DATA SOURCES LAYER

- SCADA/EMS Systems
- Weather APIs
- Market Data
- Historical Archives
- Forecast Data
- Topology Changes

INGESTION LAYER

- Python/Julia API Clients
- Kafka Consumers (Real-time)
- Batch Extractors (Scheduled)
- File Watchers (S3/Local)

RAW DATA STORAGE

- S3/MinIO (Data Lake)
- TimescaleDB (Time-series)
- PostgreSQL (Metadata)

TRANSFORMATION LAYER (Airflow)

- Data Validation (Great Expectations)
- Cleaning & Normalization
- Feature Engineering
- Format Conversion (to PowerSystems.jl)

PROCESSED DATA STORAGE

- Parquet Files (Columnar)
- HDF5 (Julia-optimized)
- PostgreSQL (Relational queries)

POWERLASCOPF.jl EXECUTION LAYER

- Data Loading Module
- ADMM/APP Solver Engine
- Distributed Computing (Julia)
- Results Aggregation

RESULTS & ANALYTICS LAYER

- Results Database (PostgreSQL/TimescaleDB)
- Visualization Dashboard
- Report Gen.
- API Endpoints