

INTRODUCTION TO BIG DATA

ECAP456

Dr. Rajni Bhalla
Associate Professor

Learning Outcomes



After this lecture, you will be able to

- hadoop - Big Data Overview
- hadoop - Big Data Solutions

Introduction



Introduction



Data produced by mankind is growing rapidly every year

Introduction

The Exponential Growth of Data

5 Exabytes = 5 Billion Gigabytes

From the start of time → ~ 2003

In 2010 ~ 2 days

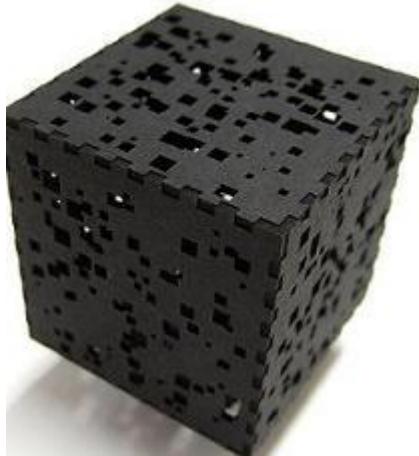
In 2013 ~ 10 minutes

Source: Eric Schmidt, Abu Dhabi Media Summit, 2010

What is Big Data?

- Big data is a collection of large datasets that cannot be processed using traditional computing techniques.
- It is not a single technique or a tool, rather it has become a complete subject, which involves various tools, techniques and frameworks.

What Comes Under Big Data?



Black Box Data



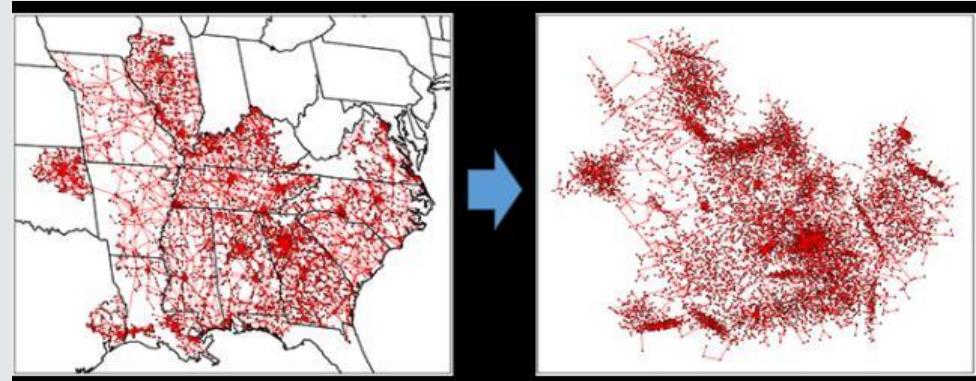
Social Media Data

Big data involves the data produced by different devices and applications. Given below are some of the fields that come under the umbrella of Big Data.

What Comes Under Big Data?

39.16	- .85	red heart	+37.53	41.14	39.70	39.13	17.95	West New York	10
23.18	+ .17	green triangle	-23.20	23.25	23.54	22.84	50.46	Westing	10
16.71	- .06	red heart	-16.71	16.74	16.89	16.53	37.00	47	Westing
35.39	- .18	red heart	-35.00	36.35	35.87	35.34	80.00	West New York	10
69.47	- .65	red heart	-69.25	70.49	70.10	69.34	38.75	West New York	10
24.41	- .73	red heart	-24.37	24.65	25.10	24.41	44.65	10	West New York
49.24	- .45	red heart	-48.50	50.32	49.87	49.24	17.95	West New York	10
42.58	- .36	red heart	-42.05	44.25	43.02	42.47	57.45	West New York	10
63.16	- .52	red heart	-62.78	64.14	63.71	62.70	82.75	West New York	10
83.48	- .86	red heart	-83.07	84.00	84.50	83.12	10.28	48	West New York

Stock Exchange Data



Power Grid Data

What Comes Under Big Data?



Transport Data



What Comes Under Big Data?

