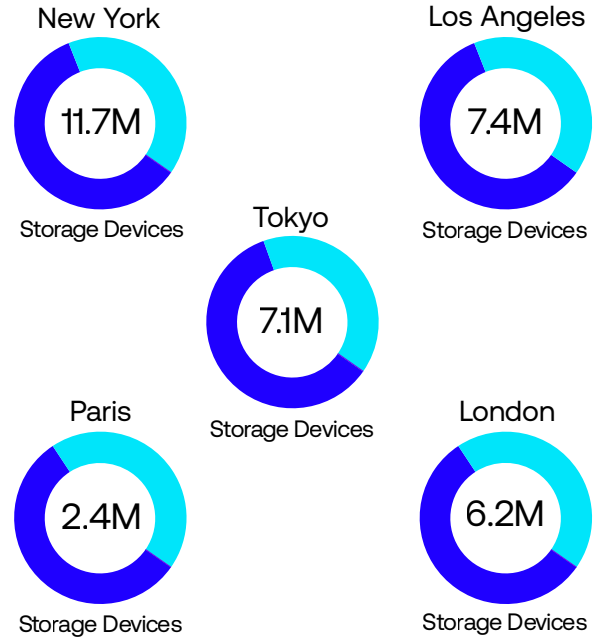


Fig. 11. *Data Gravity Index™ 2.0*, June 2023.

Highlights

- Significant incremental number of active storage devices are required globally to address enterprise Data Gravity
- Blended mix across public cloud and non-cloud reflects the need for a cloud-adjacent placement of storage
- Growth driven by factors including presence of data intensive industries and region/country-specific data regulations

*Enterprise Storage measures the predicted number of storage devices needed to support forecasted enterprise data. For more information, see Methodology on pg. 17.
**Active Data Units defined as annualized number of utilized devices providing active performance focused storage. Data on these devices is required to be online and performant for purposes such as Data Science, AI/ML, SSOT, and mission critical DBs, etc.

Enterprise Compute*

Global

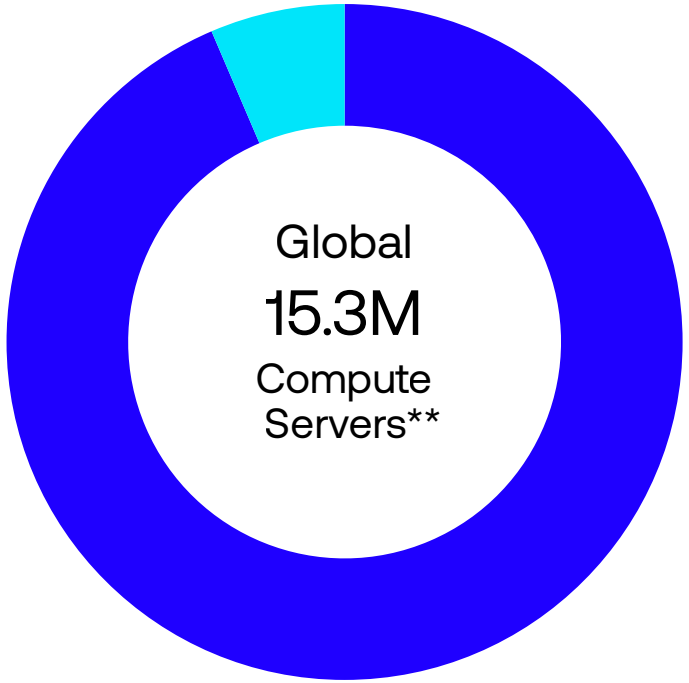


Fig. 12. *Data Gravity Index™ 2.0*, June 2023.

Enterprise Compute	2025
Non-Cloud	
Public cloud	

Regional

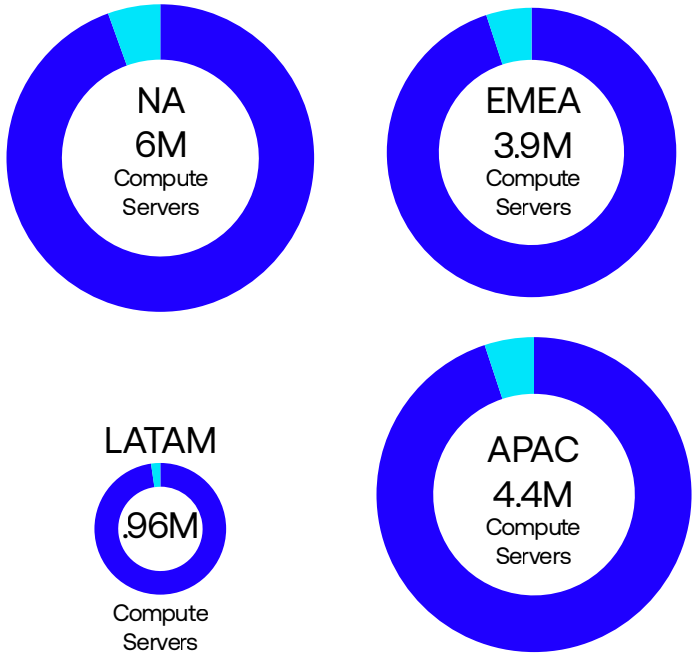


Fig. 13. *Data Gravity Index™ 2.0*, June 2023.

