Basic Concepts of Big Data (20 Hours)

- **Session 1-4:**

o Concept and characteristics of Big Data
o History of Big Data
o Jobs in Big Data
o Types of Big data (structured, semi-structured, unstructured)

- **Session 5-9:**

o Big Data Frameworks
o Big Data Programming Paradigms
o Big Data Programming Languages

- **Session 10-11:**

o Introduction to Data Science and Skillset required for working with Big Data

- **Session 12-15:**

o Simplified Overview of Machine Learning Algorithms and Neural Networks
o Types of Machine Learning (Supervised, Un-Supervised, Reinforcement)

- **Session 16-18:**

ACTS, Head Quarters, Pune
o Examples of Big Data and Data Science in Practice (Healthcare, Logistics & Transportation, Manufacturing etc.

- **Session 19-20:**

o Application Examples and Real –World Use Cases (e.g., Healthcare, finance, marketing, etc.)

Types of Big Data Technologies (+ Management Tools)

1. Data storage

- Apache Hadoop
- Apache Spark
- Apache Hive
- Apache Flume
- ElasticSearch
- MongoDB

2. Data mining

- Rapidminer
- Presto

3. Data analytics

- Apache Spark
- Splunk
- KNIME

4. Data visualization

- Tableau
- Power BI

1. Data storage

Apache Hadoop

The Apache Hadoop software library is a framework that allows for the distributed processing of large data sets across clusters of computers using simple programming models. It is designed to scale up from single servers to thousands of machines, each offering local computation and storage.

MongoDB

MongoDB is a source-available cross-platform document-oriented database program.

Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas

2. Data mining

Rapidminer

pros:

1. Multiple deployment options based on our preference.
2. Strong visualization.
3. Accurate Preprocessing.
4. Multiple interfaces.
5. Java API available that can be used in programs.

cons:

1. It takes too much memory and so slows down your system.
2. Less forums for support.

Presto

A single Presto query can process data from multiple sources like HDFS, MySQL, Cassandra, Hive and many more data sources. Presto is built in Java and easy to integrate with other data infrastructure components. Presto is powerful, and leading companies like Airbnb, DropBox, Groupon, Netflix are adopting it.

