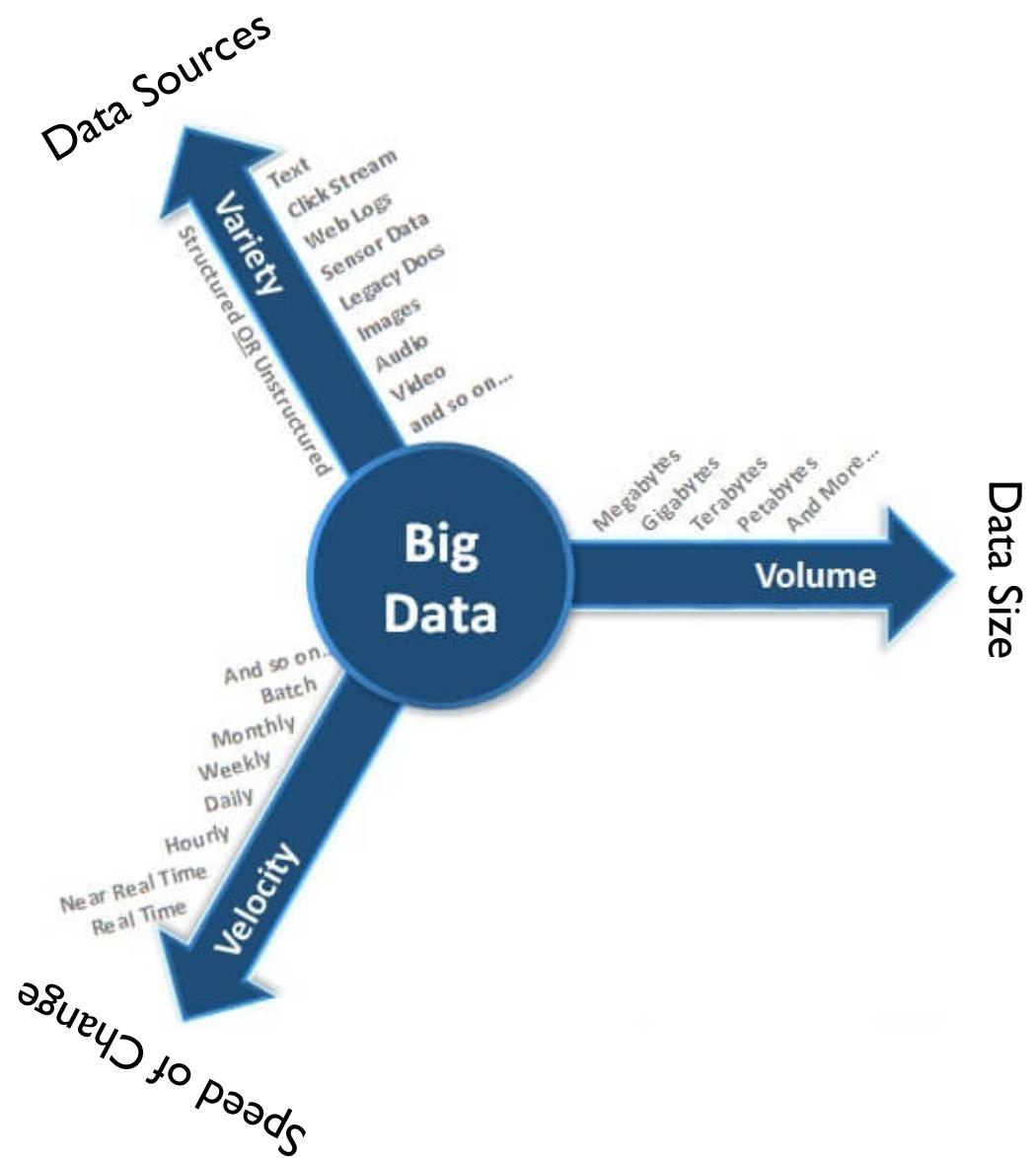


BIG DATA

INTRODUÇÃO



ORIGEM





2003

The Google File System

- [Paper](#)



2010

Dremel: Interactive Analysis of Web-Scale Datasets

- [Paper](#)



MapReduce: Simplified Data Processing on Large Clusters

- [Paper](#)



2004



GOOGLE

GOOGLE

- A scalable distributed file system for large distributed data-intensive applications
`#scalable #distributed #large #data-intensive`
- ... shares many of the same goals as previous distributed file systems such as performance, scalability, reliability, and availability
`#performance #reliability #availability`
- Its design has been driven by observations of our application workloads and technological environment that reflect a marked departure from some earlier file system design assumptions.
`#workloads #technological-environment`

The Google File System

Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung
Google*

1. Component failures are the norm rather than the exception
2. Files are huge by traditional standards. Multi-GB files are common. Each file typically contains many application objects such as web documents
3. Most files are mutated by appending new data rather than overwriting existing data
4. Co-designing the applications and the file system API benefits the overall system by increasing our flexibility.

