Cloud and Big Data

Big Data Overview

Gaurav Parashar

January 15, 2020

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- How to perform operations on Big Data in Cloud Environment

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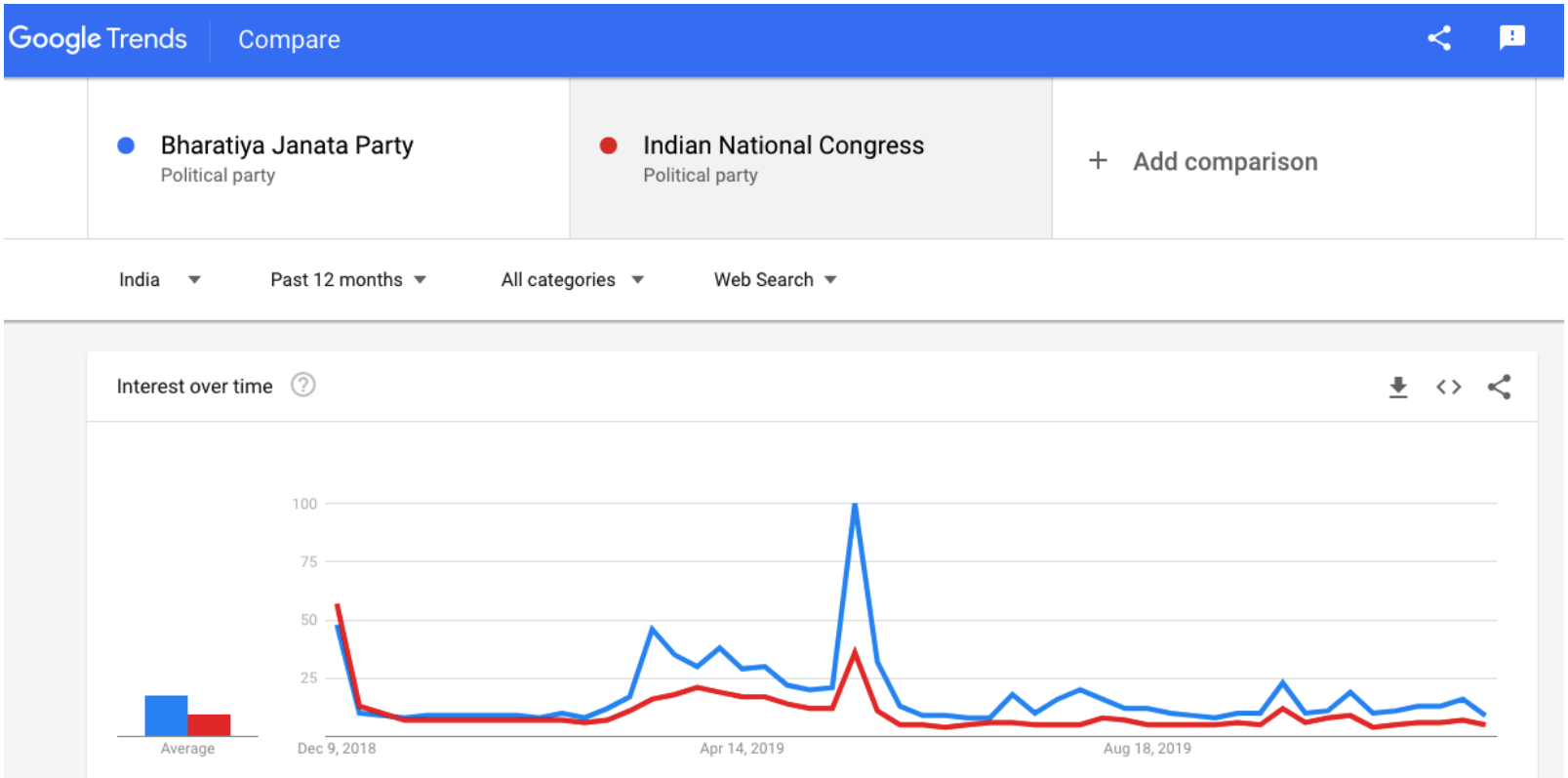
- Predicting Future

Applications of Big Data

Examples:
Google Trends

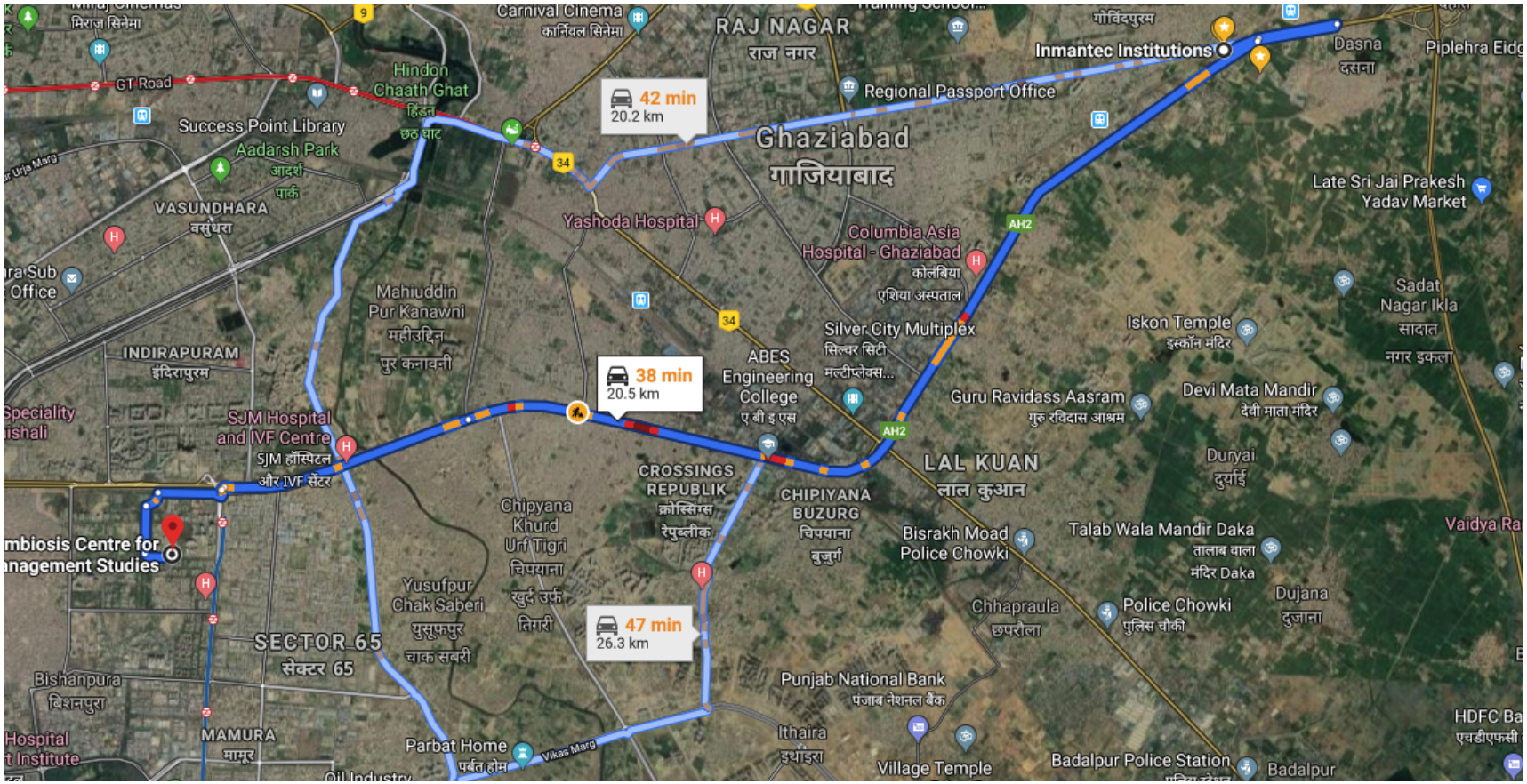


1

[1] Google Trends for BJP and INC

Applications of Big Data

Maps



[2]