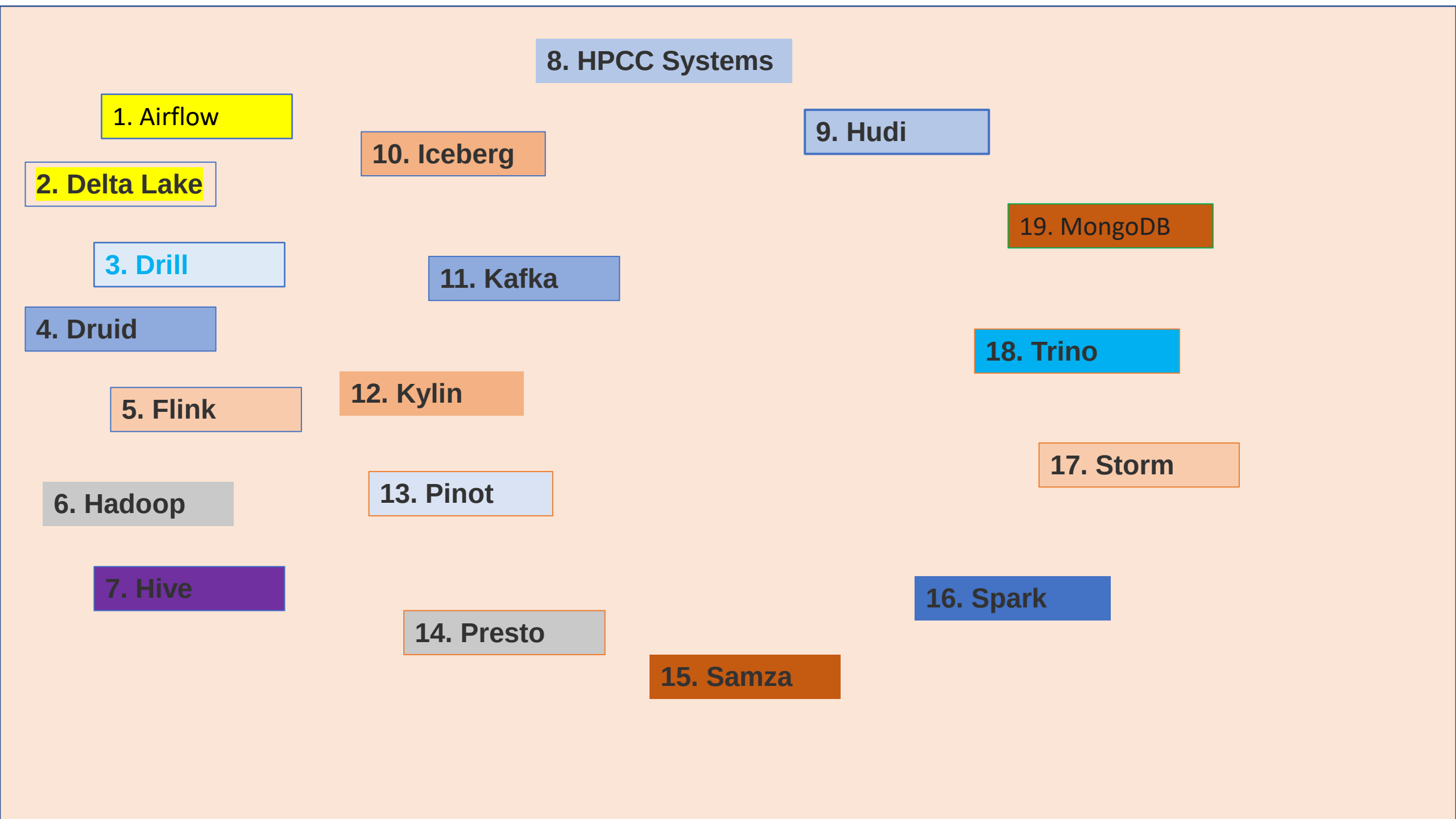
Apache Spark

Apache Spark is an open-source unified analytics engine for large-scale data processing. Spark provides an interface for programming clusters with implicit data parallelism and fault tolerance

Splunk

Splunk is a program that enables the search and analysis of computer data. It analyzes semi-structured data and logs generated by various processes with proper data modeling as per the need of the IT companies. The user produces the data by means of any device like- web apps, sensors, or computers. It has built-in functionality for defining data types, field separators, and search process optimization. For the searched result, it also provides visualization of data.

Tableau can handle huge columns of data and still offer better performance.	Power BI is best for a limited volume of data.
Tableau has better data visualization.	Power BI offers many data points for data visualization.
Tableau works best with huge data.	Power BI is suboptimal with huge data.
Experts and experienced users use Tableau.	Power BI is used by beginners and experienced alike.


8. HPCC Systems
1. Airflow
9. Hudi
10. Iceberg
2. Delta Lake
19. MongoDB
3. Drill
11. Kafka
4. Druid
18. Trino
12. Kylin
5. Flink
17. Storm
13. Pinot
6. Hadoop
7. Hive
16. Spark
14. Presto
15. Samza

1. Data storage

- Apache Hadoop
- Hortonworks
- Data lake
- Apache Spark
- MongoDB
- Apache Cassandra
- P r e s t o
- Cloudera
- Cloud storage
- Elastic search
- Hybrid storage

Cloud Service Providers

Microsoft Azure

Google Cloud Platform

Amazon Web Service (AWS)

Oracle Cloud

IBM Cloud Services

Rackspace

Adobe Creative Cloud

Red Hat

SAP

Kamatera

Salesforce

Verizon Cloud

VMware

1. Airflow

Airflow in Apache is a popularly used tool to manage the automation of tasks and their workflows. They are also primarily used for scheduling various tasks. Consider that you are working as a data engineer or an analyst and we might need to continuously repeat a task that needs the same effort and time every time. The kind of such tasks might consist of **extracting, loading,** or **transforming data** that need a regular analytical report. We can simply automate such tasks using Airflow in Apache by training your machine learning model to serve these kinds of tasks on a regular interval specified while training it

2. Delta Lake

What is Big Data

Data which are very large in size is called Big Data. Normally we work on data of size MB(WordDoc ,Excel) or maximum GB(Movies, Codes) but data in Peta bytes i.e. 10^15 byte size is called Big Data. It is stated that almost 90% of today's data has been generated in the past 3 years.

Sources of Big Data

These data come from many sources like

- **Social networking sites:** Facebook, Google, LinkedIn all these sites generates huge amount of data on a day to day basis as they have billions of users worldwide.

