What are the different layers of a data warehouse?

INTRODUCTION TO DATA WAREHOUSING

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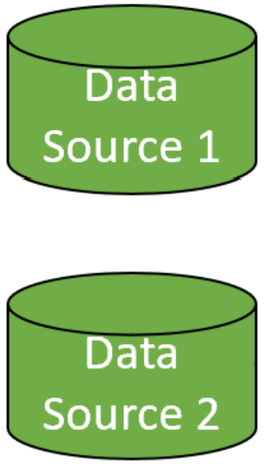
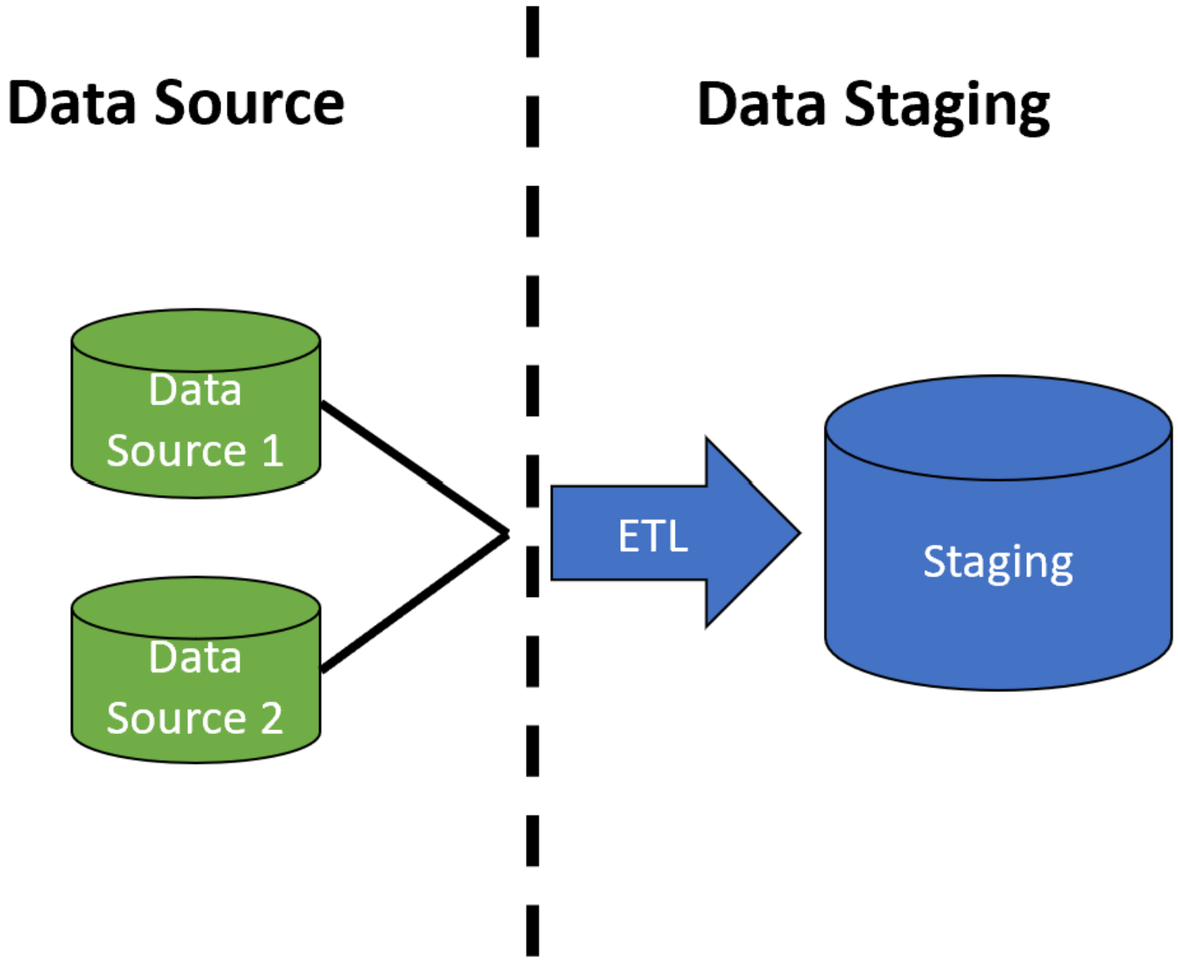
Layer overview - data source