[2]Display path, traffic, terrain, etd. time

Applications of Big Data

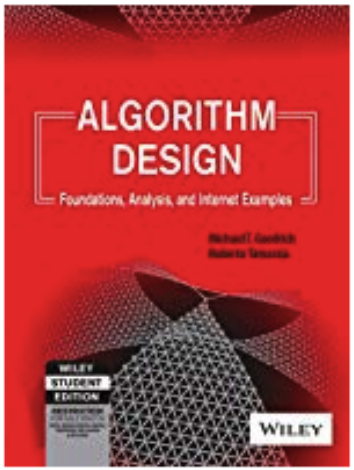
Recommendation Systems

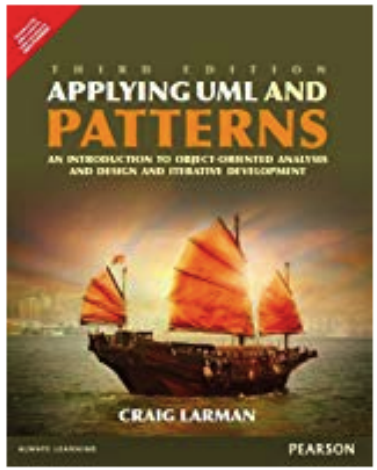
Explore all

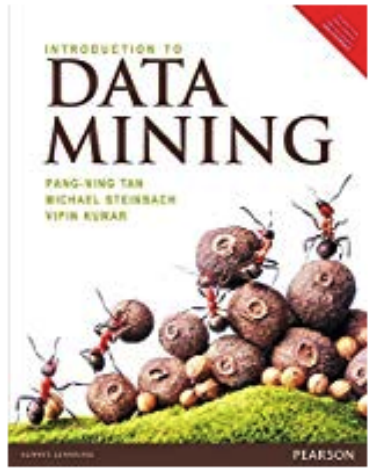
See more

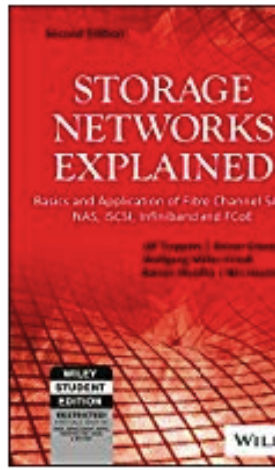
See more

Recommendations for you in Books









[3] Recommendation Engine

Applications of Big Data

Twitter Trends

[4]

[4] Trending in Twitter

Applications of Big Data

Big Data in Sports [2]

