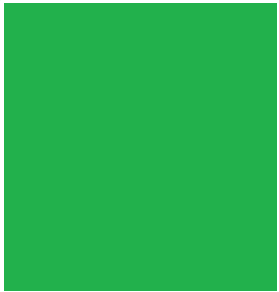
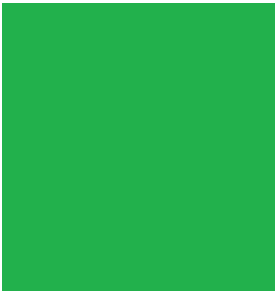
Course Introduction



Course Target



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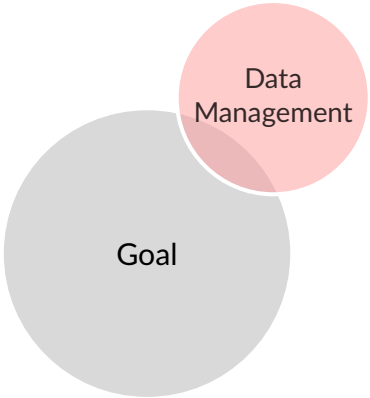

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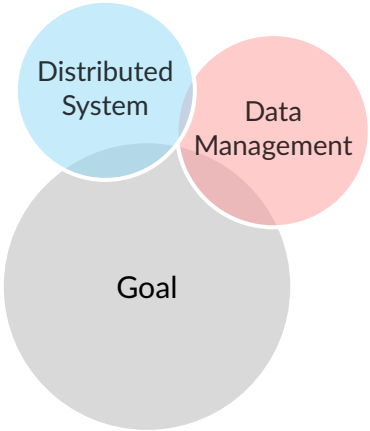

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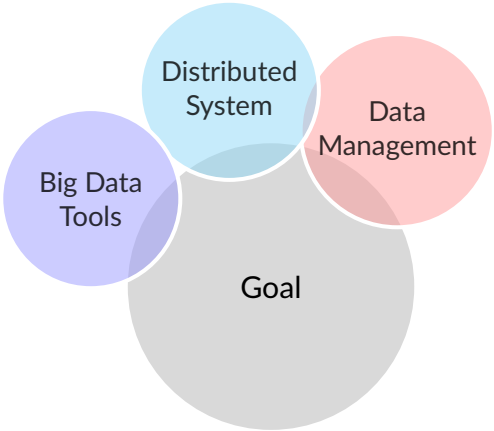

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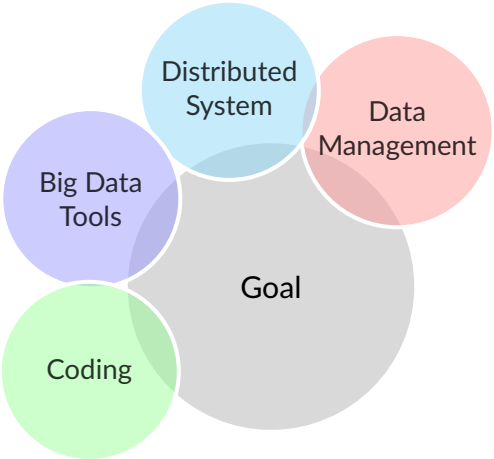

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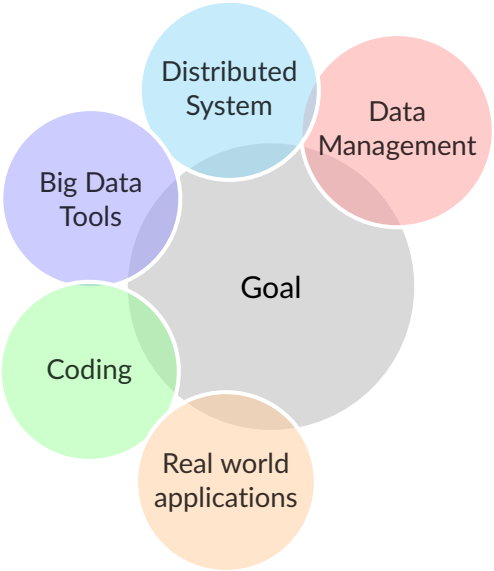

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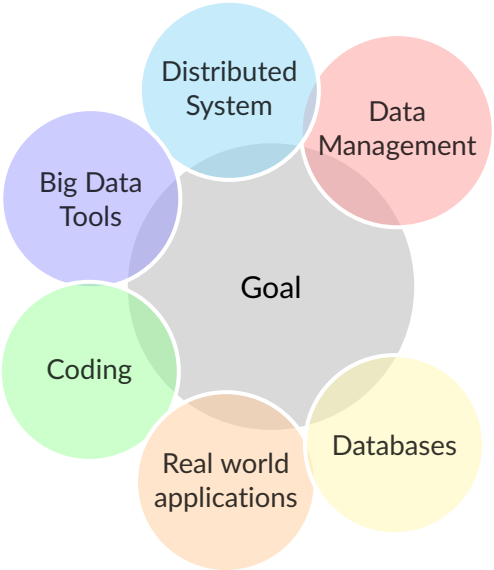
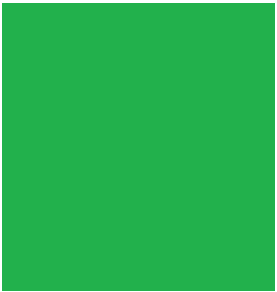


Course Target

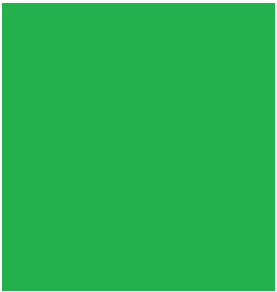
Learning Objectives

- Simplify the concepts in data management.



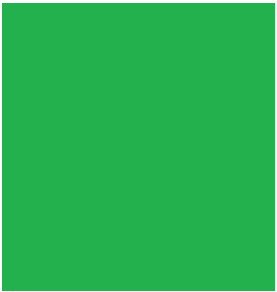
Learning Objectives

- Simplify the concepts in data management.
- Understand the data management life-cycle.



Learning Objectives

- Simplify the concepts in data management.
- Understand the data management life-cycle.
- Illustrate the basics of distributed systems concepts



Learning Objectives

- Simplify the concepts in data management.
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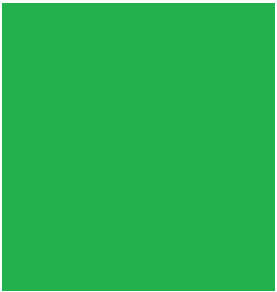

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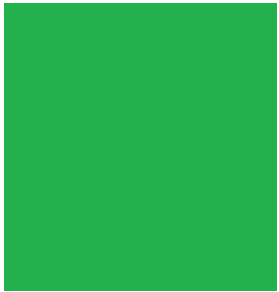

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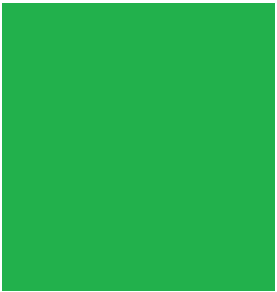

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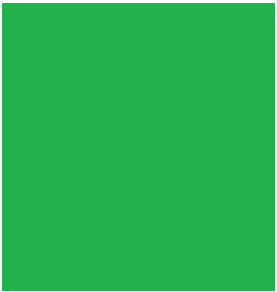

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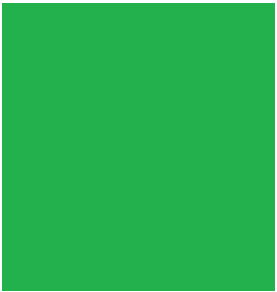

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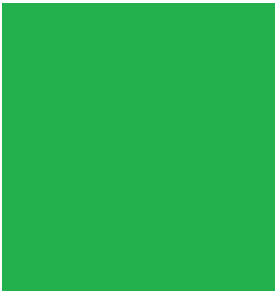

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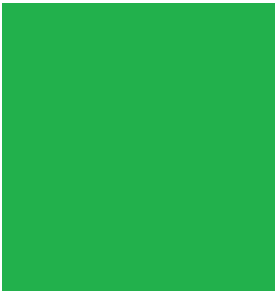
- Understanding of the DevOps tools and functions in data life-cycle.



Audience: Who Should Take This Course?

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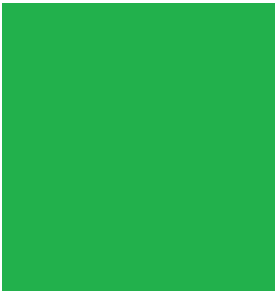

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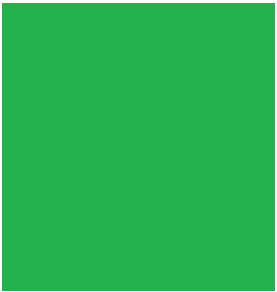

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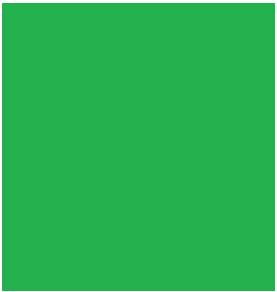

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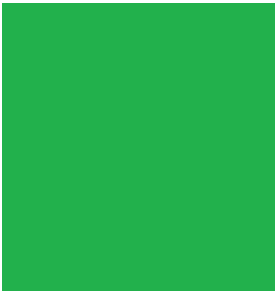

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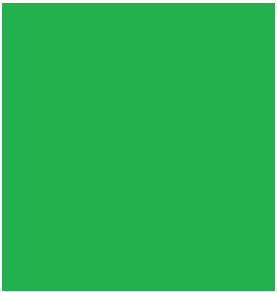
- Business or entrepreneur who needs to get more information about how to build or manage a data product.



Getting max benefit from this course

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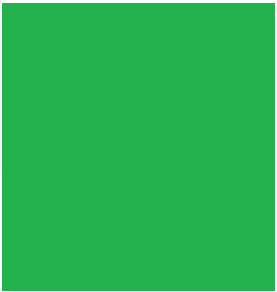

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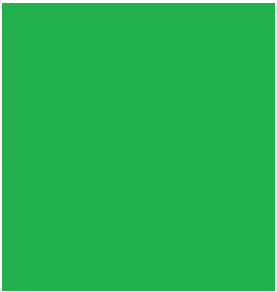

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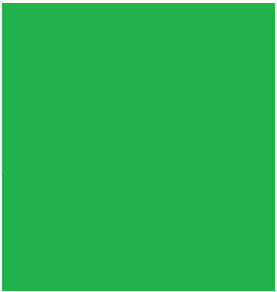

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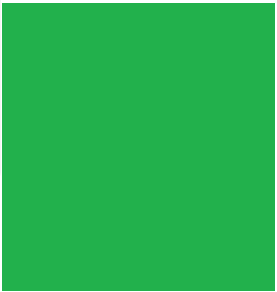

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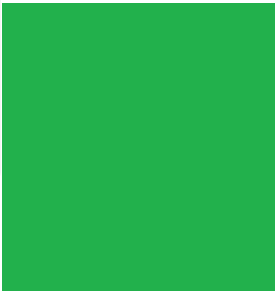

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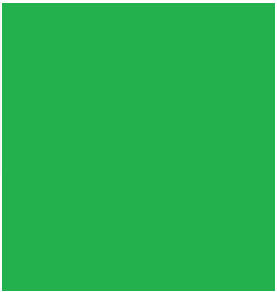