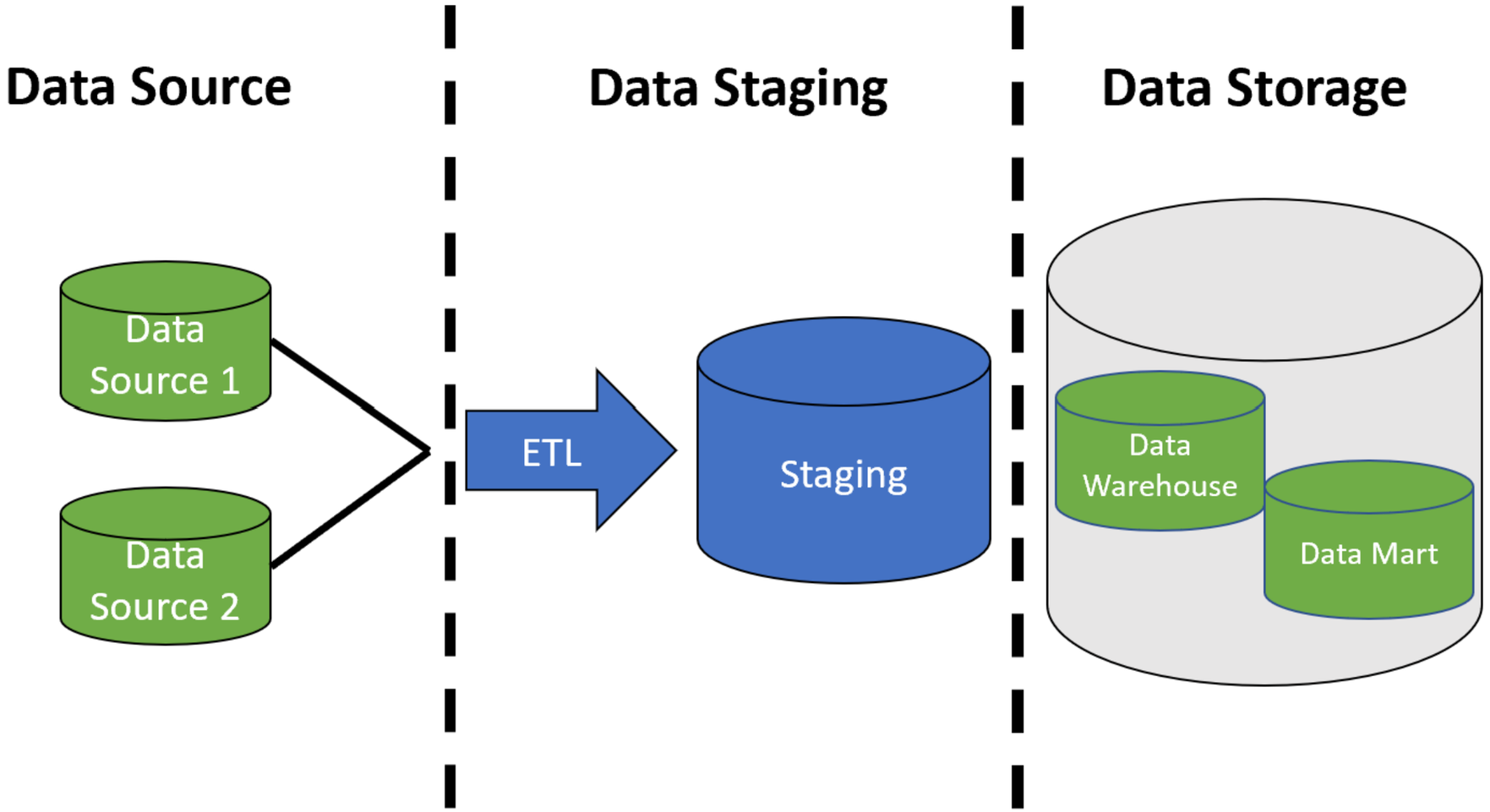
Data Source



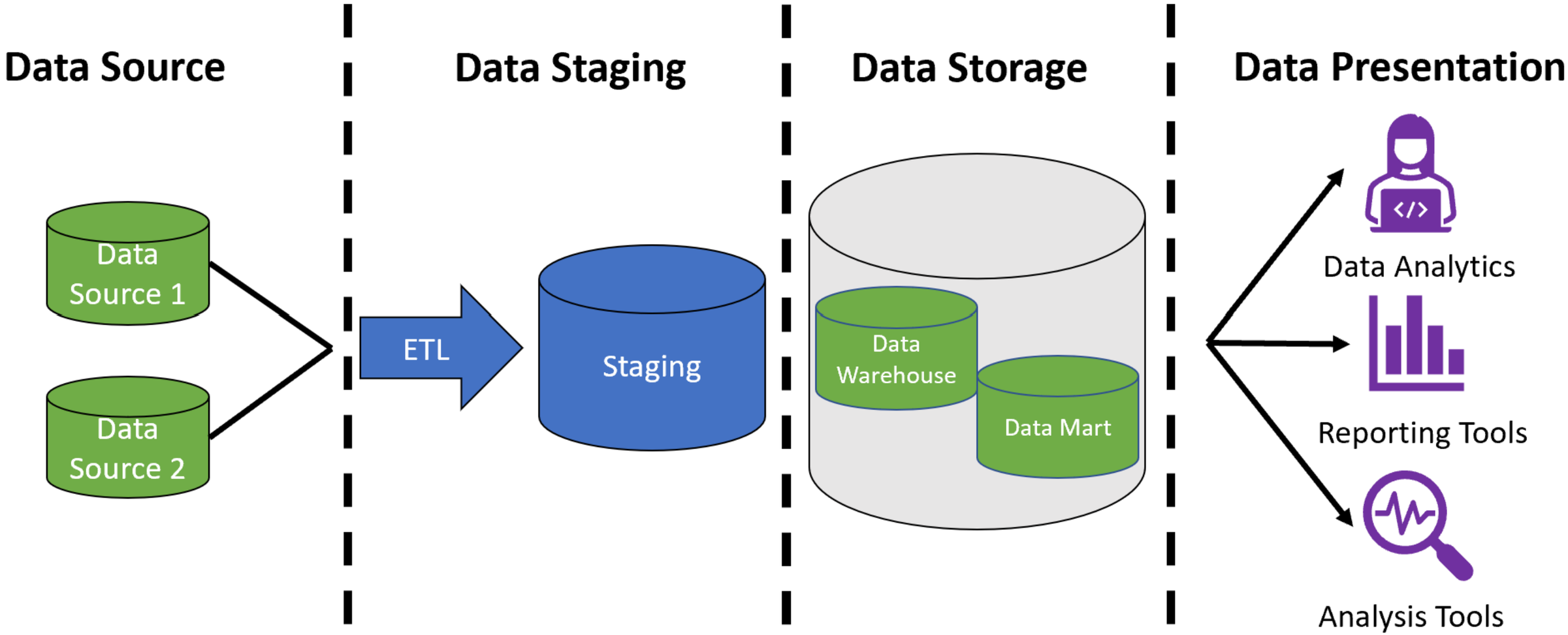
Layer overview - data staging



Layer overview - data storage

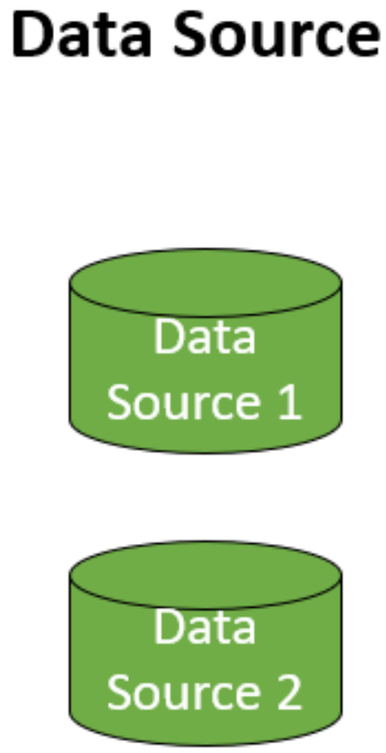