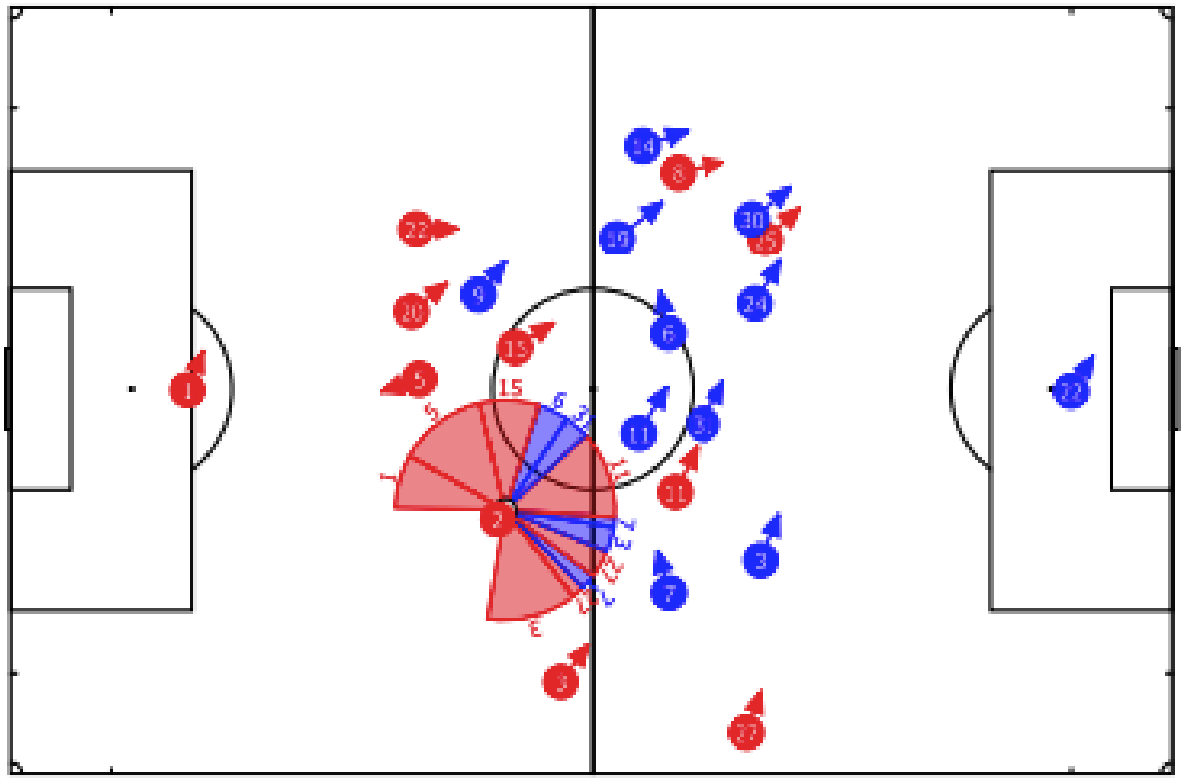


Figure: Available receivers of pass by Red2

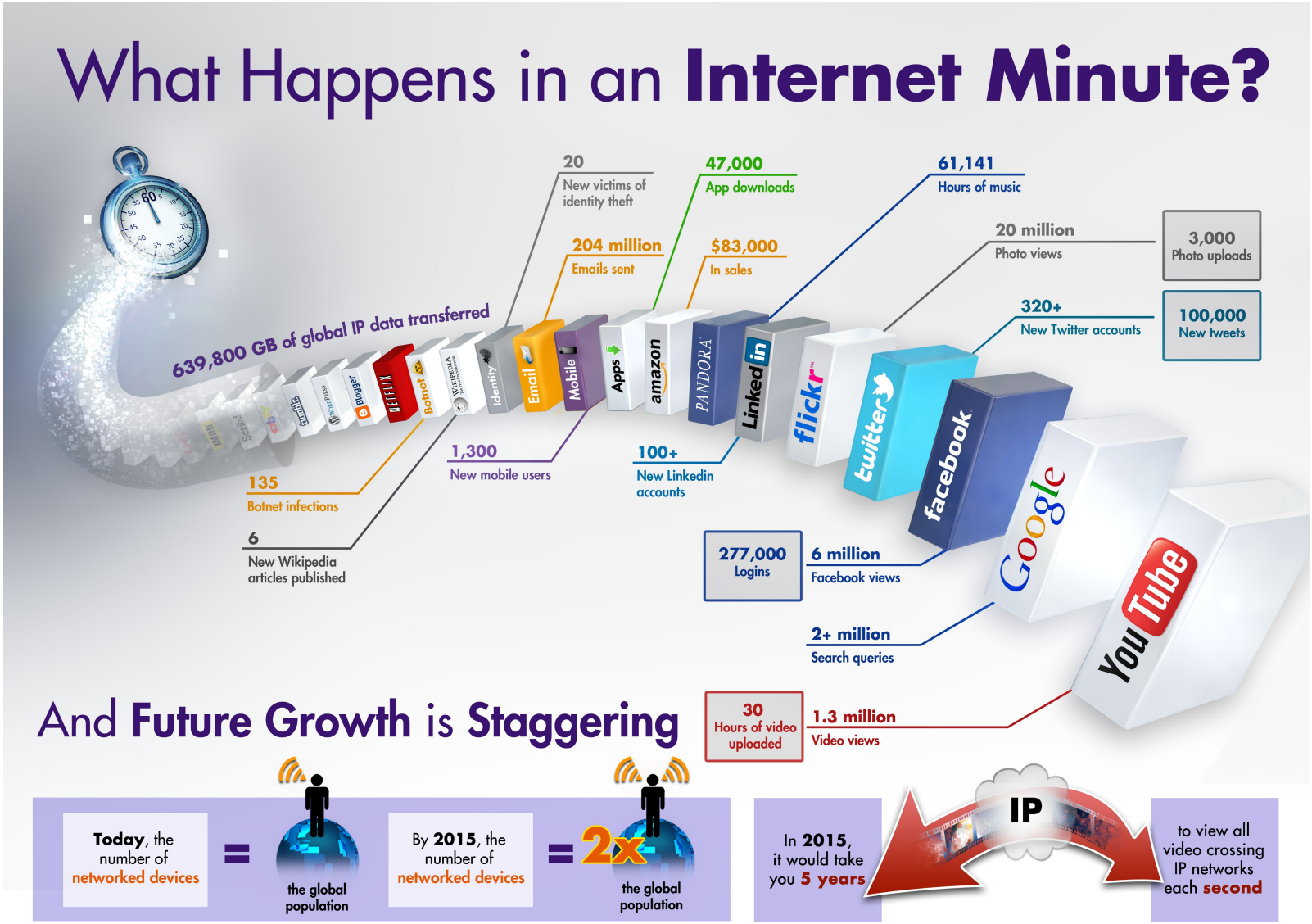
5

[5] Spatio-Temporal Analysis of Team Sports - A Survey

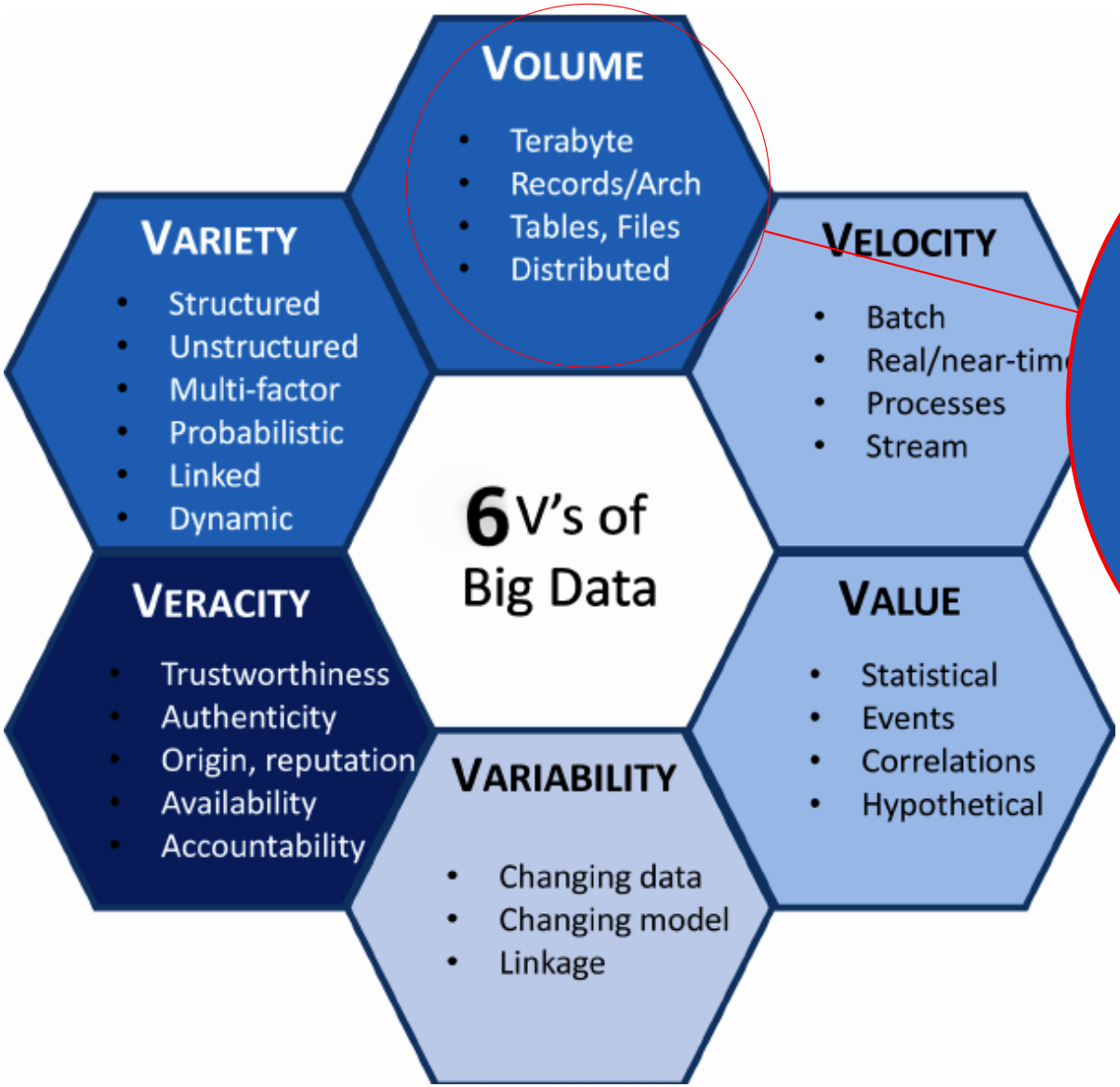
Applications of Big Data

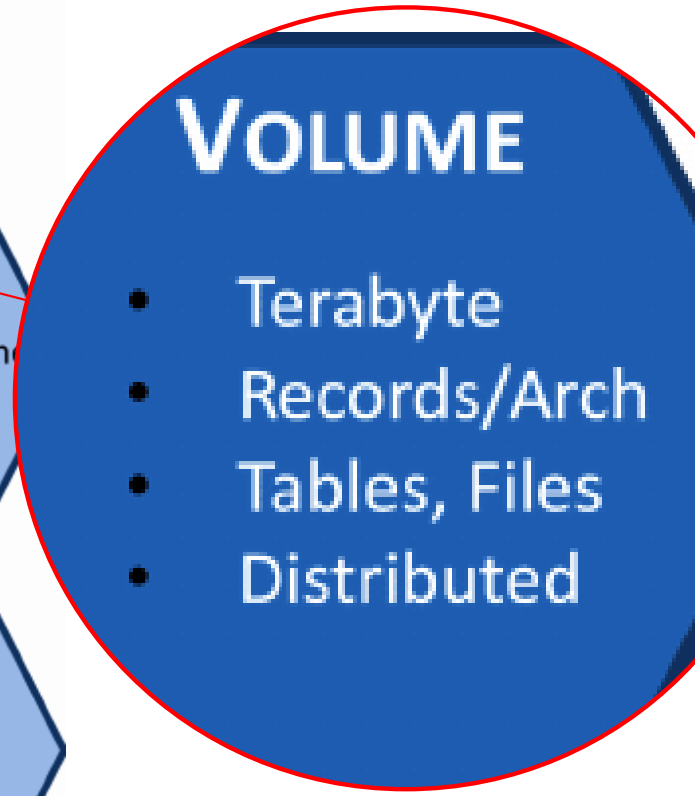
- Weather Prediction
- Medical Diagnosis
- Smart Cities and Buildings

Generation of Big Data



6 Vs of Big Data[3]: Volume 20





Scenario: Volume

What is the staring limit of Big Data?

