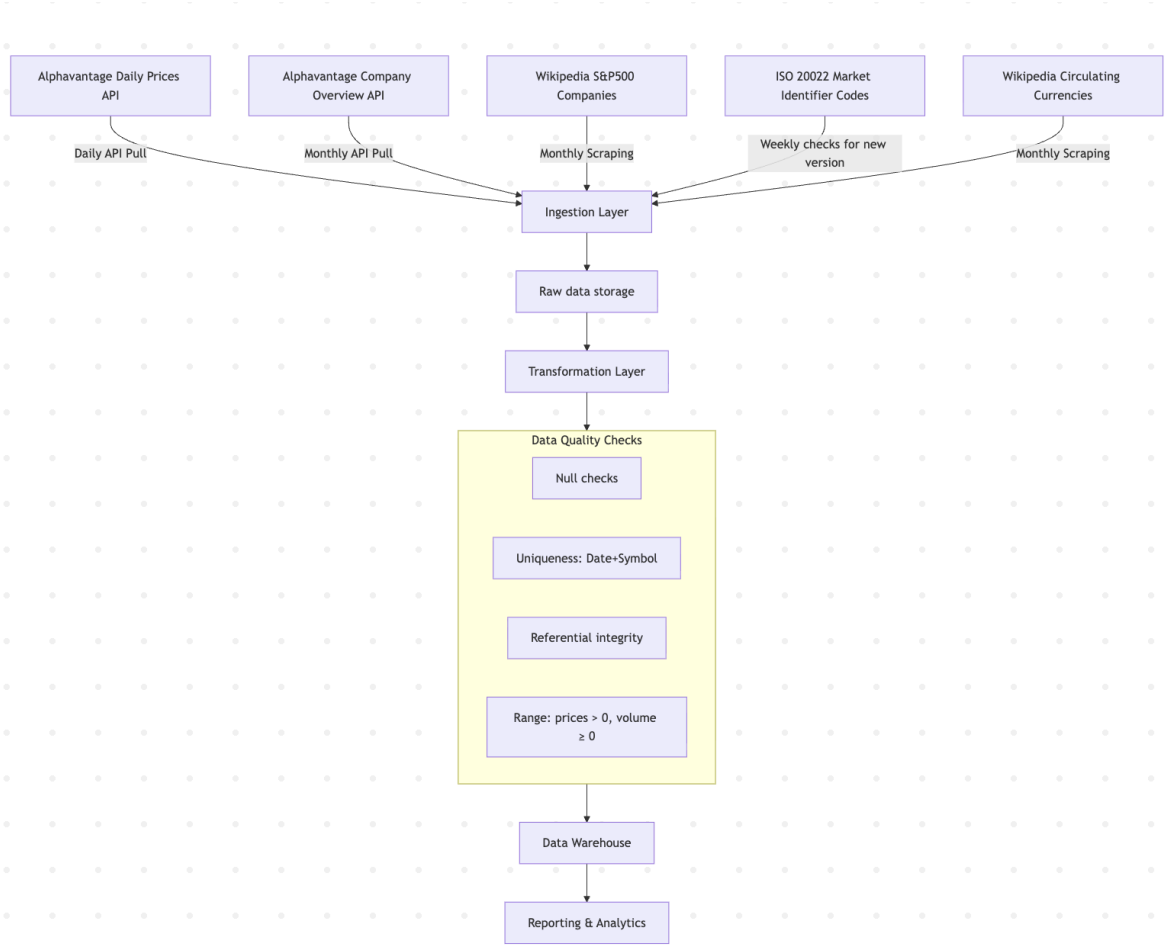
Data flow



Data Architecture & Data Flow

The project integrates four data sources:

1. **Alphavantage Daily Prices** (API, refreshed daily) – TIME_SERIES_DAILY example
2. **Alphavantage Company Overview** (API, refreshed monthly) – OVERVIEW example
3. **Wikipedia — List of S&P 500 Companies** (scraped into CSV, refreshed monthly) – Wikipedia S&P 500 component stocks
4. **ISO 20022 Market Identifier Codes (MIC)** (CSV file, refreshed weekly) – ISO 20022 MIC
5. **Wikipedia — List of circulating currencies** (scraped into CSV, refreshed monthly) - https://en.wikipedia.org/wiki/List_of_circulating_currencies

Ingestion Layer

- **Alphavantage data** (prices and overviews) is collected with scheduled API pulls.
- The **Wikipedia S&P 500 list** is scraped monthly and saved as CSV.
- **ISO 20022 MIC** is downloaded as CSV and checked weekly for updates.
- All ingestion tasks are orchestrated with **Apache Airflow**.
- Refresh frequencies:
  - Daily → stock prices
  - Monthly → company overviews & S&P 500 list
  - Weekly → MIC data

Storage Layer

- All ingested files (API pulls, CSVs) are stored in a **S3 object storage** in their original form for traceability.
- Data is read from raw storage directly into transformation processes.

Processing & Transformation

- Data is transformed into a **star schema** using for example **Spark**.
- Transformations include:
  - Parsing API/CSV data into structured tables
  - Key generation (surrogate keys for fact and dimension tables)
  - Type casting and schema alignment across sources
  - Applying data quality checks
- The **Wikipedia CSV** enriches DimCompany with ticker symbols and company details.
- **MIC data** is integrated into DimExchange to standardize exchange identifiers and allow consistent joins with company listings.

Data Quality Checks

- **Null checks** on numeric fields (Open, High, Low, Close, Volume)
- **Uniqueness** of (Date, Symbol) in fact table
- **Referential integrity** between fact and dimension tables (no “orphan” fact records)
- **Range checks** (prices > 0, volume ≥ 0)

Warehouse Layer

- The dimensional model is stored in a **cloud data warehouse.**
- **Fact Table**: one row per company per trading day
- **Dimensions**:
  - DimDate (calendar breakdown: year, month, day, quarter, etc.)
  - DimCompany (SCD Type 2, with attributes from Alphavantage and Wikipedia)
  - DimExchange (with MIC integration, SCD Type 2)
  - Sector/Industry attributes embedded in DimCompany

Reporting & Analytics

- BI tools (Power BI, Tableau, Metabase, etc.) connect to the warehouse.
- Enable dashboards and reports for:
  - Daily stock movements
  - Sector or industry comparisons
  - Exchange-level analysis using standardized MIC codes
- MIC integration ensures globally consistent exchange reporting.

```
flowchart TD
    A[Alphavantage Daily Prices API] --> |Daily API Pull| B[Ingestion Layer]
    A2[Alphavantage Company Overview API] --> |Monthly API Pull| B
    A3[Wikipedia S&P500 Companies] --> |Monthly Scraping| B
    A4[ISO 20022 Market Identifier Codes] --> |Weekly checks for new versi
on| B
```

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A5[Wikipedia Circulating Currencies] --> |Monthly Scraping| B

B --> C[Raw data storage]
C --> D[Transformation Layer]

E --> F[Reporting & Analytics]

subgraph DataQuality[Data Quality Checks]
   Q1[Null checks]
   Q2[Uniqueness: Date+Symbol]
   Q3[Referential integrity]
   Q4[Range: prices > 0, volume ≥ 0]
end

D --> DataQuality --> E[Data Warehouse]
```