Chapter 1: Introduction to Big Data & Hadoop

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Introduction to Big Data

- The term Big Data refers to huge collections of data that are structured and unstructured which can’t be processed or analyzed using traditional processes or tools
- Big data is larger, more complex data sets, especially from new data sources. These data sets are so voluminous that traditional data processing software just can’t manage them.
- These massive volumes of data can be used to address business problems you wouldn’t have been able to tackle before.
- Data may be sourced from servers, customer profile information, order and purchase data, financial transactions, ledgers, search history, and employee records.

Introduction to Big Data - Big Data Principles

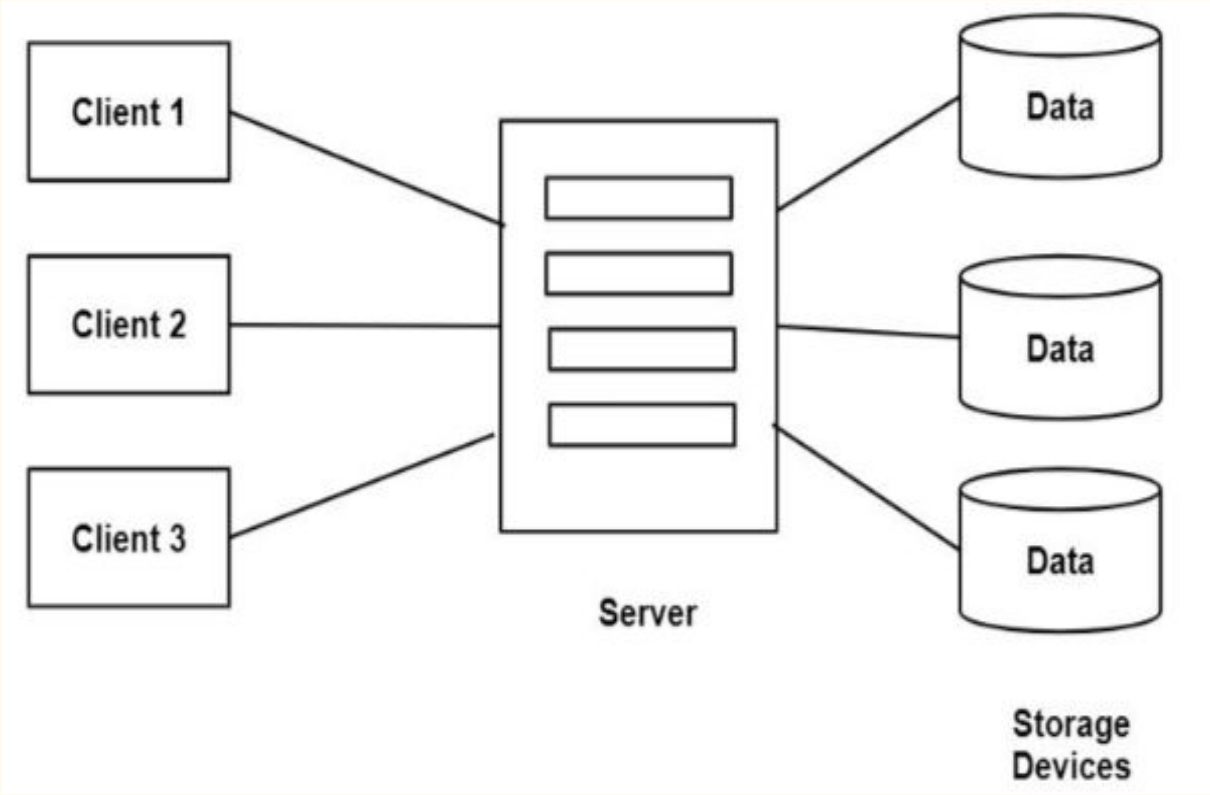
- Big Data solutions are ideal for analyzing not only raw structured data, but semistructured and unstructured data from a wide variety of sources.
- Big Data solutions are ideal when all, or most, of the data needs to be analyzed versus a sample of the data; or a sampling of data isn’t nearly as effective as a larger set of data from which to derive analysis.
- Big Data solutions are ideal for iterative and exploratory analysis when business measures on data are not predetermined.

Distributed file system

DFS is a file system that enables clients to access file storage from multiple hosts through a computer network as if the user was accessing local storage.

Files are spread across multiple storage servers and in multiple locations, which enables users to share data and storage resources.

