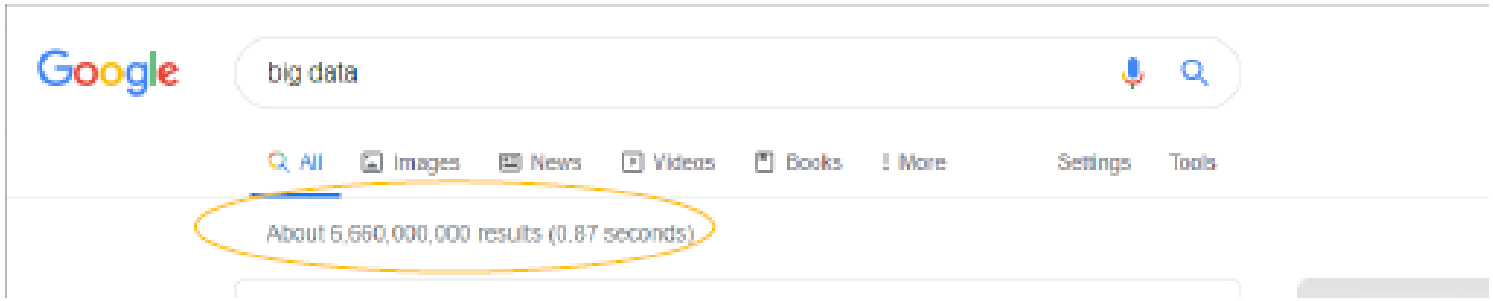
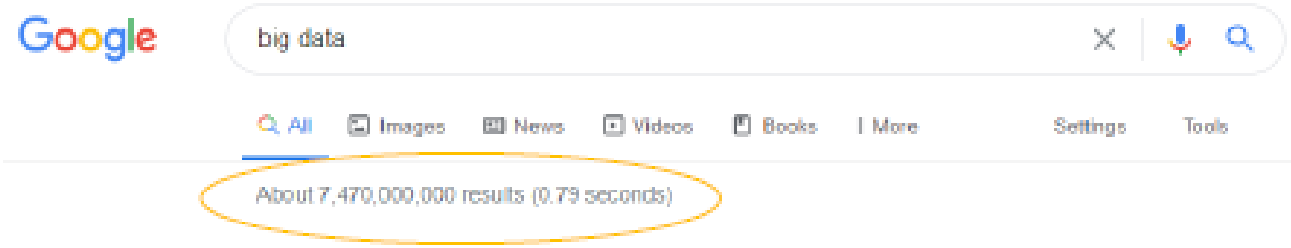
# UPRAVLJANJE VELIKIM KOLIČINAMA PODATAKA

Predavanje 1.

# BUZZ WORD *BIG DATA*


2019-10-28




2020-10-14

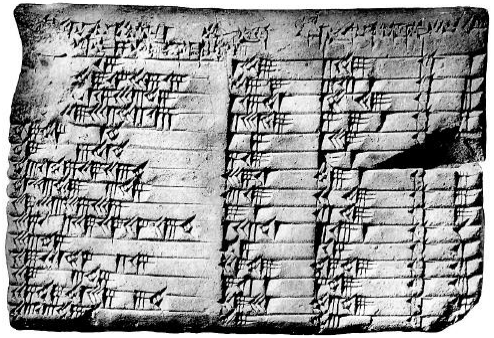
# VELIKI PODACI

VELIKI PODACI

# BAZE PODATAKA ISTORIJA

Komunikacija / Zapisi

Pismo

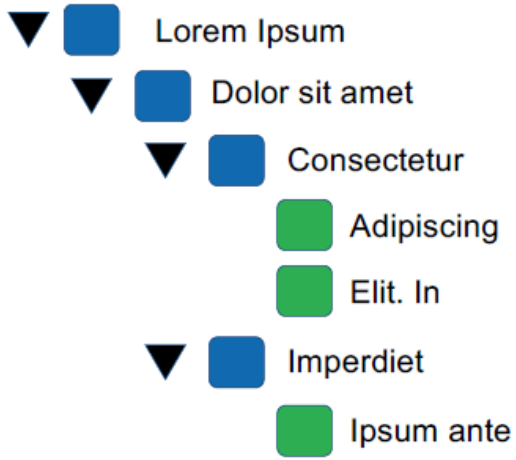


Račun

Štampa

# BAZE PODATAKA ISTORIJA

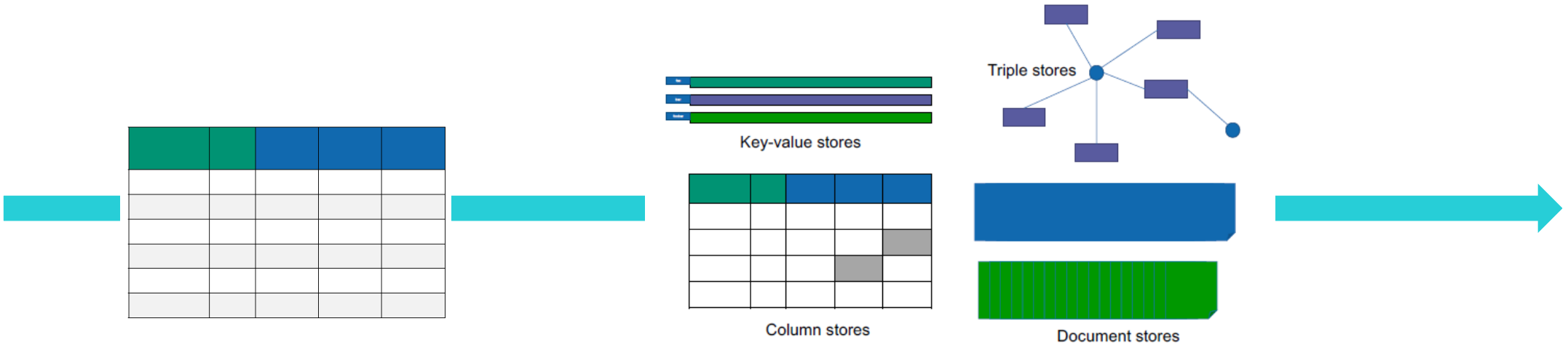

Računari




Fajl sistem (60te)