Layer overview - data presentation



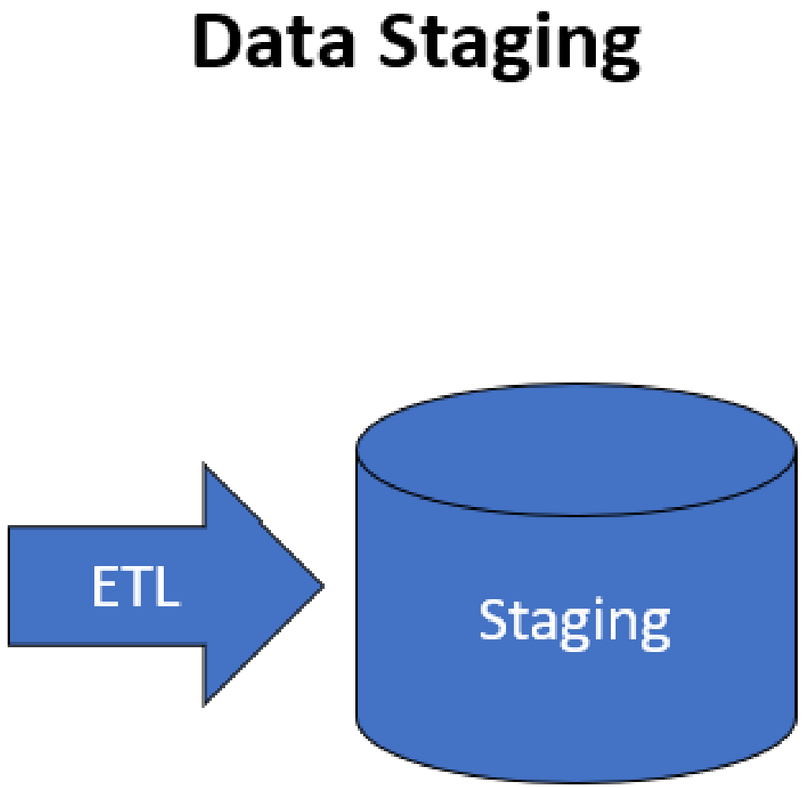
Data source layer

- All data sources for data warehouse
- Examples of data sources:
  - Transactional database
  - Log files
  - Spreadsheets