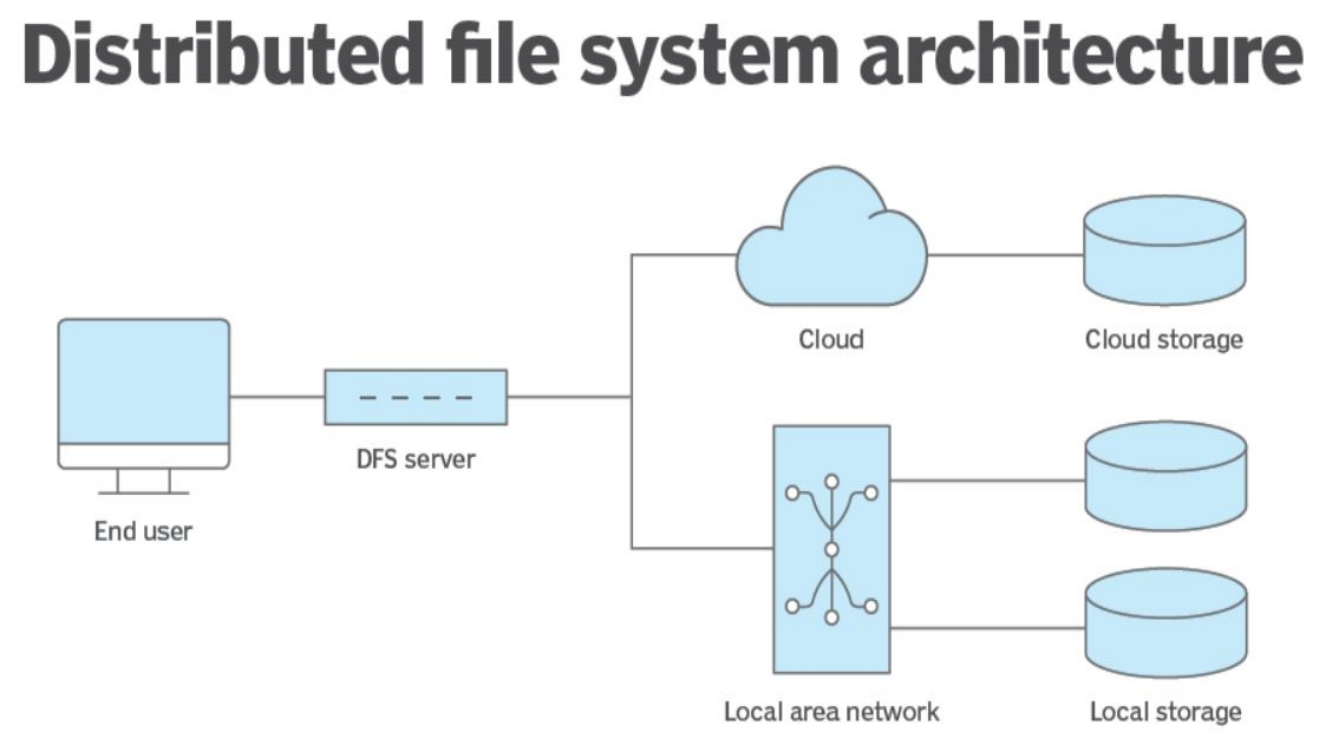
If organizations need to scale up their infrastructure, they can add more storage nodes to the DFS.



Distributed file system

DFS clusters together multiple storage nodes and logically distributes data sets across multiple nodes that each have their own computing power and storage. The data on a DFS can reside on various types of storage devices.

DFS is located on a collection of servers, mainframes or a cloud environment over a local area network (LAN)

