Data warehouse data modeling

DATA WAREHOUSING CONCEPTS

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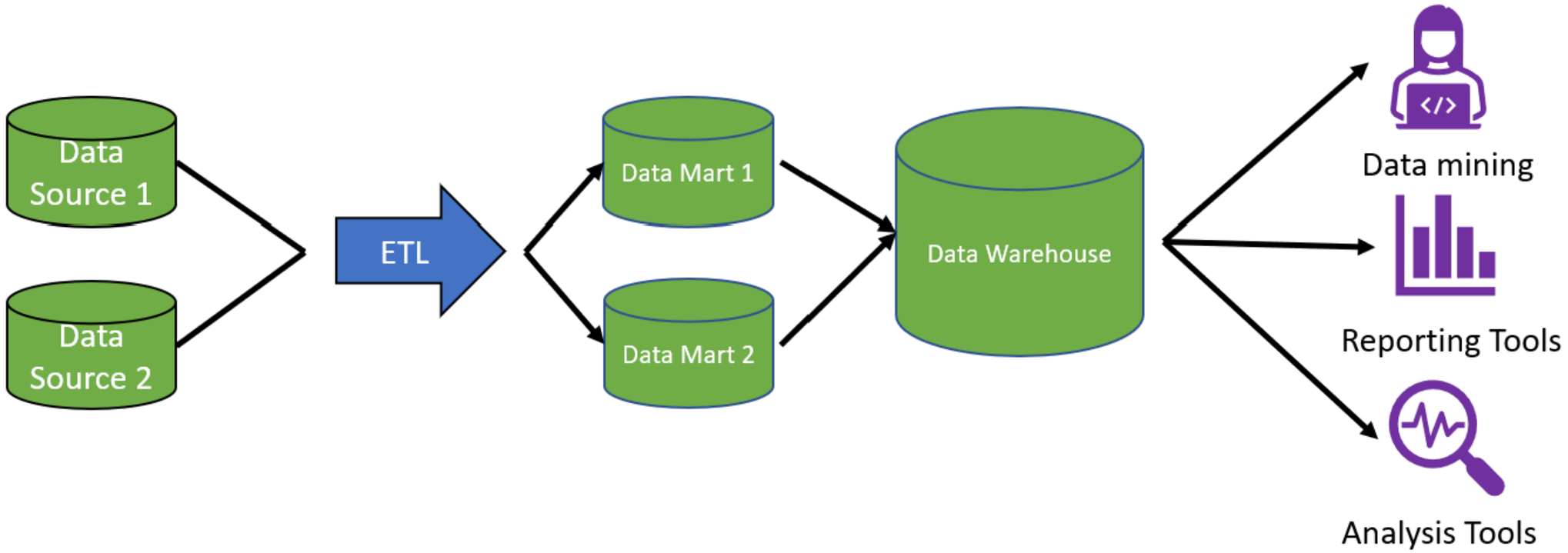
Data models

- Bottom-up, Kimball model = star & snowflake schemas
- Denormalized data models



It's Bravo again!

- Hypothetical publicly traded company
  - Sells home office furniture

[1] Photo from Pexel by Pixabay

Fact table

- Measurements, metrics, or facts about an organization
- Links to dimension tables for more details

Table Name: Sales_Order_Fact

Keys	ColumnName
FK	CustomerID
FK	DateID
FK	ProductID
	UnitSold
	SalesAmount
	Tax

Legend: FK = Foreign Key

Dimension table

- Dimensions/attributes about a process
- Holds reference data
- Dimension tables add more detail to fact table