A $>$ 1 GB - $<$ 1TB

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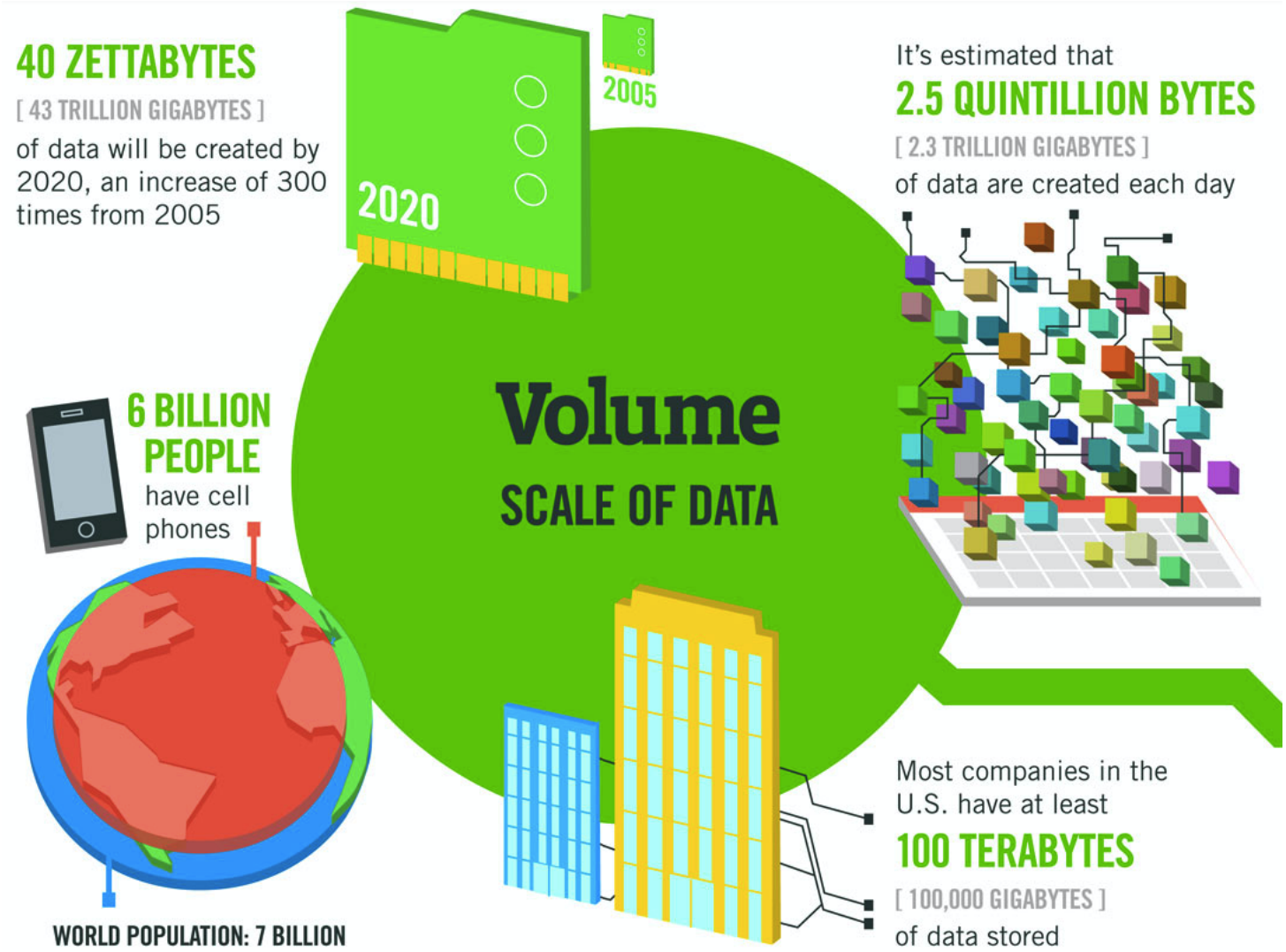
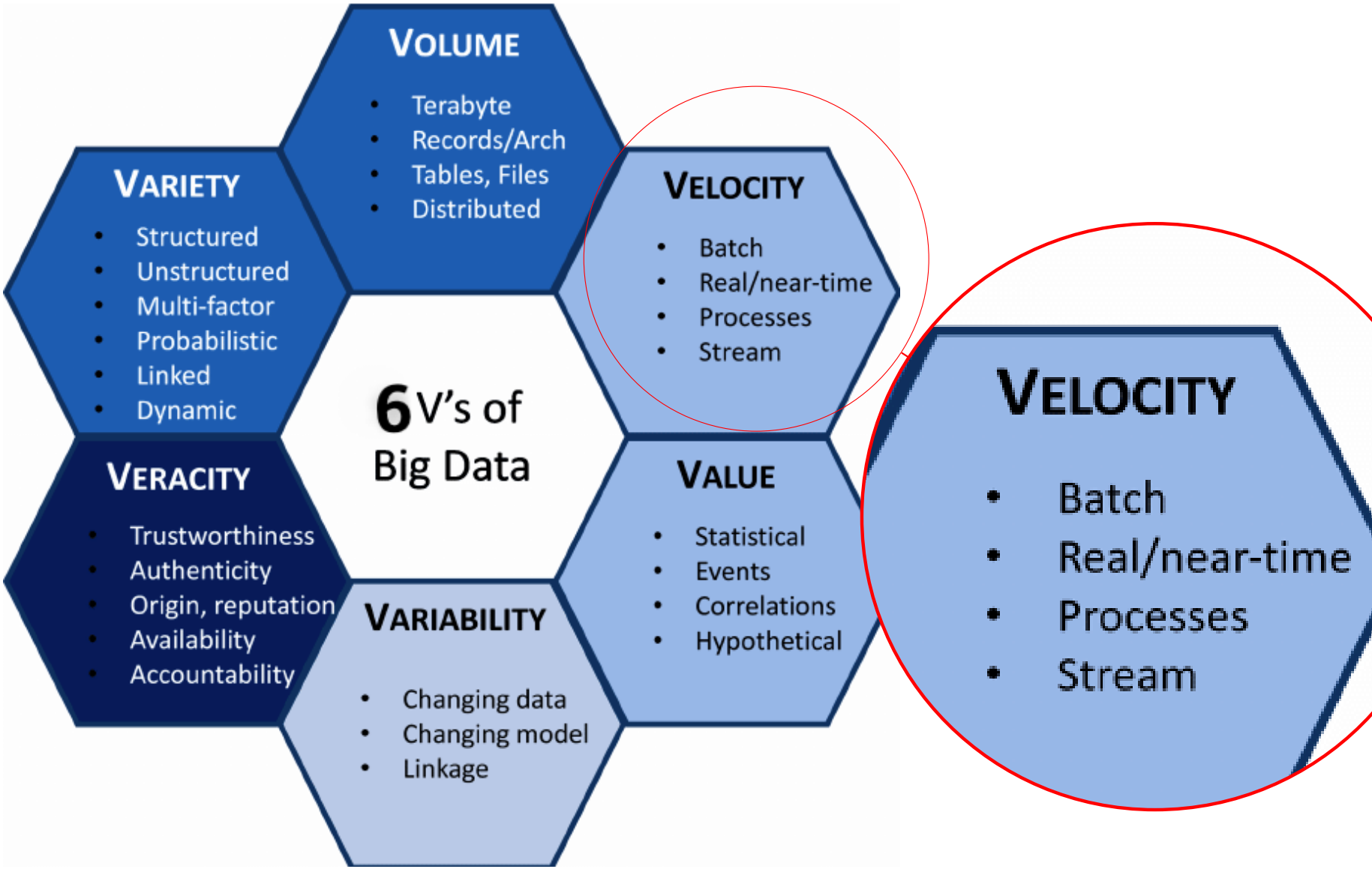
Answer:
Depends upon the organisation definition of Big Data. Relative term.