70te
Era baza podataka

# BAZE PODATAKA ISTORIJA




70te RDBMS

2000te
NoSQL era

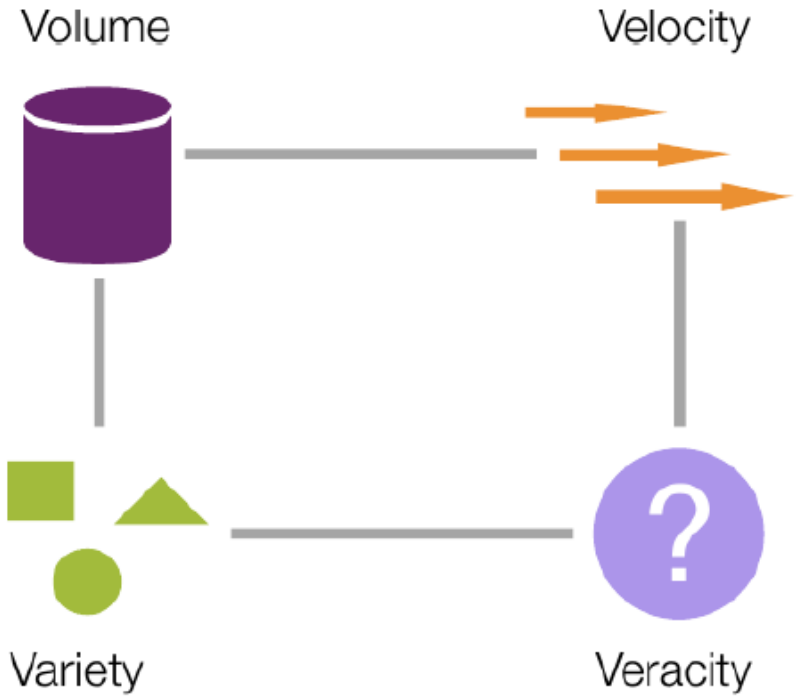
# VELIKI PODACI

VELIKI PODACI

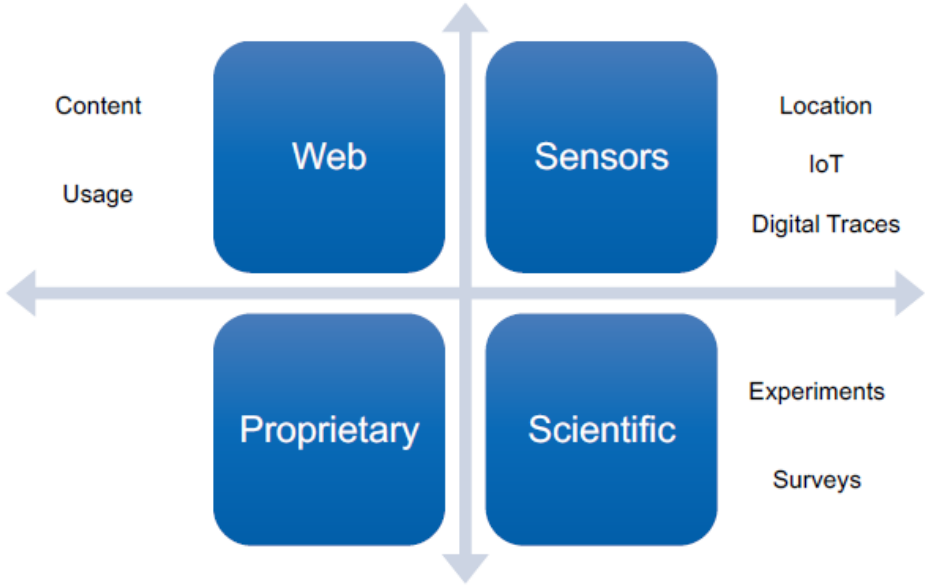
# ŠTA JE VELIKO?

3+1Vs – četiri dimenzije velikih podataka

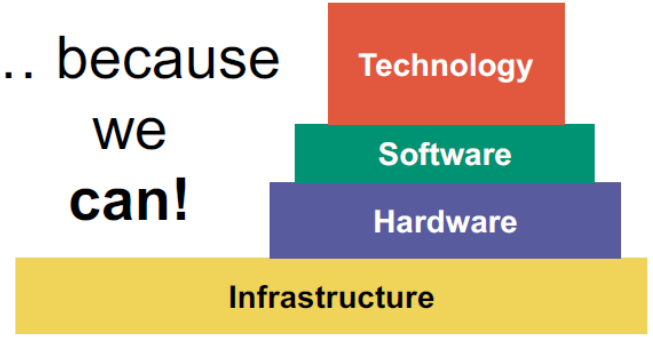
1. Volume - količina
2. Velocity – brzina
3. Variety – raznovrsnost
4. Vacilliation – kolebljivost
   - Veracity – verodostojnost
   - Variability - promenljivost
   - Value - vrednost



# KOLIČINA




… because we **can!**




… because **data** carries ***value***

**Utility( + )**

**>**

**Utility( ) + Utility( )**

# JEDINICE

| | |
|---|---|
| **kilo (k)** | 1,000 (3 zeros) |
| **Mega (M)** | 1,000,000 (6 zeros) |
| **Giga (G)** | 1,000,000,000 (9 zeros) |
| **Tera (T)** | 1,000,000,000,000 (12 zeros) |
| **Peta (P)** | 1,000,000,000,000,000 (15 zeros) |
| **Exa (E)** | 1,000,000,000,000,000,000 (18 zeros) |
| **Zetta (Z)** | 1,000,000,000,000,000,000,000 (21 zeros) |
| **Yotta (Y)** | 1,000,000,000,000,000,000,000,000 (24 zeros) |

| | |
|---|---|
| **kibi (ki)** | 1,024 ($2^{10}$) |
| **Mebi (Mi)** | 1,048,576 ($2^{20}$) |
| **Gibi (Gi)** | 1,073,741,824 ($2^{30}$) |
| **Tebi (Ti)** | 1,099,511,627,776 ($2^{40}$) |
| **Pebi (Pi)** | 1,125,899,906,842,624 ($2^{50}$) |
| **Exbi (Ei)** | 1,152,921,504,606,846,976 ($2^{60}$) |
| **Zebi (Zi)** | 1,180,591,620,717,411,303,424 ($2^{70}$) |
| **Yobi (Yi)** | 1,208,925,819,614,629,174,706,176 ($2^{80}$) |

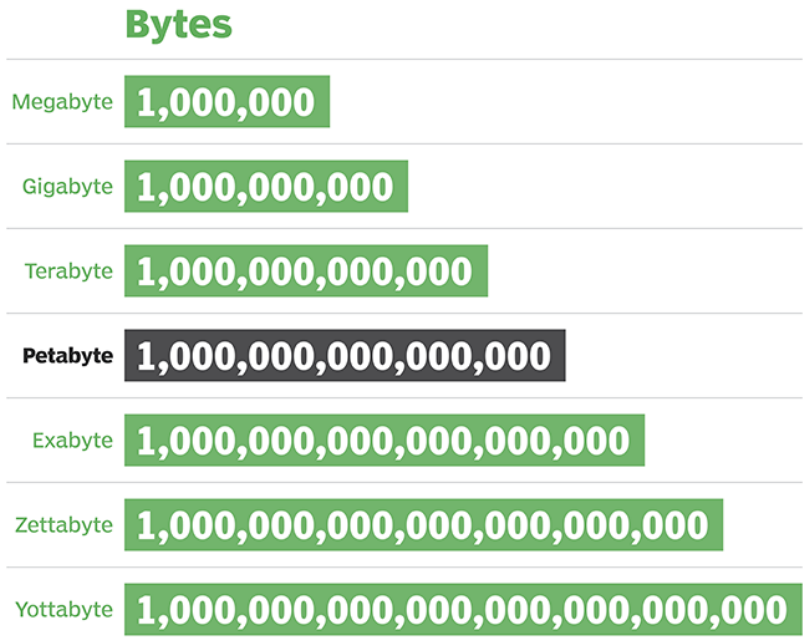
# KOLIČINA

https://techjury.net/stats-about/big-data-statistics/

**Do 2020 - 40 ZB**

https://followthedata.wordpress.com/2014/06/24/data-size-estimates

- Google: 15 EB
- Facebook: 300 PB
- Spotify: 100 PB



# RAZNOVRSNOST

https://followthedata.wordpress.com/2014/06/24/data-size-estimates

| | | | | |
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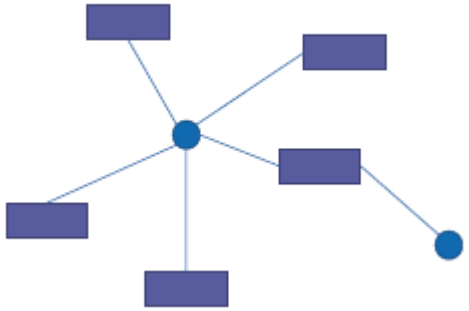