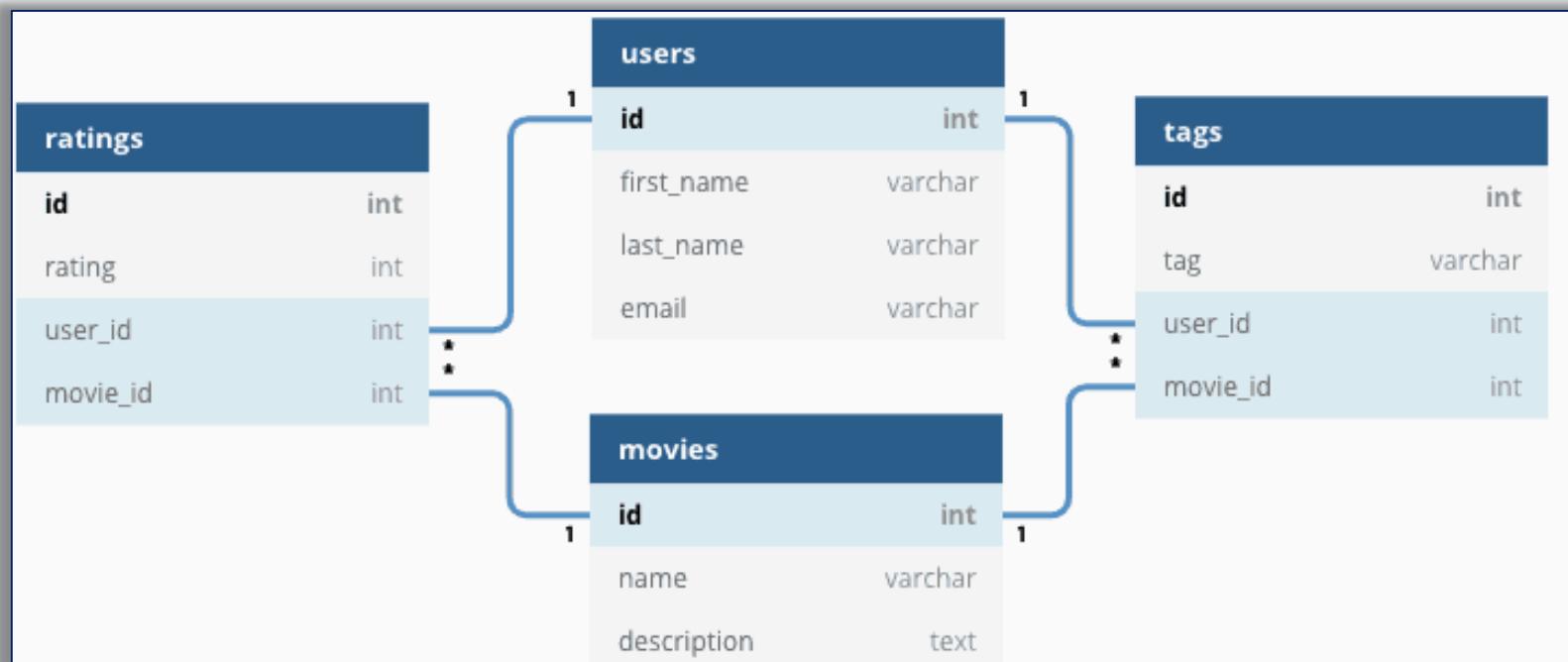
- Thus, Big Data includes huge volume, high velocity, and extensible variety of data..
 - Structured data – Relational data.
 - Semi Structured data – XML data.
 - Unstructured data – Word, PDF, Text, Media Logs.

What Comes Under Big Data?