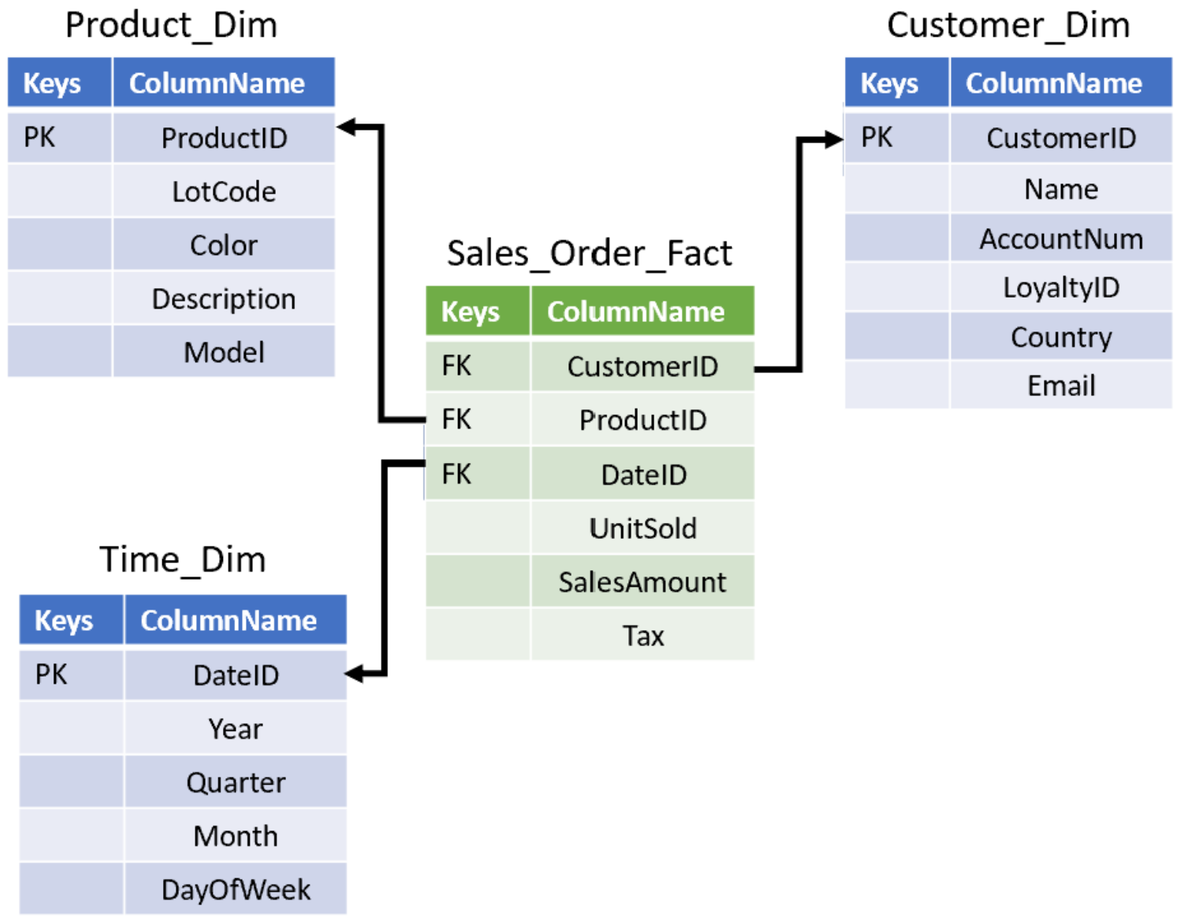
Table Name: Customer_Dim

Keys	ColumnName
PK	CustomerID
	Name
	AccountNum
	LoyaltyID
	Country
	Email

Legend: PK = Primary Key

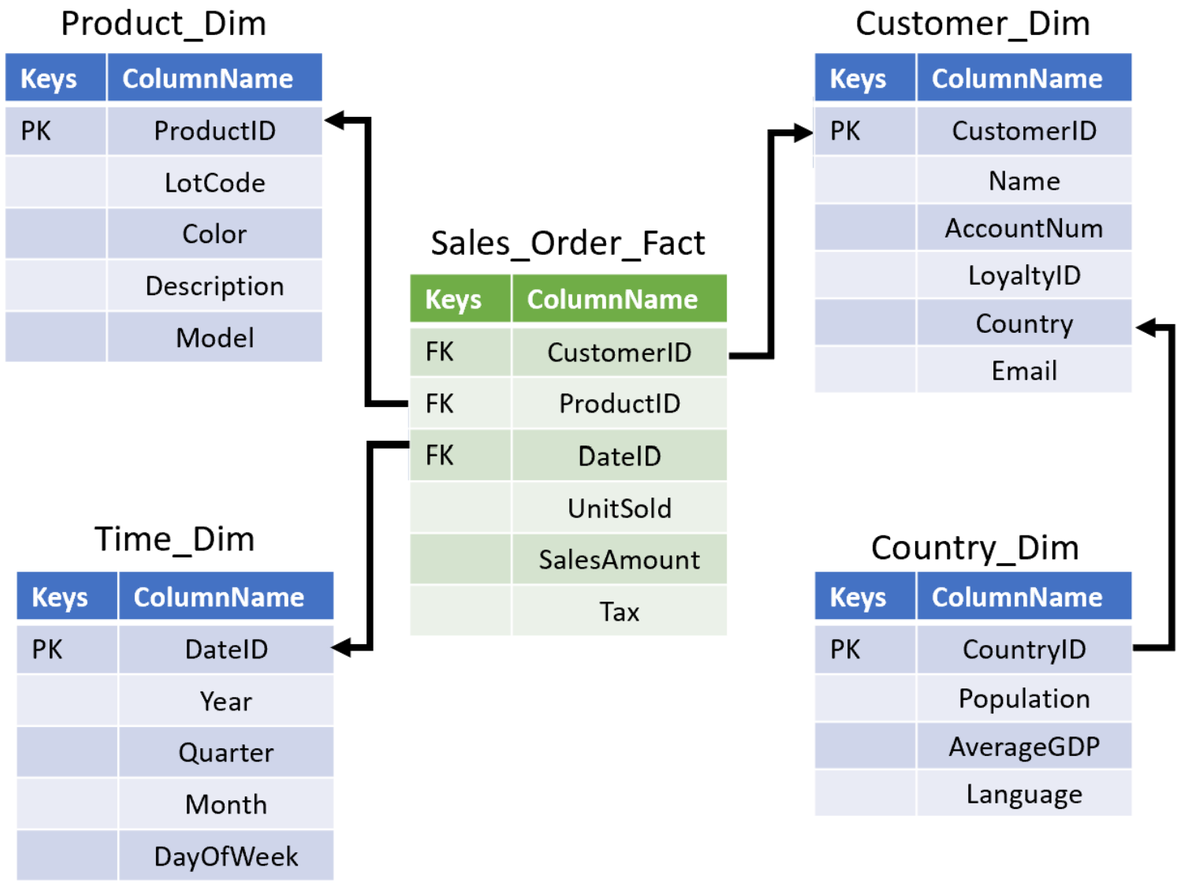
Star schema

- A central fact table, with one or more dimensional tables
- Easy for business users



Snowflake schema

- Dimensional table connected through another dimensional table



Let's practice!

DATA WAREHOUSING CONCEPTS

Kimball's four step process

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Step 1 - Select the organizational process

- Ask questions about a process