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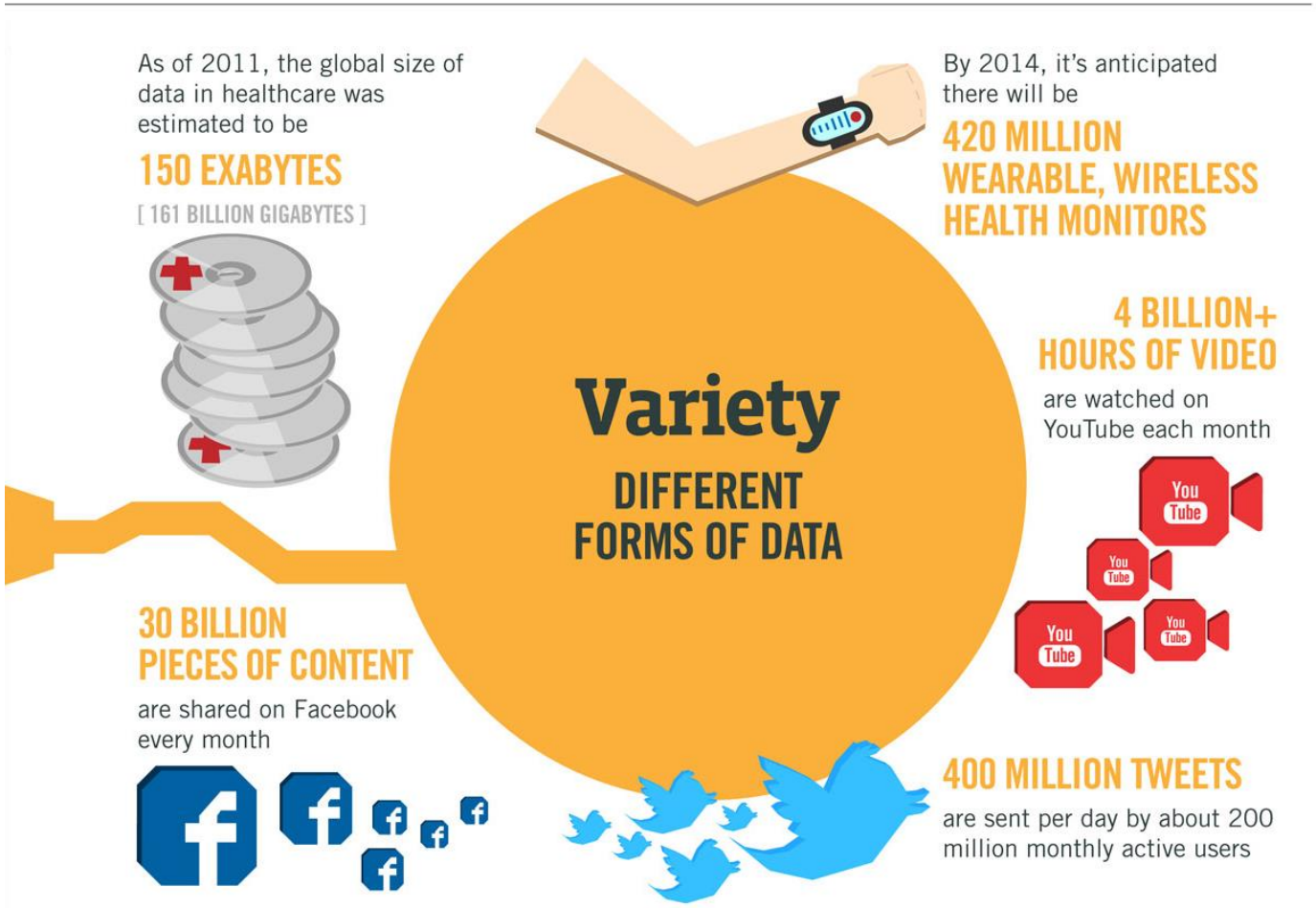


# BRZINA

- Brzina pristizanja
  Brzina procesiranja
- Podaci:
  - Se generišu automatski
  - Predstavljaju nusproizvod aktivnosti ljudi
- Google: procesira 100 PB/dnevno
- Facebook: procesira 600 TB/ dnevno
- Spotify: procesira 2.2 TB/ dnevno

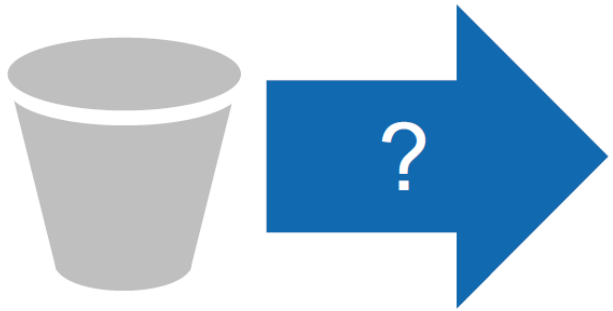
https://followthedata.wordpress.com/2014/06/24/data-size-estimates
http://www.ibmbigdatahub.com/sites/default/files/infographic_file/4-Vs-of-big-data.jpg

# TRI KLJUČNA FAKTORA

Kapacitet (Capacity)


"How much data can we store?"

Propusnost (Throughput)




"How fast can we transmit data?"

Čekanje (Latency)


"When do I start receiving data?"