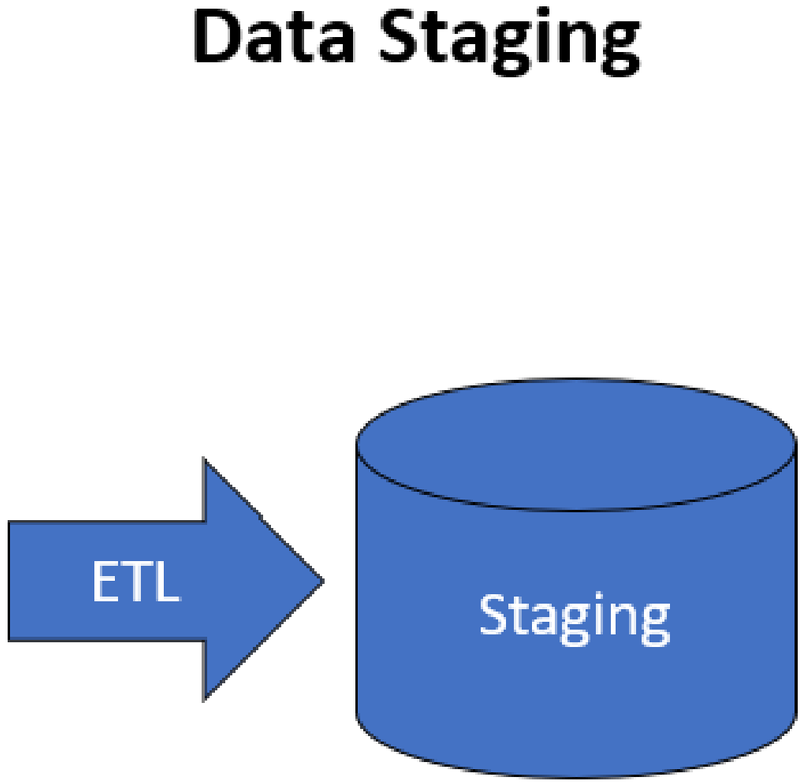
Data staging layer

- Layer extracts, transform, and clean data through ETL process
- Contains ETL process and storage tables



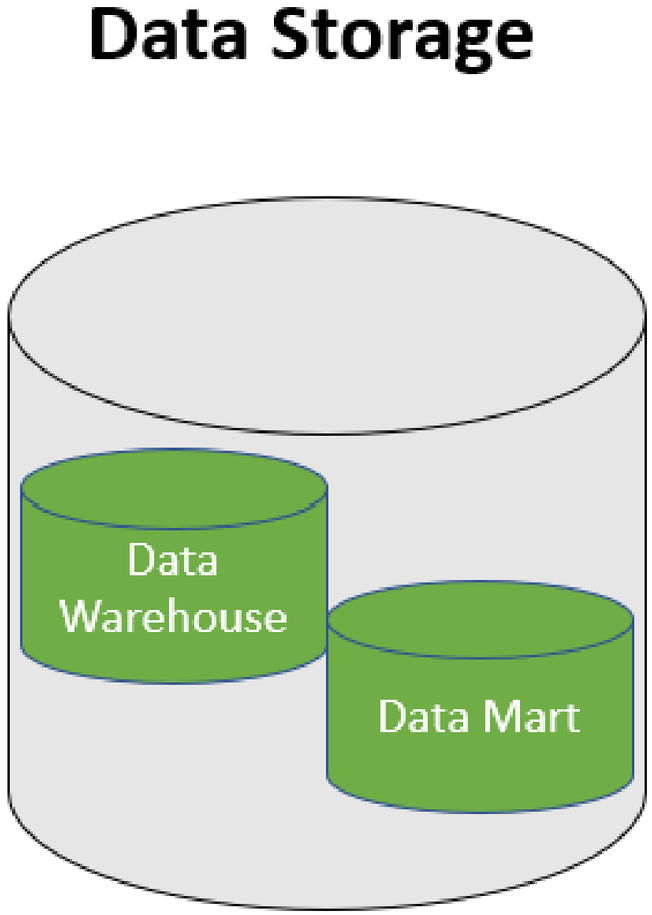
ETL process within data staging layer

- Extracted
- Business rules applied and cleaned
- Staging database often used
- Must be able to extract valid data
- Batch / full loading