- Structured data
- Semi Structured data
- Unstructured data

The data in it will be of three types

Structured data



Relational data

The data in it will be of three types

Semi Structured data

```
<?xml version="1.0"?>
- <ROOT>
  - <Customers>
    - <Customer CustomerName="Arshad Ali" CustomerID="C001">
      - <Orders>
        - <Order OrderDate="2012-07-04T00:00:00" OrderID="10248">
          <OrderDetail Quantity="5" ProductID="10"/>
          <OrderDetail Quantity="12" ProductID="11"/>
          <OrderDetail Quantity="10" ProductID="42"/>
        </Order>
      </Orders>
      <Address> Address line 1, 2, 3</Address>
    </Customer>
    - <Customer CustomerName="Paul Henriot" CustomerID="C002">
      - <Orders>
        - <Order OrderDate="2011-07-04T00:00:00" OrderID="10245">
          <OrderDetail Quantity="12" ProductID="11"/>
          <OrderDetail Quantity="10" ProductID="42"/>
        </Order>
      </Orders>
      <Address> Address line 5, 6, 7</Address>
    </Customer>
    - <Customer CustomerName="Carlos Gonzlez" CustomerID="C003">
      - <Orders>
        - <Order OrderDate="2012-08-16T00:00:00" OrderID="10283">
          <OrderDetail Quantity="3" ProductID="72"/>
        </Order>
      </Orders>
      <Address> Address line 1, 4, 5</Address>
    </Customer>
  </Customers>
</ROOT>
```

XML data

The data in it will be of three types

Unstructured data



Word



PDF

"We booked a Napa group tour. Booking and pickup was seamless. All very professional. Rob our driver was fantastic. He has very deep roots in Napa and is a wealth of info."

Text

The data in it will be of three types

Unstructured data

Social Media Log

Done

Options

Search By Date

Broadcast Archived Broadcast

Date Options Today

Broadcasts Fall 2011 Newsletter

Archived Broadcasts

[View Report](#) [Download CSV Report](#)

Report Details:

Broadcast Name	Submitted by	Post Date	Facebook Destination	Facebook Status	Facebook Content	Twitter User	Twitter Status	Twitter Content
Fall 2011 Newsletter	schoolmessenger	Jul 20, 2011	180057282024621	Posted	The Fall newsletter is...			

Social Media Log

Benefits of Big Data



Big Data Technologies

- Accurate analysis
- Greater operational efficiencies,
- cost reductions,
- and reduced risks for the business.