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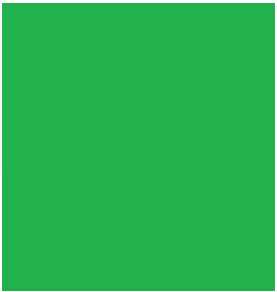
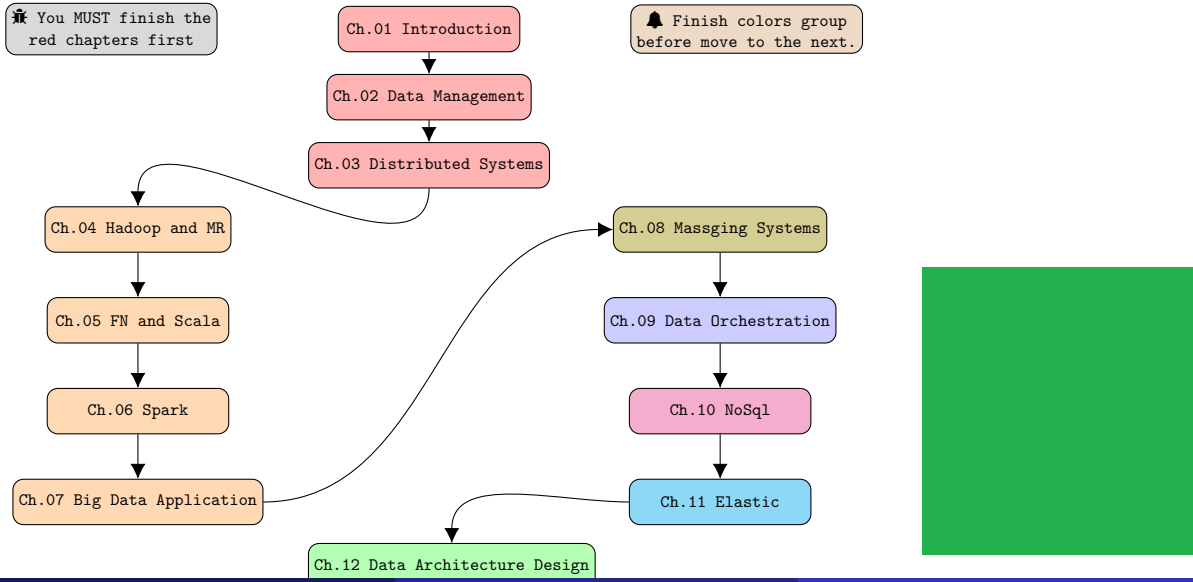
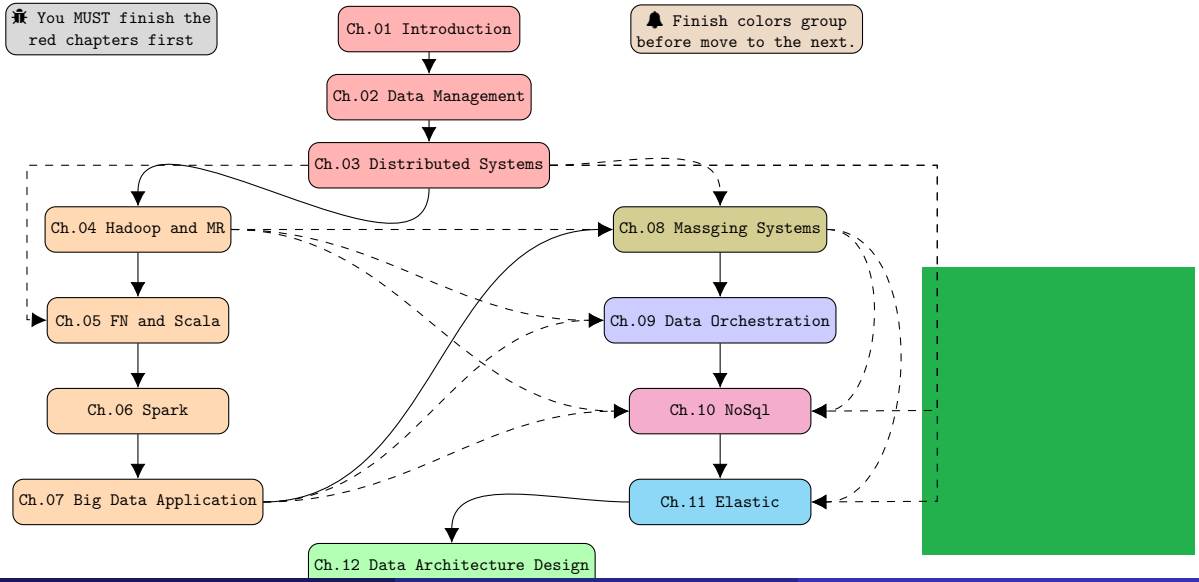


Chapter Dependencies



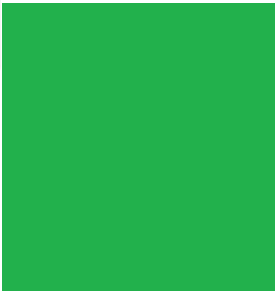
Chapter Dependencies (Jump Out Path)



Assignments and Labs

Remark

- Full project code.



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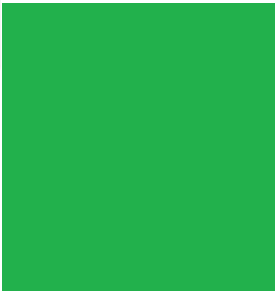

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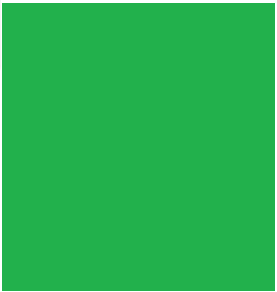
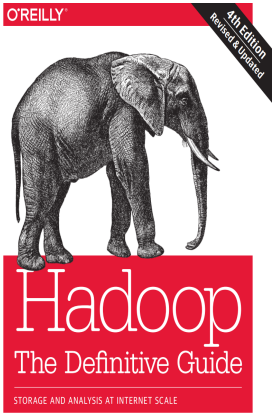
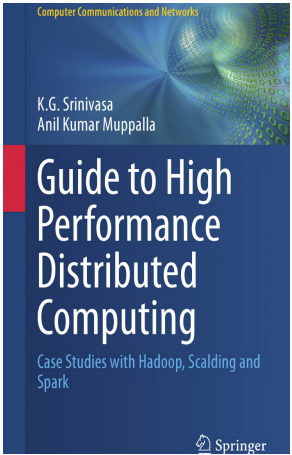


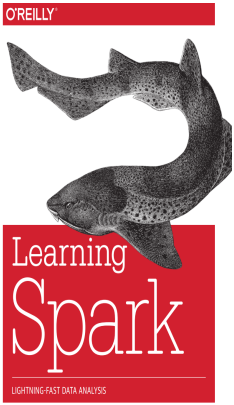
Textbooks-1


O'REILLY
4th Edition
Revised & Updated
Hadoop
The Definitive Guide
STORAGE AND ANALYSIS AT INTERNET SCALE
Tom White


Computer Communications and Networks
K.G. Srinivasa
Anil Kumar Muppalla
Guide to High Performance Distributed Computing
Case Studies with Hadoop, Scalding and Spark
Springer

Textbooks-2

Holden Karau &
Rachel Warren



Holden Karau, Andy Konwinski,
Patrick Wendell & Matei Zaharia

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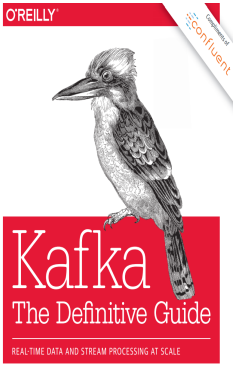
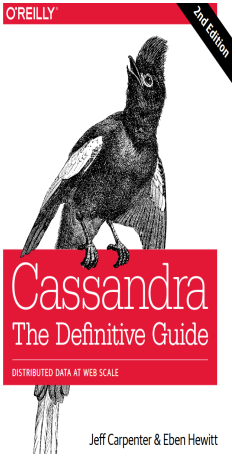
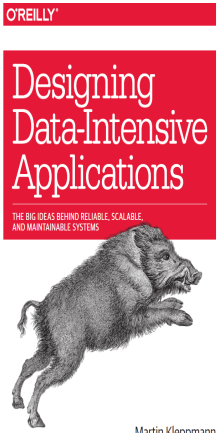
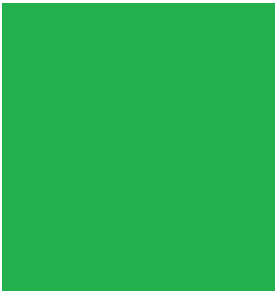

O'REILLY
Compliments of
Confluent
Kafka
The Definitive Guide
REAL-TIME DATA AND STREAM PROCESSING AT SCALE
Neha Narkhede,
Gwen Shapira & Todd Palino


O'REILLY
2nd Edition
Cassandra
The Definitive Guide
DISTRIBUTED DATA AT WEB SCALE
Jeff Carpenter & Eben Hewitt


O'REILLY
Designing
Data-Intensive
Applications
THE BIG IDEAS BEHIND RELIABLE, SCALABLE,
AND MAINTAINABLE SYSTEMS
Martin Kleppmann

Ugly but important

- User stories or technical discussions are not related to any of my current work or my previous companies.
- I am working at EPAM Systems. My company approved me for doing this online course public but the materials are not reviewed or assessed by my company. It is on my own responsibilities.



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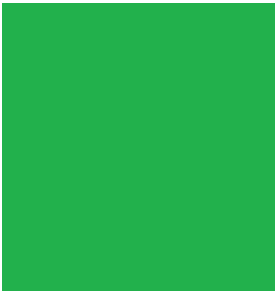
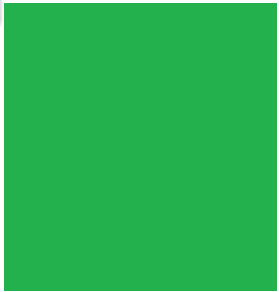
   - Learning Objectives
   - Getting max benefit from this course
   - Assignments and Labs

2. Introduction To Data Management and Data Warehouse
   - Data Management
   - From DWH to Big Data



Introduction To Data Management and Data Warehouse



Chapter Objectives

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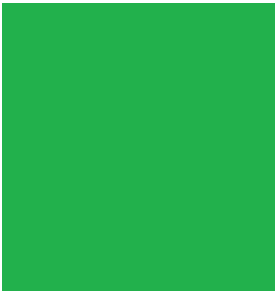

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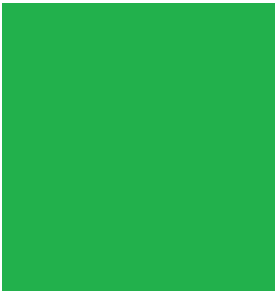

Chapter Objectives

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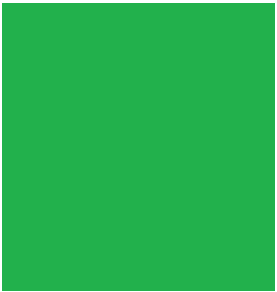

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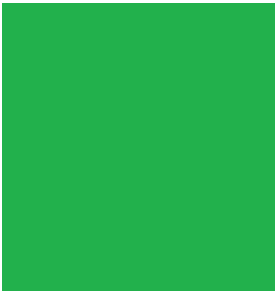

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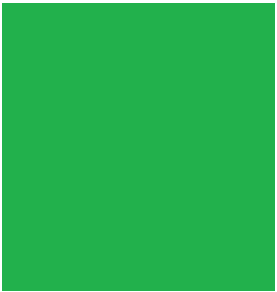

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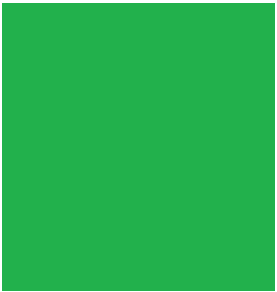

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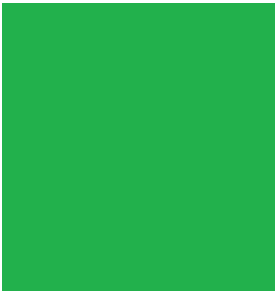

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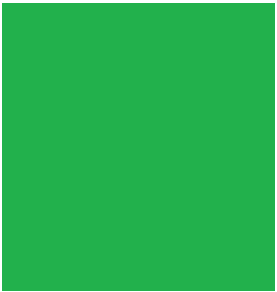

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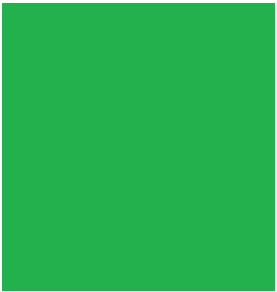

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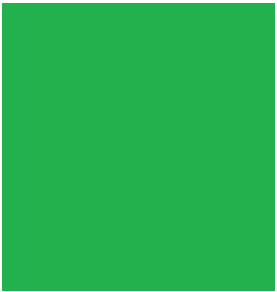

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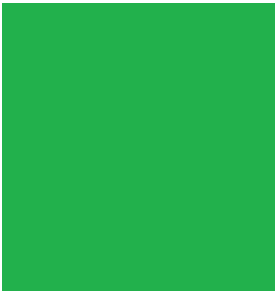

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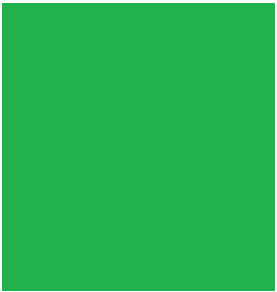

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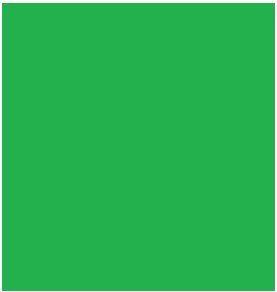

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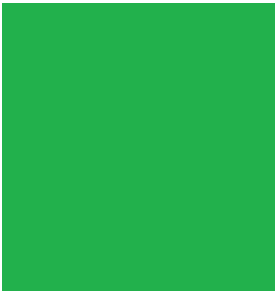