- **E-commerce site:** Sites like Amazon, Flipkart, Alibaba generates huge amount of logs from which users buying trends can be traced.

- **Weather Station:** All the weather station and satellite gives very huge data which are stored and manipulated to forecast weather.

- **Telecom company:** Telecom giants like Airtel, Vodafone study the user trends and accordingly publish their plans and for this they store the data of its million users.

- **Share Market:** Stock exchange across the world generates huge amount of data through its daily transaction.

3V's of Big Data

1.Velocity: The data is increasing at a very fast rate. It is estimated that the volume of data will double in every 2 years.

2.Variety: Now a days data are not stored in rows and column. Data is structured as well as unstructured. Log file, CCTV footage is unstructured data. Data which can be saved in tables are structured data like the transaction data of the bank.

3.Volume: The amount of data which we deal with is of very large size of Peta bytes.

Use case

An e-commerce site XYZ (having 100 million users) wants to offer a gift voucher of 100$ to its top 10 customers who have spent the most in the previous year.Moreover, they want to find the buying trend of these customers so that company can suggest more items related to them.

Issues

Huge amount of unstructured data which needs to be stored, processed and analyzed.

Solution

Storage: This huge amount of data, Hadoop uses HDFS (Hadoop Distributed File System) which uses commodity hardware to form clusters and store data in a distributed fashion. It works on Write once, read many times principle.

Processing: Map Reduce paradigm is applied to data distributed over network to find the required output.

Analyze: Pig, Hive can be used to analyze the data.

Cost: Hadoop is open source so the cost is no more an issue.

What is Hadoop

Hadoop is an open source framework from Apache and is used to store process and analyze data which are very huge in volume. Hadoop is written in Java and is not OLAP (online analytical processing). It is used for batch/offline processing.It is being used by Facebook, Yahoo, Google, Twitter, LinkedIn and many more. Moreover it can be scaled up just by adding nodes in the cluster.

Modules of Hadoop

1.HDFS: Hadoop Distributed File System. Google published its paper GFS and on the basis of that HDFS was developed. It states that the files will be broken into blocks and stored in nodes over the distributed architecture.

2.Yarn: Yet another Resource Negotiator is used for job scheduling and manage the cluster.

3.Map Reduce: This is a framework which helps Java programs to do the parallel computation on data using key value pair. The Map task takes input data and converts it into a data set which can be computed in Key value pair. The output of Map task is consumed by reduce task and then the out of reducer gives the desired result.

4.Hadoop Common: These Java libraries are used to start Hadoop and are used by other Hadoop modules.

Hadoop Architecture

The Hadoop architecture is a package of the file system, MapReduce engine and the HDFS (Hadoop Distributed File System). The MapReduce engine can be MapReduce/MR1 or YARN/MR2.

A Hadoop cluster consists of a single master and multiple slave nodes. The master node includes Job Tracker, Task Tracker, NameNode, and DataNode whereas the slave node includes DataNode and TaskTracker.

Using Big Data Analytics Tools

1.Healthcare: Big data analytics technologies and tools are being used in healthcare to predict patient outcomes, identify at-risk patients, and improve population health.

2.Retail: Big data analytics tools are being used by retailers to improve customer experience, target marketing campaigns, and prevent fraud.

3.Manufacturing: Big data analytics tools are being used in manufacturing to improve quality control, reduce downtime, and optimize production processes.

4.Banking: Real time big data analytics tools are being used by banks to detect fraudulent activities, prevent money laundering, and improve customer service.

1.Government: Big data analytics tools are being used by government agencies to improve public services, combat fraud and corruption, and better understand citizen needs.

Limitations of Big Data Analytics Tools

There are several limitations to big data analytics tools, including:

1.They can be expensive and require a lot of resources to implement.

2.They can be complex to use and require skilled staff to get the most out of them.

3.They can require a lot of data to be effective, which can be a challenge to collect.

4.They can be slow and may not be able to keep up with rapidly changing data.

5.They can produce biased results, depending on how they are configured.

Best tool for big data analytics?

Big Data frameworks such as Apache Hadoop are widely used in the market. Clusters of computers can be used to process massive data sets using Hadoop. Scaling up from one server to tens of thousands of commodity computers is one of the best features of this Big Data Tool.

Five types of big data analytics?