GOOGLE

- Programming Model
- Implementation
- Runtime System
- Partitioning
- Scheduling Execution
- Large cluster of commodity machines
- Handling machine failures
- Managing inter-machine communication
- Map, Combiner, Partitioner, Shuffle, Sort, Reduce

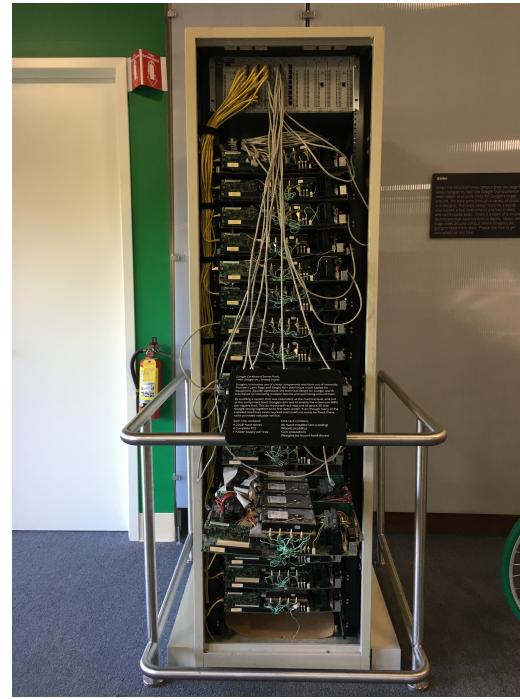
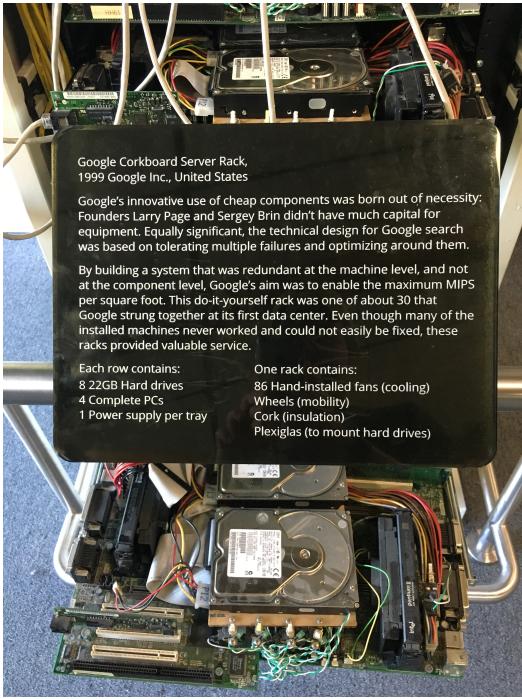
- MapReduce is a programming model and an associated implementation for processing and generating large data sets. **Users** specify:
 - A map function: processes a key/value pair to generate a set of intermediate key/value pairs,
 - A reduce function: merges all intermediate values associated with the same intermediate key.
- Programs written in this functional style are automatically parallelized and executed on a large cluster of commodity machines.
- The runtime system takes care of the details of partitioning the input data, scheduling the program's execution across a set of machines, handling machine failures, and managing the required inter-machine communication.

MapReduce: Simplified Data Processing on Large Clusters

Jeffrey Dean and Sanjay Ghemawat

jeff@google.com, sanjay@google.com

Google, Inc.



CLUSTER

GOOGLE

- Dremel is a **scalable, interactive ad-hoc query system** for **analysis of read-only** nested data.
- By combining multi-level execution trees and **columnar data layout**, it is capable of running aggregation queries over trillion-row tables in seconds.
- The system **scales to thousands of CPUs** and **petabytes of data**.
- Dremel has been in production since 2006 and has thousands of users within Google
- Dremel builds on ideas from web search and parallel DBMSs:
 - Its architecture borrows the concept of a serving tree used in distributed search engine
 - Dremel **provides a high-level, SQL-like language** to express ad hoc queries. In contrast to layers such as Pig and Hive, **it executes queries natively without translating them into MR jobs**.

