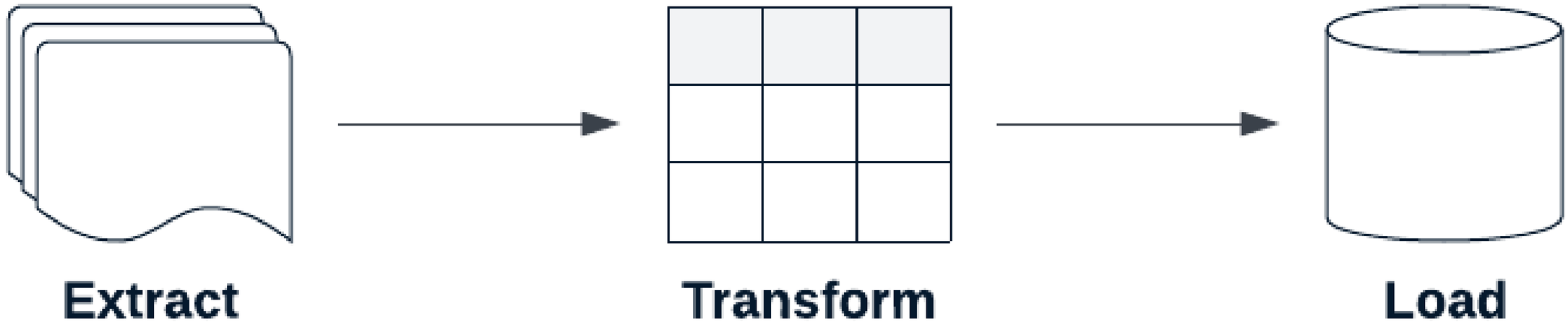
Introducing data pipelines

INTRODUCTION TO DATA PIPELINES

What is a data pipeline?

Definition:

- An **automated** process that extracts data from a source system, transforms it into a desired model, and loads the data into a file, database, or other data storage tool.



Data pipeline users

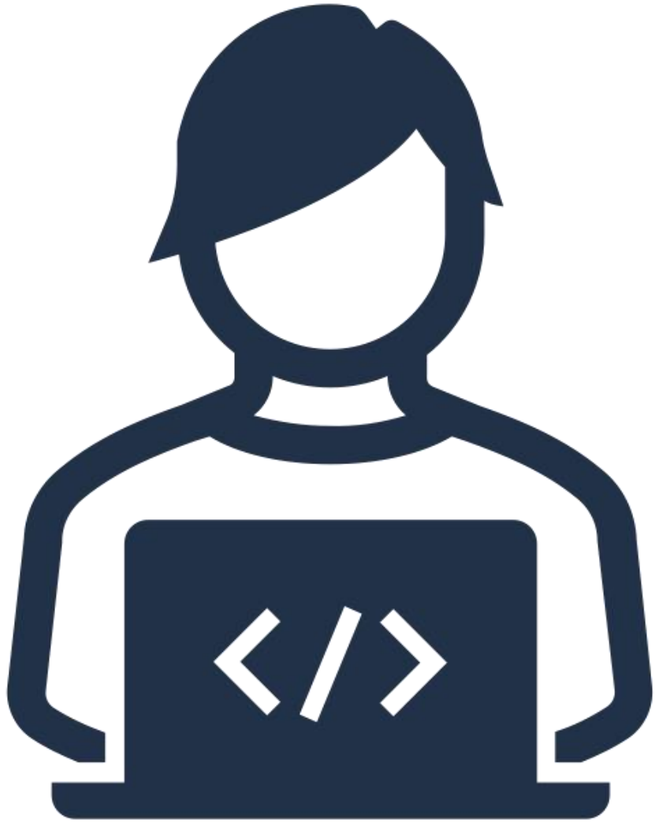
Data pipelines are used by:

- Data Analysts
- Data Scientists
- Machine Learning Engineers
- Business Intelligence Analysts
- ... other data pipelines

Data pipelines are used to:

- Populate dashboards
- Build machine learning models
- Support ad hoc analyses
- ... pretty much anything data-related!