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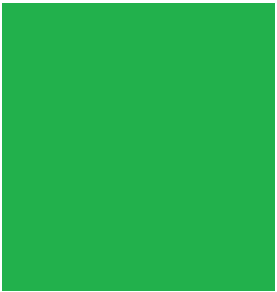

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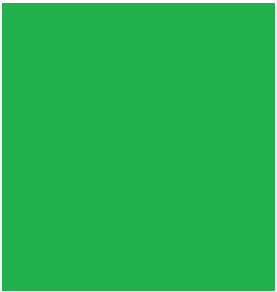

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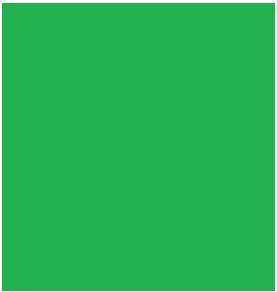

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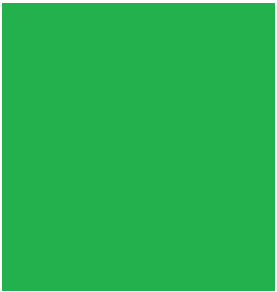

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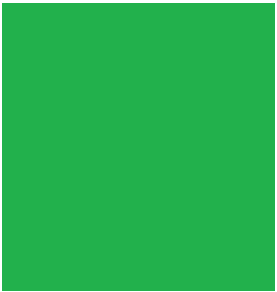

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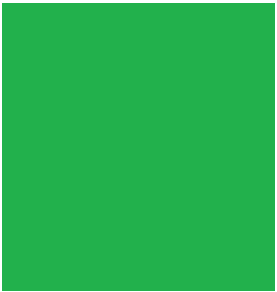

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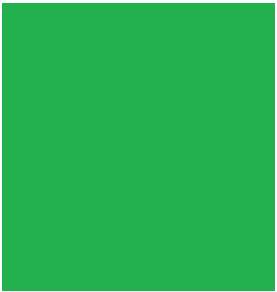

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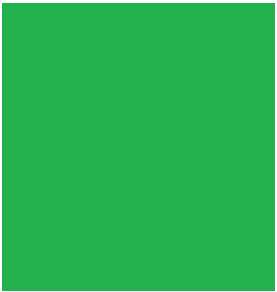

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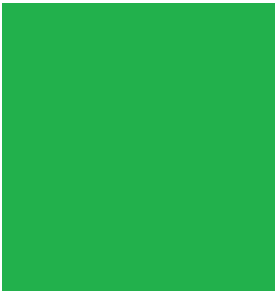

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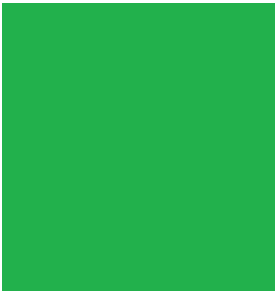

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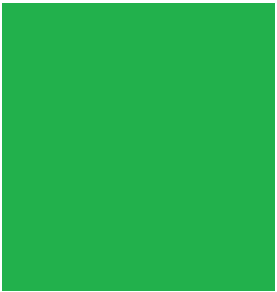

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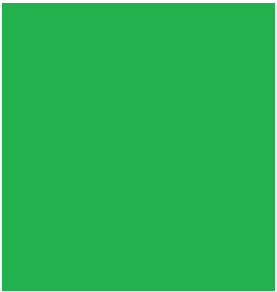

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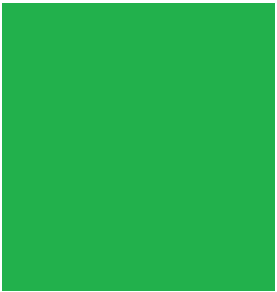

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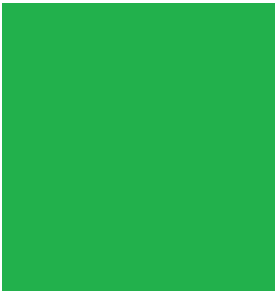

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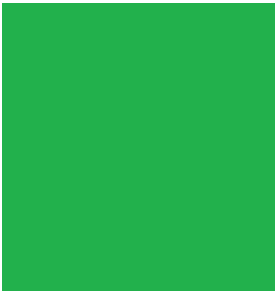

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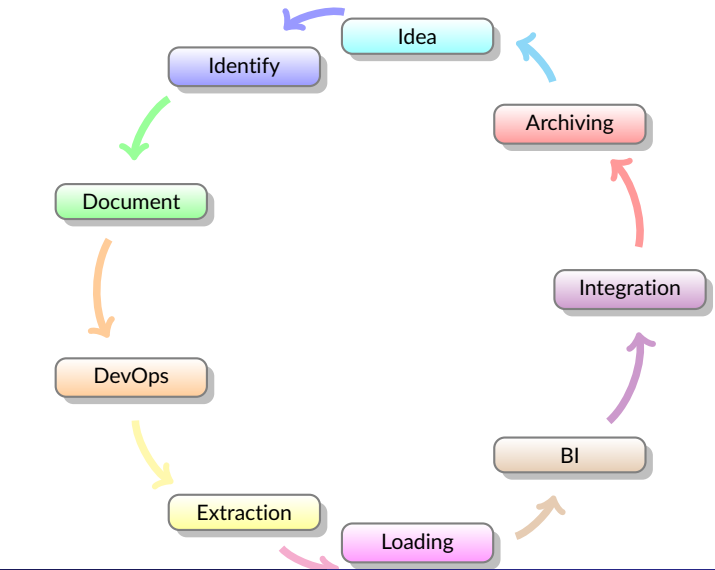

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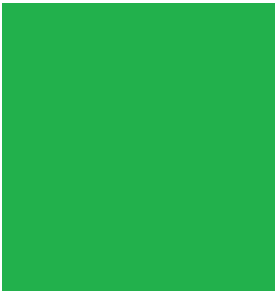

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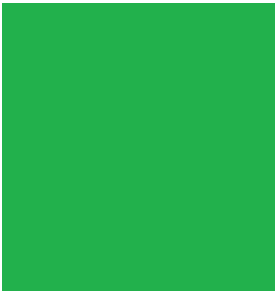

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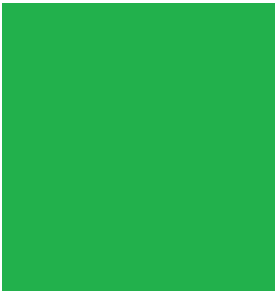

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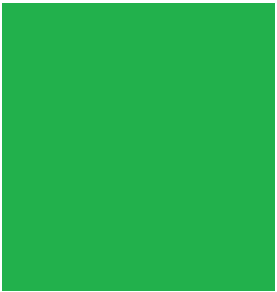

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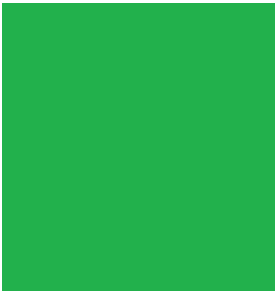

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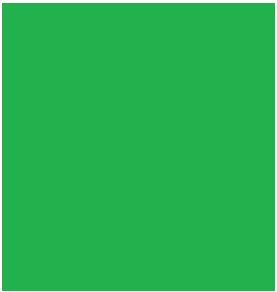

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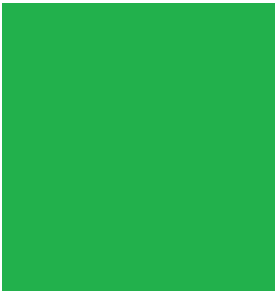

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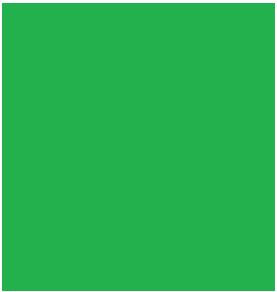
- Vendors who are working to solve the above challenges creating their own product of DWH and their ultimate work is to optimize the above points.



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Definition (What is Data Warehousing?)

A DWH is defined as a technique for collecting and managing data from varied sources to **provide meaningful business insights**. It is a blend of technologies and components which aids the strategic use of data.

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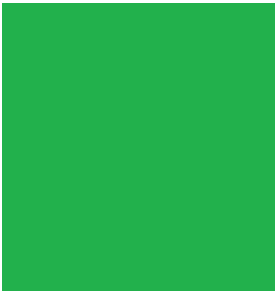

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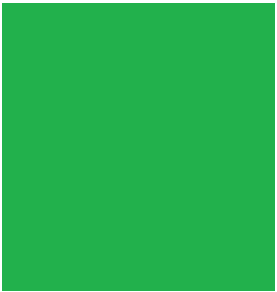

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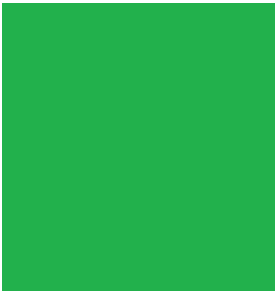
- It is an architectural construct of an information system which provides users with current and historical decision support information which is difficult to access or present in the traditional operational data store.

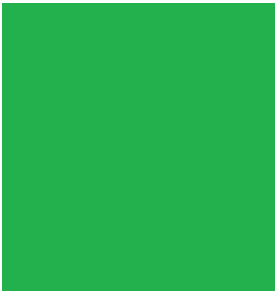


Motivation to Data Warehouse (DWH)

Definition (What is Data Warehousing?)

A DWH is defined as a technique for collecting and managing data from varied sources to **provide meaningful business insights**. It is a blend of technologies and components which aids the strategic use of data.

- The DWH is not a product but an environment.
- It is a process of transforming data into information and make it available to users in a **timely manner** to make a difference.
- It is an architectural construct of an information system which provides users with current and historical decision support information which is difficult to access or present in the traditional operational data store.
- The DWH is the core of the BI system which is built for data analysis and reporting.

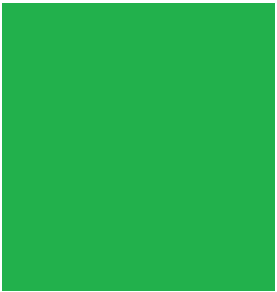


Motivation to Data Warehouse

Data warehouse system is also known by the following names:

- Decision Support System (DSS).
- Business Intelligence Solution.
- Executive Information System.
- Management Information System.
- Analytic Application.
- Data Warehouse.

The real concept was given by Inmon Bill. He was considered as a father of the DWH. He had written about a variety of topics for building, usage, and maintenance of the warehouse & the Corporate Information Factory



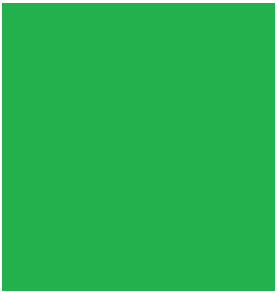
Motivation to Data Warehouse

Types of Data Warehouse

Enterprise Data Warehouse (EDWH) It provides decision support service across the enterprise. It offers a unified approach for organizing and representing data (DWH Model). It offers data classifications according to the subject with privileges policy.

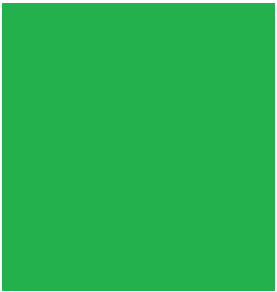
Operational Data Store (ODS): is a central database that provides an up-to-date (real-time) data from multiple transnational systems for operational reporting into a single DWH.

Data Mart: A data mart is a subset of the data warehouse. It specially designed for a particular line of business, such as sales, finance, sales or finance. In an independent data mart, data can collect directly from sources.