Dremel: Interactive Analysis of Web-Scale Datasets

Sergey Melnik, Andrey Gubarev, Jing Jing Long, Geoffrey Romer,
Shiva Shivakumar, Matt Tolton, Theo Vassilakis
Google, Inc.



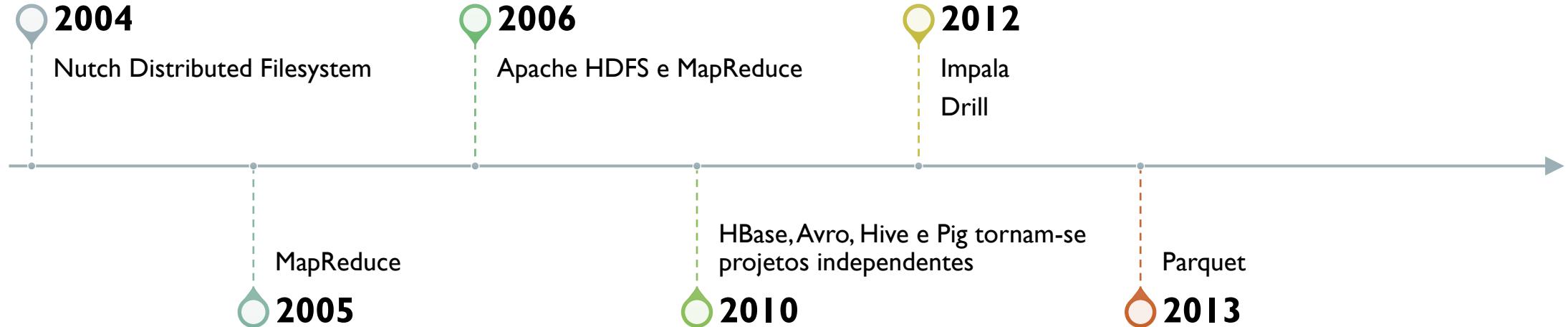
APACHE HADOOP

- **Hadoop** é uma plataforma de computação distribuída voltada para processamento de grandes volumes de dados, com atenção a tolerância a falhas.
- Foi inspirada no MapReduce e no GoogleFS
- Composto pelos seguintes módulos:
 - **Hadoop Distributed File System (HDFS™)**:A distributed file system that provides high-throughput access to application data.
 - **Hadoop YARN**:A framework for job scheduling and cluster resource management.
 - **Hadoop Common**:The common utilities that support the other Hadoop modules.
 - **Hadoop MapReduce**:A YARN-based system for parallel processing of large data sets.