Scenario: Volume 20



6 Vs of Big Data: Velocity 20



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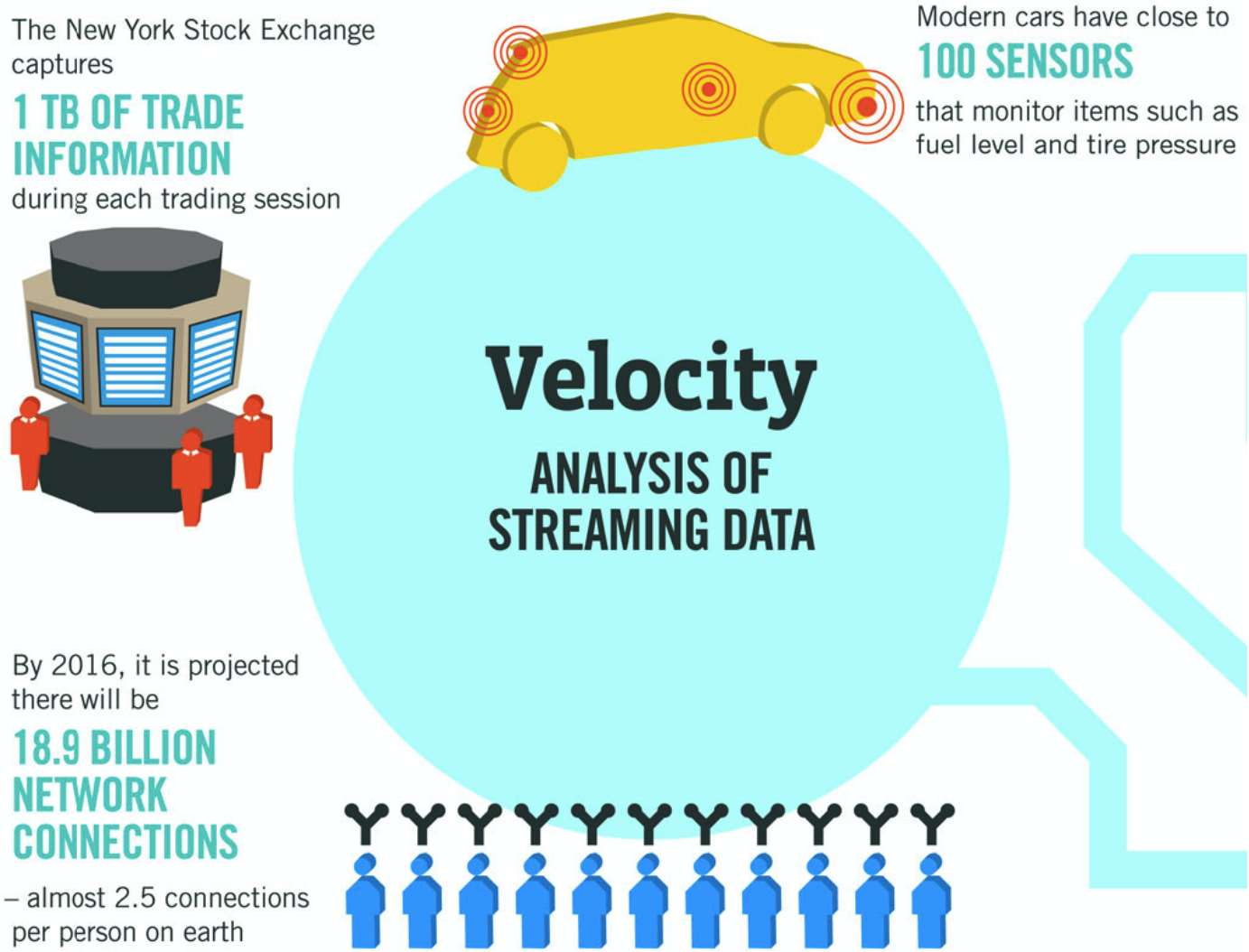
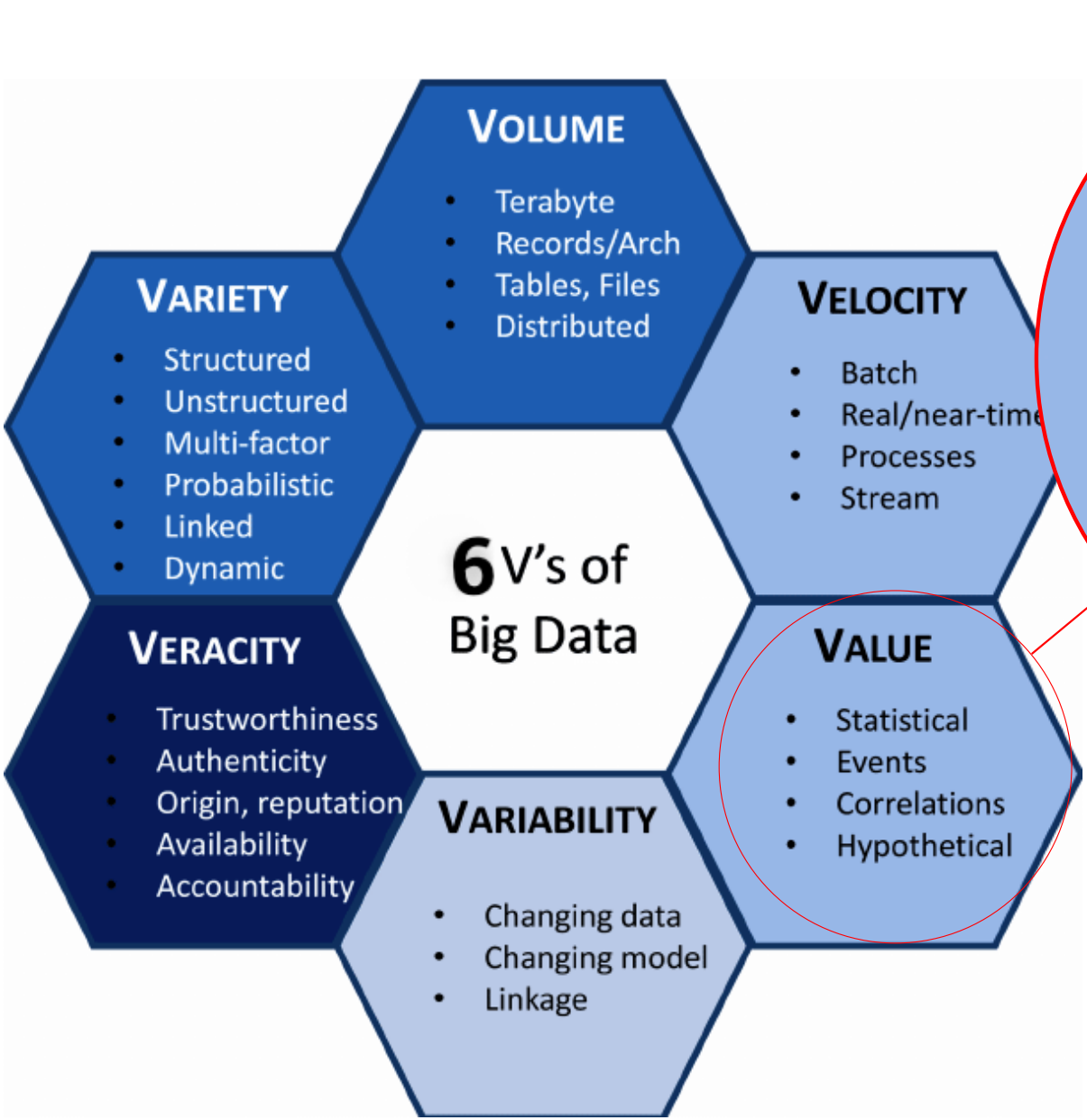
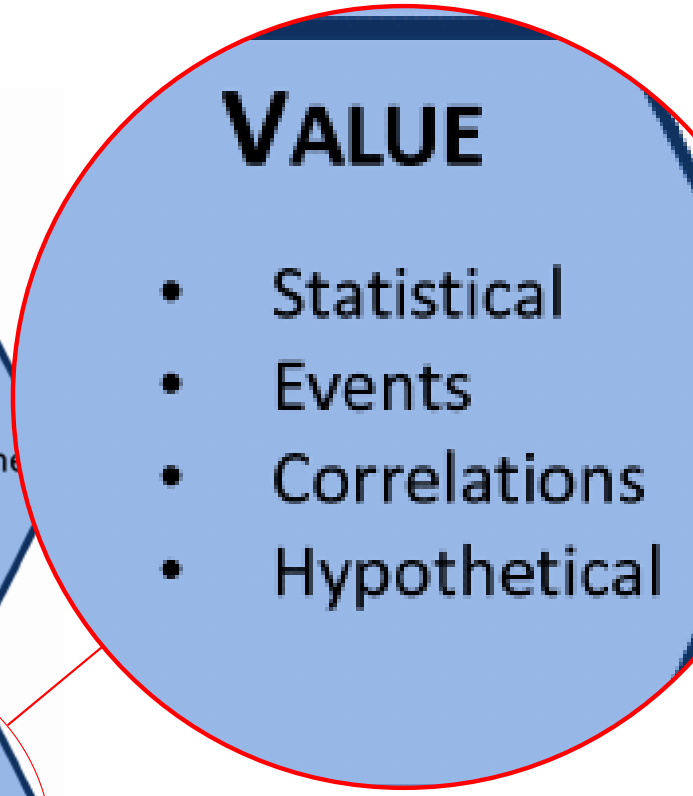
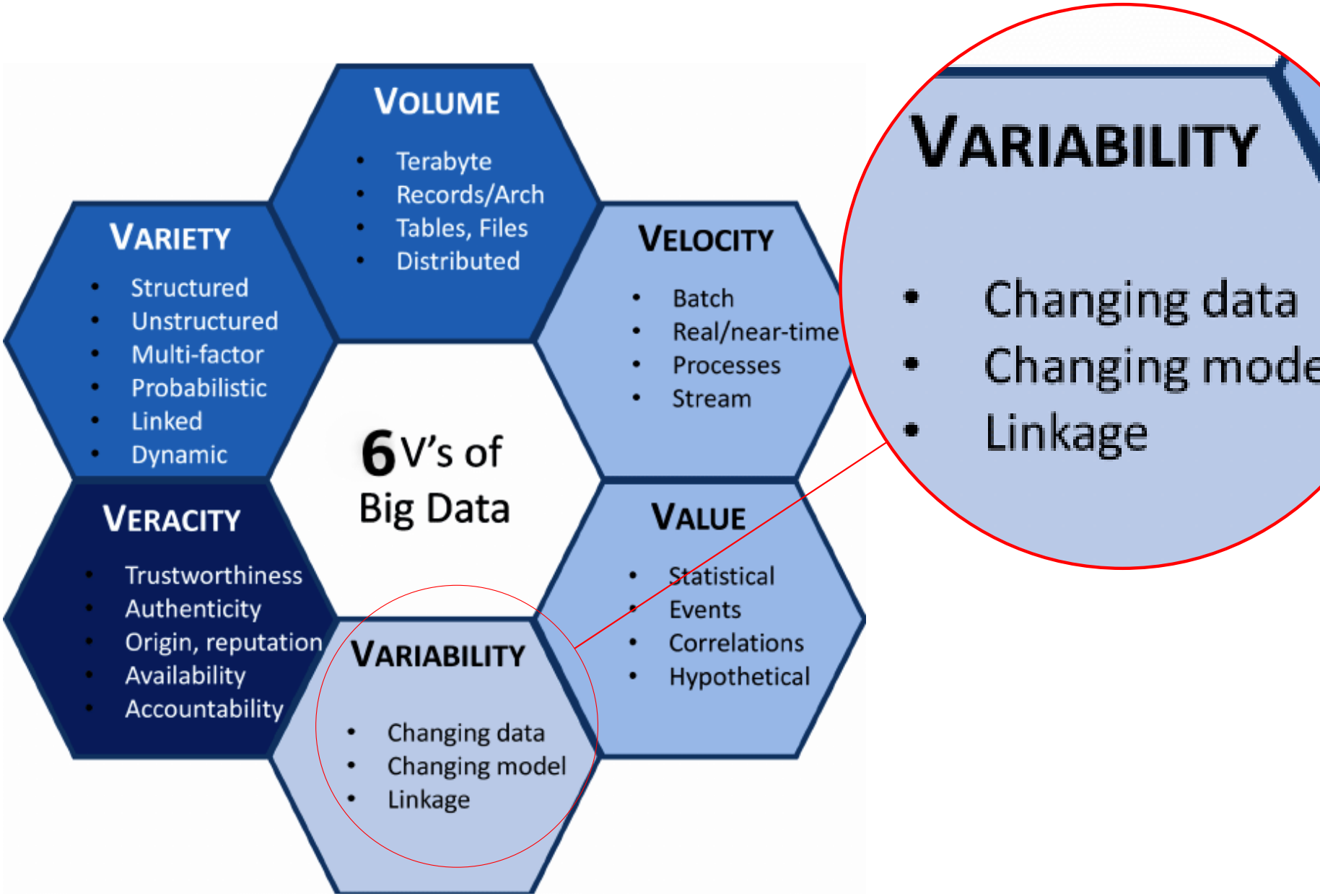