# KAPACITET

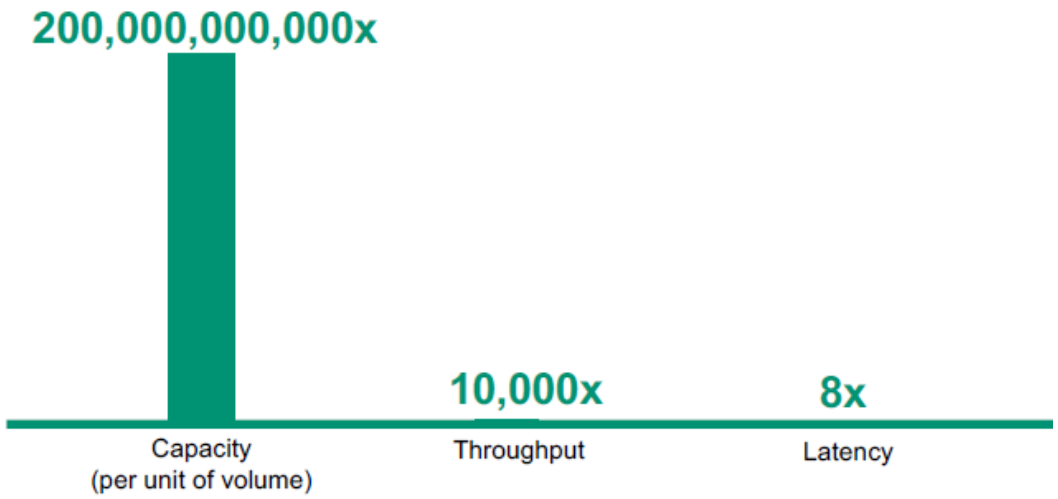
1956. IBM RAMAC 350

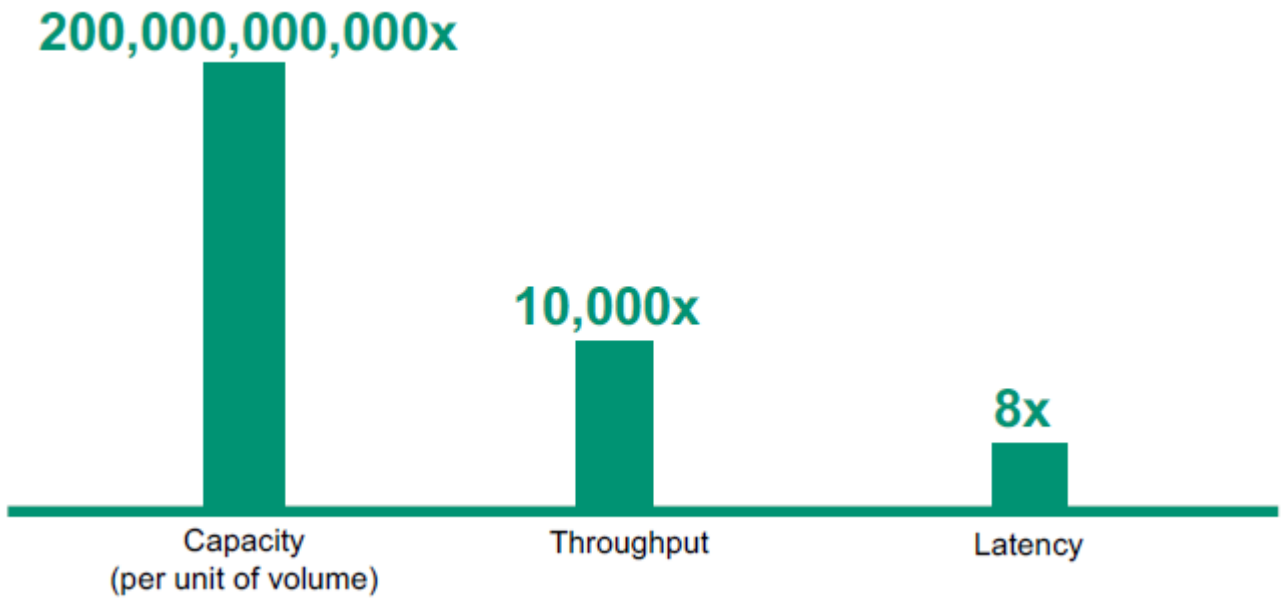
3.75 Megabytes

2020. WD HC650


20TB

# 1956-2020


200,000,000,000x
10,000x
8x
Capacity
(per unit of volume)
Throughput
Latency

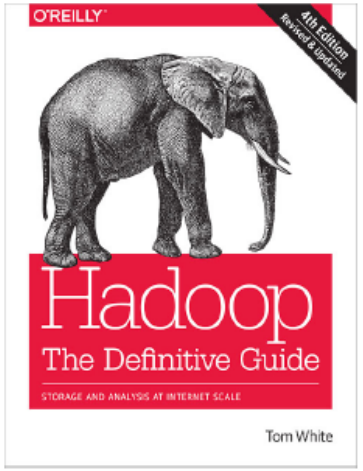

200,000,000,000x
10,000x
8x
Capacity
(per unit of volume)
Throughput
Latency

# PARALELA

Throughput:

~1,000 word per minute

Capacity:

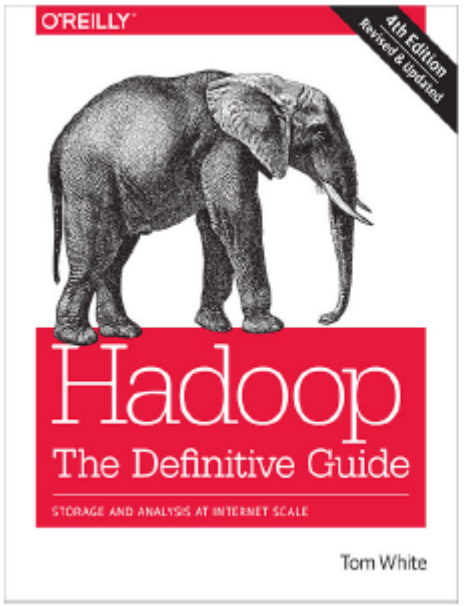



~ 600,000 words.

Latency:

~ 1 minute to stand up, go to the shelf, pick the book, find the page.

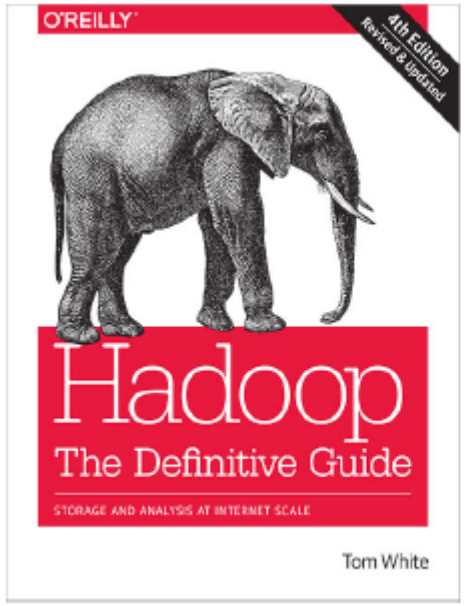
# PARALELA




600,000 words

1,000 words per minute

**10 hours**



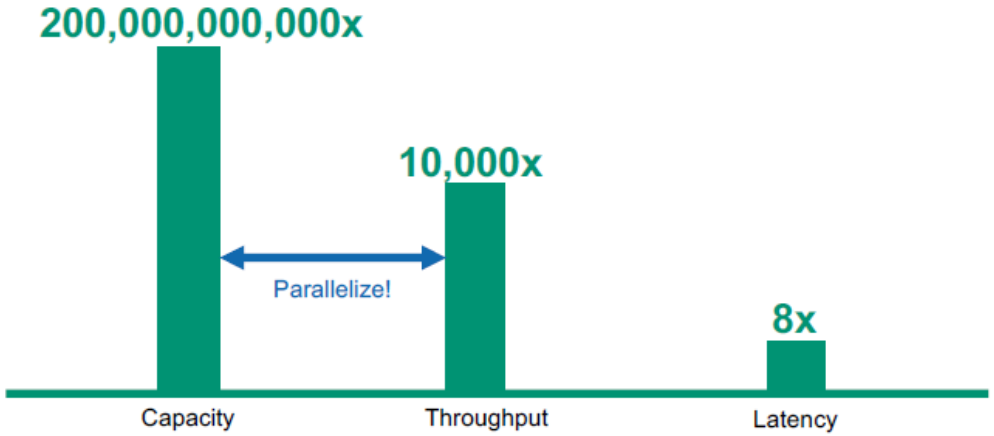

120,000,000,000,000,000 words

10,000,000 words per minute

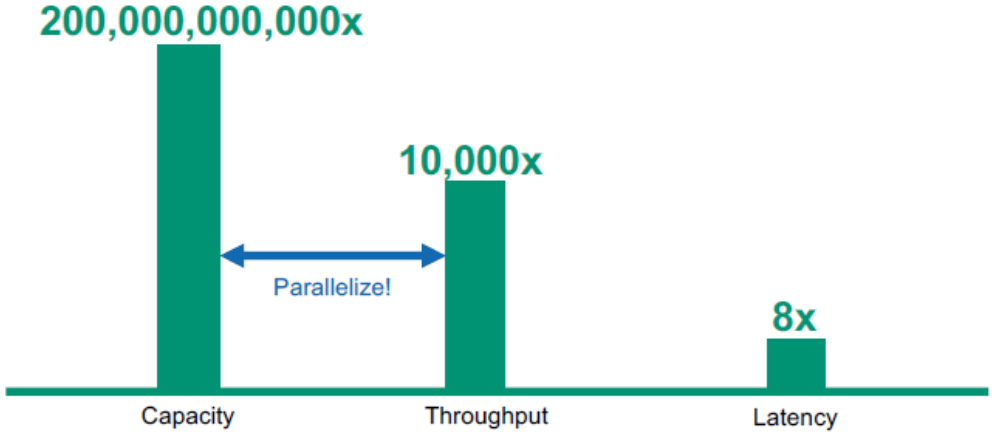
**22,800 years**

# REŠENJA?

2220: 200,000,000 persons could read it all in 10 hours.