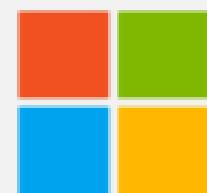
Big Data Technologies



Structure

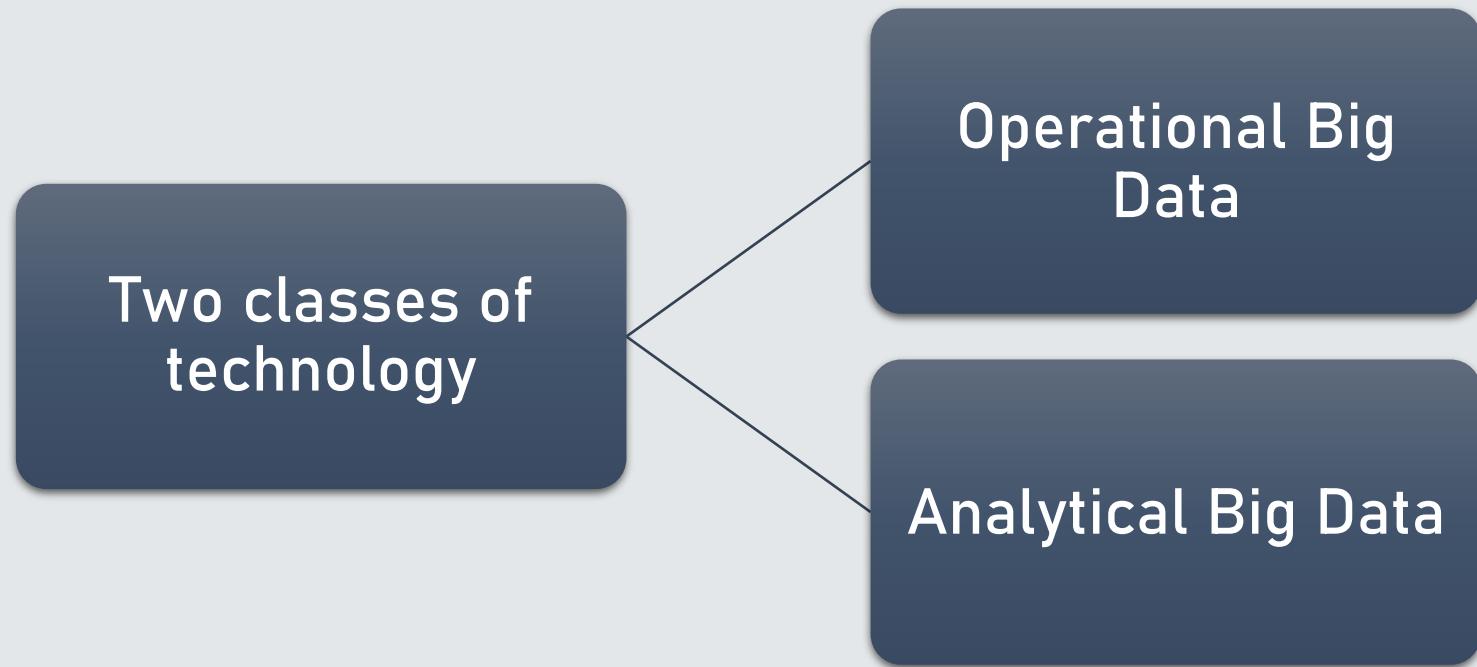


Unstructured



**Big Data
Technologies**

Big Data Technologies



Operational Big Data



mongoDB

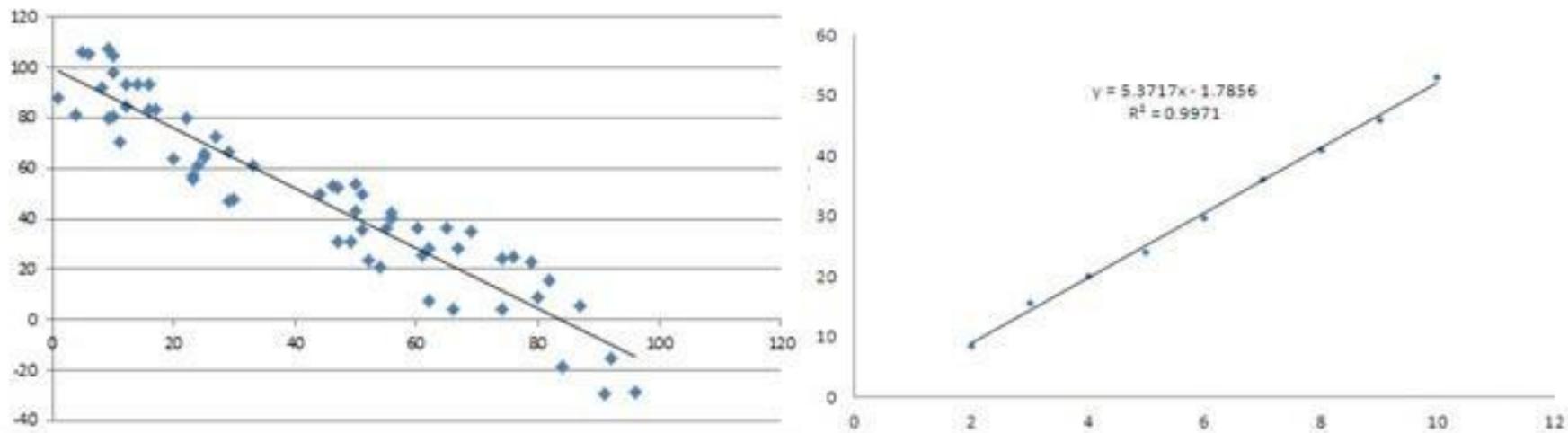
Operational Big Data

Manage

Cheaper

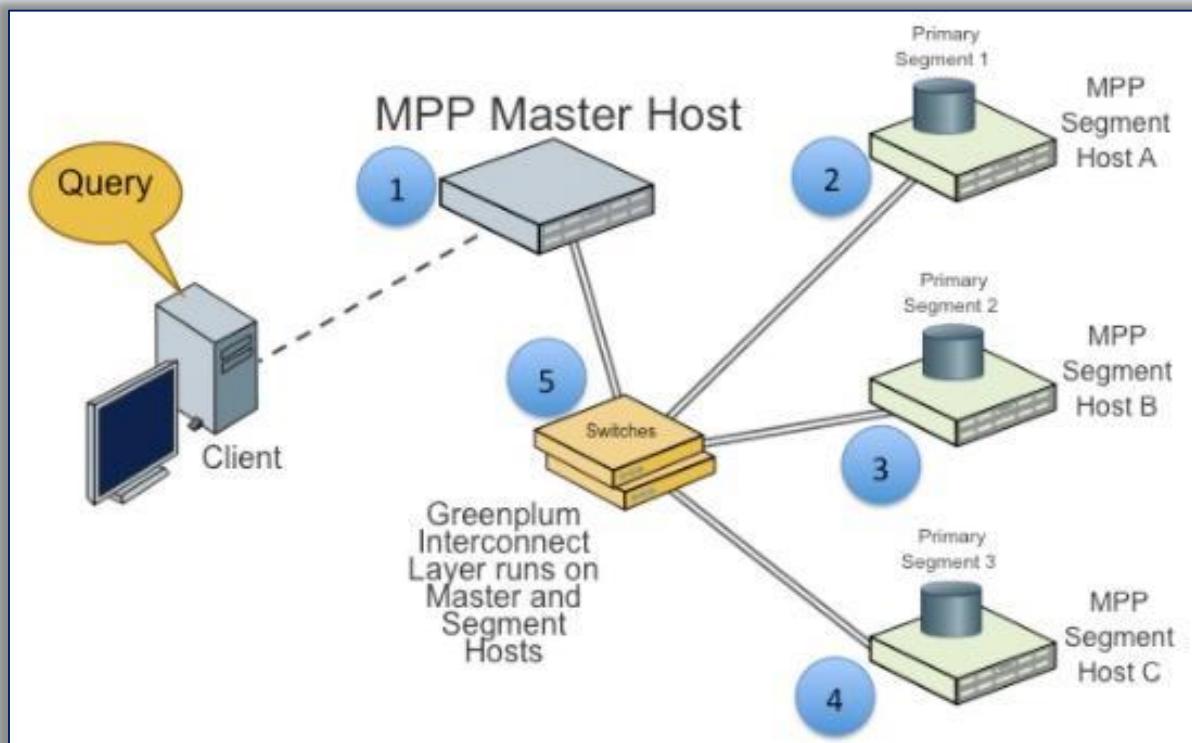
Faster

Operational Big Data



Patterns and Trends

Analytical Big Data



Massively Parallel Processing

Analytical Big Data



MapReduce provides a new method of analyzing data that is complementary to the capabilities provided by SQL, and a system based on MapReduce that can be scaled up from single servers to thousands of high- and low-end machines.