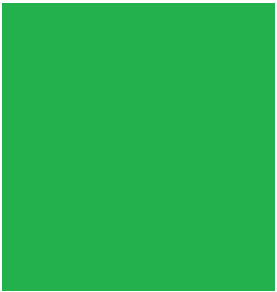
DWH vs ODS vs Data Mart

Metric	DWH	ODS	Data Mart
Latency	Day -1	Real-time	Day -1
Data level	Transnational	Transnational	Summary
Historical	Long-term	Snapshot	Aggregated Long-Term
Size	TB/PB	GB	GB/TB
Orientation	Multi sources	Multi sources	Product
Business Units	Multi organizational units	Product team	Business team



DWH vs Operational databases

Metric	Transactions DB	DWH
Volume	GB/TB	TB/PB
Historical	Short-term	Long-Term
rows	¡1000M	1000M¿
Orientation	Product	Subject or multi products
Business Units	Product team	Multi organizational units
Normalization	Normalized	Not required (De-normalized in many use cases)
Data Model	Relational	Star Schema or Multi-dim
Intelligence	Reporting	Advanced reporting and Machine Learning
Use cases	Online transactions & operations	Centeralized storage (360°)



Transnational DB Use cases

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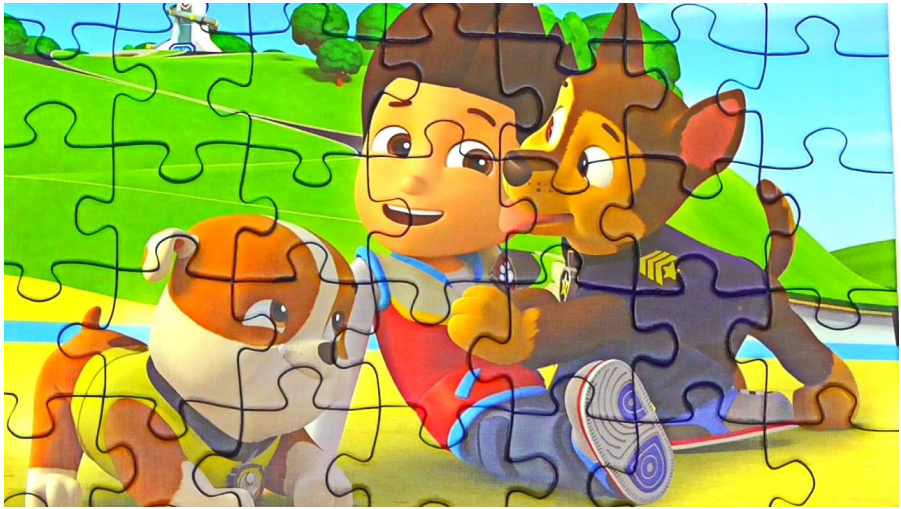

DWH Use cases

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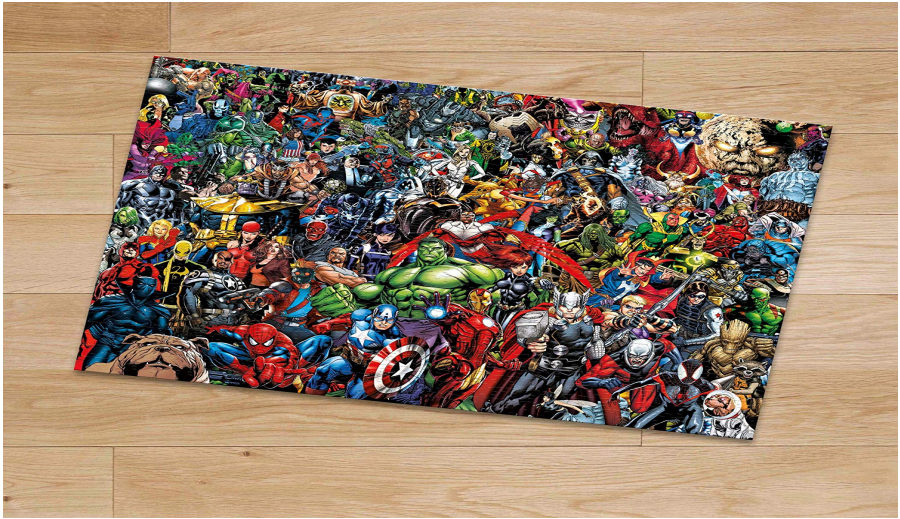
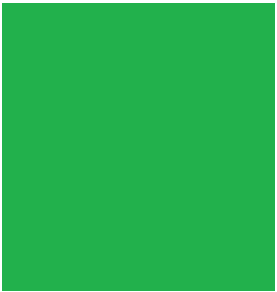


DWH Use cases

Use case (Operational DB)

- A telecommunication company named **XTec**.



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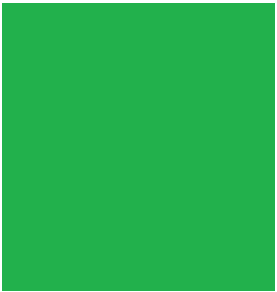
- A telecommunication company named **XTec**.
- They have lots of systems. One of this systems is a CRM system as example of operational DB.



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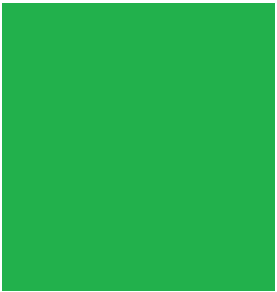

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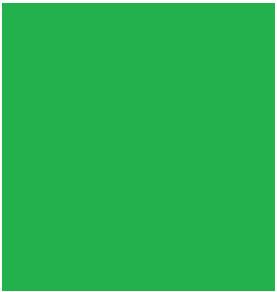

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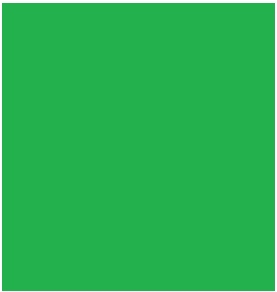

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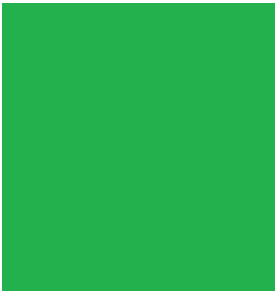
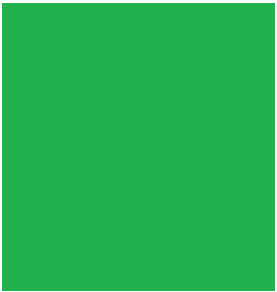
  - This system has a backend database (MySQL).
  - CRM team can report their sales and customer activities from their database.
  - Product owner can take a decision based on their system backend reports.



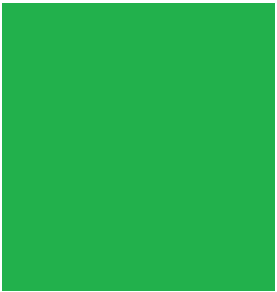
Use case (DWH)

- What is the need for DWH?



Use case (DWH)

- What is the need for DWH?
  - This company has other systems for example: billing, charging, signaling.



Use case (DWH)

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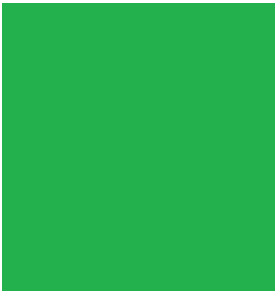
  - They need to report information related to the CRM, billing, and signaling source systems in one report.



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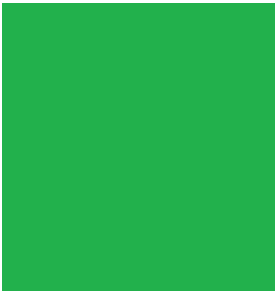

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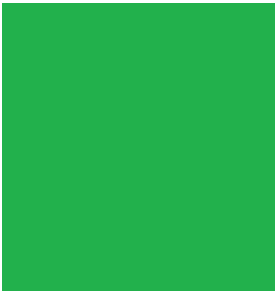

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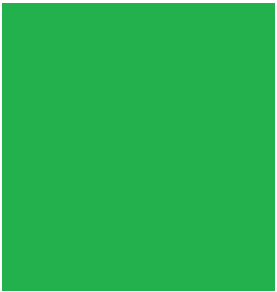
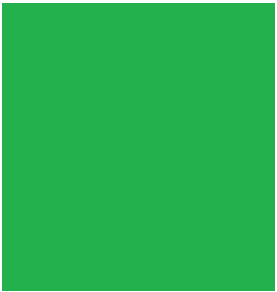
  - The decision from the DHW is a **global and strategical decision.**
  - If the company needs to build a machine learning model which needs data from different sources. They need to load the data from a centralized database rather than read each source alone.



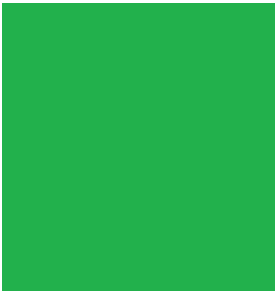
Use case (DWH)

The Full picture required a DWH. However, we still need the other operational databases for product development perspective.



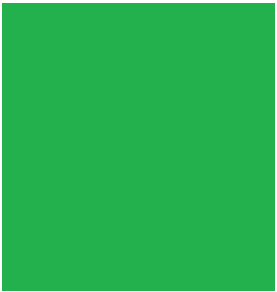
Use case (ODS)

- Why do we need the ODS?



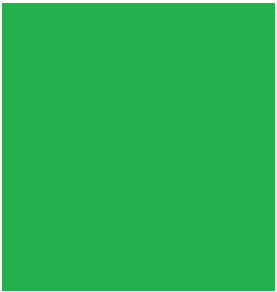
Use case (ODS)

- Why do we need the ODS?
- How does it fit in our system?



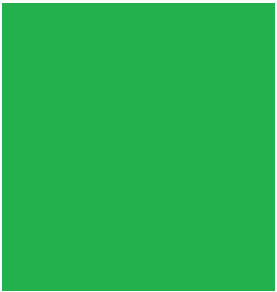
Use case (ODS)

XTec has a call center system which handles the customer inquiries. This system requires the some data related to usage, customer information, billing details to be calculated and accumulated in **real-time** to be able to give the customer the right answer for his inquires.



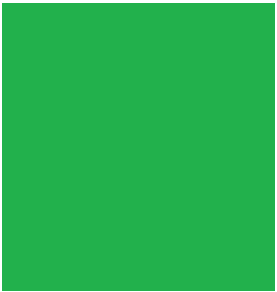
Use case (ODS)

- So, What is the challenge for this system?



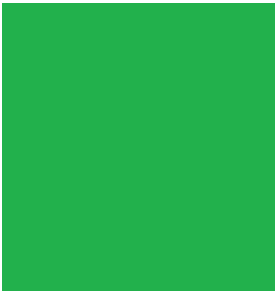
Use case (ODS)

- So, What is the challenge for this system?
  - It needs specific information from different source systems.



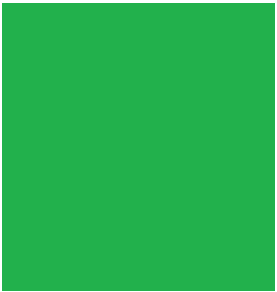
Use case (ODS)

- So, What is the challenge for this system?
  - It needs specific information from different source systems.
  - It requires to track the source system database changes or update in real-time.



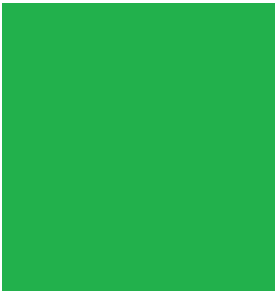
Use case (ODS)

- So, What is the challenge for this system?
  - It needs specific information from different source systems.
  - It requires to track the source system database changes or update in real-time.
  - It's functionality is based on the aggregate data not the transactions for example (It needs the total outgoing calls till time or it needs the total charging amounts from prepaid or the available limits from billing if it is postpaid).



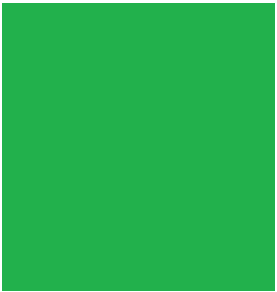
Use case (ODS)

- ODS is based on change data capture (CDC). This approach used to determine the data change and apply action based on this change.



Use case (ODS)

- ODS is based on change data capture (CDC). This approach used to determine the data change and apply action based on this change.
- ODS uses the real-time aggregations to support the online systems from different source systems.



DWH Architecture Overview

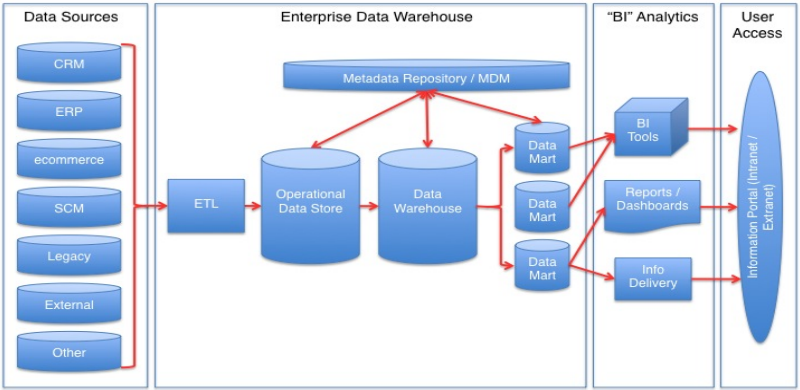
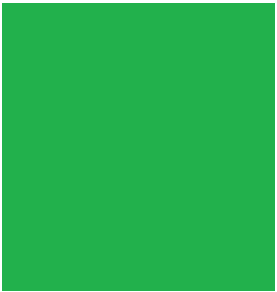


Figure: taken from XXXX

Thinking about data as a product

- How can we think about a data solution?