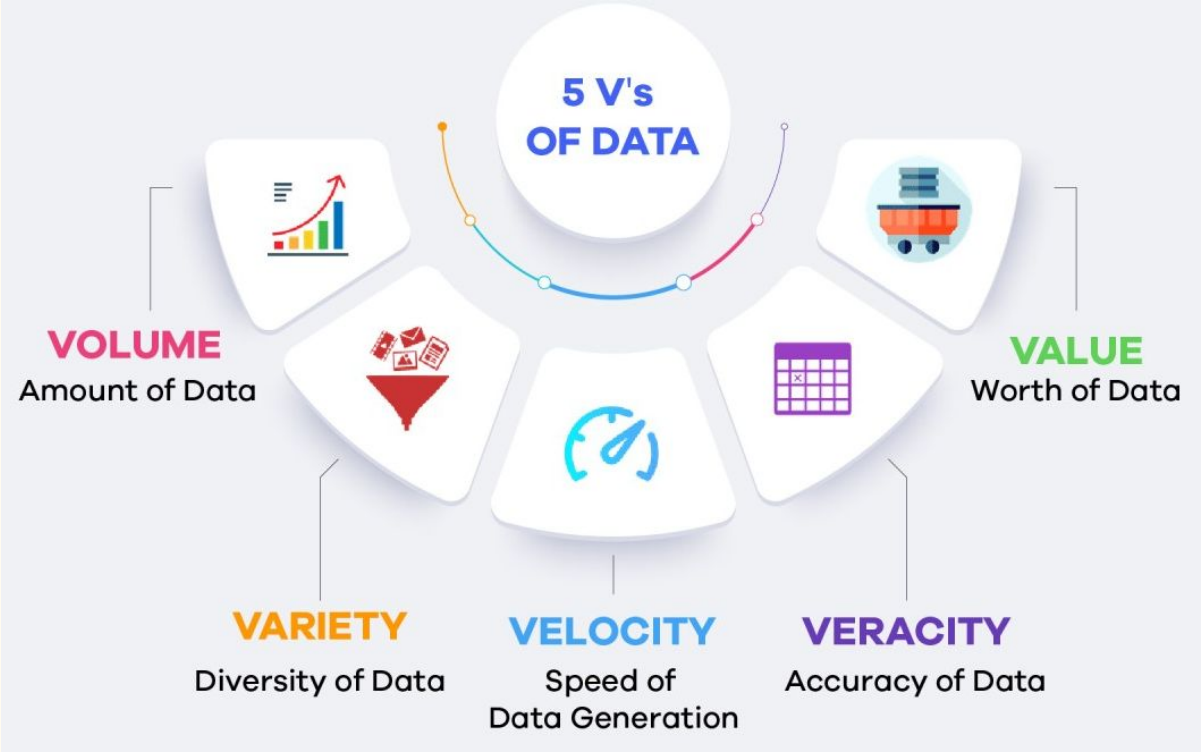


Various Units of Memory - Data Size Storage

Name	Equal to:	Size in Bytes
Bit	1 bit	1/8
Nibble	4 bits	1/2 (rare)
Byte	8 bits	1
Kilobyte	1,024 bytes	1,024
Megabyte	1,024 kilobytes	1,048,576
Gigabyte	1,024 megabytes	1,073,741,824
Terrabyte	1,024 gigabytes	1,099,511,627,776
Petabyte	1,024 terrabytes	1,125,899,906,842,624
Exabyte	1,024 petabytes	1,152,921,504,606,846,976
Zettabyte	1,024 exabytes	1,180,591,620,717,411,303,424
Yottabyte	1,024 zettabytes	1,208,925,819,614,629,174,706,176

Big Data characteristics - 5 V’s of Big Data Drivers, types of Big Data

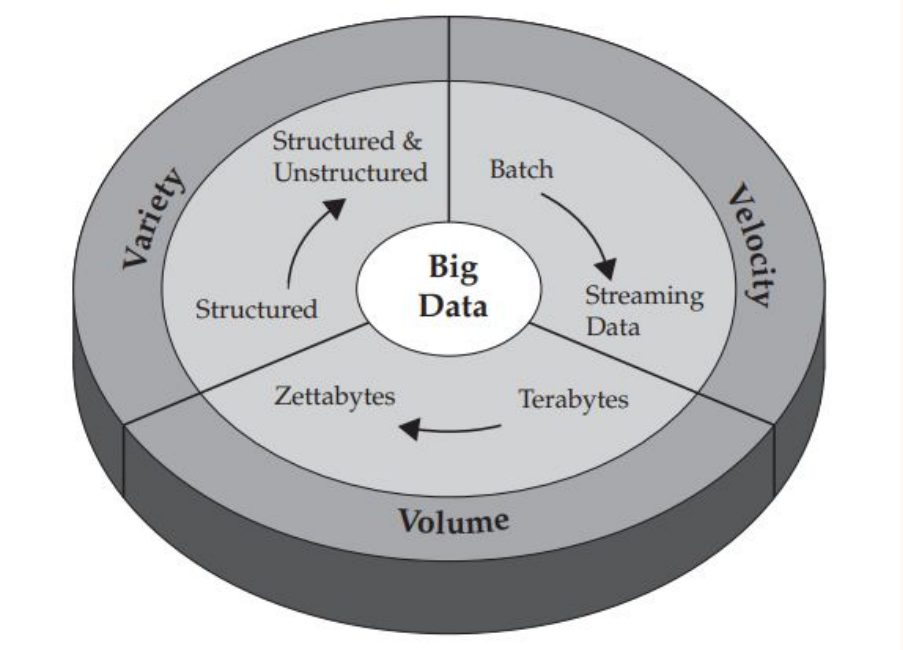
- **Volume-** Huge amount of data generated from various sources
- **Variety**- Different sources of data and its nature
- **Velocity-** speed at which data is generated and speed. Data processing is related to this increased speed of generation