Data storage layer

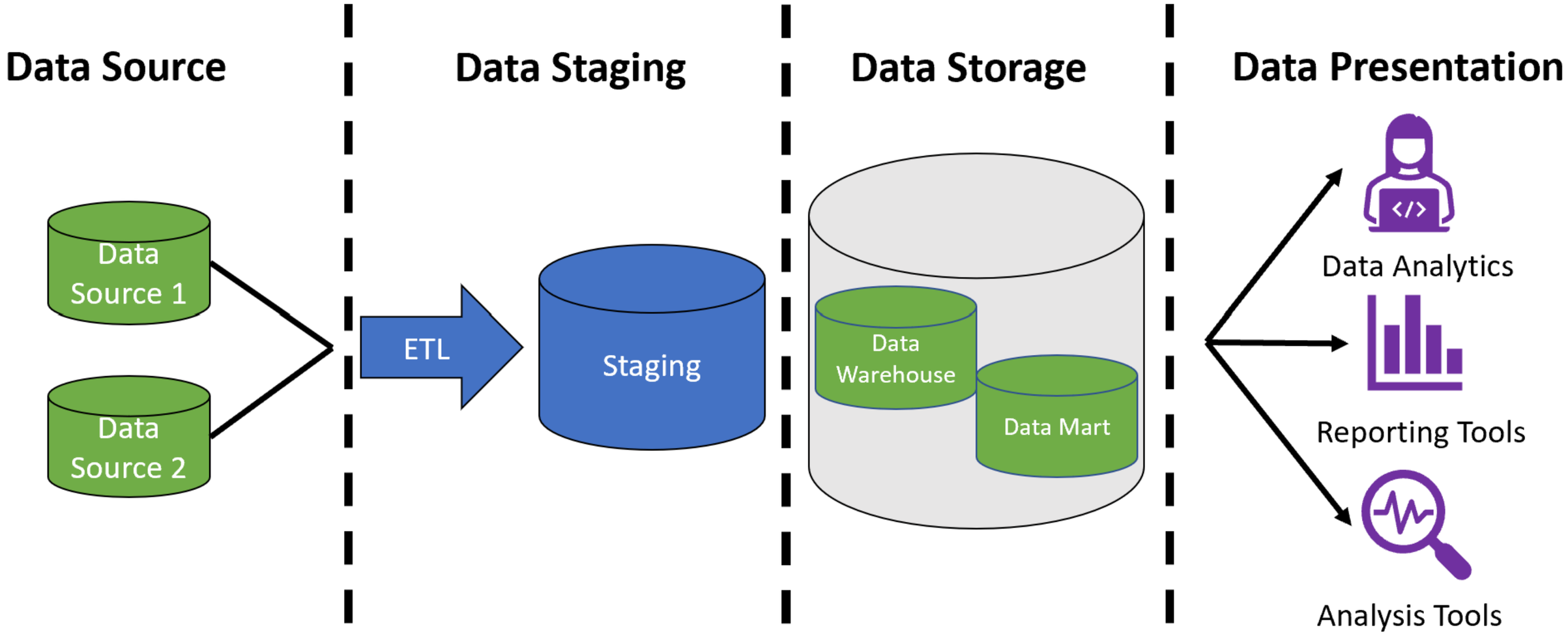
- Data is stored in warehouse and data marts
  - *Data warehouse -> Data mart*
  - *Data mart -> Data warehouse*



Data presentation layer

- Users interact with stored data
- Users:
  - Use BI (Business Intelligence) tools
  - Use data mining tools
  - Create direct queries

Summary


Data Source
Data Staging
Data Storage
Data Presentation
Data Source 1
Data Source 2
ETL
Staging
Data Warehouse
Data Mart
Data Analytics
Reporting Tools
Analysis Tools

Let's practice!

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The presentation layer

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Presentation layer tools

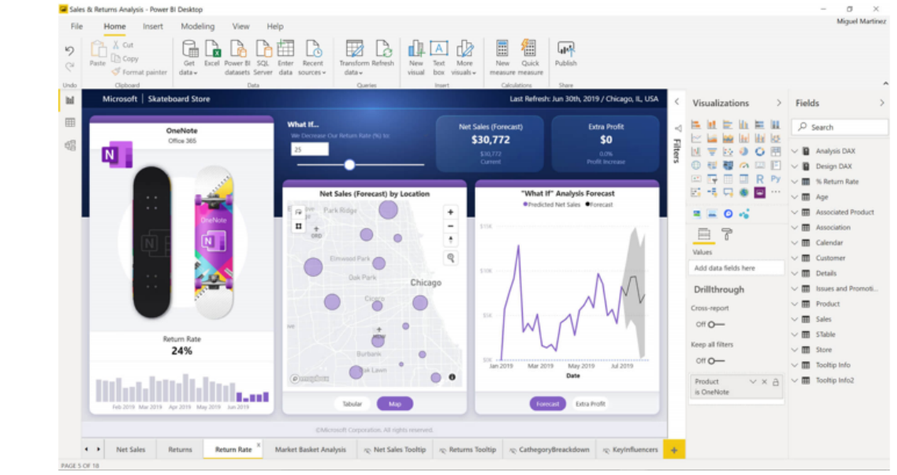
- Users interact with the presentation layer
  - Area of constant development

Presentation Layer Groups:

- Automated reporting/dashboarding tools
- BI/data analytics
- Direct queries

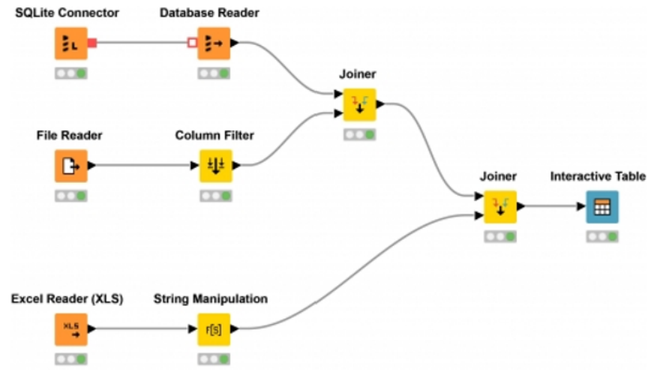
Automated reporting/dashboarding

- Goal:
  - Create reports needed for decision making making
  - Create dashboards using historical data
- Users:
  - Analysts
  - Citizen Data Scientist