Operational vs. Analytical Systems

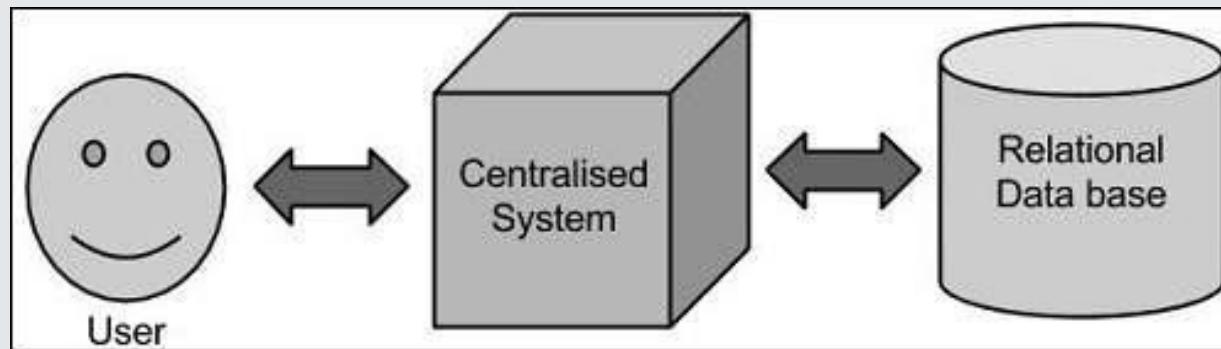
	Operational	Analytical
Latency	1 ms - 100 ms	1 min - 100 min
Concurrency	1000 - 100,000	1 - 10
Access Pattern	Writes and Reads	Reads
Queries	Selective	Unselective
Data Scope	Operational	Retrospective
End User	Customer	Data Scientist
Technology	NoSQL	MapReduce, MPP Database

A complex network graph composed of numerous small, glowing blue dots connected by thin white lines, forming a dense web of triangles and polygons against a dark blue background.