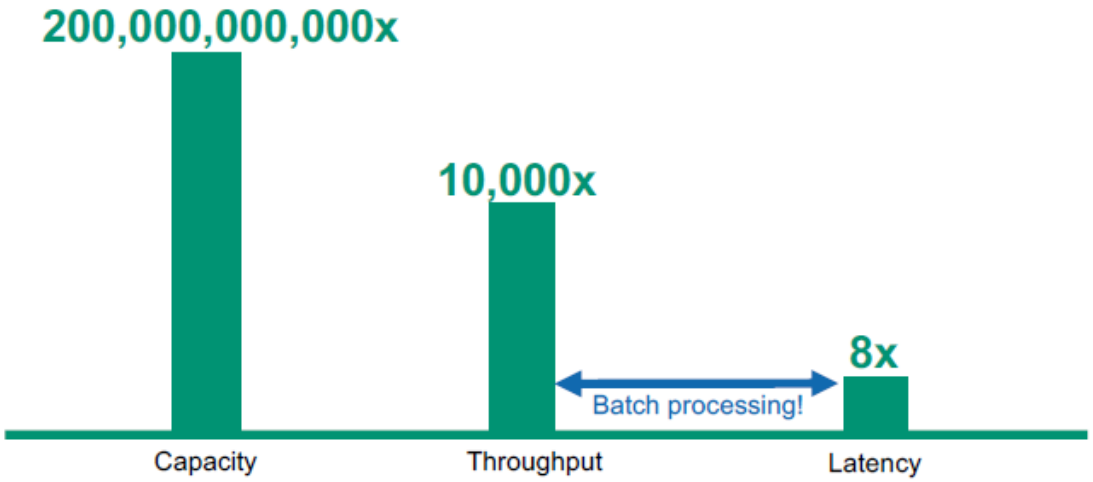



# REŠENJA?




clusters of machines (10,000s)

# REŠENJA?




clusters of machines (10,000s)

# PRILAGOĐAVANJE VELIČINI - SKALIRANJE

- Vertikalno – dodavanje resursa jednom nodu u sistemu
  - Skuplje od horizontalnog
- Horizontalno – dodavanje više nodova
  - Teže za kontrolu grešaka/otkaza
  - Teže za razvoj

# BIG DATA DEFINICIJA

**Big Data** is a portfolio of technologies that were designed to

**store, manage** and **analyze data** that is too **large** to fit on a single machine

while accommodating for the issue of growing **discrepancy** between **capacity, throughput** and **latency.**

# ŠTA SA PODACIMA?

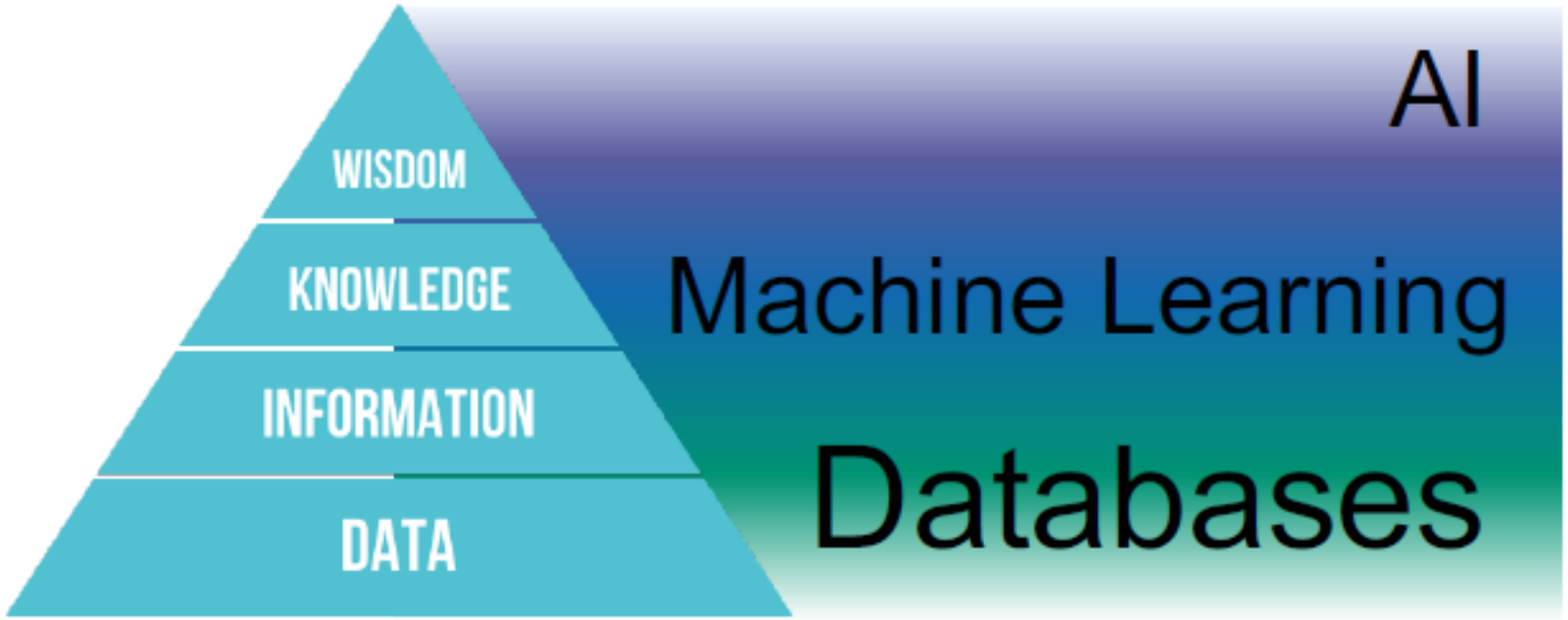
Ekstrakcija informacija iz podataka i donošenje odluka