Metros

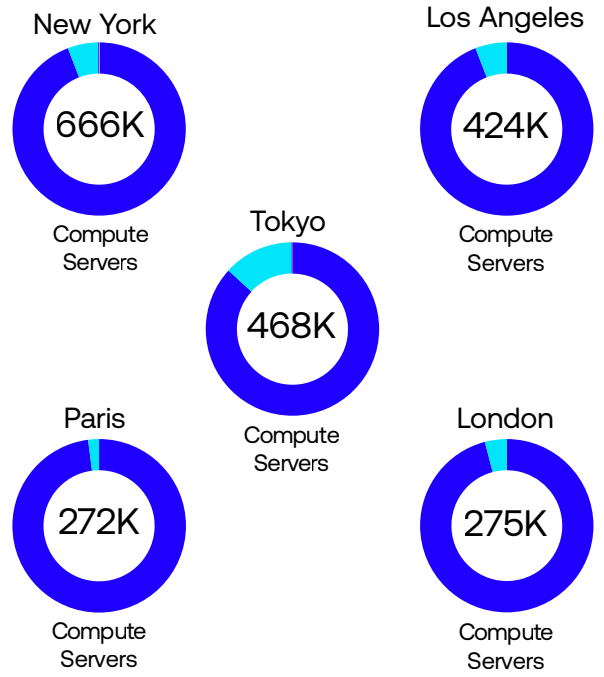


Fig. 14. *Data Gravity Index™ 2.0*, June 2023.

Highlights

- Substantial number of incremental servers are required globally to address enterprise Data Gravity
- Large percentage of servers required outside, yet adjacent, to public cloud to address enterprise Data Gravity
- Growth driven by factors including presence of data intensive industries and use of AI, Analytics, and Big Data

*Enterprise Storage measures the predicted number of storage devices needed to support forecasted enterprise data. For more information, see Methodology on pg. 17.
**Number of servers providing data processing capacity. Server defined as being multiprocessor (50 cores on average), based with a size profile of 1-2U, with 500 watts of power draw.

Methodology

The Data Gravity Index (DGx)™ 2.0 measures Data Gravity, correlated with the growth of Gross Domestic Product (GDP), and its impact on companies globally.

Using a macroeconomic lens to aggregate **all global enterprises, Data Gravity Index™ 2.0 calculates all enterprise data created and utilized across cloud and non-cloud data centers** at the global, regional, and metro level, and **predicts the incremental storage and processing needs** to support that data.

The data used in these calculations was sourced from the International Data Corporation (IDC), the International Monetary Fund (IMF), the Organization for Economic Cooperation and Development (OECD), the US Bureau of Economic Affairs, and economic data provided by individual country governments.

Data Gravity
Data Gravity is the attractive force caused by data creation and exchange, drawing applications, servers, and other data. As data creation and exchange grows, it accelerates exponentially due to this attractive force. In centers of data creation and exchange, this explosion of data can be onerous for legacy servers and applications, and Data Gravity can cause challenges that can impede efficiency, security, customer experiences, and innovation on a global scale.

Measuring Data Gravity within Locations
The intensity of Data Gravity globally, as well as in regions, countries, and metros is gauged by the enterprise data created and utilized within locations, measured in exabytes. It includes the measurement of both non-cloud and cloud enterprise data.

Predicting Incremental Storage and Processing
Enterprise storage and processing needs, measured in number of storage devices and servers, are calculated through the combined projection of enterprise data mass and activity and acceleration of enterprise storage and processing capacity.