APACHE HADOOP

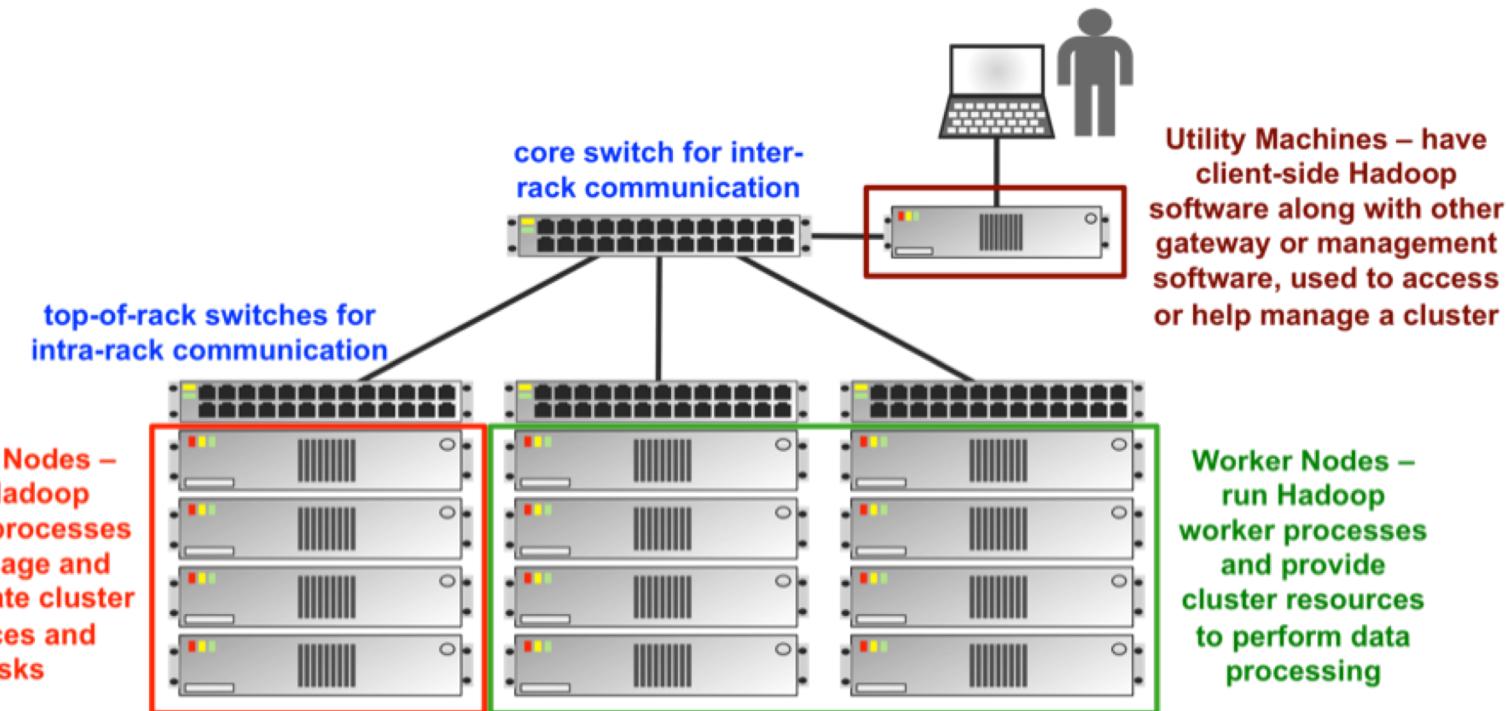
Projetos relacionados

- **Avro:** A data serialization system.
- **HBase:** A scalable, distributed database that supports structured data storage for large tables.
- **Hive:** A data warehouse infrastructure that provides data summarization and ad hoc querying.
- **ZooKeeper:** A high-performance coordination service for distributed applications.

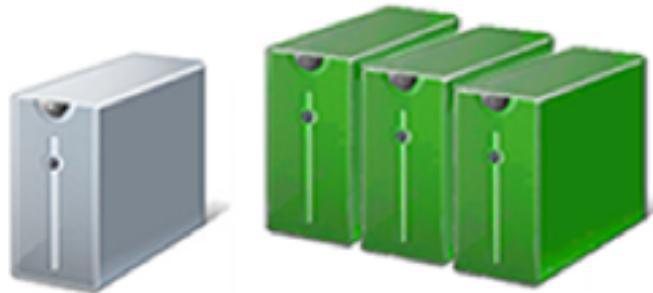


OPEN SOURCE (HADOOP & OUTROS)