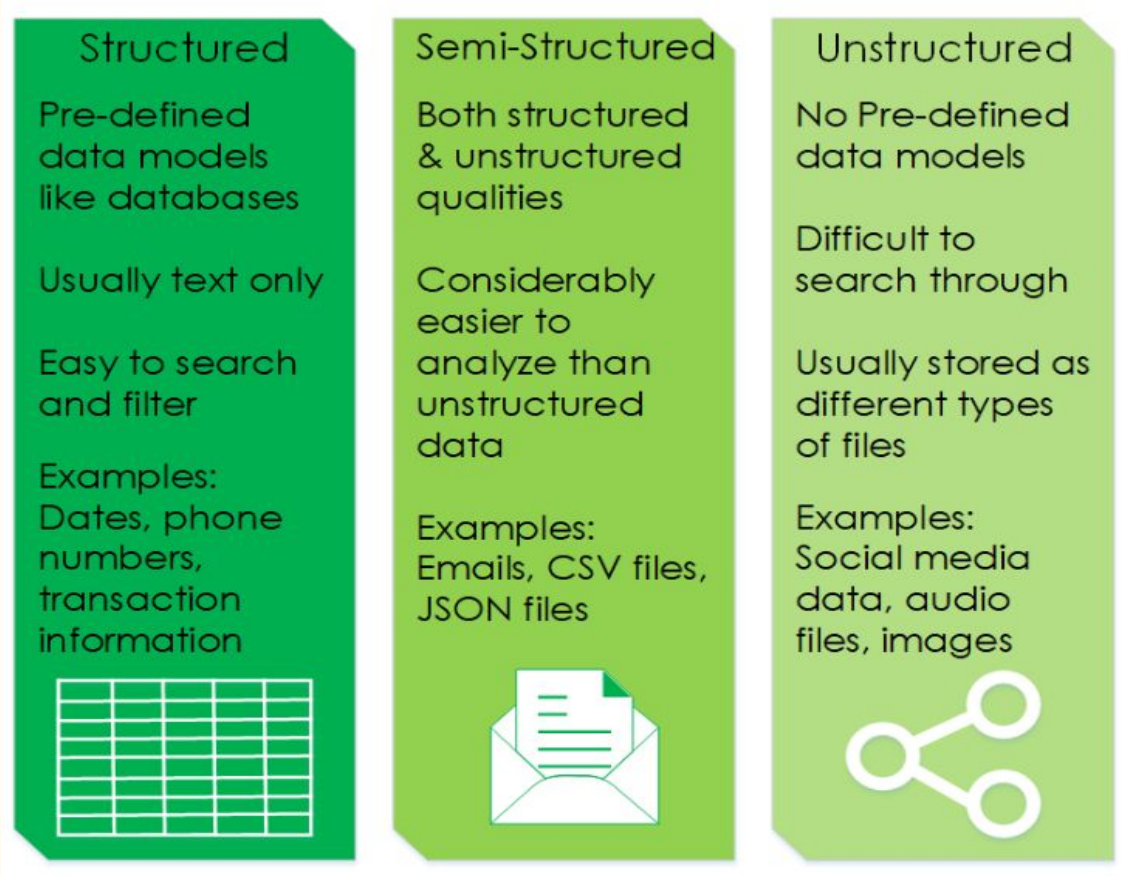
Big Data characteristics - 5 V's of Big Data Drivers, types of Big Data

- **Veracity**- It defines the degree of *trustworthiness* of the data. It denotes data inconsistency as well as data uncertainty.
- **Value-** has to be reliable and useful.
- volume is useful in determining whether a collection of data is Big Data or not.
- variety of data is crucial for its storage and analysis.