Building data pipelines



Data Engineers build data pipelines!

- Help to power data-driven insights and decisions
- Use tools such as Python and SQL
- Leverage orchestration tools, such as Airflow

Components of an ETL pipeline

Extract

- Pull data from a source system
- File, database, API

Transform

- Convert raw data to desired model
- Simple and advanced transformations

Load

- Persist data for downstream use
- Files, data warehouse, API

Designing data pipelines

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datacamp

Architecture diagrams

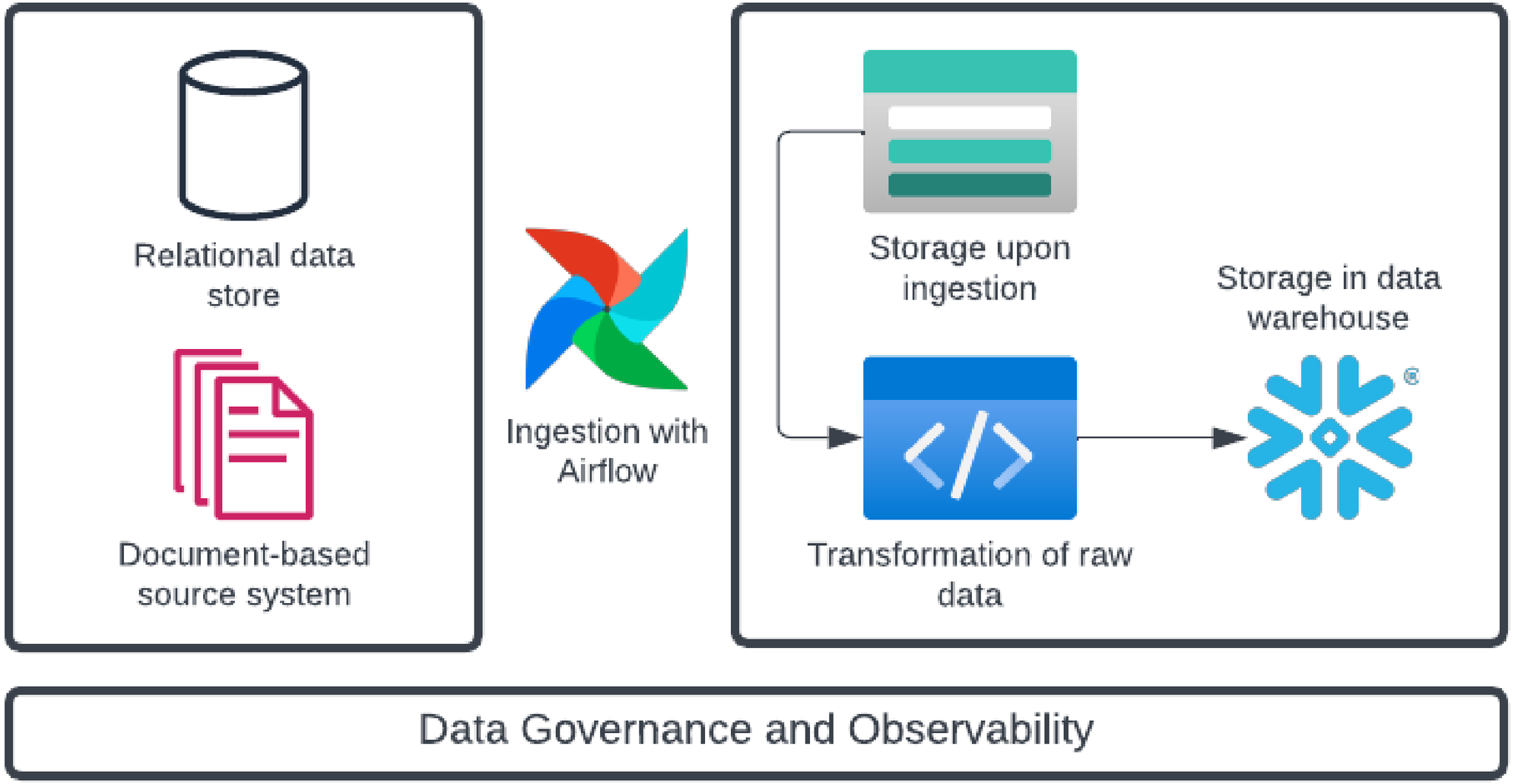
Architecture diagrams:

- Visually represent components in a data pipeline
- Illustrates dependencies between steps in a data solution
- Identifies technical or security vulnerabilities

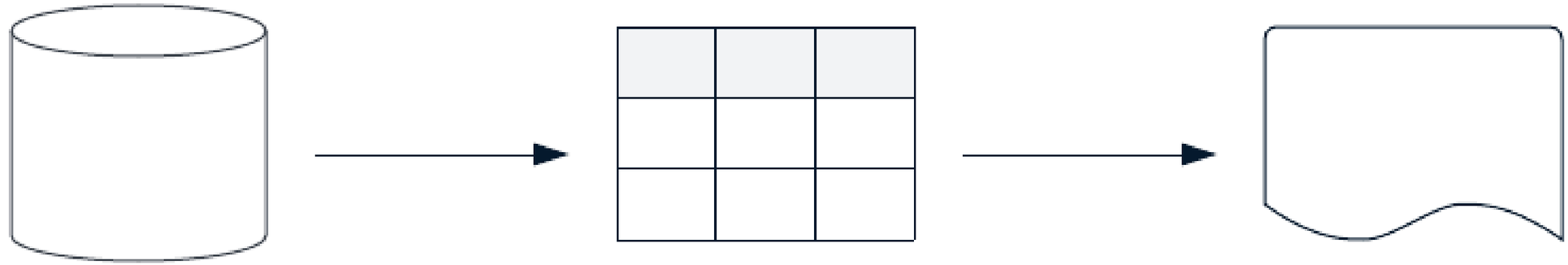
Useful for:

- Determining where previous tooling/logic can be applied
- Ensuring requirements are met before development begins
- Sharing pipeline design with non-technical stakeholders