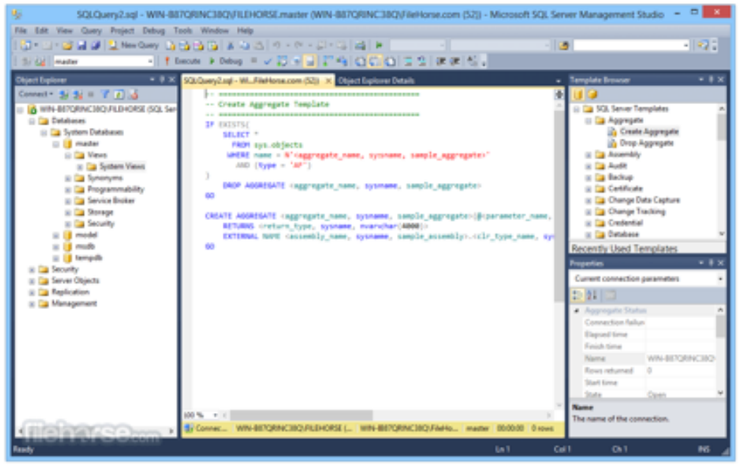
BI/data analytics

- Goal:
  - Tools for exploration
  - Looking for patterns
- Users:
  - Analysts
  - Data Scientist



Direct queries

- Goal:
  - Sophisticated tools for exploration
- Users:
  - Analysts
  - Data Scientist
  - Data Engineer



Let's practice!

INTRODUCTION TO DATA WAREHOUSING

Data warehouse architectures

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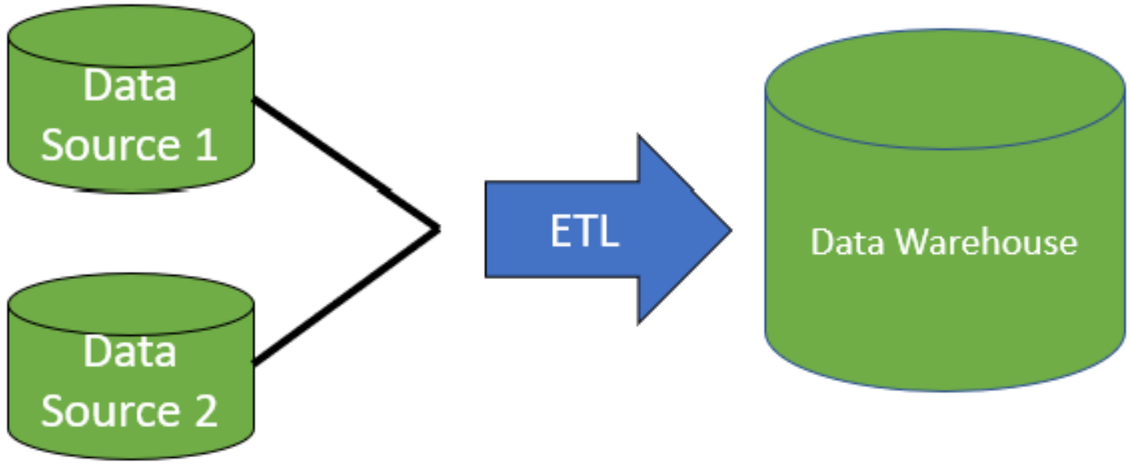
Inmon - top-down

Inmon - top-down

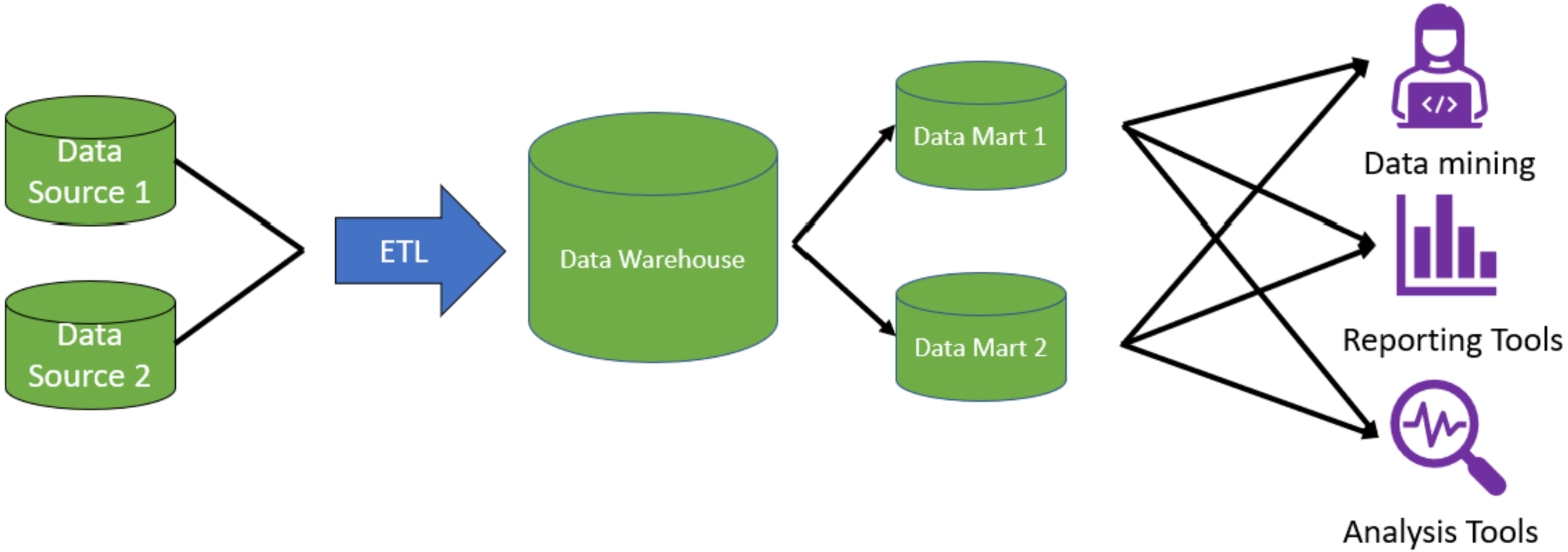
Must decide:

- On all data definitions, cleaning, and business rules
- Before any data enters warehouse

Inmon - top-down



Inmon - top-down



Pros and cons of top-down

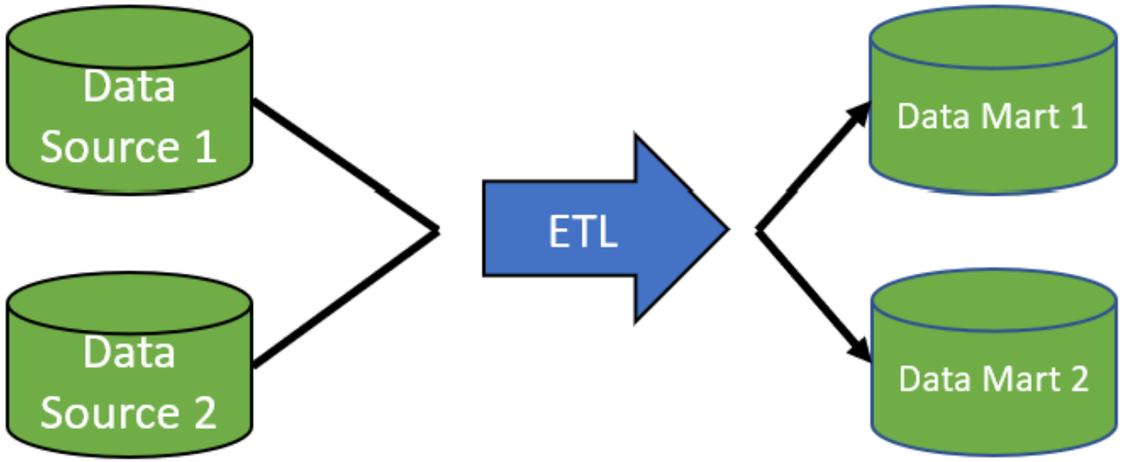
Advantages:

- Single source of truth for organization
- Normalization = less storage
- Easy to change data marts to support reporting changes

Disadvantages:

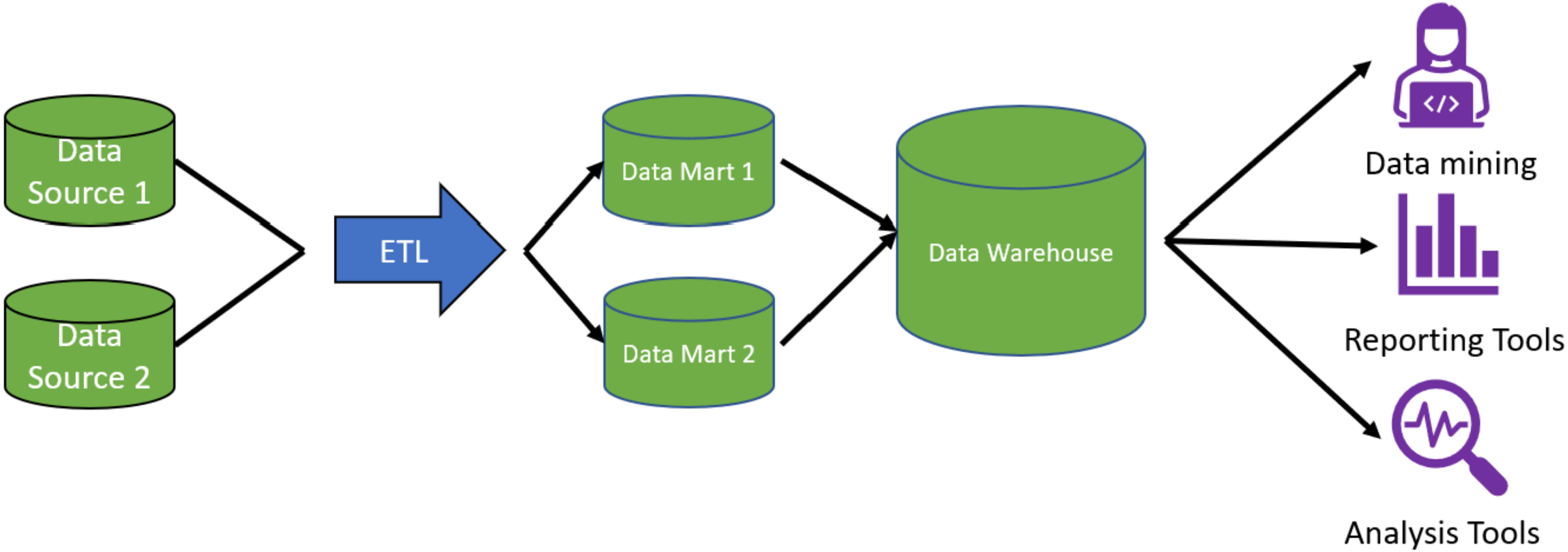
- More joins = slower response time
- Lengthy upfront work
  - Higher startup cost

Kimball - bottom-up



- Denormalizes data
- Focus on departmental data mart
- Data moves directly from ETL to data marts

Kimball - bottom-up



Pros and cons of bottom-down

Advantages:

- Upfront development speed
  - Lower startup cost
- Denormalized = user friendly

Disadvantages:

- Increased ETL processing time
- Greater possibility of duplicate data
- Ongoing development needed

Let's practice!