Raw Data

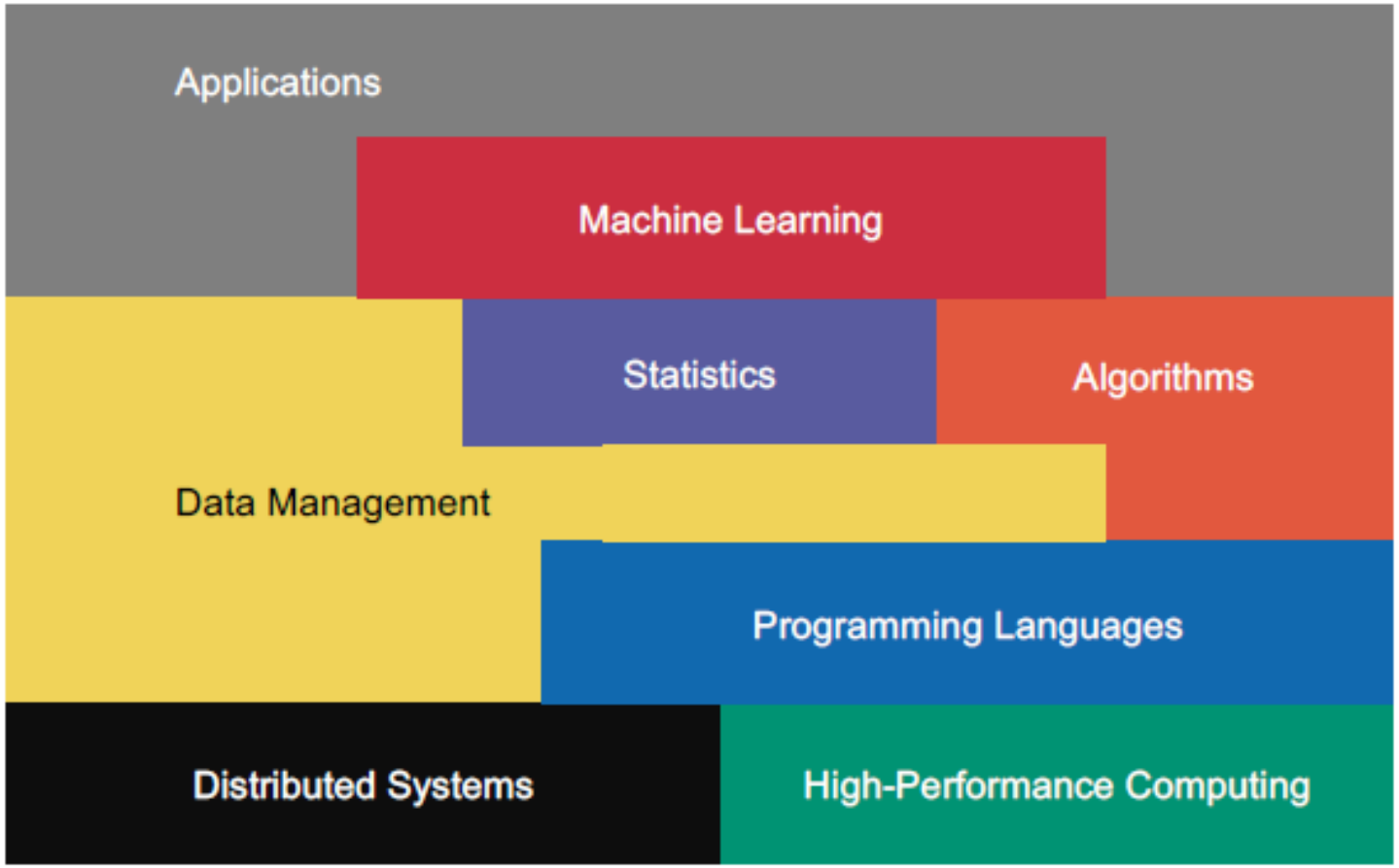

Derived Data


big data

# ŠTA SA PODACIMA?



# VELIKI PODACI KROZ DISCIPLINE



# TEHNOLOGIJE

Tehnologije Velikih podataka - fokus na osmišljavanju efikasnih tehnika:

- reprezentacije i skladištenja;
- procesiranja i donošenja zaključaka!

| | Koncepti | Tehnologije |
|---|---|---|
| Skladišta | Object storage<br>Distributed file systems<br>Syntax | S3, Azure Blog Storage<br>HDFS<br>XML, JSON |
| Modeli | Wide column stores<br>Data models and schemas<br>Graphs | Hbase<br>XML/JSON Schema<br>neo4j, Cypher |
| Procesiranje | 2-step distributed query processing<br>DAG-based distributed query processing | Hadoop MapReduce<br>Spark |
| Upravljanje | Document storage<br>Query languages | DB |