Architecture diagrams



Data delivery pipeline

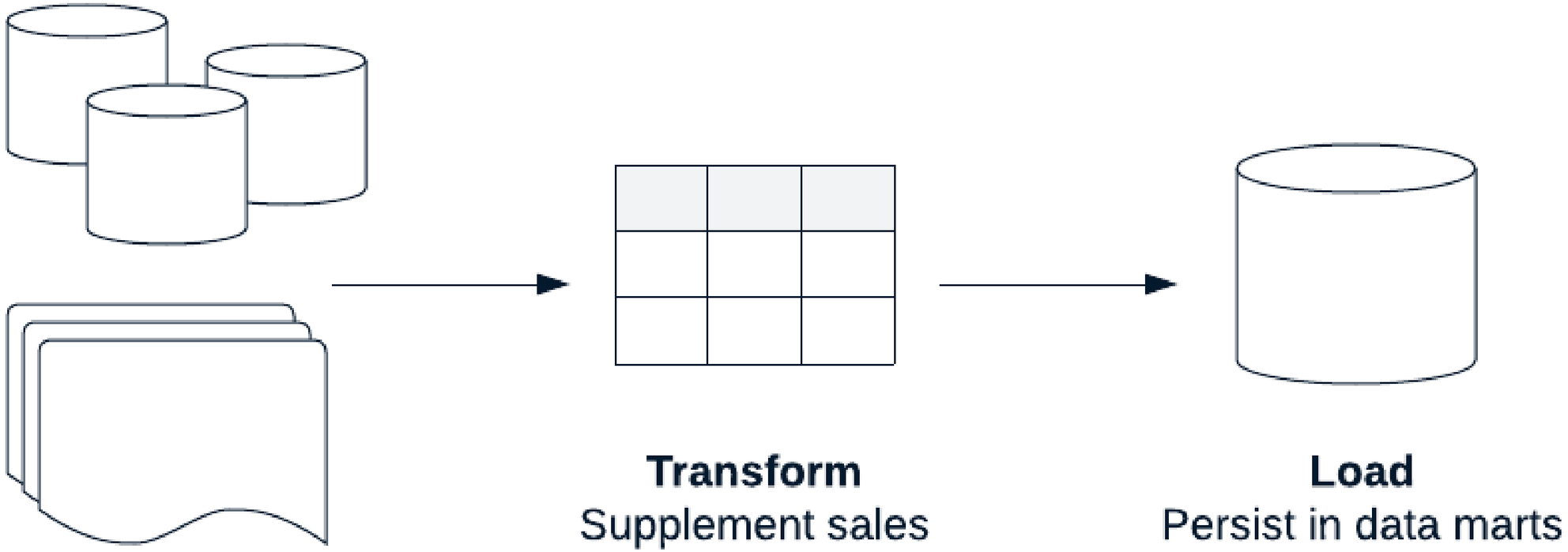


Extract
Item-level sales from ERP

Transform
Remove canceled transactions

Load
Store in file, deliver to client

Data ingestion pipeline

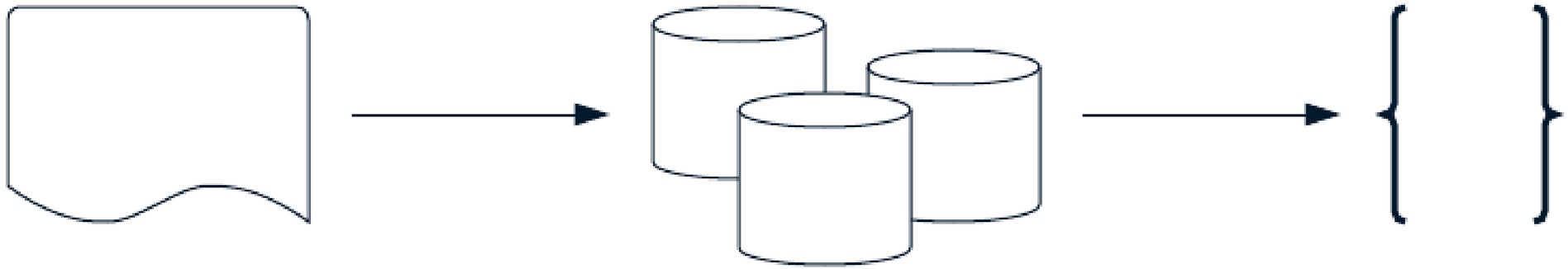


Extract
Query from data warehouse, pull from weather API

Transform
Supplement sales data, join with weather

Load
Persist in data marts for analytics team

Designing ELT pipelines



Extract
File from operations manager

Load
Load CSV file into data warehouse

Transform
Stored-procedure to model data

ELT is best applied when:

Designing data pipelines

A thorough **design process** helps to ensure that the right solution is implemented, and can mitigate wasted time later in the development process.

- Understand source system details
- Determine nature of transformations
- Ensure persisted data is accessible
- Align stakeholders on implementation details

Qualities of great data pipelines

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Building quality data pipelines