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- How can we think about a data solution?
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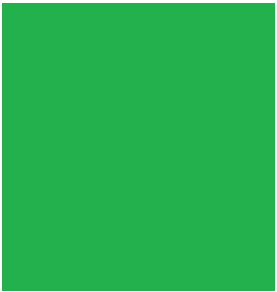

Thinking about data as a product

- How can we think about a data solution?
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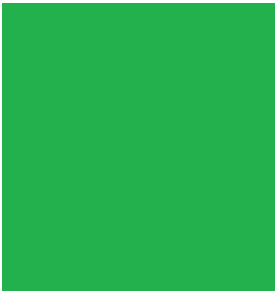
  - Identify the problem (challenges)



Thinking about data as a product

- How can we think about a data solution?
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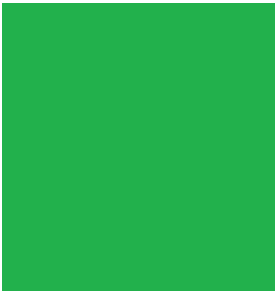

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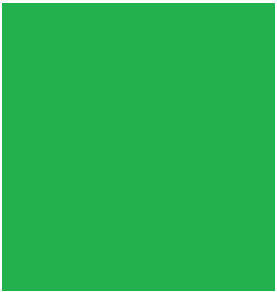

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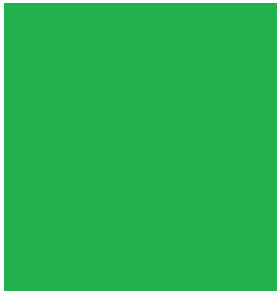

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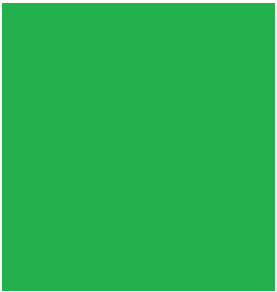

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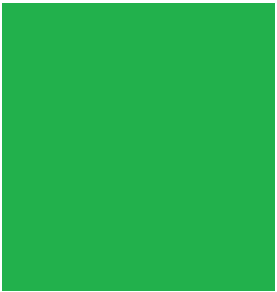

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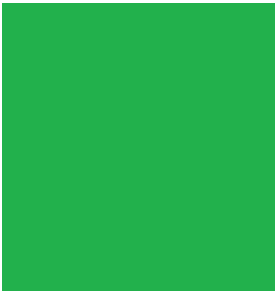
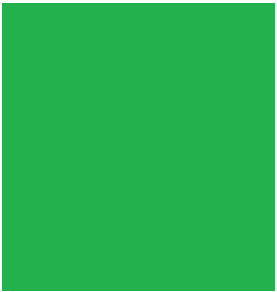
- To answer these questions you need to understand the **data layers**.



Data Layers (Abstraction)

- Any data product (database) contains multi-layers.



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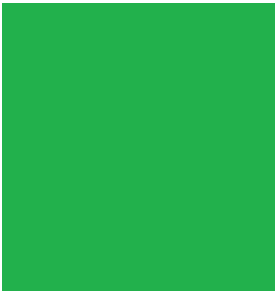

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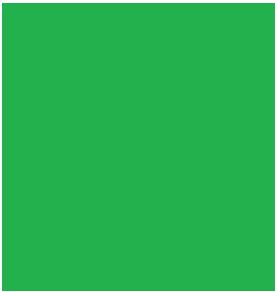

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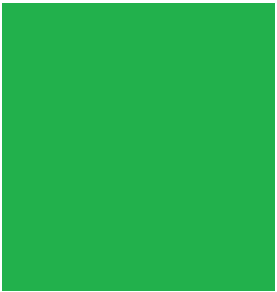

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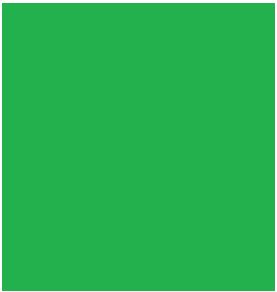

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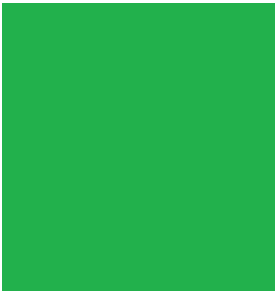
- The process of **hiding** irrelevant details from developer (user) is called data **abstraction**.

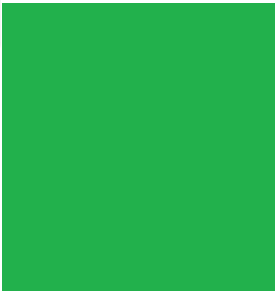


Data Layers (Abstraction)

Definition

Data Abstraction and Data Independence: Database systems comprise of complex data-structures. In order to make the system efficient in terms of retrieval of data, and reduce complexity in terms of usability of users, developers use abstraction i.e. hide irrelevant details from the users. This approach simplifies database design.

- There are 3 levels of data abstraction.



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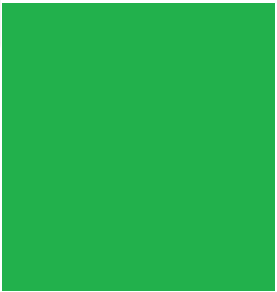

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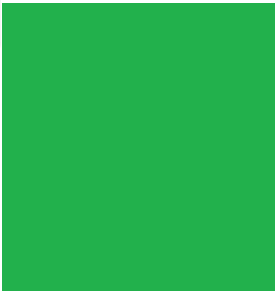

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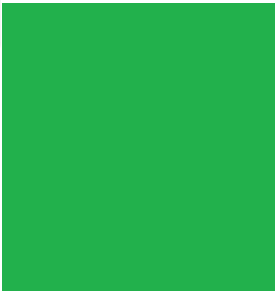

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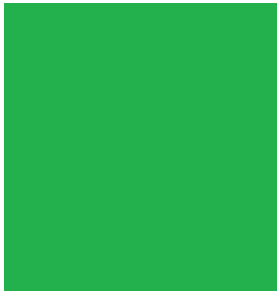

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- **Physical level**:
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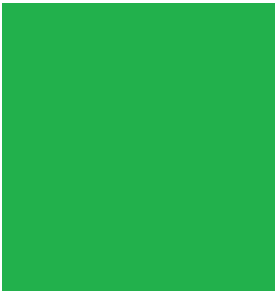

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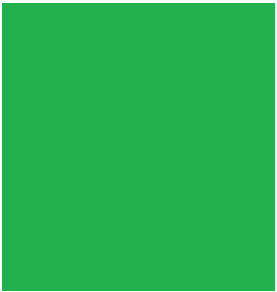

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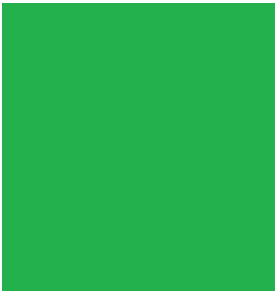

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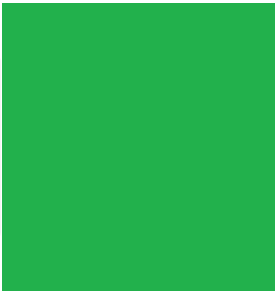

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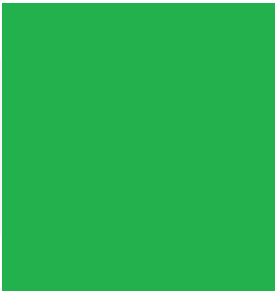

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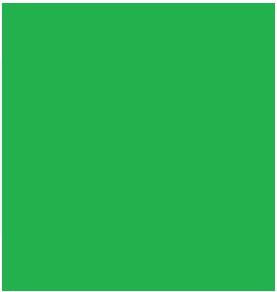

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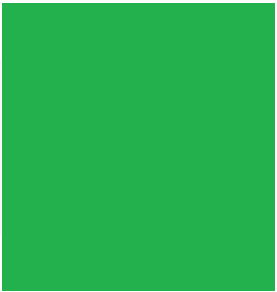

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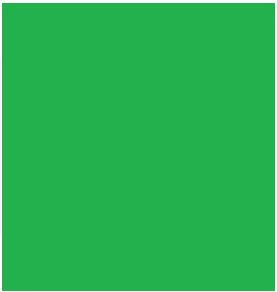

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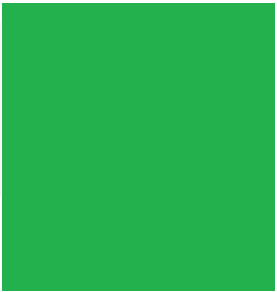

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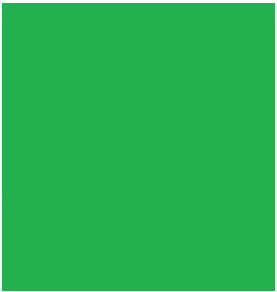

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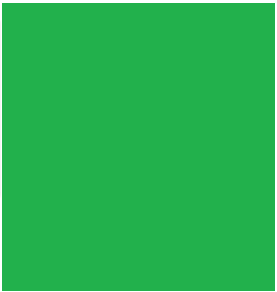

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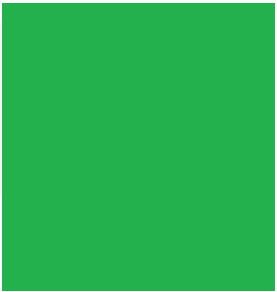

Data Abstraction

- **Logical level (Conceptual)**:
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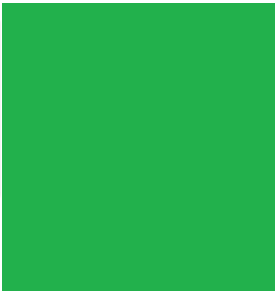

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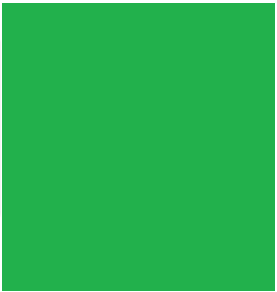

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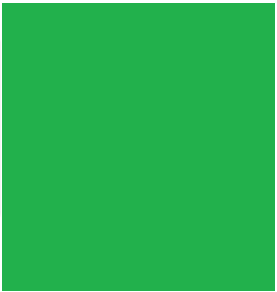

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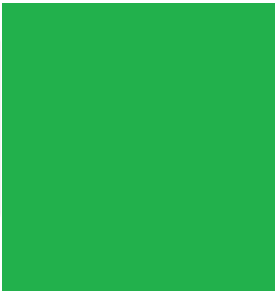

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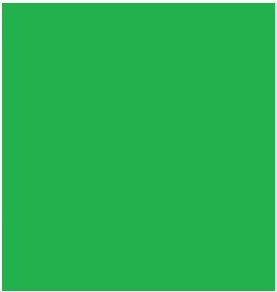

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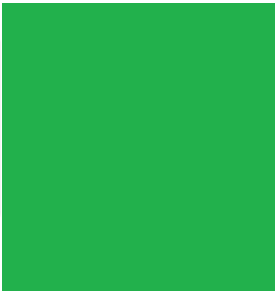

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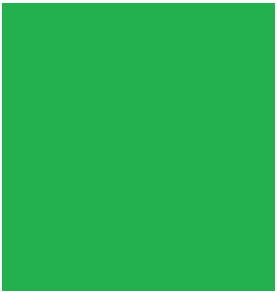

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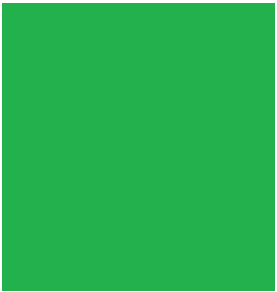

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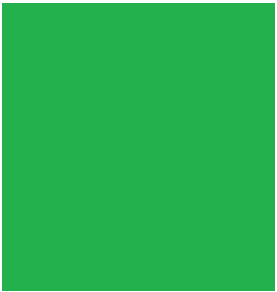

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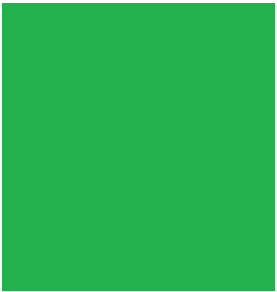

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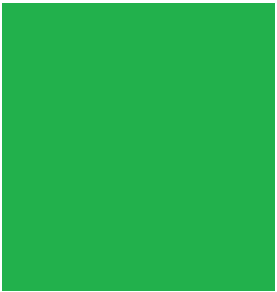

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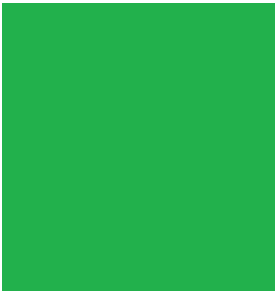
- It refers to a set of concepts used in defining such as entities, attributes, relations, or tables.



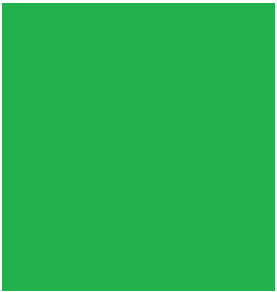
What is data model?