The five types of big data analytics are as follows:

Cyber Analytics
Prescriptive Analytics
Descriptive Analytics
Diagnostic Analytics
Predictive Analytics

Data engineering

Data engineering is the process of building robust data architecture that allows for data processing. This includes data transfers between databases and building data warehouses for easy accessibility.

Through data engineering, the following question is answered: “How do I make all the data we collect easier for our data analysts and other stakeholders to wade through?” Data engineering makes the data more reliable, accurate, and ingestible through robust data processing systems.

Data Engineer and a Data Analyst?

Data Engineer

Build and optimise the systems that allow data scientists and data analysts to perform their work

Requirements:

1. Strong programming skills
2. Cloud computing technologies
3. Big data

Tech stack: SQL, Python, Cloud, Distributed Computing

Data Analyst

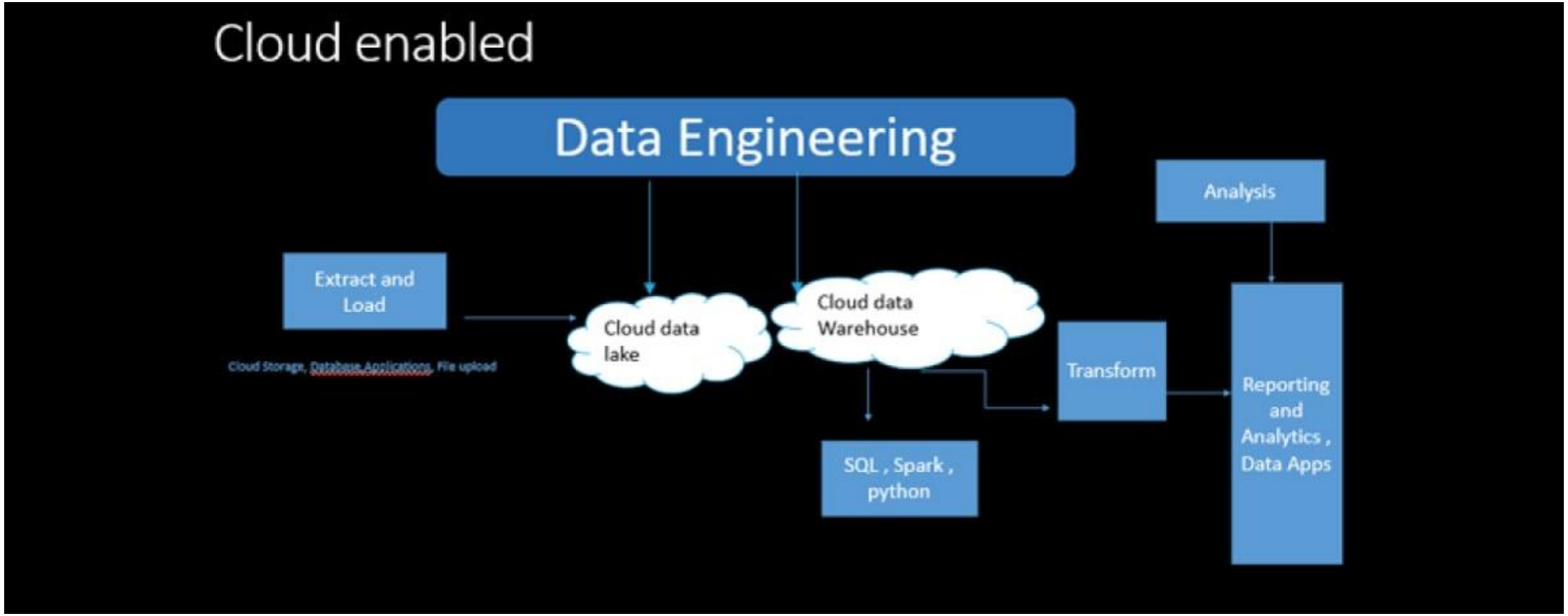
Deliver value by analysing data, communicating the results to help make business decisions

Requirements:

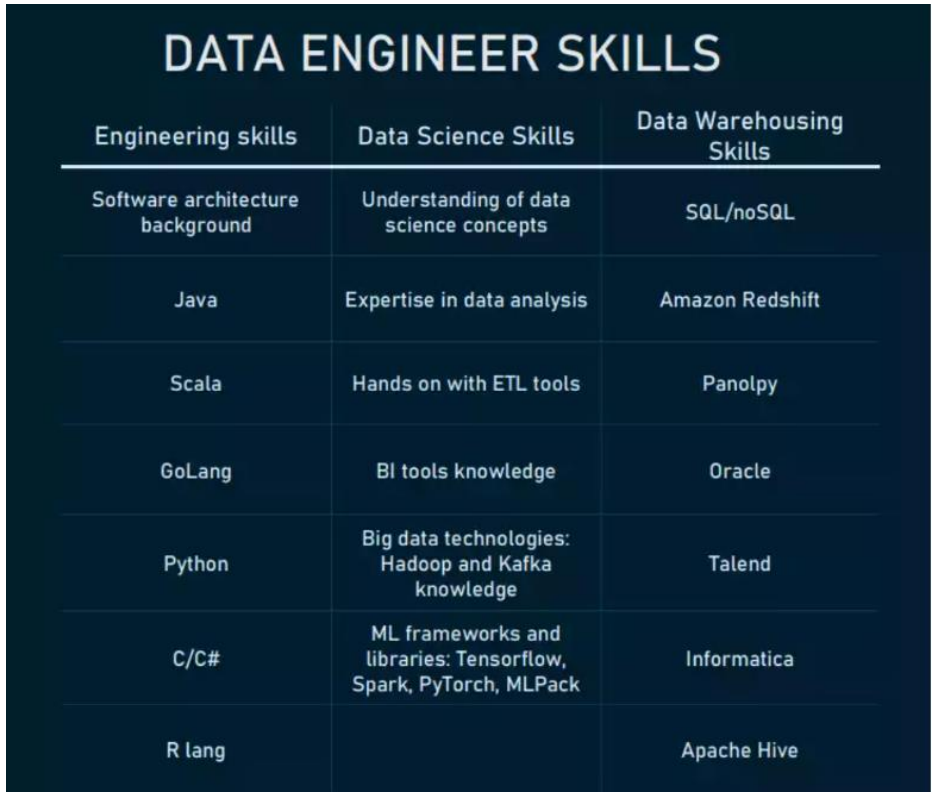
1. Communication skills
2. Business savvy/domain knowledge

Tech stack: SQL, BI tools, Python, R

Data Engineering



Requirements To Become a Data Engineer



Requirements To Become a Data Analyst

Data Analyst, Data Engineer and Data Scientist

Data Analyst	Data Engineer	Data Scientist
Data Analyst analyzes numeric data and uses it to help companies make better decisions.	Data Engineer involves in preparing data. They develop, constructs, tests & maintain complete architecture.	A data scientist analyzes and interpret complex data. They are data wranglers who organize (big) data.

1. **Data in ____ bytes size is called Big Data.**

Tera
Giga
Peta
Meta

2. **How many V's of Big Data?**

2
3
4
5
Answer: D) 5
Volume, Velocity, Variety, Value and Veracity

3. Unprocessed data or processed data are observations or measurements that can be expressed as text, numbers, or other types of media.

True
False

4. In Big Data environments, Velocity refers –

Data can arrive at fast speed

Enormous datasets can accumulate within very short periods of time

Velocity of data translates into the amount of time it takes for the data to be processed

All of the mentioned above

5. In Big Data environments, Variety of data includes –

Includes multiple formats and types of data

Includes structured data in the form of financial transactions,

Includes semi-structured data in the form of emails and unstructured data in the form of images

All of the mentioned above

6. Which of the following are Benefits of Big Data Processing?

Cost Reduction

Time Reductions

Smarter Business Decisions

All of the mentioned above

7. Data that does not conform to a data model or data schema is known as _____.

Structured data

Unstructured data

Semi-structured data

All of the mentioned above

8. Amongst which of the following is/are not Big Data Technologies?

Apache Hadoop
Apache Spark
Apache Kafka
Apache Pytarch

9._____ involves the simultaneous execution of multiple sub-tasks that collectively comprise a larger task.

Parallel data processing

Single channel processing

Multi data processing

None of the mentioned above

10 Amongst which of the following can be considered as the main source of unstructured data.

Twitter

Facebook

Webpages

All of the mentioned above

11. Amongst which of the following shows an example of unstructured data,

Students roll number, age

Videos

Audio files

Both B and C

12 Scalability, elasticity, resource pooling, self-service, low cost and fault tolerance are the features of,

Cloud computing

Power BI

System development

None of the mentioned above