INTRODUCTION TO DATA WAREHOUSING

OLAP and OLTP systems

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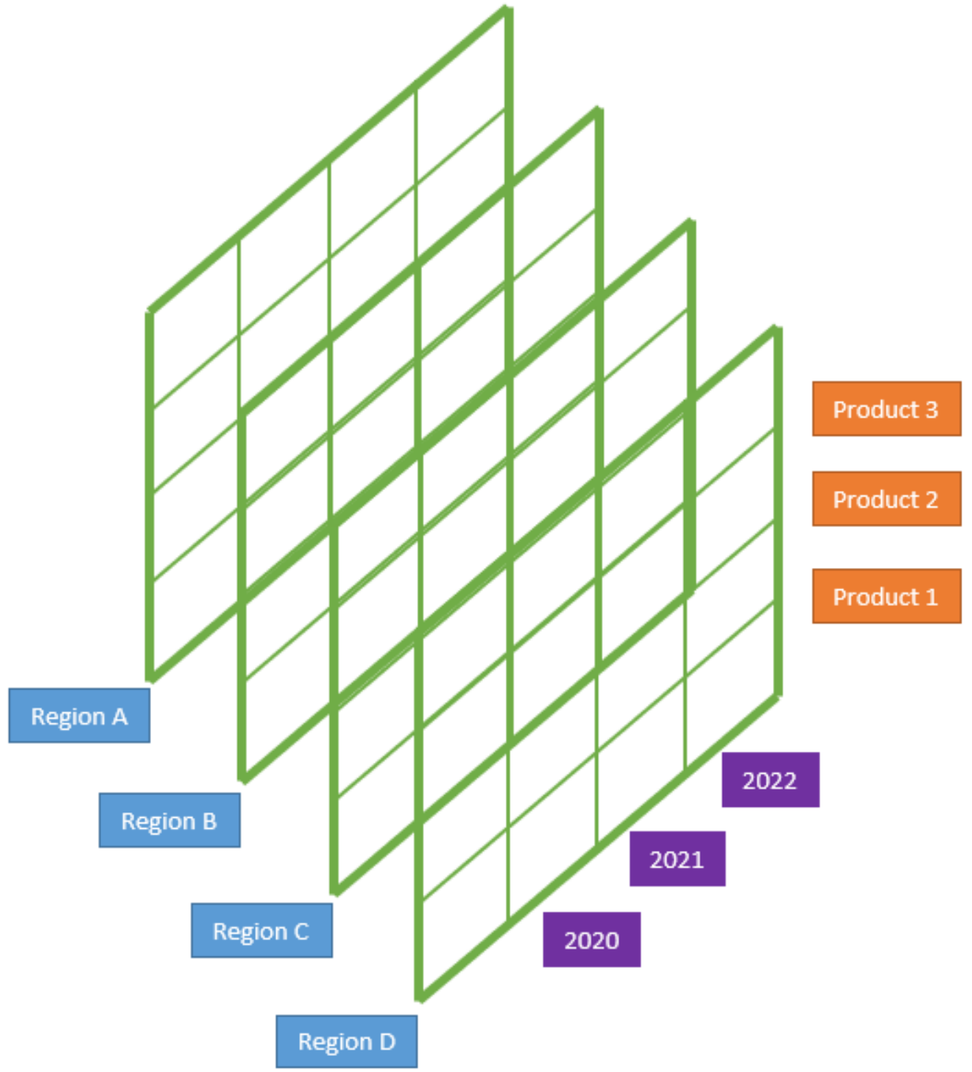
OLAP systems

- OLAP (*online analytical processing*)
- Designed to support analysis of large amounts of data
- Example dimensional organization:
  - country, state, city
  - years, months, days
- OLAP reorganizes data into multidimensional format

OLAP cube

- OLAP cube key to OLAP system
- Faster processing vs. traditional relational databases
- Hypercubes have more than three dimensions



OLTP

- OLTP (*online transaction processing*)
- Designed to processing simple database queries
- Used in source systems to data warehouse

[1] Photo by Rodnae-Productions on Pexels

Example for a credit card company

OLTP:

- System tracks customers purchase
- Processes large amount of simply database updates to account balances

OLAP:

- Designed for analyzing purchase data
- Data organized by multiple dimensions

Summary

Differences	OLAP	OLTP
Optimization:	Complex read-only queries for analysis	Simple queries
Data Representation:	Multidimensional	Rows and columns

Let's practice!

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