6 Vs of Big Data: Value 20

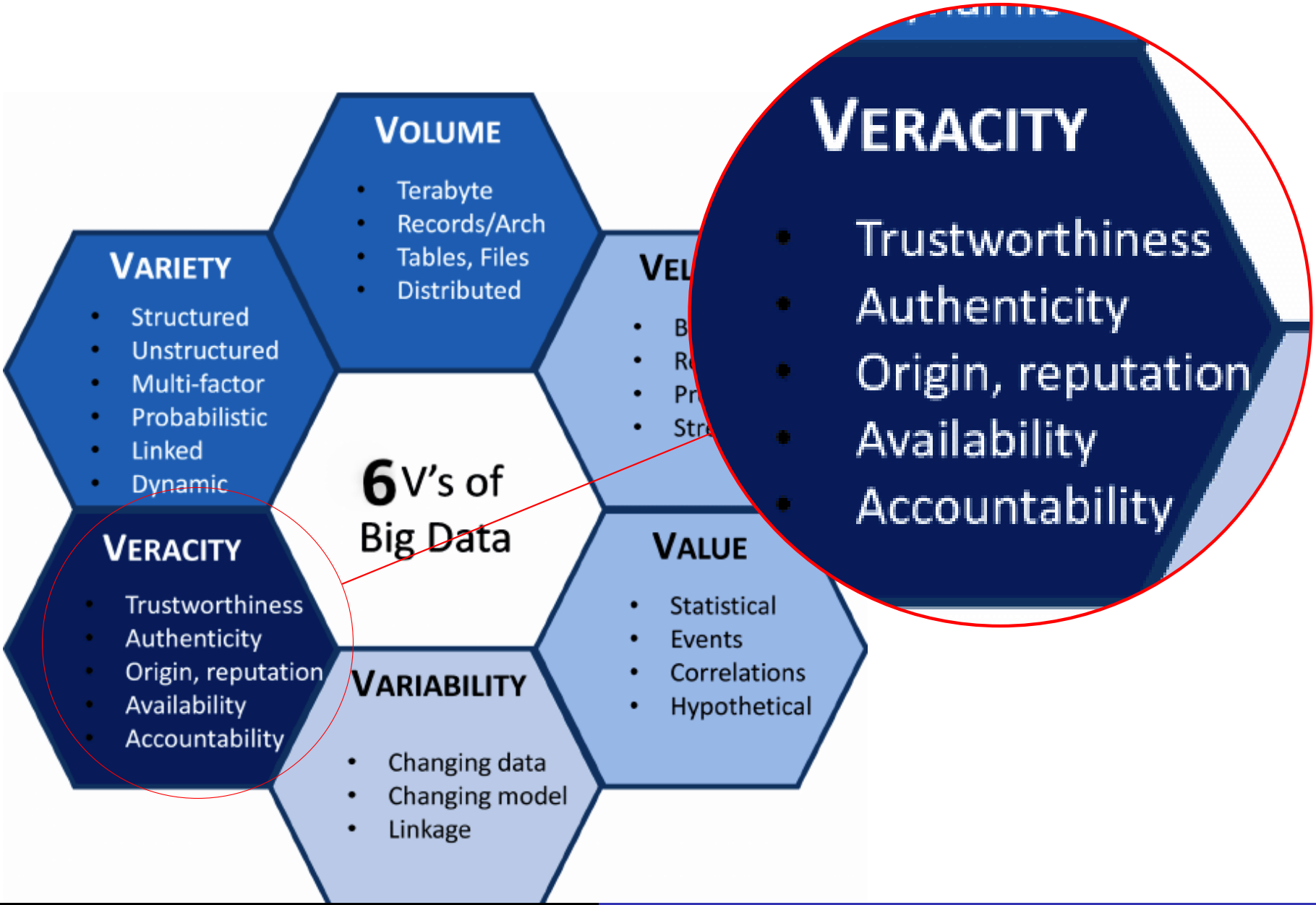




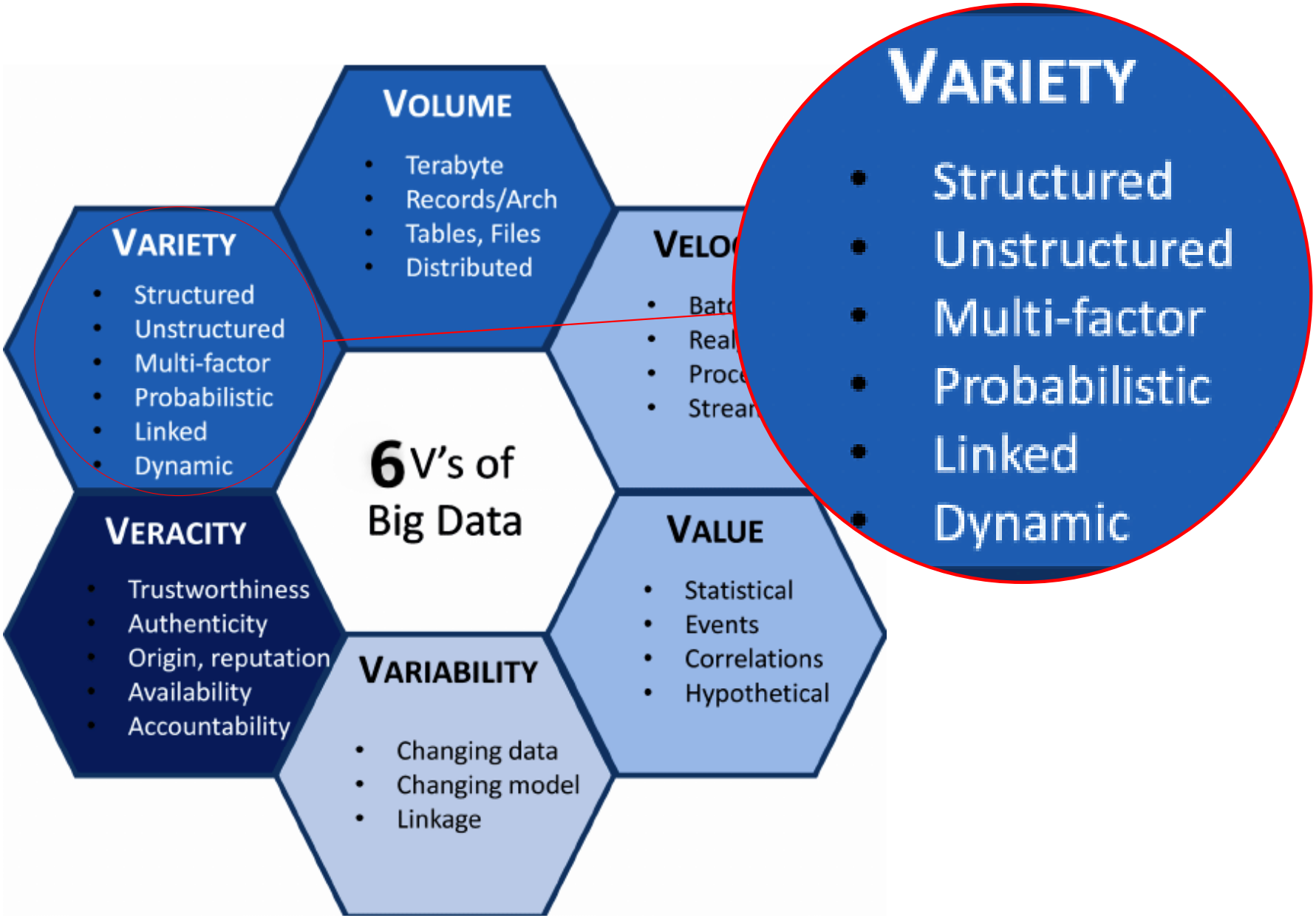
6 Vs of Big Data: Variability 20



6 Vs of Big Data: Veracity 20



6 Vs of Big Data: Variety 20



Limitations of Existing Systems

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4. Rapid Change in type of data
5. Lack of skills

Home Work Question 1:Telecom

A telco[4] serving 8 million prepaid mobile subscribers

1. Volume 10: _____
2. Velocity 13: _____
3. Value 15: _____
4. Variability 16: _____
5. Veracity 17: _____
6. Variety 18: _____

Link: https://github.com/gauravparashar/symbiosis

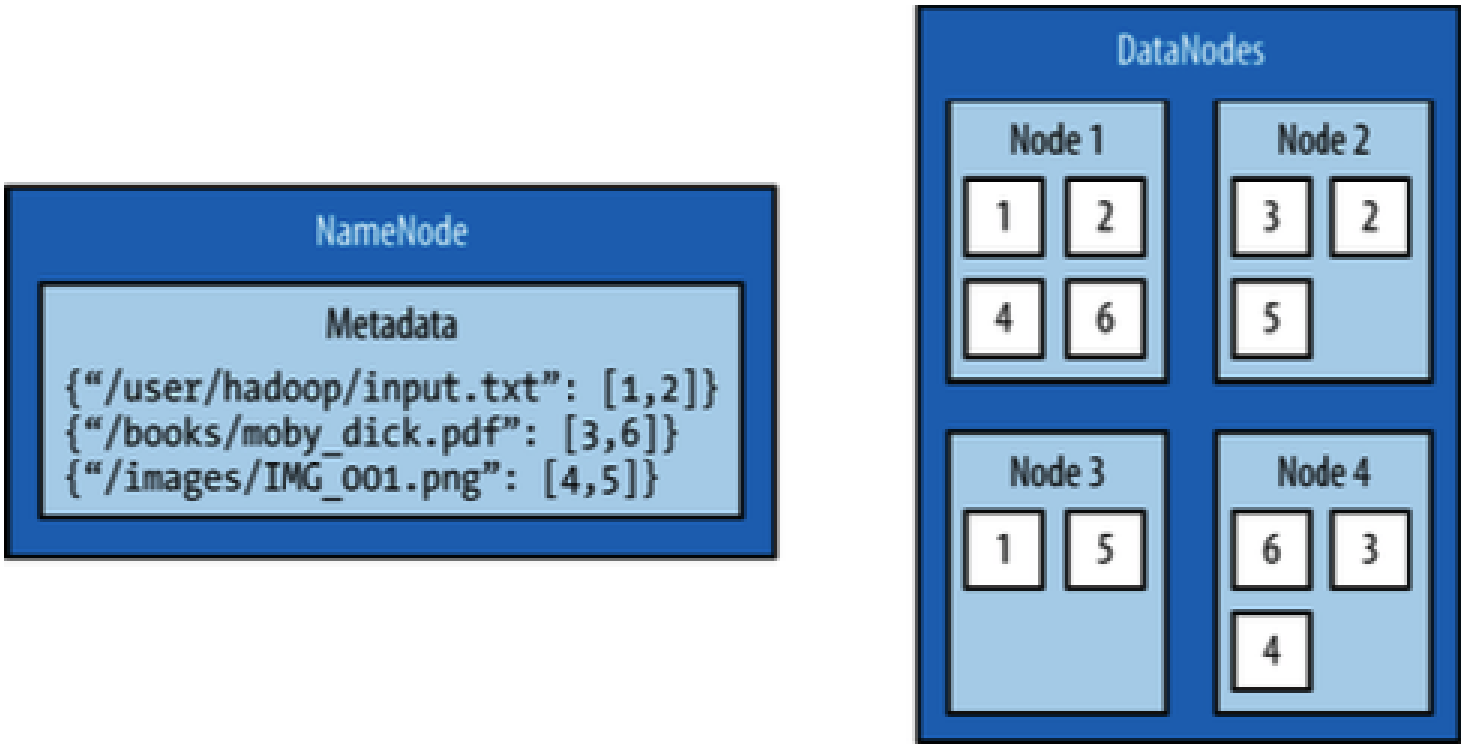
UID, DATE (yyyy-MM-dd), TRIP_SEQUENCE_ID, MOBILITY_TYPE, TRANSPORT_MODE, TOTAL_DISTANCE, TOTAL_TIME, START_TIME, END_TIME, TOTAL_POINTS, POINT_LIST
422a837717,2015-06-06,1,STAY,STAY,0.000,57749.000,00:00:00,16:02:29,1,1|2015-06-01 00:00:00|6.373743|-10.772951

422a837717,2015-06-06,2,MOVE,WALK,3153.708,2323.000,16:02:29,16:41:12,39,1|2015-06-01 16:02:29|6.373497|-10.773267;2|2015-06-01 16:03:30|6.374243|-10.773447;3|2015-06-01 16:04:31|6.374983|-10.773652;4|2015-06-01 16:05:32|6.375711|-10.773898;5|2015-06-01 16:06:33|6.376103|-10.774265;6|2015-06-01 16:07:34|6.375691|-10.774913;7|2015-06-01 16:08:35|6.375280|-10.775561;8|2015-06-01 16:09:36|6.374868|-10.776209;9|2015-06-01 16:10:38|6.374457|-10.776858;10|2015-06-01 16:11:39|6.374046|-10.777506;11|2015-06-01 16:12:40|6.373634|-10.778154;12|2015-06-01 