Data model is not

- a science.
- a static design for each organization.
- a type of database.
- a new invention which needs to be done for each project.

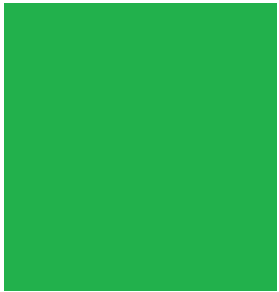
Data model is

- an engineering design practices.
- a general concepts which lead to build full architecture.
- different based on the use case and the database type.
- customizable and we can utilize some of ready built architecture.
- implementing using different ways.
- affecting the information reporting performance and ways.



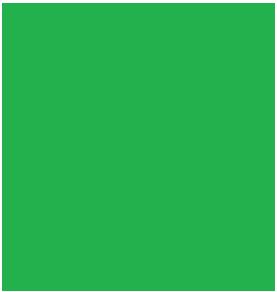
Why does data models are important?

- Data models are currently affecting software design.
- It decides how engineers will think about the problem they are solving.



Data Model Design vs Implementation

- You need to build a home. So, how do we design this home?



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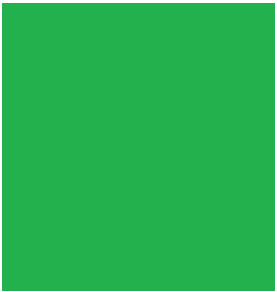

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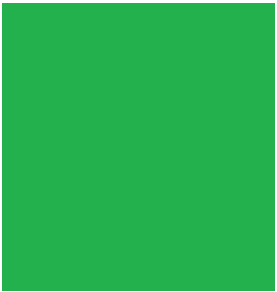

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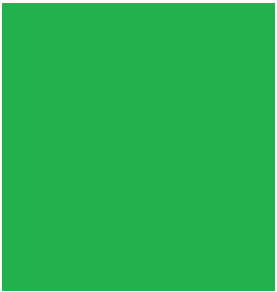
  - Decide the decorations, colors for each room, carpets, etc.



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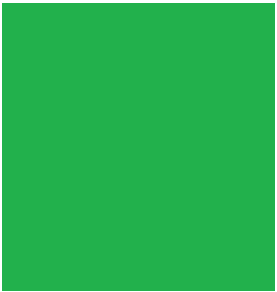

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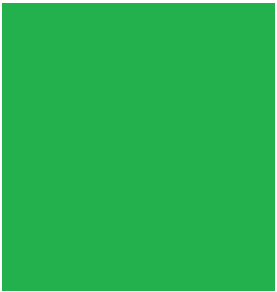

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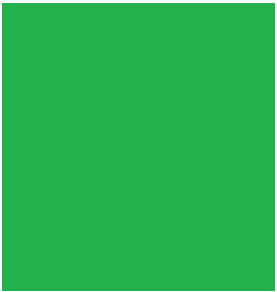
  - This phase will implement the design but it also include some detail related to the actual way to build the tools and the material. (Physical Design)



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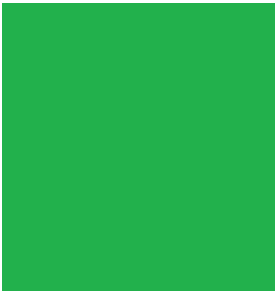

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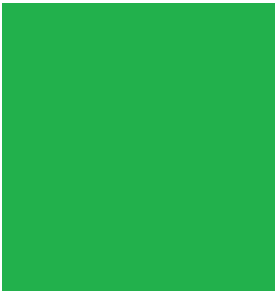

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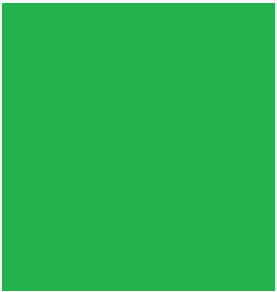

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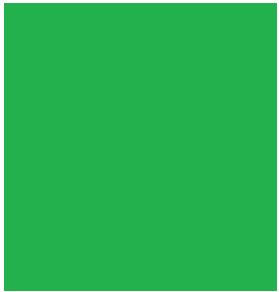
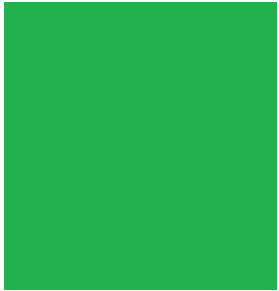


Introduction To Distributed Systems



Chapter Objectives

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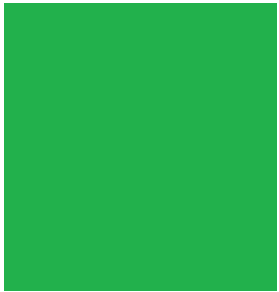

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- Understand the distributed systems concepts.
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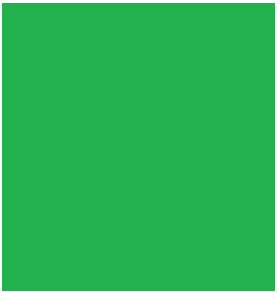

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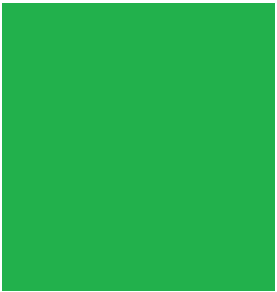

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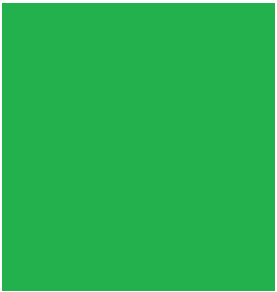

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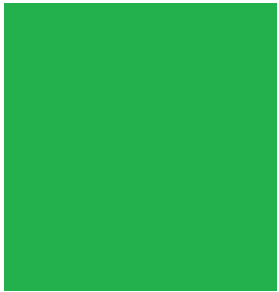

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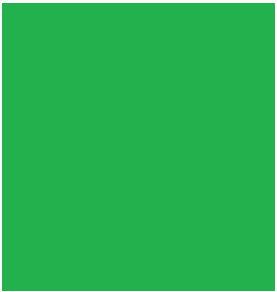

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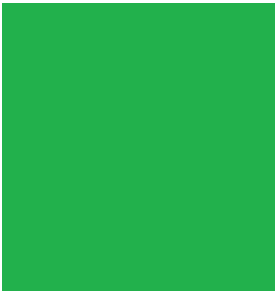

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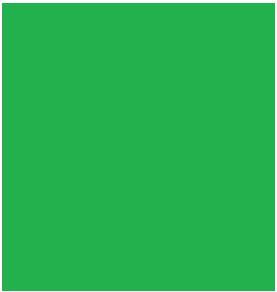

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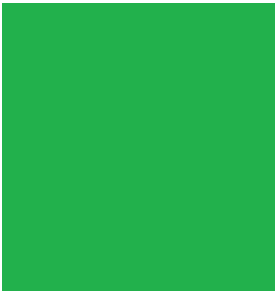

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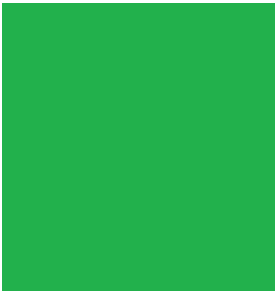

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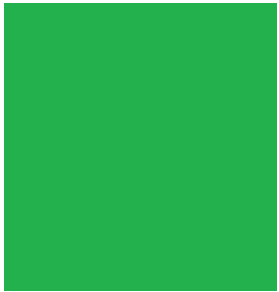
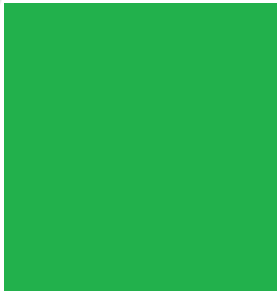


Introduction to Hadoop and Map-Reduce



Chapter Objectives

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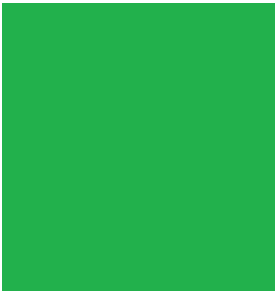

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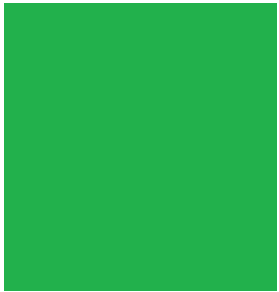

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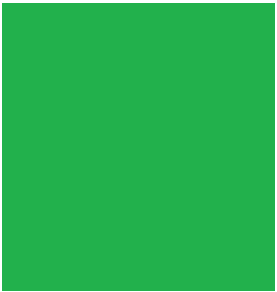

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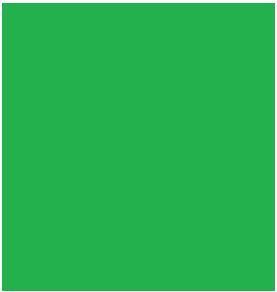

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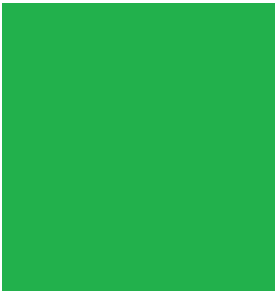

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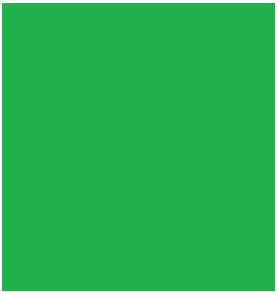

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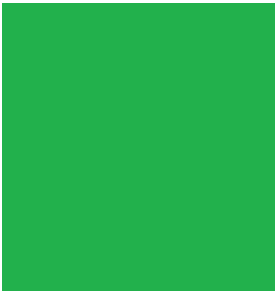

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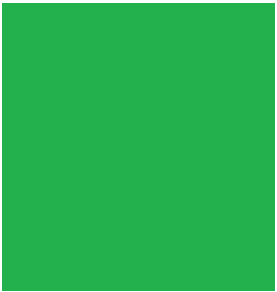

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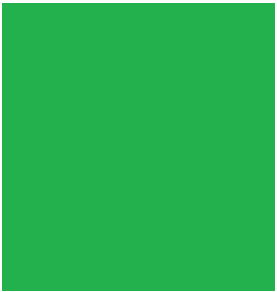

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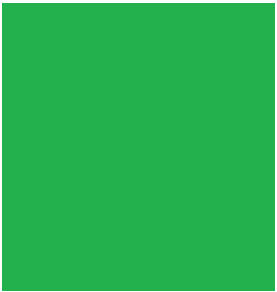

YARN

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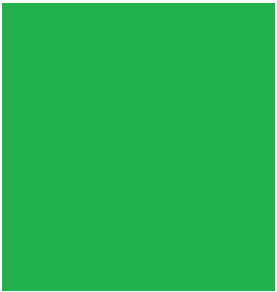

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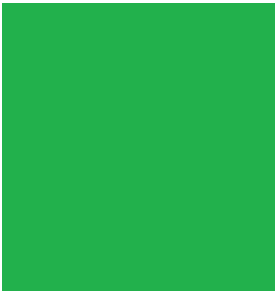

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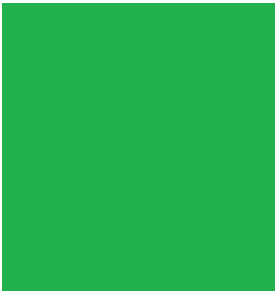

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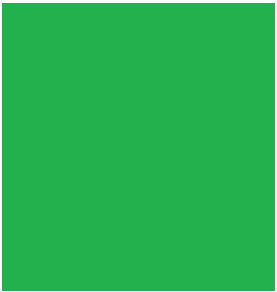

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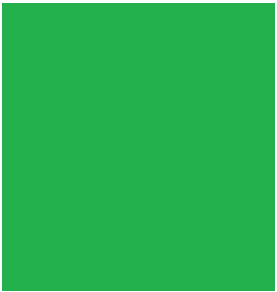

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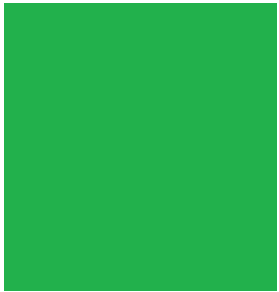

Map-Reduce

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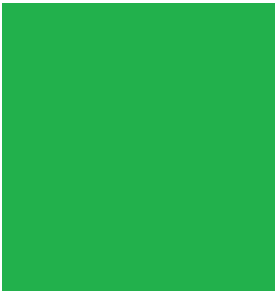

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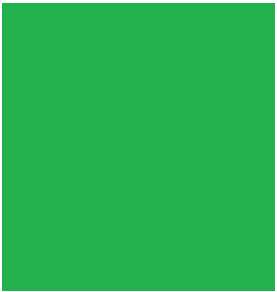