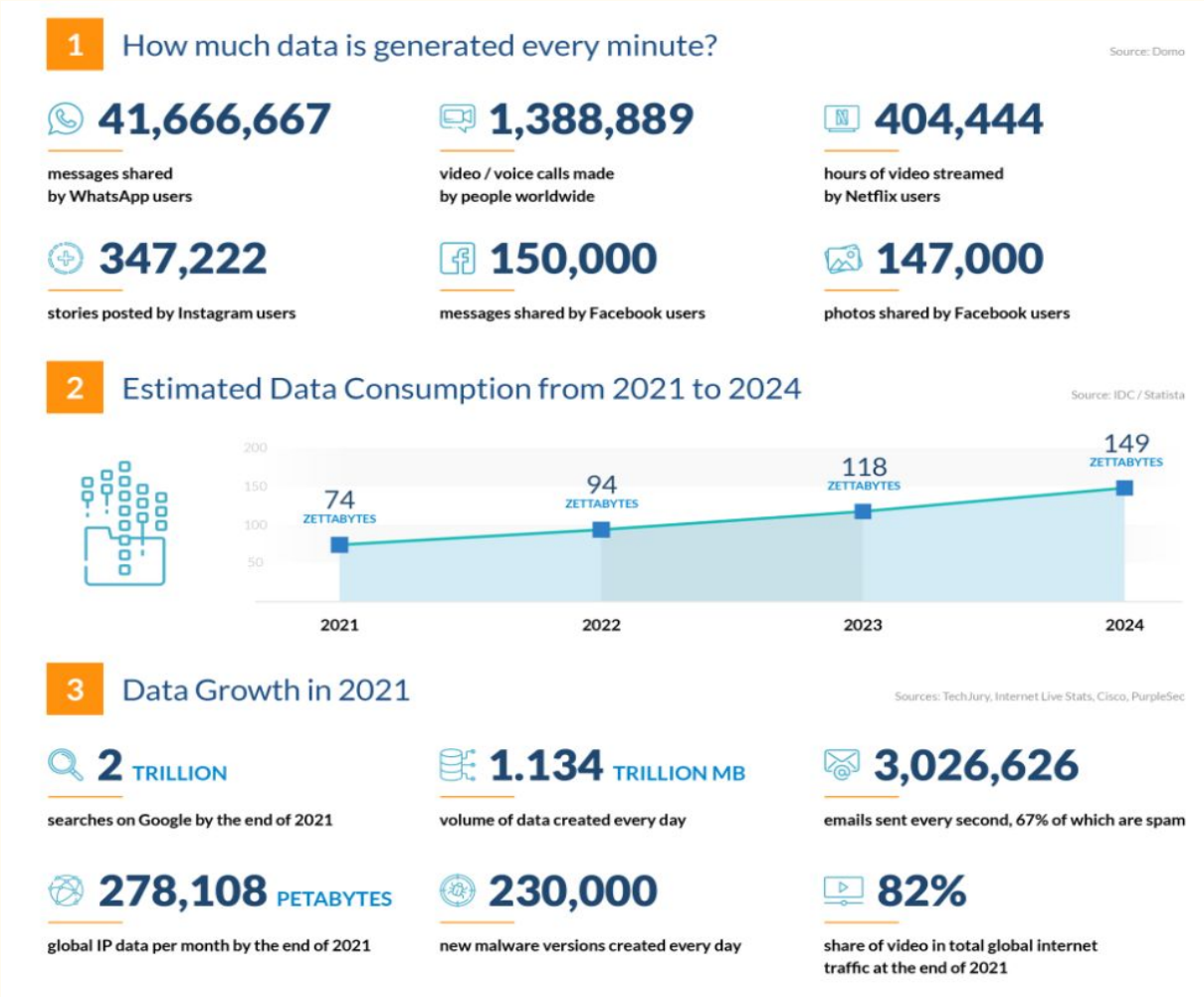
Characterised By IBM



Types of Big Data



Data growth

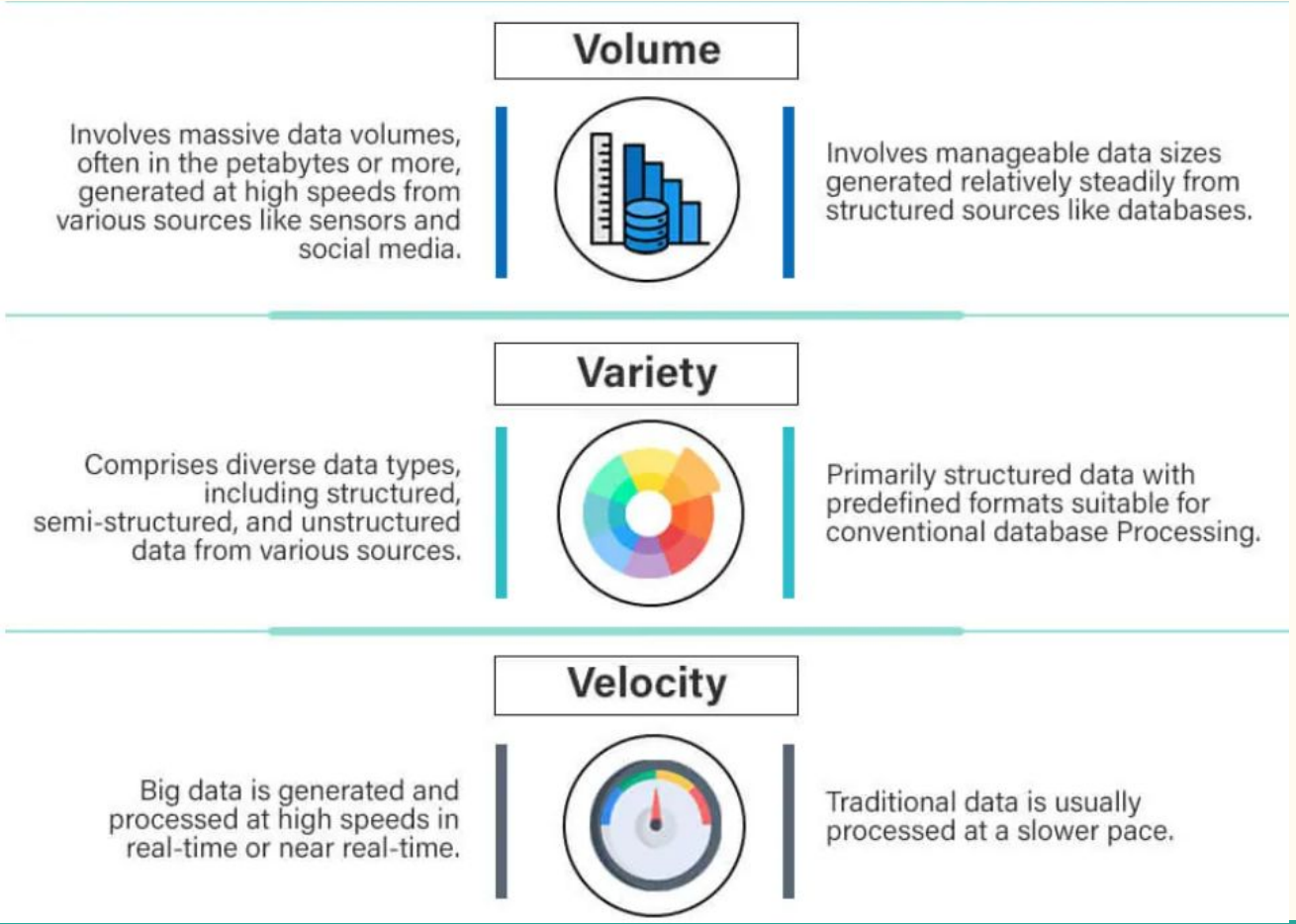

1
How much data is generated every minute?
Source: Domo
41,666,667
messages shared by WhatsApp users
1,388,889
video / voice calls made by people worldwide
404,444
hours of video streamed by Netflix users
347,222
stories posted by Instagram users
150,000
messages shared by Facebook users
147,000
photos shared by Facebook users
2
Estimated Data Consumption from 2021 to 2024
Source: IDC / Statista
200
150
100
50
74 ZETTABYTES
94 ZETTABYTES
118 ZETTABYTES
149 ZETTABYTES
2021
2022
2023
2024
3
Data Growth in 2021
Sources: TechJury, Internet Live Stats, Cisco, PurpleSec
2 TRILLION
searches on Google by the end of 2021
1.134 TRILLION MB
volume of data created every day
3,026,626
emails sent every second, 67% of which are spam