Resiliency

- Handle routine failures
- Automatically retry on failures

Idempotency

- A data pipeline can be run multiple times, and the output remains the same

Scalability

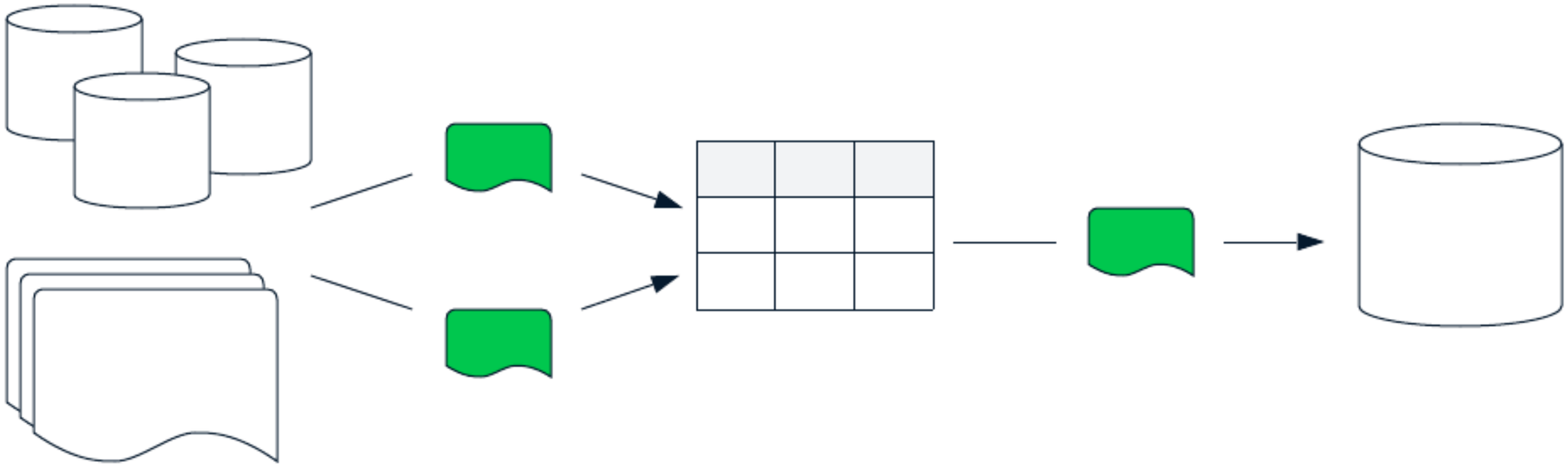
- Large amounts of data
- High frequency of invocations

Transparency

- Avoid black-box transformations
- Well-tested and documented

Data persistence

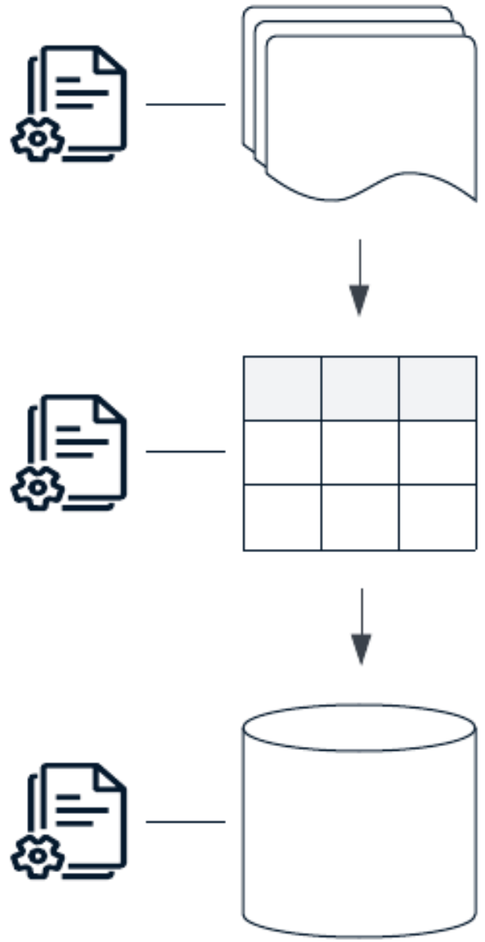
- Allows for pipeline to be rerun from last point of failure
- Easy to document the journey that data takes throughout the pipeline



Data lineage

Definition:

Documenting the journey that data takes through a data pipeline



- Increases transparency of data solutions
- Instills trust in data consumers
- Provides a starting point for troubleshooting

Ensuring a data pipeline works as expected

Before deployment:

- Unit tests
- End-to-end testing
  - Small and large data
  - Empty files
  - Bad data
- Code review

In production:

- Logging
- Alerting upon retries and failures.
- Communicate with data consumers
- Check final storage medium.