16:13:41|6.373223|-10.778802;13|2015-06-01 16:14:42|6.372842|-10.779469;14|2015-06-01 16:15:43|6.372488|-10.780150;15|2015-06-01 16:16:44|6.372098|-10.780811;16|2015-06-01 16:17:45|6.371690|-10.781461;17|2015-06-01 16:18:47|6.371286|-10.782115;18|2015-06-01 16:19:48|6.370883|-10.782768;19|2015-06-01 16:20:49|6.370479|-10.783421;20|2015-06-01 16:21:50|6.370076|-10.784074;21|2015-06-01 16:22:51|6.369672|-10.784727;22|2015-06-01 16:23:52|6.369238|-10.785360;23|2015-06-01 16:24:53|6.368795|-10.785988;24|2015-06-01 16:25:55|6.368358|-10.786618;25|2015-06-01 16:26:56|6.368053|-10.787320;26|2015-06-01 16:27:57|6.368022|-10.787936;27|2015-06-01 16:28:58|6.368780|-10.788057;28|2015-06-01 16:29:59|6.369542|-10.788139;29|2015-06-01 16:31:00|6.370310|-10.788158;30|2015-06-01 16:32:01|6.371075|-10.788096;31|2015-06-01 16:33:02|6.371611|-10.788376;32|2015-06-01 16:34:04|6.371883|-10.789094;33|2015-06-01 16:35:05|6.372137|-10.789817;34|2015-06-01 16:36:06|6.372195|-10.790581;35|2015-06-01 16:37:07|6.372183|-10.791348;36|2015-06-01 16:38:08|6.372054|-10.791999;37|2015-06-01 16:39:09|6.371293|-10.791979;38|2015-06-01 16:40:10|6.371313|-10.792746;39|2015-06-01 16:41:12|6.371295|-10.793513

422a837717,2015-06-06,3,STAY,STAY,0.000,34295.000,16:41:12,23:59:59,1,1|2015-06-06 16:41:12|6.371295|-10.793513

Hadoop is a distributed system which is based on HDFS (Hadoop Distributed File System). It is scalable, distributed, and portable file system for large commodity systems.