Map-Reduce Components

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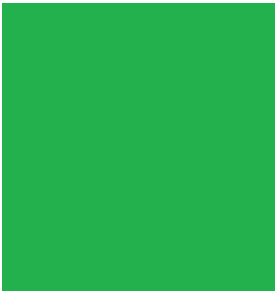

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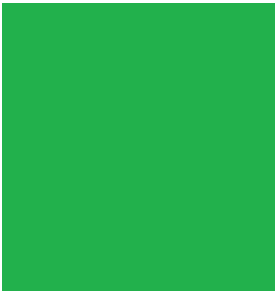

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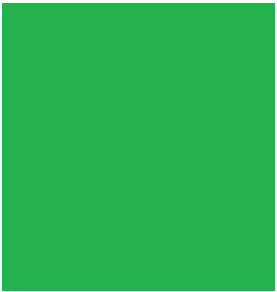

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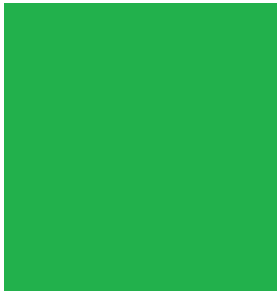

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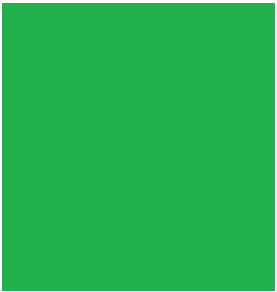

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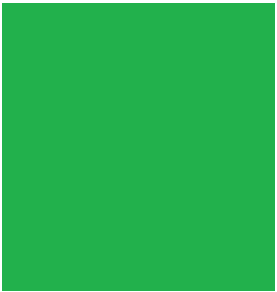

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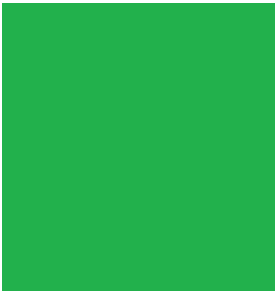

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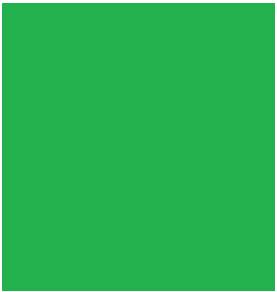

ZooKeeper

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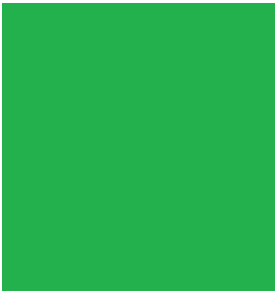

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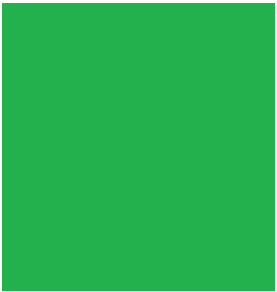
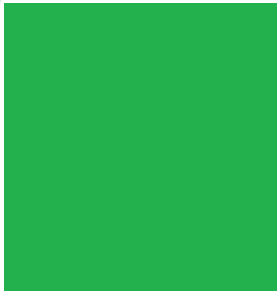
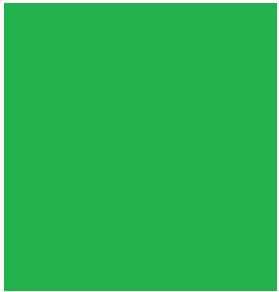


Functional Programming



Spark Framework



Spark Framework: Spark Philosophy towards the Engine and the Programming languages

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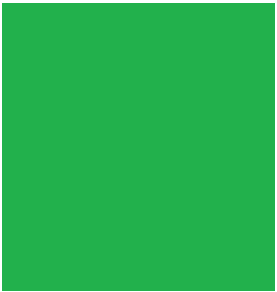

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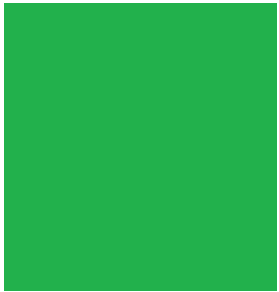

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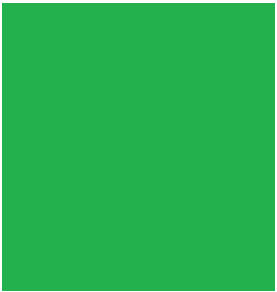

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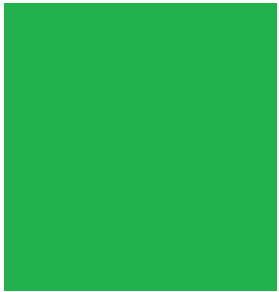

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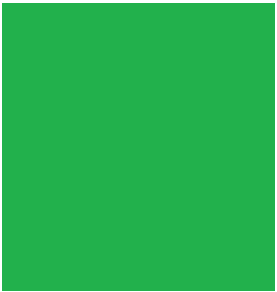

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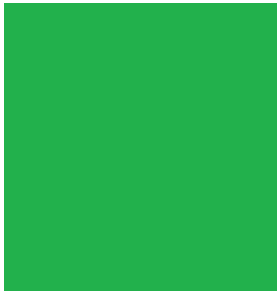

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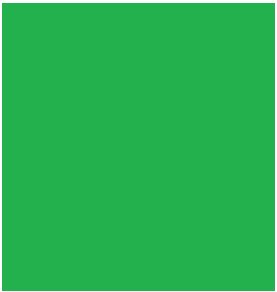

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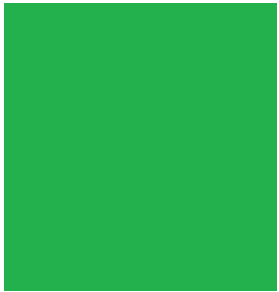

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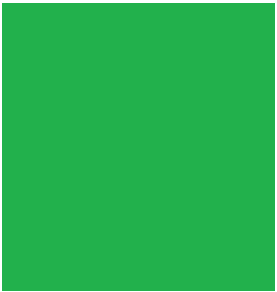

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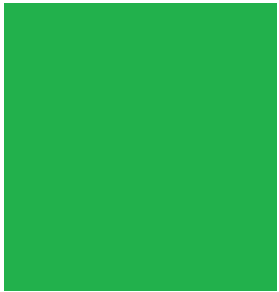

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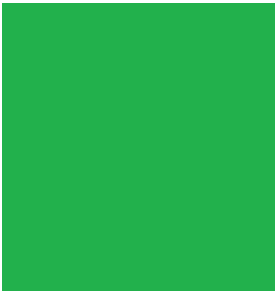

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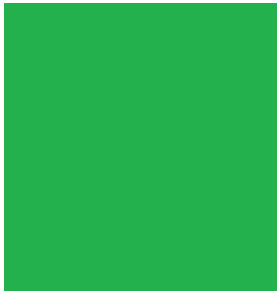

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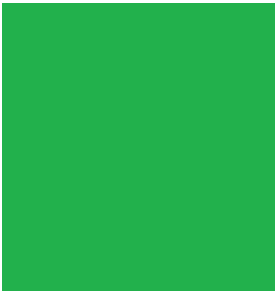

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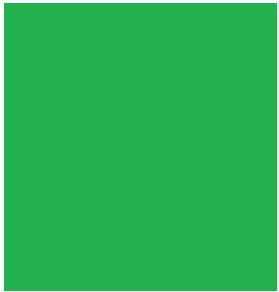

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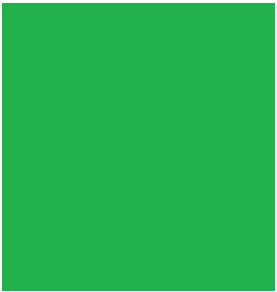

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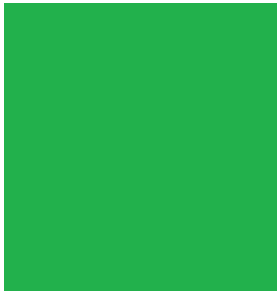

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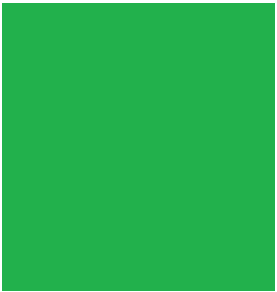

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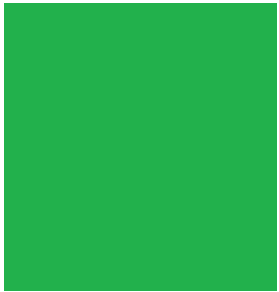

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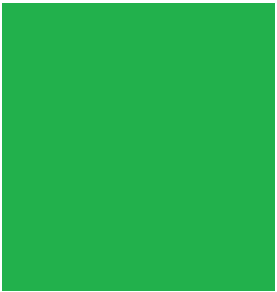

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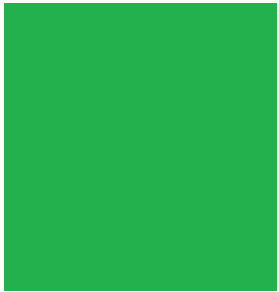

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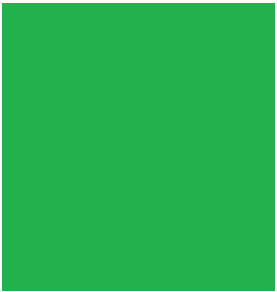

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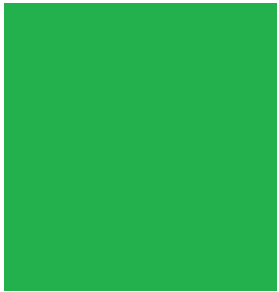

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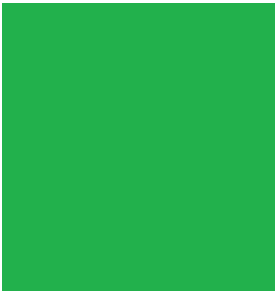

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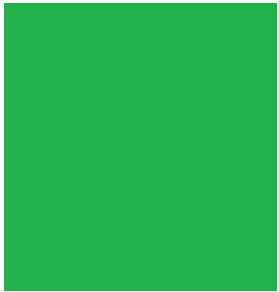

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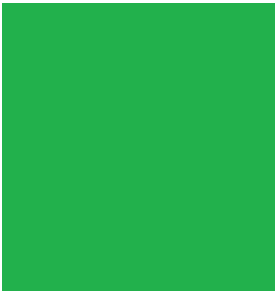

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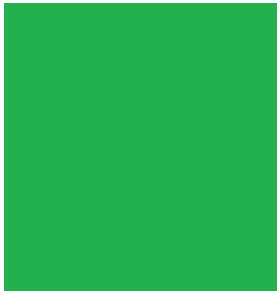

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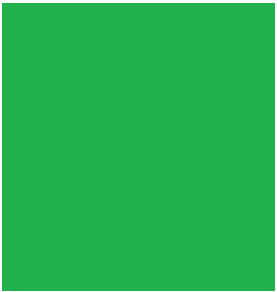

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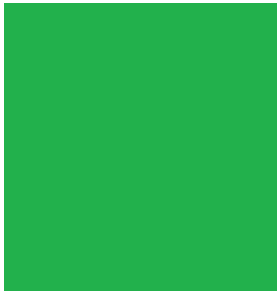

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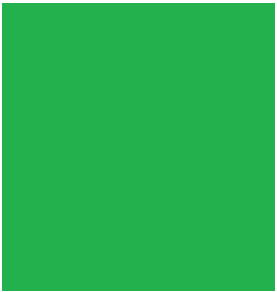

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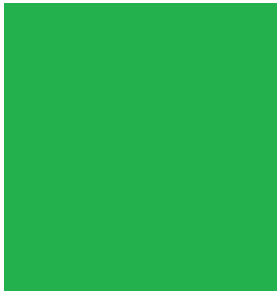

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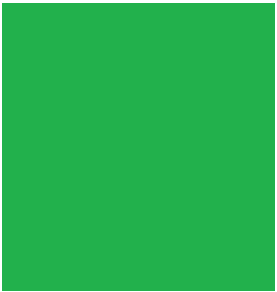

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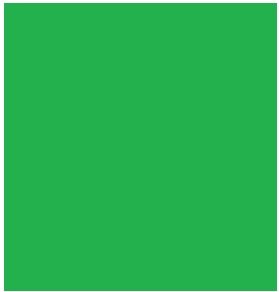

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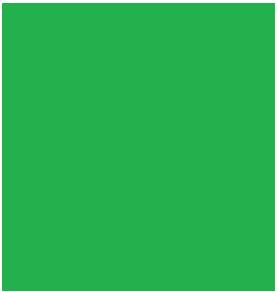

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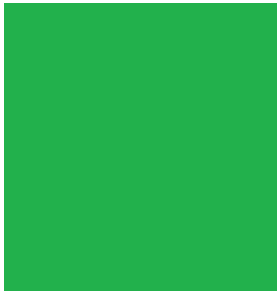