# BIG DATA SLUČAJEVI

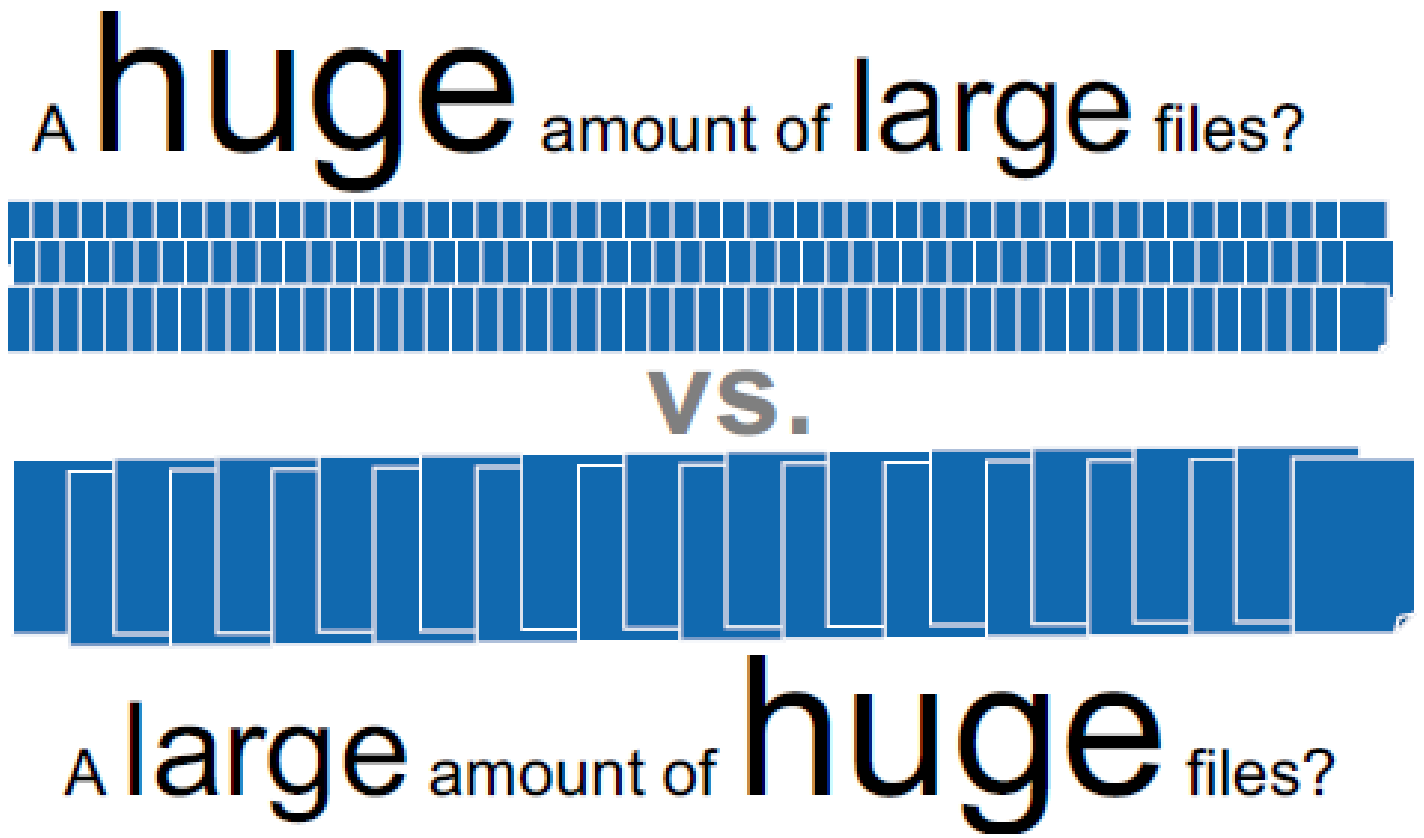
There is

Big Data 

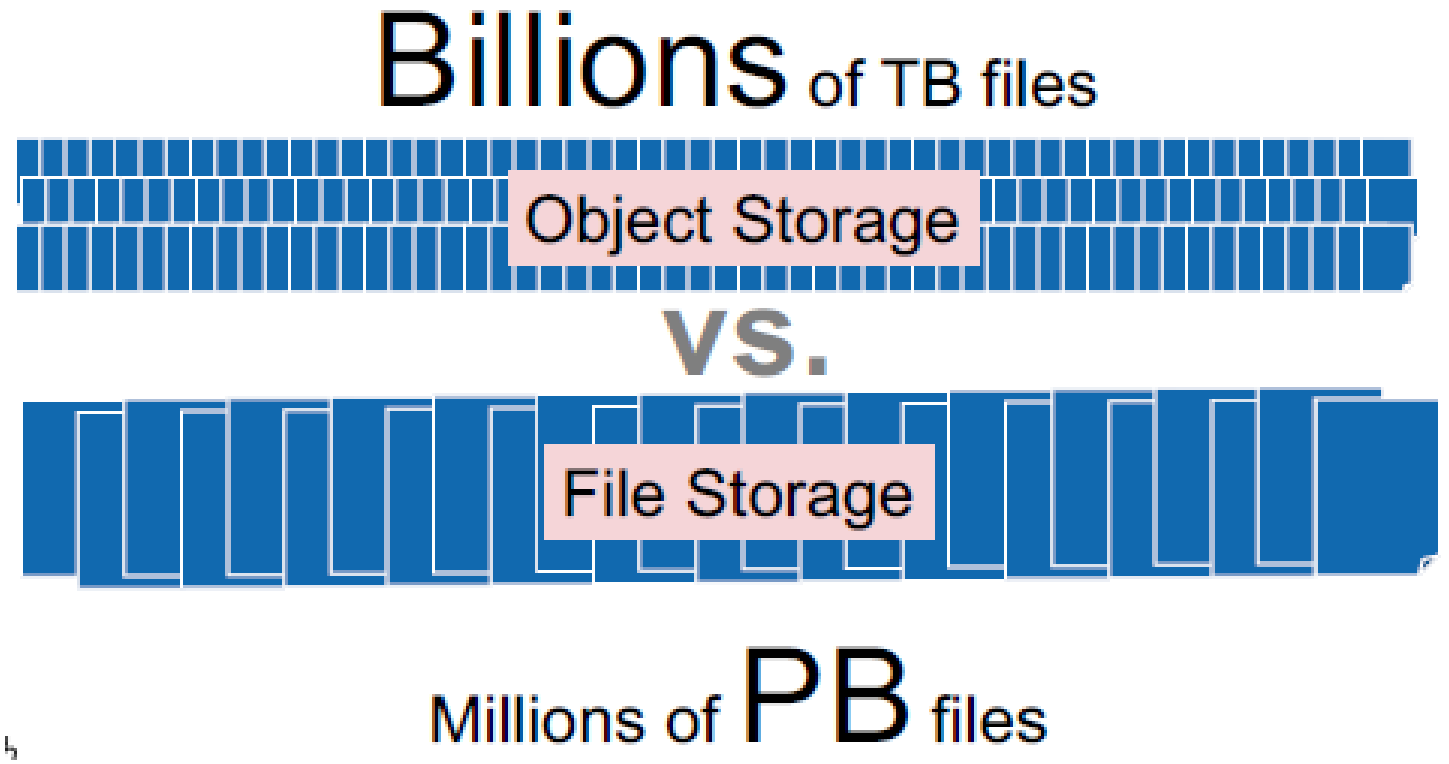
and

 Big Data

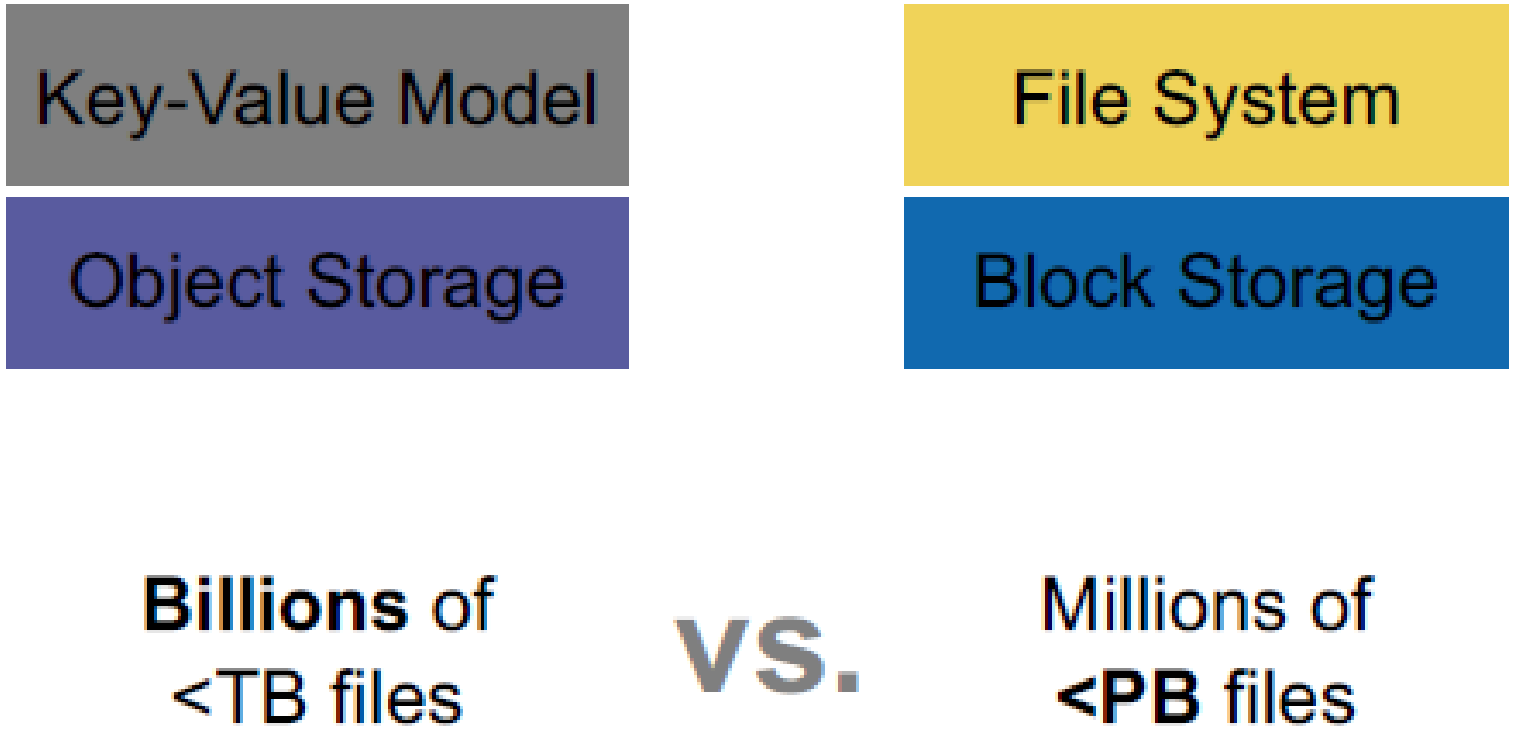
# BIG DATA SLUČAJEVI



# BIG DATA SLUČAJEVI



# BIG DATA SLUČAJEVI



# DISTRIBUIRANI FS

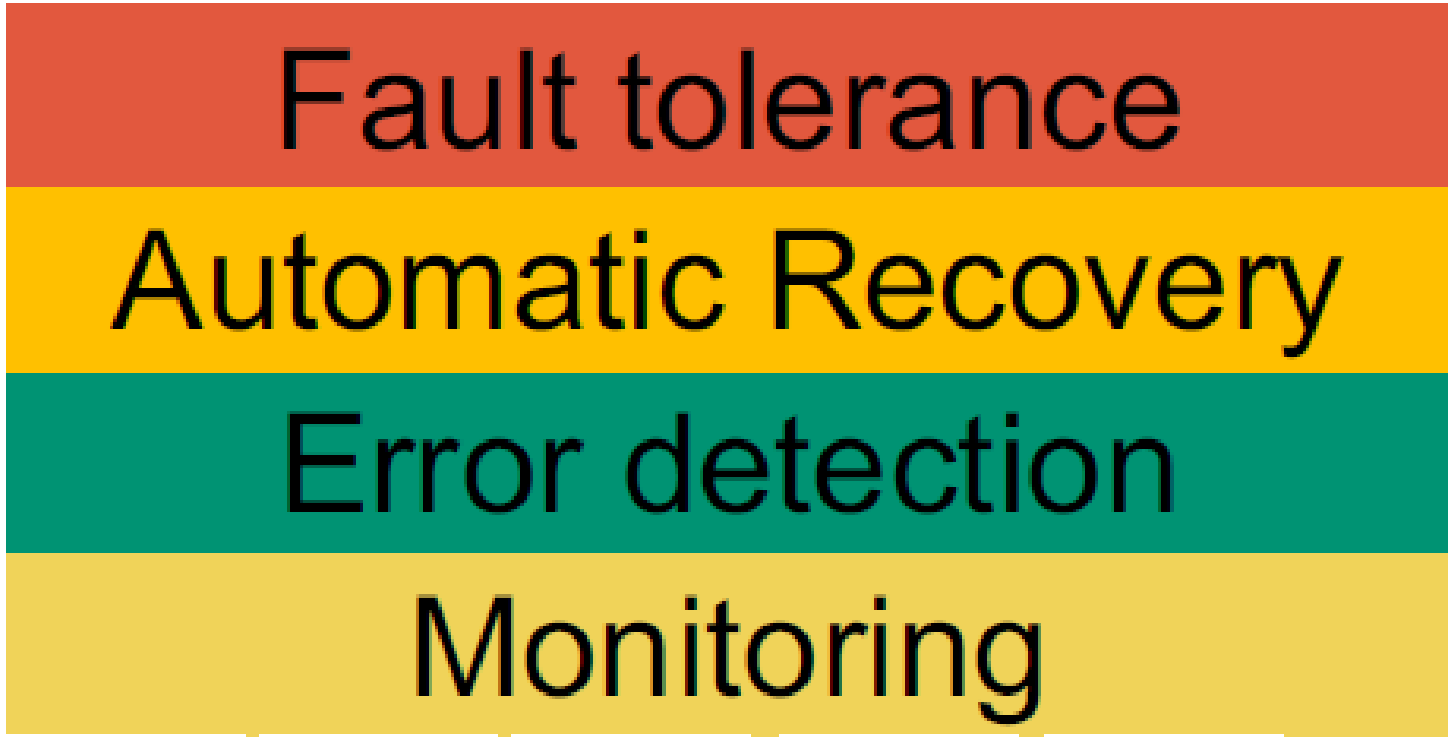