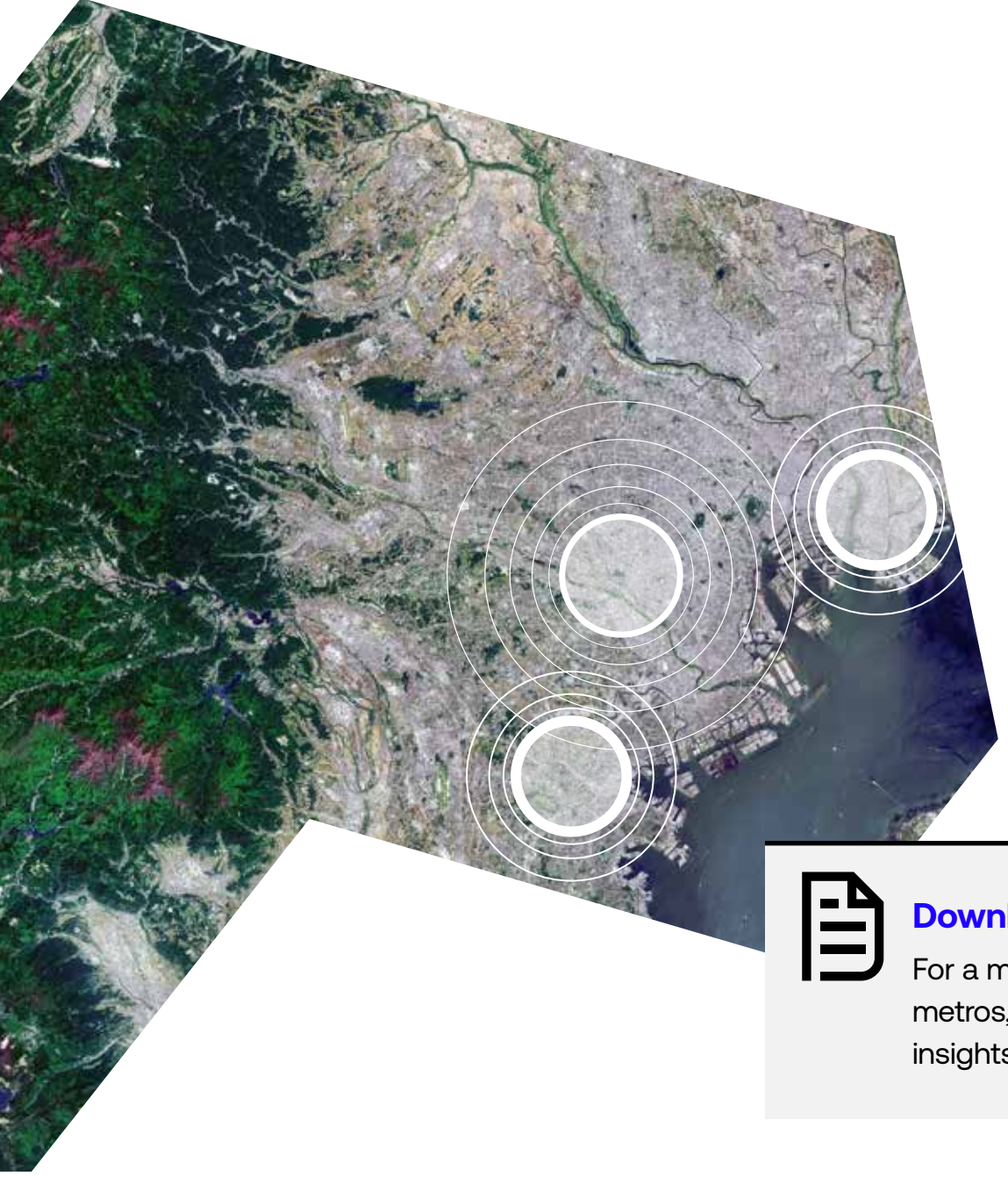
Cloud Data versus Non-Cloud Data
Cloud data refers to enterprise data mass and activity created and utilized through traditional cloud providers. Non-cloud data refers to enterprise data mass and activity created and utilized outside of the cloud – for example, in traditional data centers.

The Data Gravity calculation considers attributes from 11,000 large multi-national companies with more than $1 billion revenues including:

Firmographic data
- Industry segment(s)
- Employee data
- Revenue data
- Location data
- Corporate entity

Technographic data
- IT spend
- Preferred vendors
- Network traffic distribution
- Network PoPs
- Data center PoPs
- Cloud PoPs

Industry Benchmarks
- Data creation/ transfer rates
- Latency by access method, user type, location, application type
- Growth rates
- Cloud usage
- Networking services
- Distributed services
- Data technologies
- End points, user devices
- Application use cases



Learn More

- Rich, powerful insights derived from 1 billion operations against over 100 million data points across more than 190 countries and 500 metros
- In-depth data on Data Gravity across public cloud versus non-cloud destinations
- More than 80 metro forecasts for 2025
- Details on the incremental number of enterprise storage and compute required to address Data Gravity by 2025

Download the Data Gravity Index™ 2.0 Databook

For a more in-depth view of the proliferation of data within regions, countries, and metros, download the Data Gravity Index™ 2.0 Databook. Unlock data exchange insights for the future of enterprise capacity planning and infrastructure placement.

About Digital Realty

Digital Realty brings companies and data together by delivering the full spectrum of data center, colocation and interconnection solutions. PlatformDIGITAL®, the company's global data center platform, provides customers with a secure data meeting place and a proven Pervasive Datacenter Architecture (PDx®) solution methodology for powering innovation and efficiently managing Data Gravity challenges. Digital Realty gives its customers access to the connected data communities that matter to them with a global data center footprint of 300+ facilities in 50+ metros across 28 countries on six continents.

To learn more about Digital Realty, please visit **digitalrealty.com** or follow us on **LinkedIn** and **Twitter**.

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