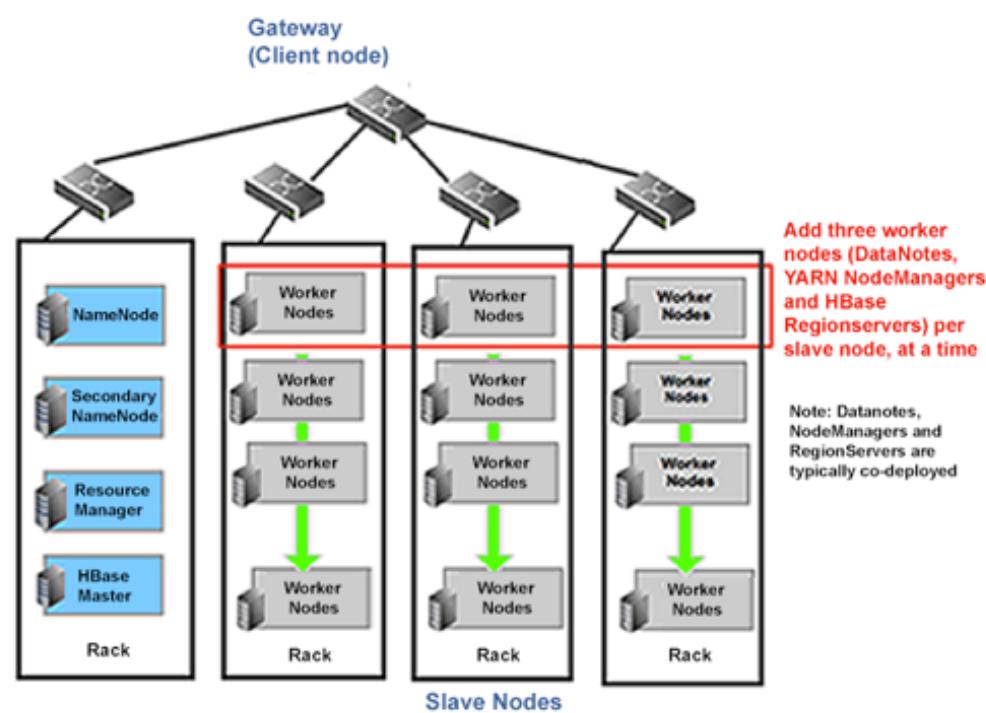
HADOOP CLUSTER



Scale out



Distribute the data and workload
over several servers



HADOOP CLUSTER

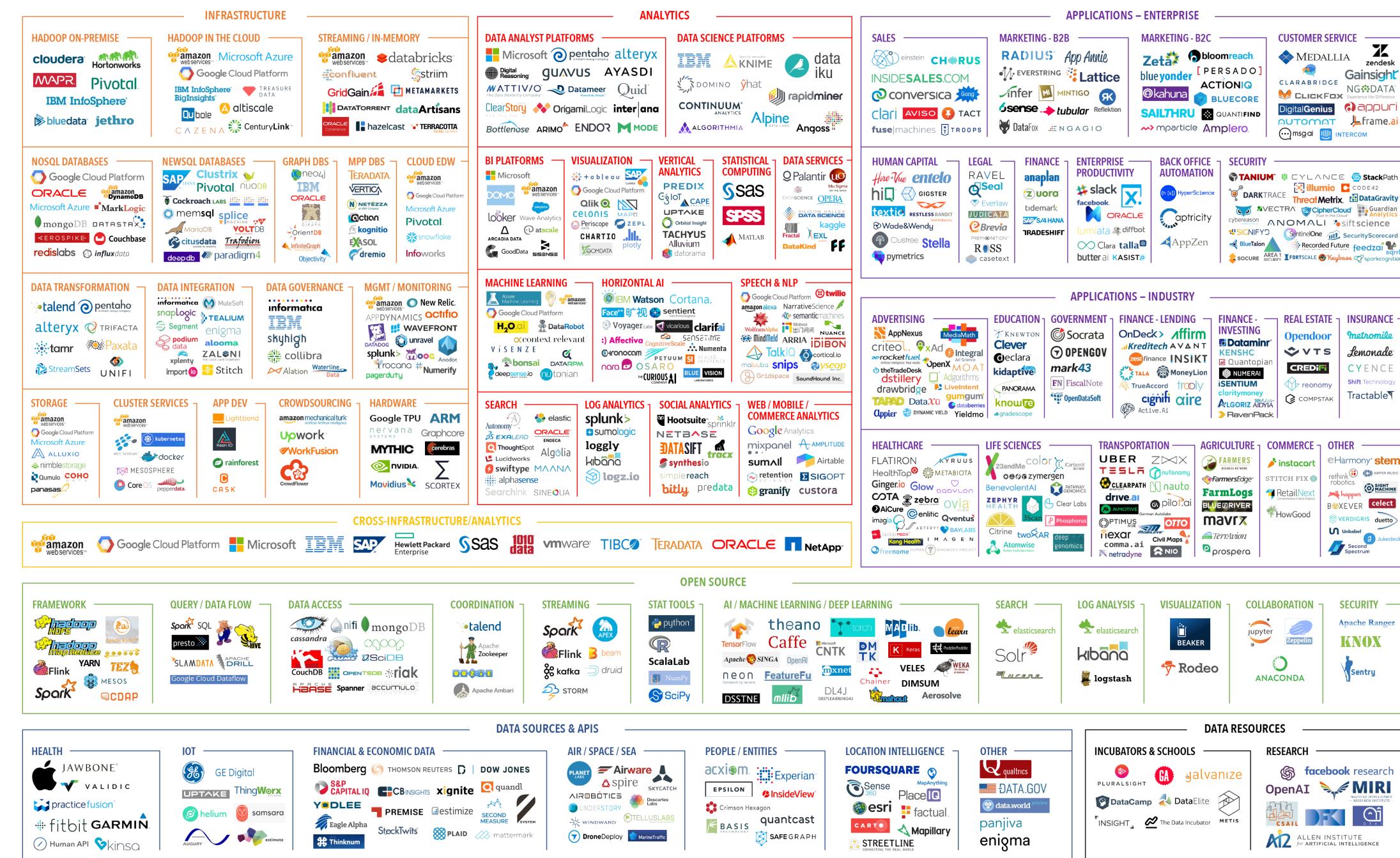
- **Gateway Node**
 - Ponto de comunicação externa com o cluster
- **Master Nodes**
 - Serviços de gerenciamento e coordenação
- **Worker Nodes**
 - Serviços de processamento