- stores large amount of data
- reliable way to store data
- scalable way to manage resources
- HDFS is composed of two main components
  - Name Node
  - Data Node



[5]

Figure: HDFS Architecture [6]

[6] HDFS cluster with replication factor of 2

Interaction with HDFS is primarily performed from the command line using command **hdfs**.

```
$ hdfs COMMAND [−option <arg>]
```

The command argument instructs which functionality of HDFS to be used.

Common File Operations

To perform basic operations on HDFS, we use **dfs** command with **hdfs**. **dfs** supports many file operations like copy, move, remove , etc.

List directory contents

```
$ hdfs dfs -ls /
```

It lists out the content of the root filesystem of HDFS.

List Directory Contents

Output:

```
$ hdfs dfs -ls /
Found 3 items
drwxr-xr-x - hadoop supergroup 0 2019-12-28 23:20 /input
drwxr-xr-x - hadoop supergroup 0 2019-12-29 00:18 /output
drwx------ - hadoop supergroup 0 2019-12-18 22:33 /tmp
```

To create a directory within HDFS.

```
$ hdfs dfs -mkdir /user
```

Output:

```
$ hdfs dfs -mkdir /user
Found 4 items
drwxr-xr-x - hadoop supergroup 0 2019-12-28 23:20 /input
drwxr-xr-x - hadoop supergroup 0 2019-12-29 00:18 /output
drwx------ - hadoop supergroup 0 2019-12-18 22:33 /tmp
drwxr-xr-x - hadoop supergroup 0 2020-01-03 22:22 /user
```

Copy data file(s) onto HDFS.

```
$ hdfs dfs −put source destination
```

Output:

```
$ hdfs dfs −put hw.csv /user
```

-get command can be used to retrieve data from HDFS to local file system

To visualise the content in the file copied onto HDFS

```
$ hdfs dfs −cat filename
```

Output:

```
$ hdfs dfs −cat /user/hw.csv
1,65.78331,112.9925
2,71.51521,136.4873
3,69.39874,153.0269
4,68.2166,142.3354
....
24999,67.52918,132.2682
25000,68.87761,124.8742
```

-head command can be used to display 50 lines from top.
-tail command can be used to display last 50 lines from bottom.

MapReduce is a programming model that enables large volumes of data to be processed and generated by dividing work into independent tasks and executing the tasks in parallel across a cluster of machines.

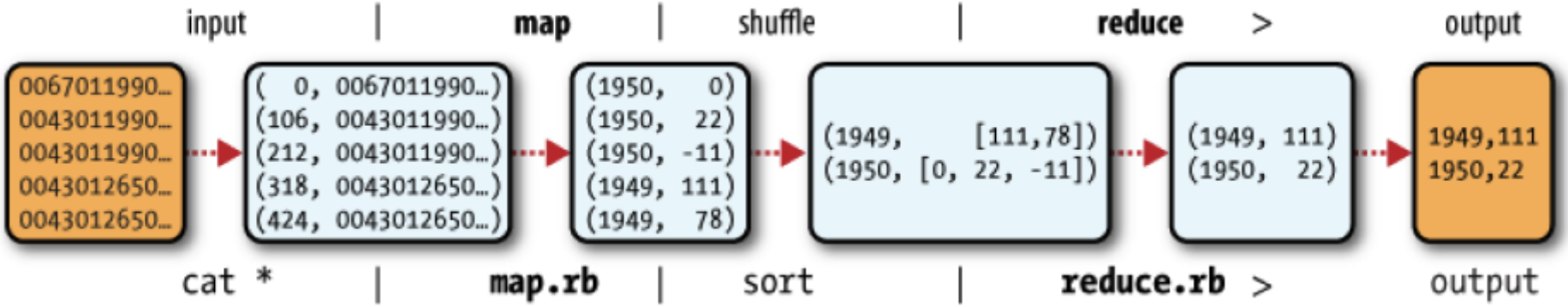


Figure: MapReduce logical data flow[6]

Word Count Example - Prerequisite

- sys module : A file containing a set of functions you want to include in your application.

```
import sys
```

- for loop : A for loop is used for iterating over a sequence (that is either a list, a tuple, a dictionary, a set, or a string).

```
students = ["Aman", "Anita", "Cherry"]
for student in students:
        print(student)
```

- lists : List is a collection which is ordered and changeable. Allows duplicate members

```
students = ["Aman", "Anita", "Cherry"]
```

Word Count Example - Prerequisite

- print : The print() function prints the specified message to the screen, or other standard output device.

```
print "%s\t%s" %("Hello", "how are you?")
print '{0}\t{1}'.format("Hello", "how are you?")
```

- split : split(separator) function returns a list of strings after breaking the given string by the specified separator.

```
line = "Mary had alittle lamb"
print (line.split(" "))
```

Word Count Example - Prerequisite

- dictionary : Dictionary is an unordered collection of data values, used to store data values like a map, which unlike other Data Types that hold only single value as an element, Dictionary holds key:value pair.

```
# Creating an empty Dictionary
Dict = {}
print("Empty Dictionary: ")
print(Dict)

# Creating a Dictionary with Integer Keys
Dict = {1: 'Geeks', 2: 'For', 3: 'Geeks'}
print("\nDictionary with the use of Integer Keys: ")
print(Dict)
```

Python Hadoop: Final Mapper code

```
for line in sys.stdin:
    line = line.strip() # Remove the leading and trailing spaces
    words = line.split() # Split the line on space
    for word in words:
        print "%s\t%s" %(word,1) # you can use this method or
        print '{0}\t{1}'.format(word, 1) #this method
```

Python Hadoop: Final Mapper output

```
$ echo Hello world. I am an Indian. and I love my country | python
    ↪ mapper.py
```

Output:

```
Hello 1
world. 1
I 1
am 1
an 1
Indian. 1
and 1
I 1
love 1
my 1
country 1
```

Python Hadoop: Final Reducer code

```
import sys
w = {}
# Process each key-value pair from the mapper
for line in sys.stdin:
    # Get the key and value from the current line
    word, count = line.split('\t')
    # Convert the count to an int
    count = int(count)
    if word in w:
        w[word] = w[word] + count
    else:
        w[word] = count

for word in w.keys():
    print "%s\t%s" %(word,w[word])
```

Python Hadoop: Final Reducer output

```
$ echo Hello world. I am an Indian. and I love my country | python
    ↪ mapper.py | python reducer.py
```

Output:

```
and 1
love 1
I 2
my 1
am 1
an 1
Indian. 1
country 1
world. 1
Hello 1
```

Python Hadoop: Final Execution on Hadoop

```
$ hdfs dfs -put code/first_code/data.txt /input
mapred streaming -input /input/data.txt -output /output/ -file ~/
    ↪ symbiosis/code/first_code/mapper.py -mapper ~/symbiosis/
    ↪ code/first_code/mapper.py -file ~/symbiosis/code/first_code/
    ↪ reducer.py -reducer ~/symbiosis/code/first_code/reducer.py
```

Python Hadoop: Final Execution on Hadoop

```
$ hdfs dfs -ls /output/
Found 2 items
-rw-r--r-- 1 hadoop supergroup 0 2020-01-07 11:59 /output/
    ↪ _SUCCESS
-rw-r--r-- 1 hadoop supergroup 69 2020-01-07 11:59 /output/
    ↪ part-00000
$hdfs dfs -cat /output/*
and 1
love 1
I 2
country 1
am 1
an 1
Indian. 1
my 1
Hello 1
world. 1
```

Dataset: Airline

Question: Find list of Airports operating in the Country India

Data set: airports_mod.dat

```
1,Goroka,Goroka,Papua New Guinea,GKA,AYGA
    ↪ ,−6.081689,145.391881,5282,10,U,Pacific/Port_Moresby
2,Madang,Madang,Papua New Guinea,MAG,AYMD
    ↪ ,−5.207083,145.7887,20,10,U,Pacific/Port_Moresby
```

Write the Mapper code for it

Dataset: Airline

Question: Find list of Airports operating in the Country India

```
import sys
lst = []
for line in sys.stdin:
    line = line.strip()
    lst = line.split(',')
    if lst[3] == 'India':
        print "%s" %(lst[0])
```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