BIG DATA SOLUTIONS

Traditional Approach

- Traditional Approach



Traditional Approach

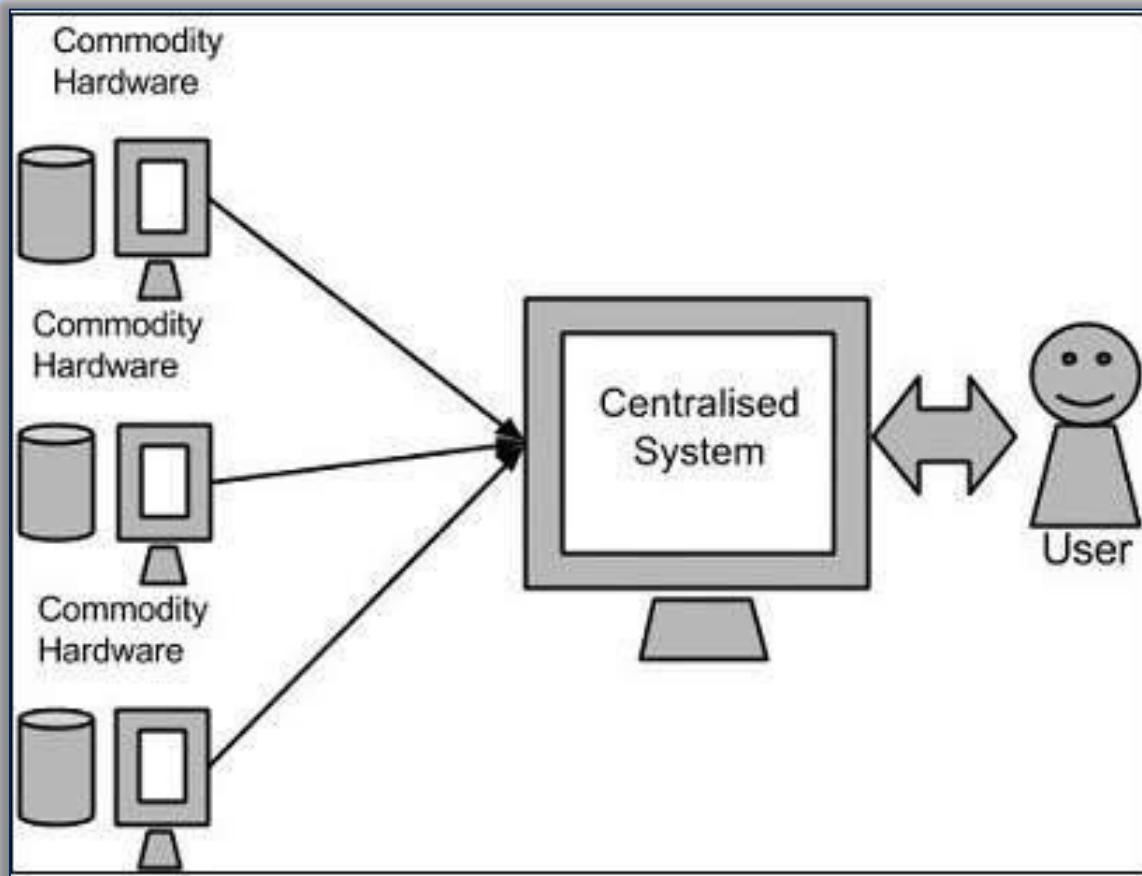
Limitation

- Process less voluminous data that can be accommodated by standard database servers
- Hectic task to process such data through a single database bottleneck.