278,108 PETABYTES
global IP data per month by the end of 2021
230,000
new malware versions created every day
82%
share of video in total global internet traffic at the end of 2021

Data growth

Category	Proportion of Internet Data Traffic
Video	53.72%
Social	12.69%
Gaming	9.86%
Web browsing	5.67%
Messaging	5.35%
Marketplace	4.54%
File sharing	3.74%
Cloud	2.73%
VPN	1.39%
Audio	0.31%

Year	Data Generated	Change Over Previous Year	Change Over Previous Year (%)
2020*	64.2 zettabytes	↑ 23.2 zettabytes	↑ 56.59%
2021*	79 zettabytes	↑ 14.8 zettabytes	↑ 23.05%
2022*	97 zettabytes	↑ 18 zettabytes	↑ 22.78%
2023*	120 zettabytes	↑ 23 zettabytes	↑ 23.71%
2024*	147 zettabytes	↑ 27 zettabytes	↑ 22.5%
2025*	181 zettabytes	↑ 34 zettabytes	↑ 23.13%

Big Data Approach vs Traditional Data Systems



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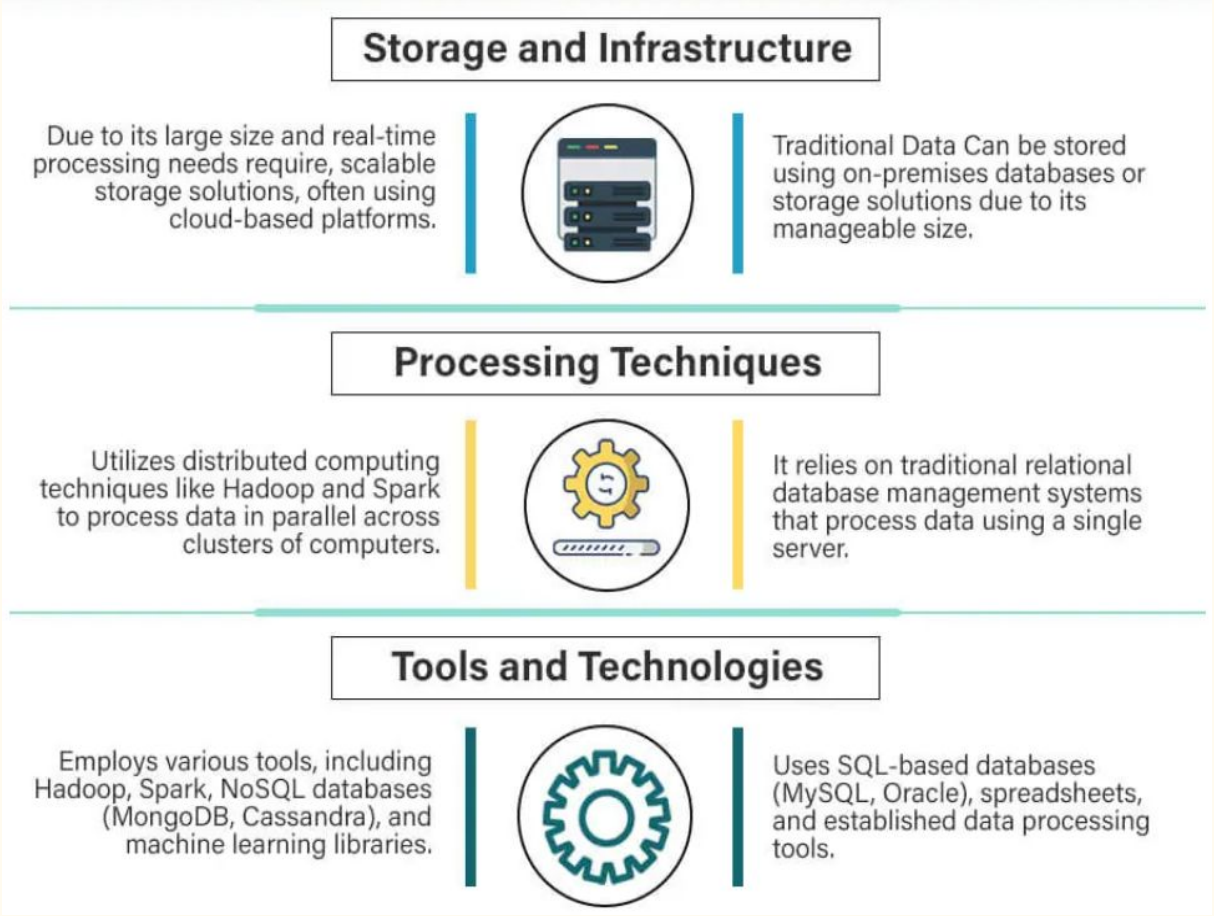