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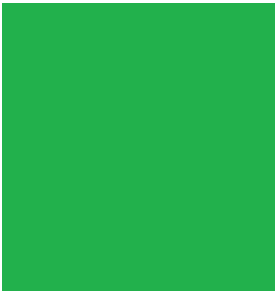

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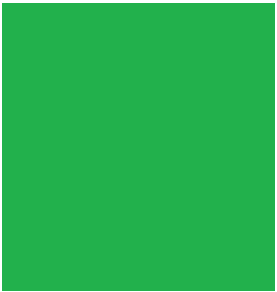

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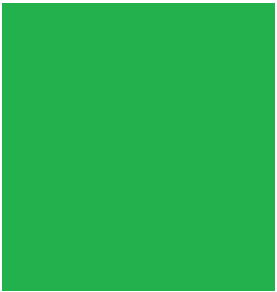

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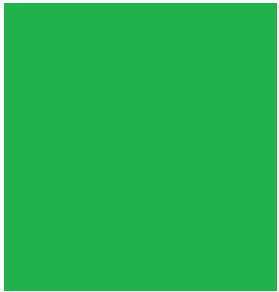

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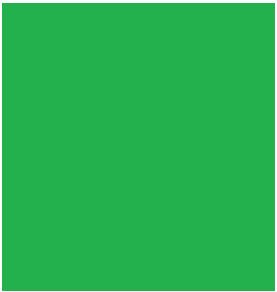

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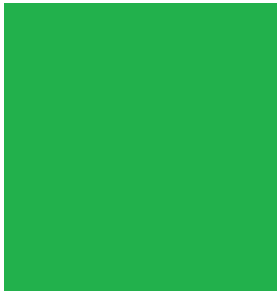

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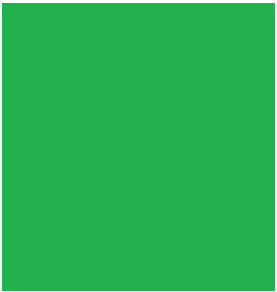

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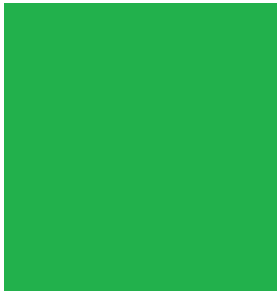

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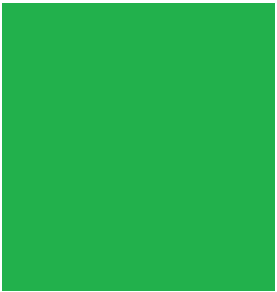

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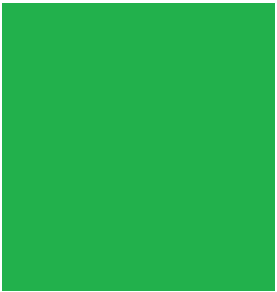

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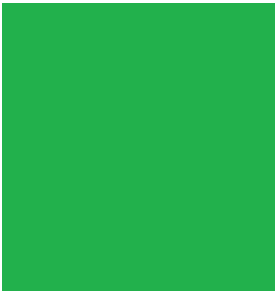

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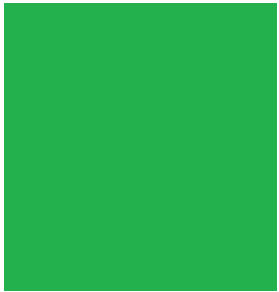

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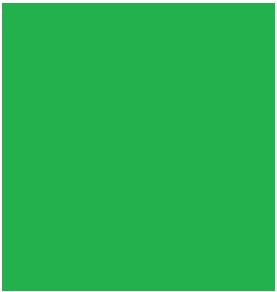

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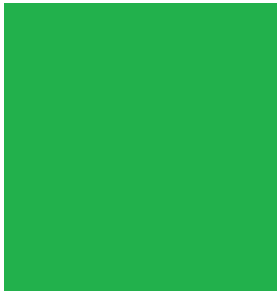

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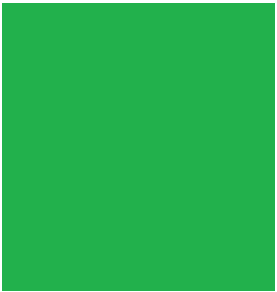

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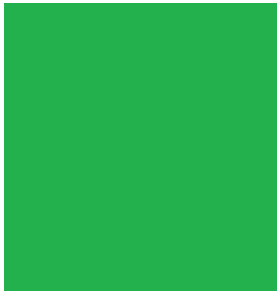

Tuning your Spark Jobs

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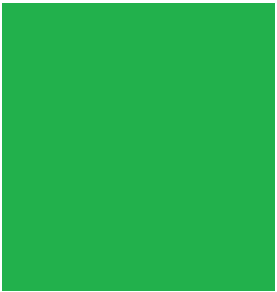

Tuning your Spark Jobs

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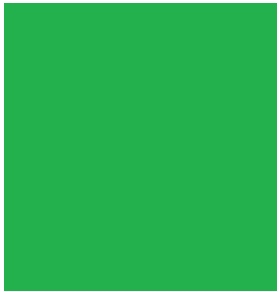
- What is distributed systems in brief?



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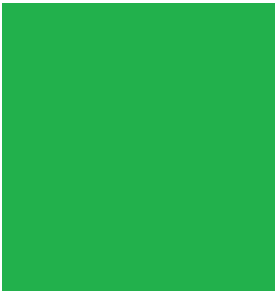

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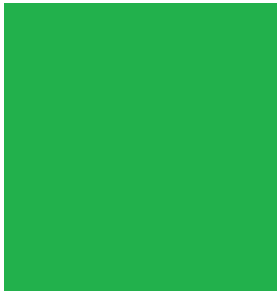
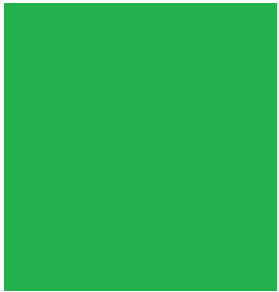
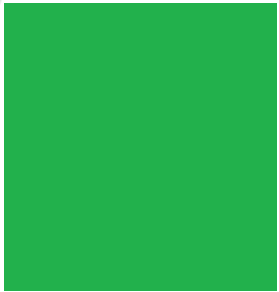


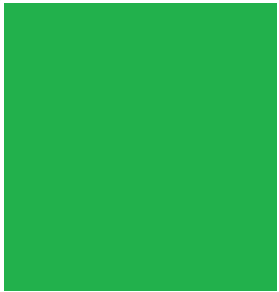
Real World Applications



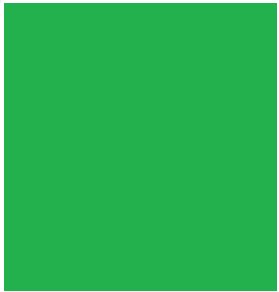
Massaging Systems



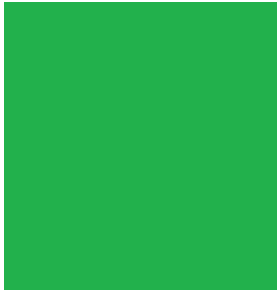
Data Orchestration



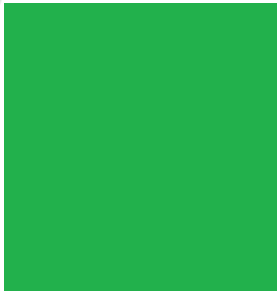
NOSQL



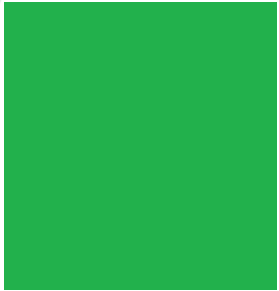
Elastic



Data Architecture Design

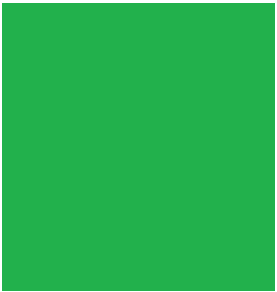


Appendix



Appendix A- Shell Programming

- Any Big Data solution working based distributed systems.



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- Any Big Data solution working based distributed systems.
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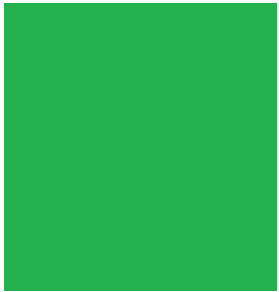
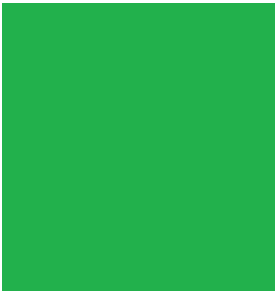


Appendix B- Java Programming

- Any Big Data solution working based distributed systems.



Appendix B- Java Programming

- Any Big Data solution working based distributed systems.
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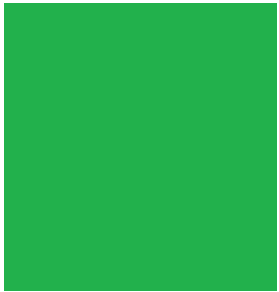
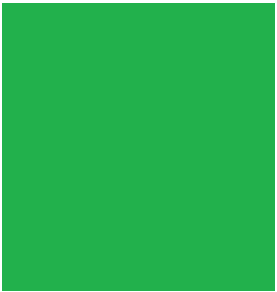


Appendix C- Scala Programming

- Any Big Data solution working based distributed systems.



Appendix C- Scala Programming

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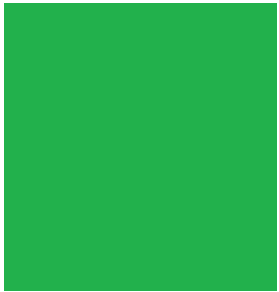
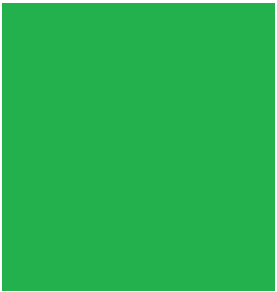


Appendix D- SQL Programming

- Any Big Data solution working based distributed systems.



Appendix D- SQL Programming

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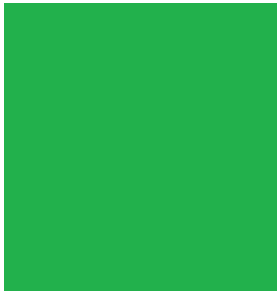
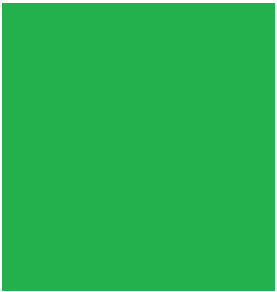


Appendix E- Oozie Orchestration

- Any Big Data solution working based distributed systems.



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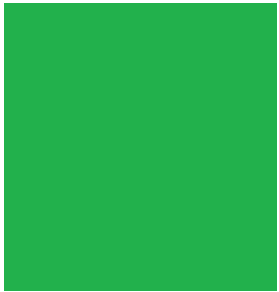
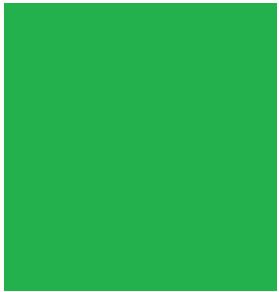


Appendix F- DWH Concepts and Data Modeling Design

- Any Big Data solution working based distributed systems.



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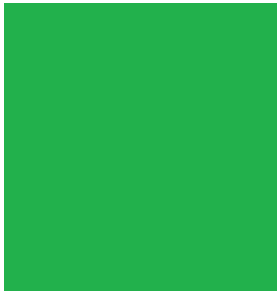
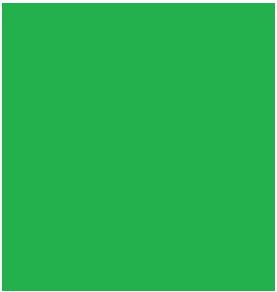


Appendix G- Machine Learning Concepts Data Engineers

- Any Big Data solution working based distributed systems.



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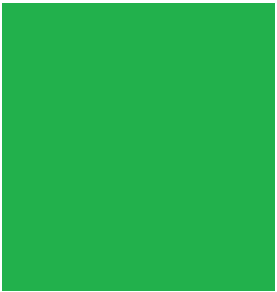
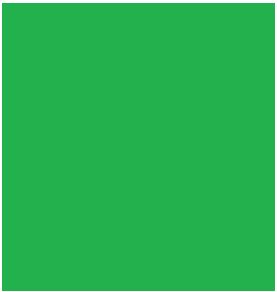


Appendix H- Docker for Data Engineers

- Any Big Data solution working based distributed systems.



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