- Kimball bottom-up approach starts with a business process

Examples of organizational processes:

- Invoice and billing
- Product quality monitoring
- Marketing

Step 2 - Declare the grain

- Grain = level to store fact table
- A level of data that cannot be split further

Examples of business processes:

- Music service -> Song grain
- Shipping service -> Line item grain

Step 3 - Identify the dimensions

- Choose dimensions that apply to each row
- How to describe the data?
- Business users and analysts = valuable feedback

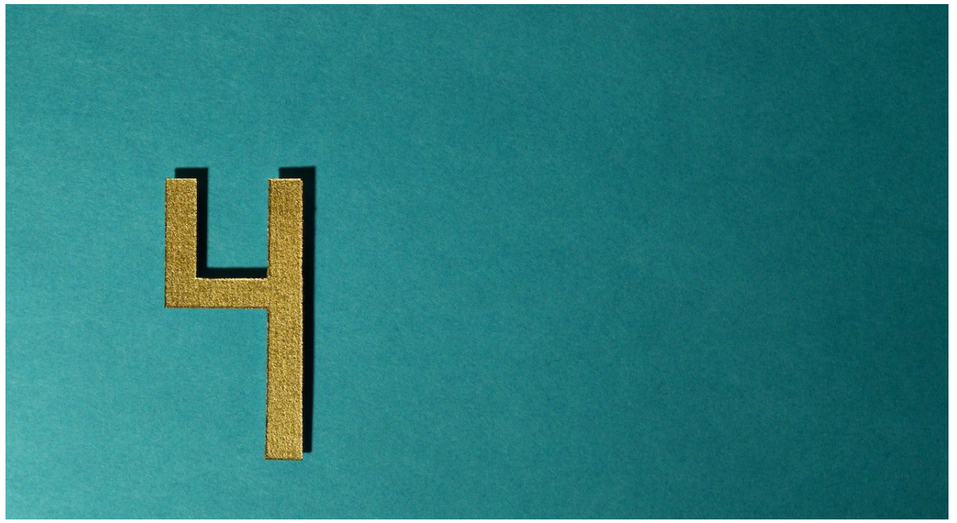
Examples of common dimensions:

- **Time:** year, quarter, and month
- **Location:** address, state, and country
- **Users:** names and email address

[1] Photo by Alison Pang on Unsplash

Step 4 - Identify the facts

- Numerical facts for each fact table row
- What are we answering?
- Metrics should be true at selected grain



Examples of facts:

- Music service: total number of plays, sales revenue of a song
- Ride-sharing: travel distance, time needed

[1] Photo by Miguel Á. Padriñán

Summary

Steps:

1. Select the organizational process.
2. Declare the grain.
3. Identify the dimensions.
4. Identify the facts.

Let's practice!

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Slowly changing dimensions

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The challenge

Original

ProductID	Description	Category
12345	Tesla-ModelY	electric-veh.

Update Category:

- **Current:** electric-veh.
- **New:** electric-crossover

Type I

- Update value in table
- Will lose any history

Original

ProductID	Description	Category
12345	Tesla-ModelY	~~electric-veh.~~

New

ProductID	Description	Category
12345	Tesla-ModelY	electric-crossover

Type II

- Add a row with the updated value
- The history is retained

Original

ProductID	Description	Category
12345	Tesla-ModelY	electric-veh.

New

ProductID	Description	Category	StartDate	EndDate
12345	Tesla-ModelY	electric-veh.	1970-01-01	2022-03-10
20053	Tesla-ModelY	electric-crossover	2022-03-11	2050-12-31

Type III

- Add column to dimension table to track changes
- Can view past and current data together
- Can require reporting changes and limited tracking

Original

ProductID	Description	Category
12345	Tesla-ModelY	electric-veh.

New

ProductID	Description	Category	PastCategory
12345	Tesla-ModelY	electric-crossover	electric-veh.

Modern approach

- Snapshot the whole dimension table
- Use historical snapshots for historical reports

Let's practice!

DATA WAREHOUSING CONCEPTS

Row vs. column data store

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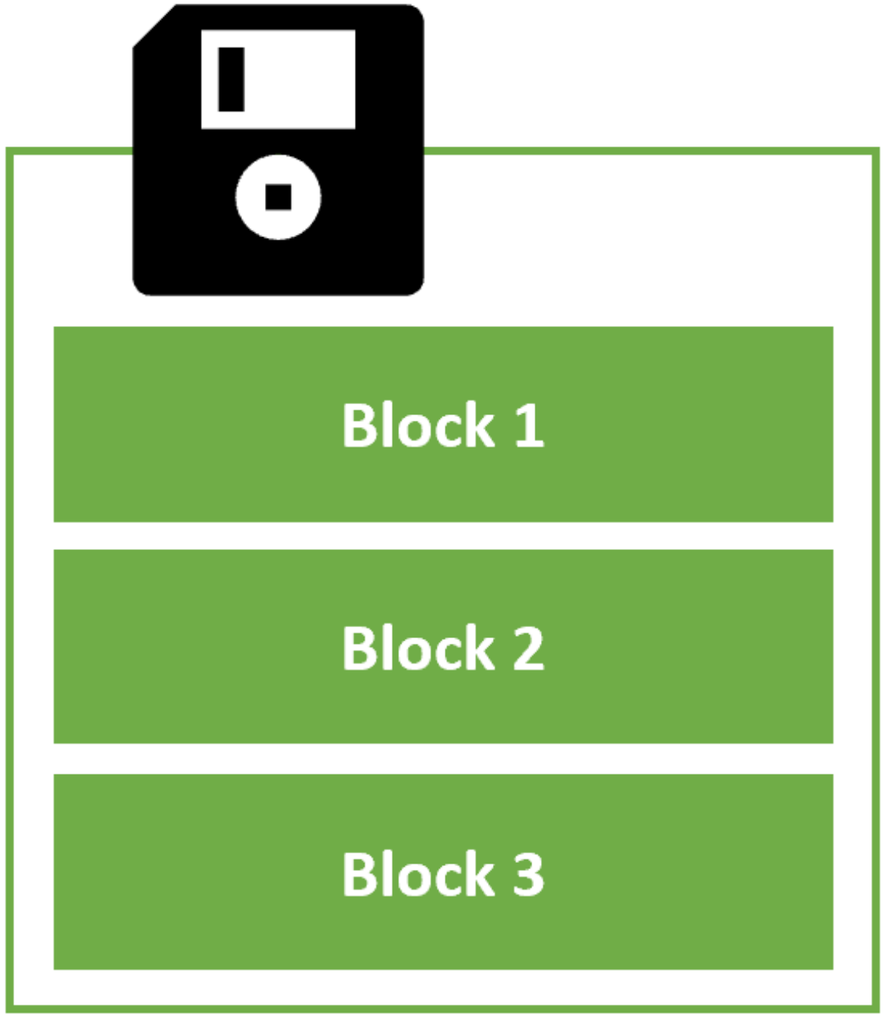
Why is it important?