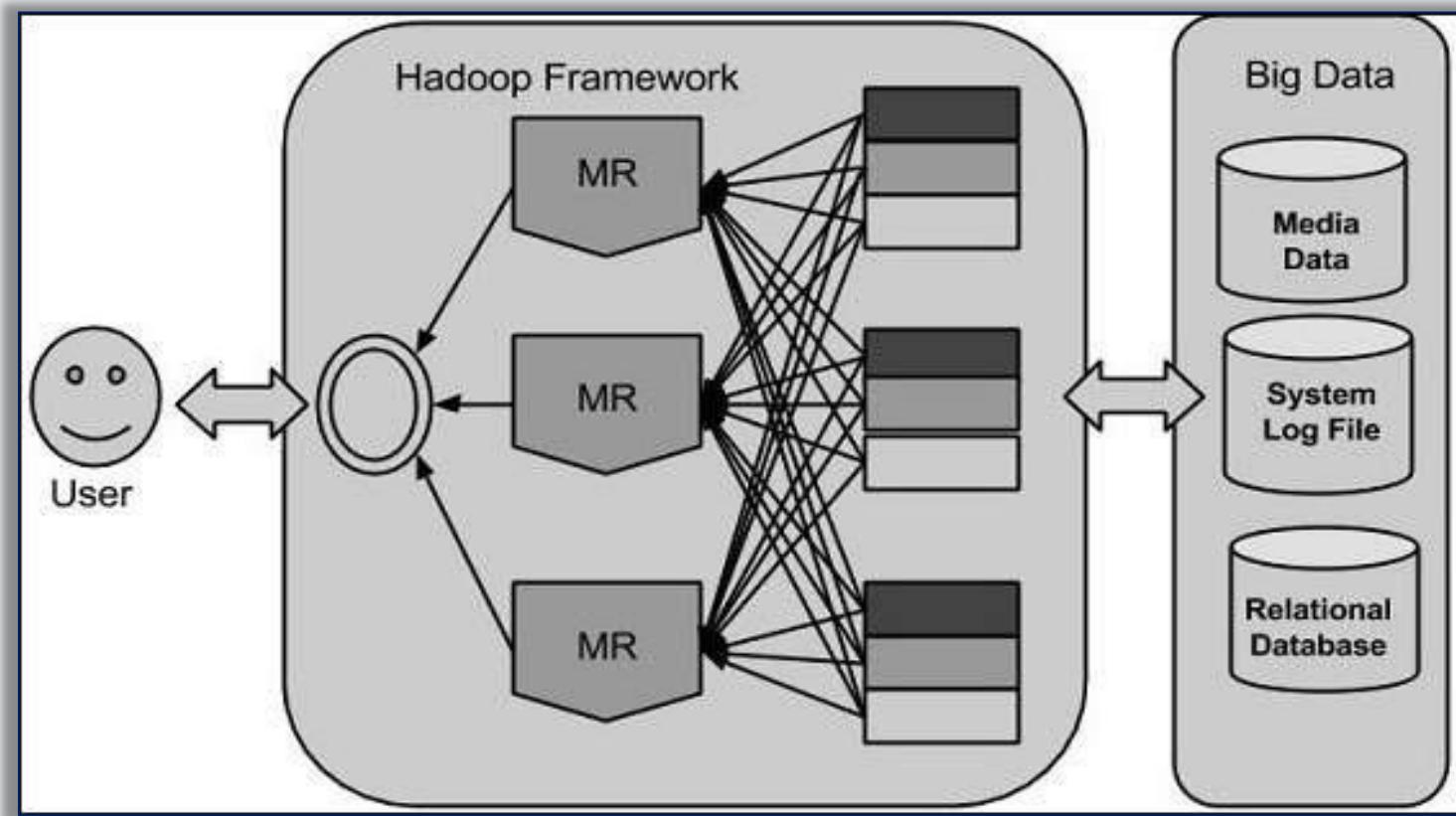
Google's Solution

- Google solved this problem using an algorithm called MapReduce.
- This algorithm divides the task into small parts and assigns them to many computers, and collects the results from them which when integrated, form the result dataset.

Google's Solution



Google's Solution





That's all for now...