PÓS-
HADOOP

NA NUVEM TEM HDFS?

WWW.GERARMEMES.COM.BR





20
17

CLOUD COMPUTING

- **IaaS** (Infrastructure as a Service)
 - O hardware e os serviços básicos (Sistema Operacional, Rede) são disponibilizados pelo provedor.
 - A instalação e configuração de todos os demais serviços é de responsabilidade do contratante
 - Exemplo:Amazon EC2
- **PaaS** (Platform as a Service)
 - O hardware, os serviços básicos, e os serviços de plataforma são disponibilizados e pré-configurados pelo provedor.
 - O contratante é responsável pela escolha da capacidade de hardware e dos serviços de plataforma que estarão disponíveis em cada servidor
 - Exemplo:Amazon Elastic MapReduce



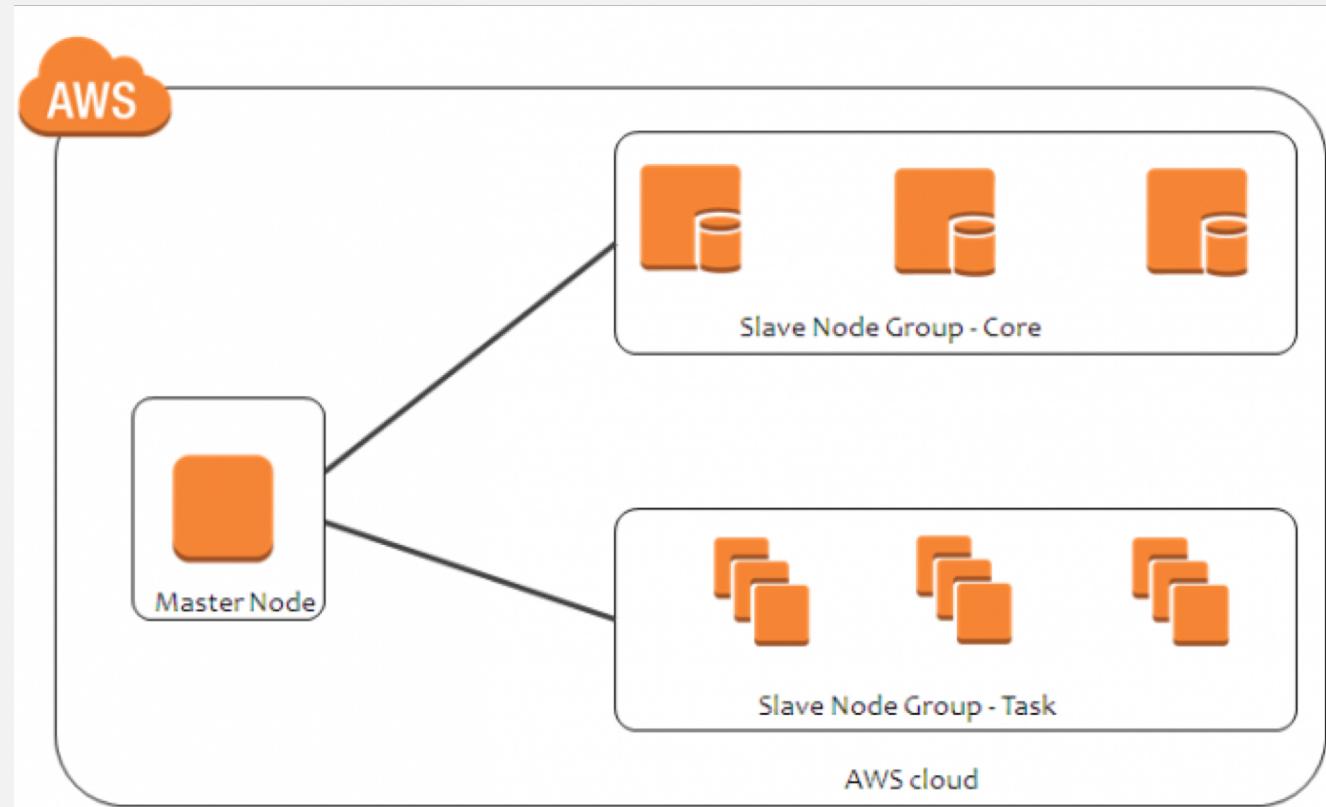
Amazon **EC2**

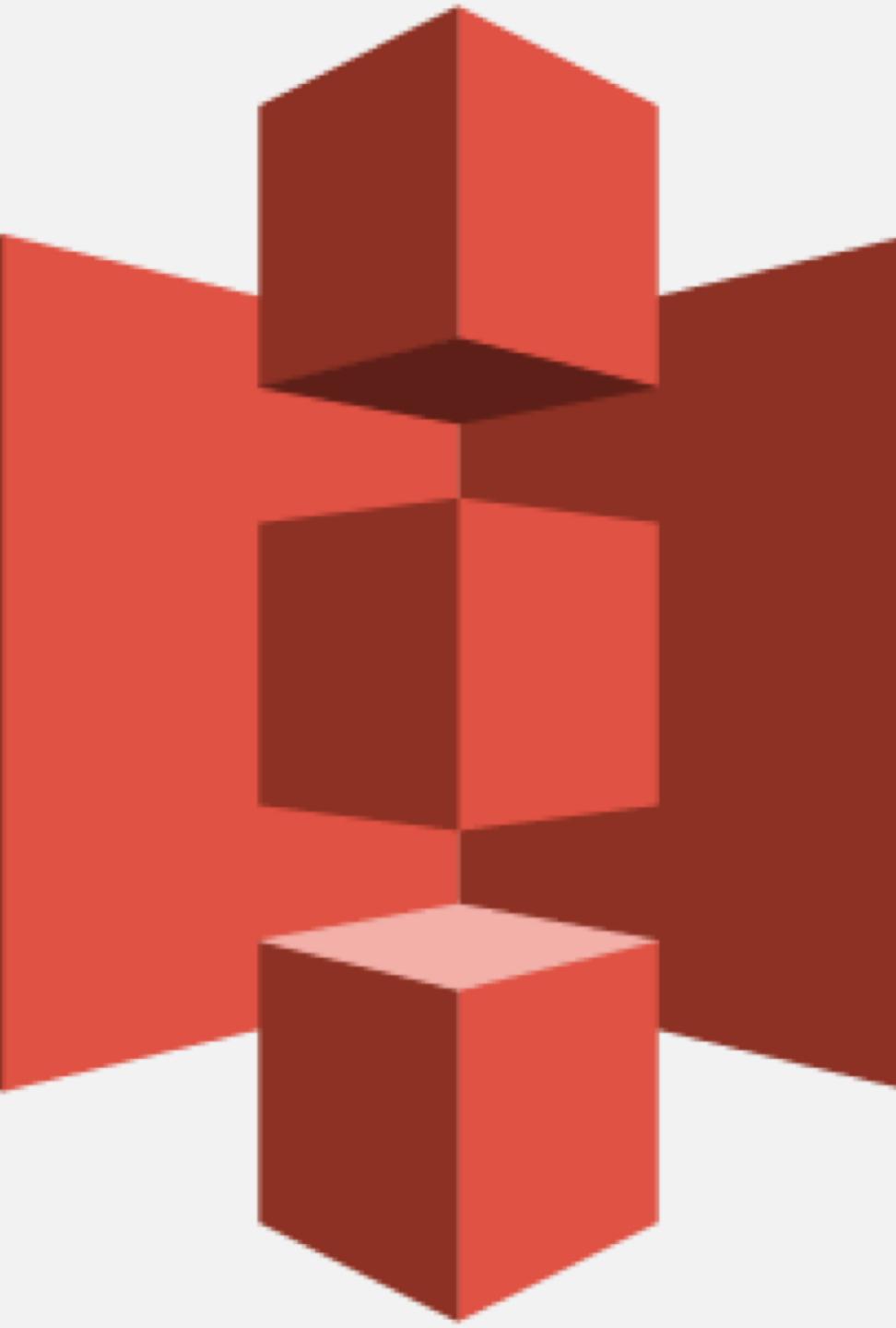


Amazon **EMR**

EMR CLUSTER

- **Master node:** A node that manages the cluster by running software components to coordinate the distribution of data and tasks among other nodes.
 - The master node tracks the status of tasks and monitors the health of the cluster.