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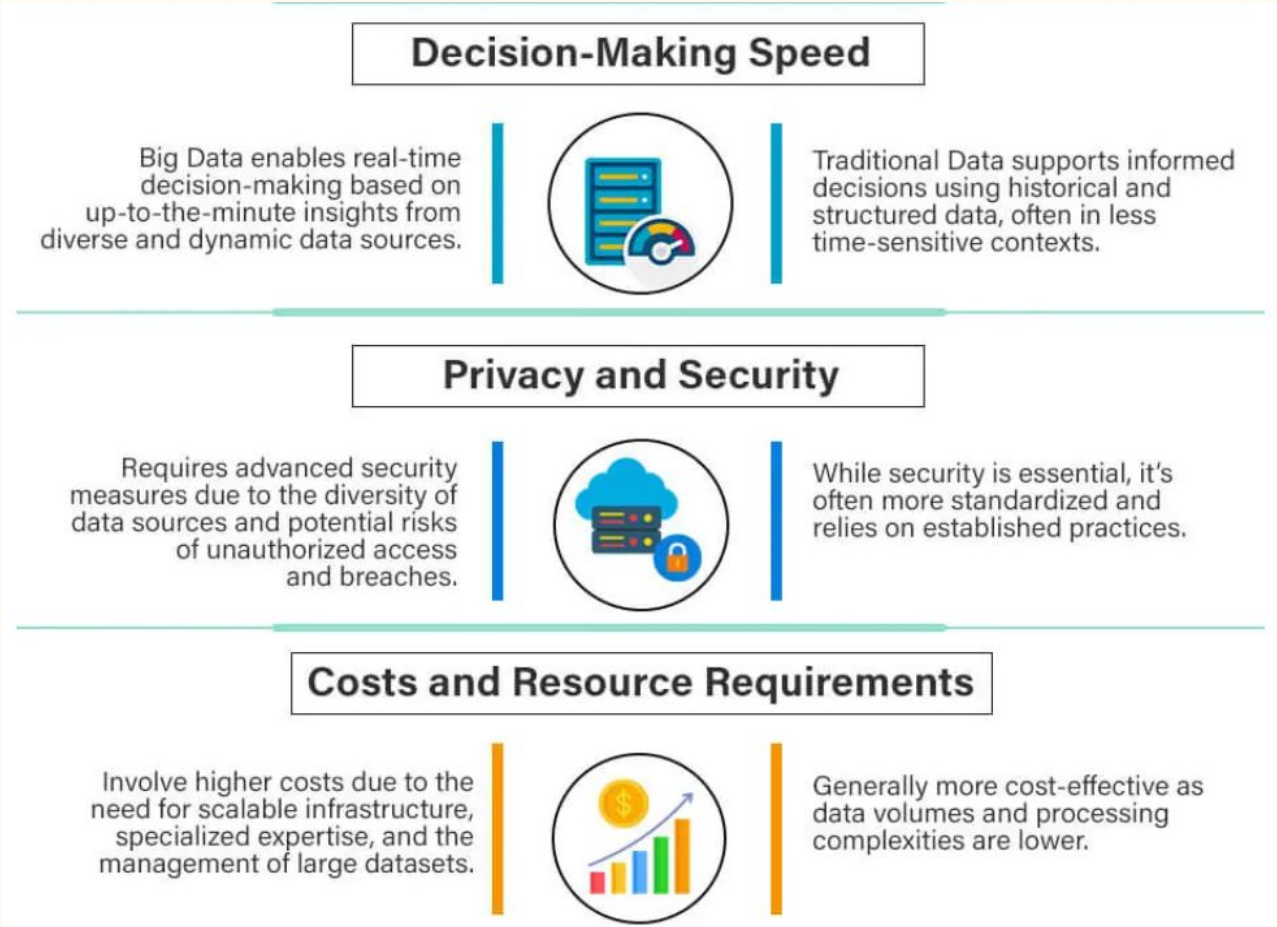


Big Data Approach vs Traditional Data Systems

Use Cases and Industries

Applied in IoT, social media analysis, predictive analytics, and real-time monitoring.

Used in transactional systems, reporting, and applications with relatively low data volume and complexity.