Local disk

It might fail

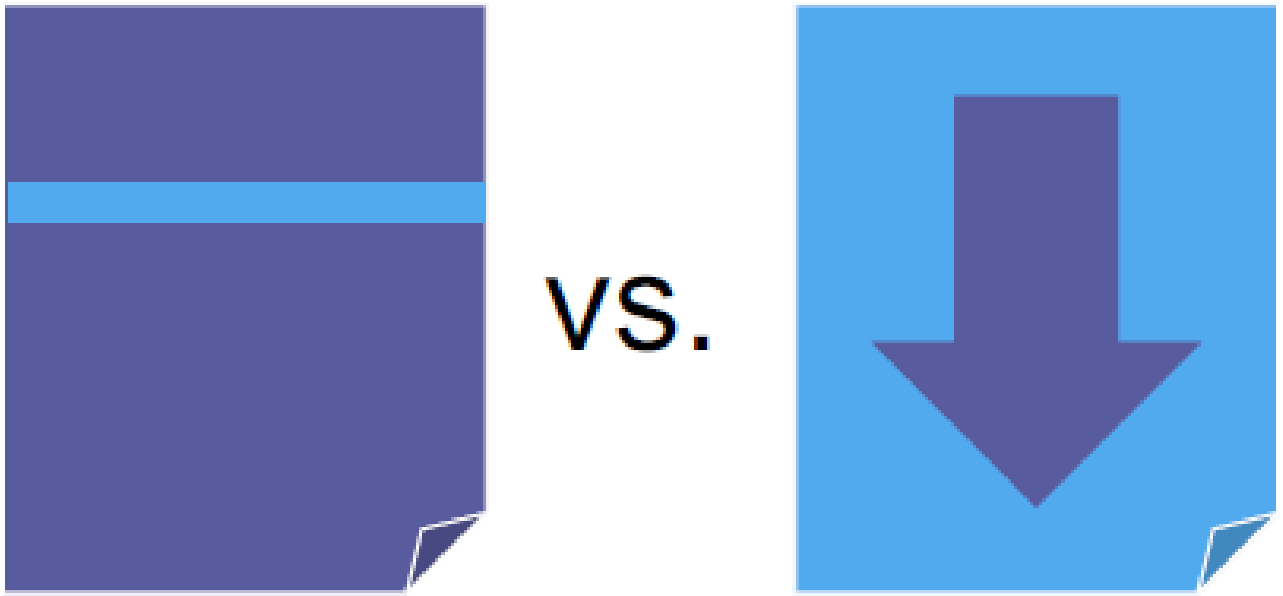
Cluster with 100s to10,000s of machines

nodes will fail

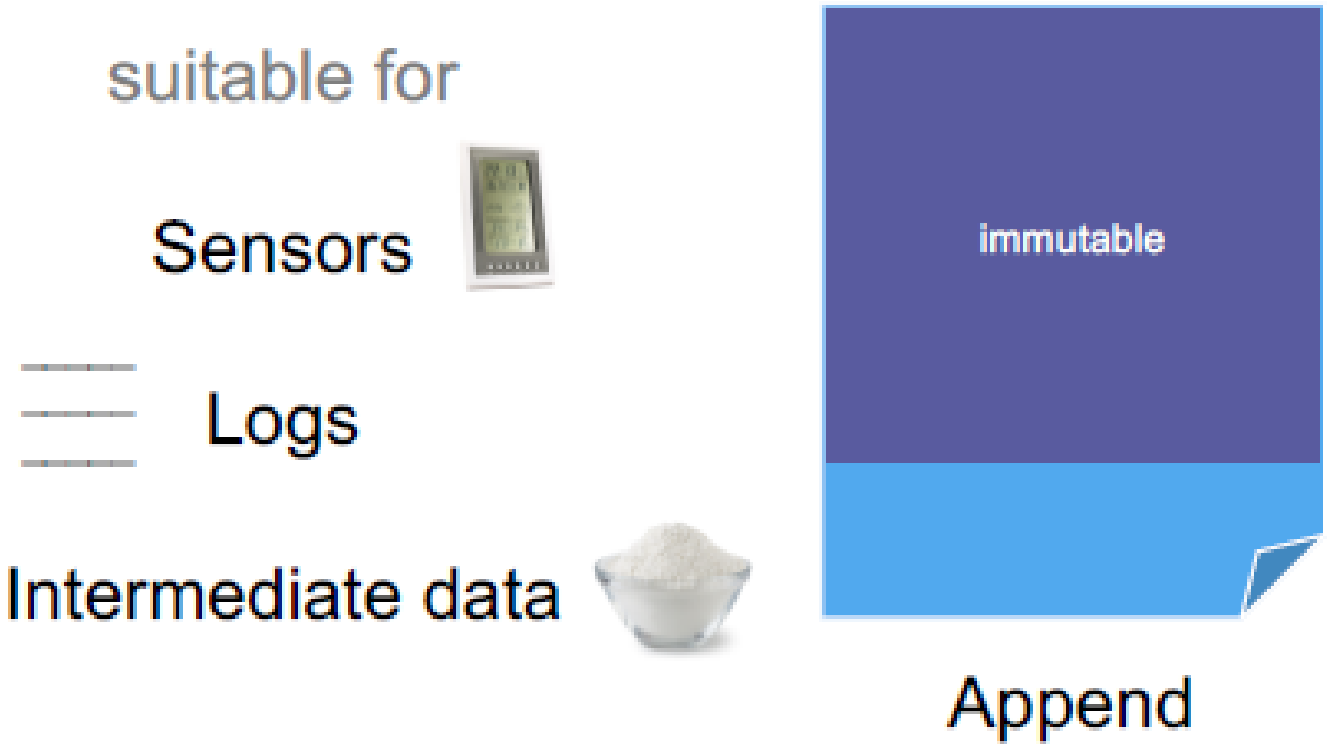
# FAULT TOLERANCE AND ROBUSTNESS



# FILE READ MODEL



# FILE UPDATE MODEL



# PEREFORMANSE

Top priority:

Throughput

Secondary:

Latency