- **Core node:** A slave node with software components that run tasks and store data in the Hadoop Distributed File System (HDFS) on your cluster.
- **Task node:** A slave node with software components that only run tasks. Task nodes are optional.





CLOUD COMPUTING

- **Storage (serverless)**
 - Object Stores como o Amazon S3 evoluíram de simples APIs de armazenamento e recuperação de dados, viabilizando a análise dos dados sem a necessidade de movimentá-los para um sistema de análises separado.
 - Em uma arquitetura Big Data nativa na nuvem, os benefícios do HDFS são mínimos e não justificam a complexidade computacional.

CLOUD COMPUTING

- **Serverless** (Servidores de outra pessoa 😊)
- Serviços de propósito específico que não requerem a contratação de infraestrutura para seu processamento.
- O provedor gerencia toda a infra subjacente e o contratante paga pelo uso.
- Exemplos:
 - Amazon Athena para processamento de consultas interativas



- Amazon SageMaker para treino e publicação de modelos de ML



Amazon Athena



Amazon SageMaker

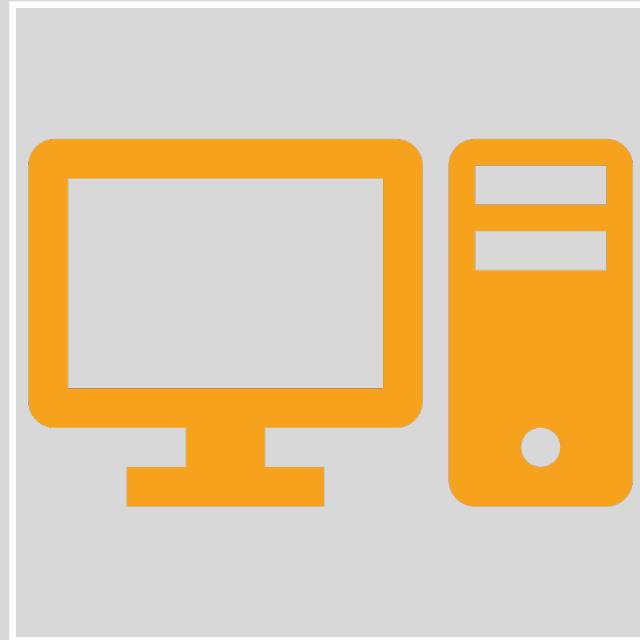
PÓS-HADOOP

- **Apache Spark:** A fast and general compute engine for Hadoop data. Spark provides a simple and expressive programming model that supports a wide range of applications, including **ETL, machine learning, stream processing, and graph computation.**
- **Apache Tez:** A generalized data-flow programming framework which provides a powerful and flexible engine to execute an arbitrary DAG of tasks to process data for both batch and interactive use-cases, being adopted by Hive, Pig to replace Hadoop MapReduce as the underlying execution engine.
- **Apache Flink:** an open-source stream processing framework for **distributed, high-performing, always-available, and accurate** data streaming applications.



CAPACIDADE COMPUTACIONAL

- Redes foram de 1GB para 10GB
- Há disponibilidade de servidores EC2 com 2TB de memória
- Intel já fornece processadores com 28 Cores / 56 Threads
- Novas arquiteturas especializadas:
 - GPUs, FPGAs, Nervana NNP
- Storage SSD de baixa latência



NOVAS TECNOLOGIAS

- Bancos de dados analíticos baseados em GPU
 - brytlyt
 - MapD*
 - Kinetica
- Aceleração de processamento de Bancos de dados com FPGA
 - Swarm64 Data Accelerator