Scalability and Future Readiness

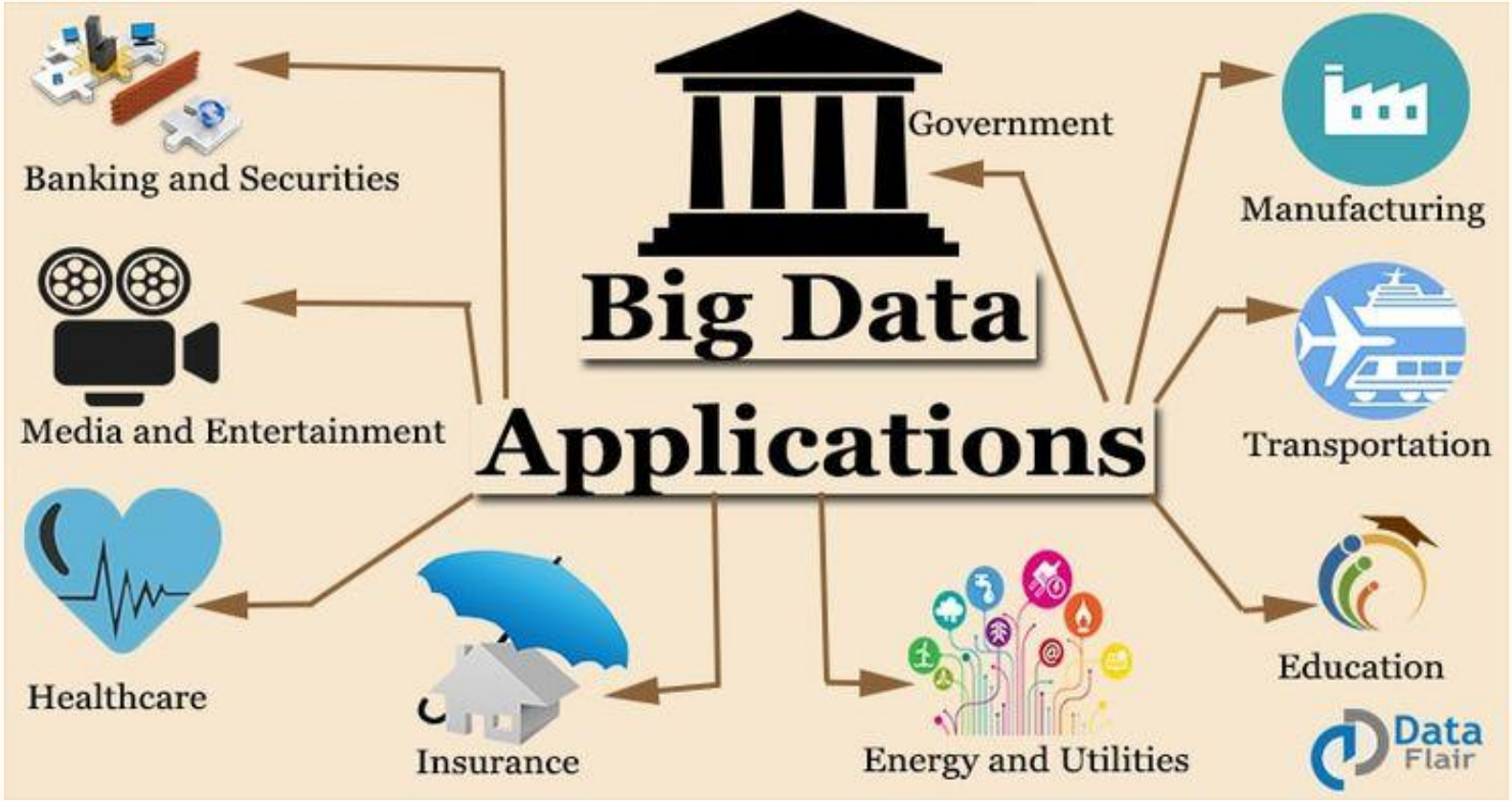
Big data systems are designed to handle massive data growth. They are built with flexibility, capable of integrating new data sources, adapting to emerging technologies, and accommodating evolving analytical methods.

Traditional data systems might struggle to handle the explosive growth of data, especially when faced with unanticipated increases in volume. They are often less agile in adapting to changing requirements.

Case Study of Big Data Solutions Examples

- Retail:
    - Product Development
    - Customer Experience
    - Customer Lifetime Value
- Health Care:
    - Healthcare billing analytics
    - Claim Frauds
- Banking:
    - Fraud Detection
    - Business process optimization and automation

Big Data Applications



Societal and Ethical issues associated with the use of big data analytics

- Private customer data and identity should remain private
- Shared private information should be treated confidentially
- Customers should have a transparent view
- Big Data should not interfere with human will
- Big data should not institutionalize unfair biases

The key privacy issues or Big Data Challenges

- Cybersecurity and Privacy
- Data Quality
- Data Storage & Processing
- Data Interpretation and Analysis
- Evaluating and selecting Big Data Technologies
- Lack of Knowledge Professionals
- Integrating data from multiple sources
- Ethical Issues.

END