- Optimizing queries for speed
- Column store format for data warehouse tables is best for analytic workloads

Basics of computer storage

- Computers **store data in blocks.**
- Reads the required blocks when retrieving data.
- Reading fewer blocks increases the overall speed of the process.



Example of health table

- CDC (Centers for Disease Control and Prevention)
- Flu infection data by age groups over multiple seasons

SEASON	AGE GROUP	HOSPITALIZATION PERCENTAGE
2019	0-17 yr	13.9%
2019	18-49 yr	22.5%
2019	50+ yr	63.7%
2020	0-17 yr	3.9%
2020	18-49 yr	18.1%
2020	50+ yr	78%
2021	0-17 yr	15.6%
2021	18-49 yr	23.3%
2021	50+ yr	61.1%

Row store example

SEASON	AGE GROUP	HOSPITALIZATION PERCENTAGE
2019	0-17 yr	13.9%
2019	***18-49 yr***	***22.5%***
2019	50+ yr	63.7%
2020	0-17 yr	3.9%
2020	18-49 yr	18.1%
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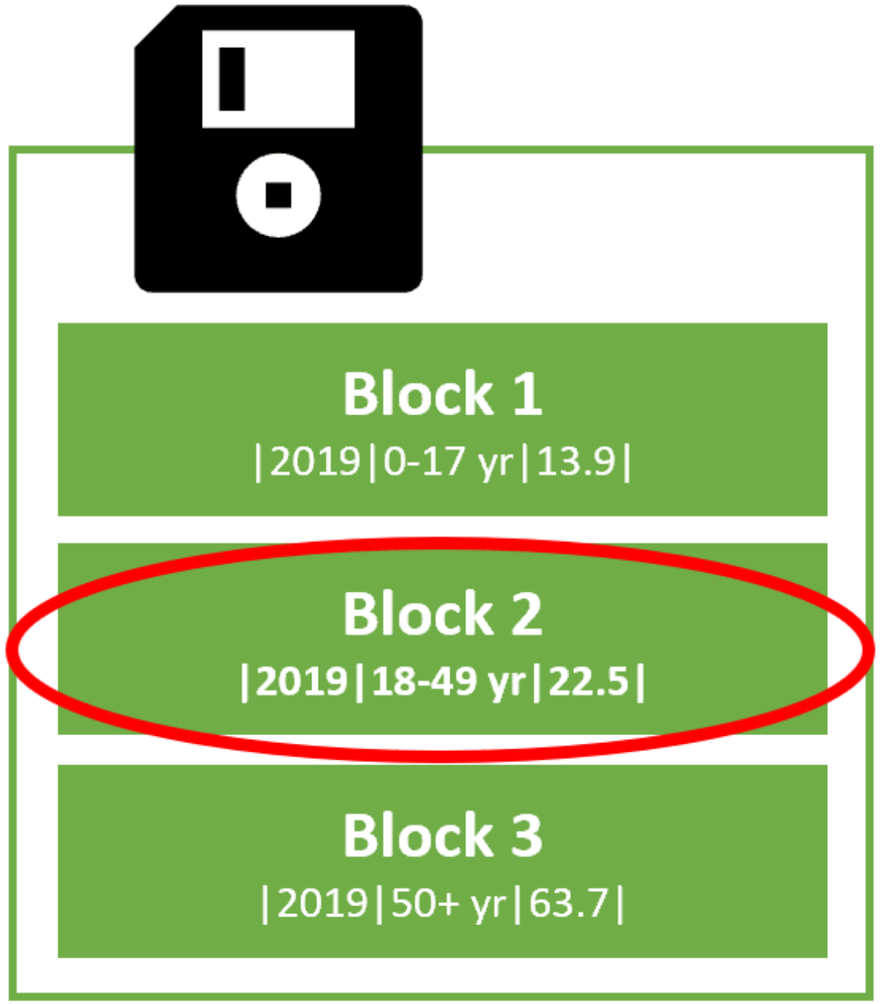
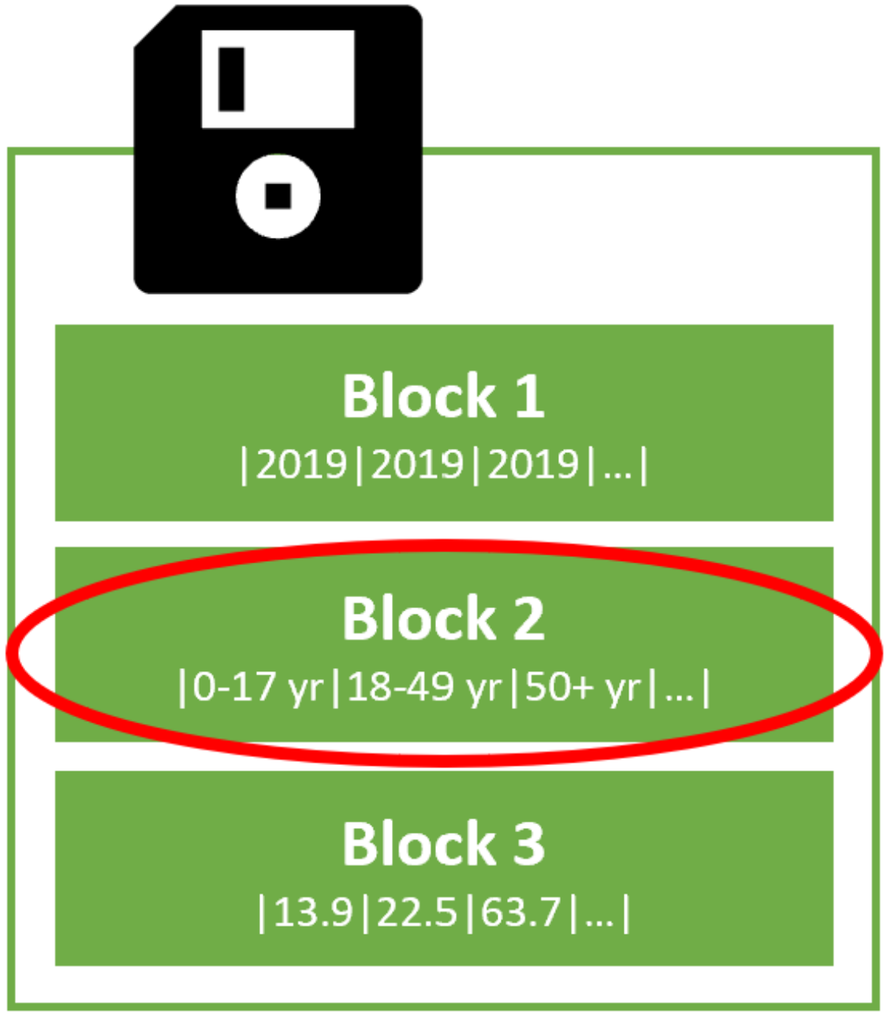


Column store example

SEASON	AGE GROUP	HOSPITALIZATION PERCENTAGE
2019	*0-17 yr*	13.9%
2019	*18-49 yr*	22.5%
2019	*50+ yr*	63.7%
2020	*0-17 yr*	3.9%
2020	*18-49 yr*	18.1%
2020	*50+ yr*	78%
2021	*0-17 yr*	15.6%
2021	*18-49 yr*	23.3%
2021	*50+ yr*	61.1%



Summary

Row Store

- Row data is stored together in blocks
- Ideal for transactional workloads

Column Store

- Column data is stored together in blocks
- Ideal for analytical workloads
- Better data compression

It's practice time!

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