APEX Rules Engine

`Java` `23` `Maven` `3.8+` `License` `Apache 2.0`

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A powerful expression processor for Java applications with comprehensive data source integration, **external data-source reference system**, scenario-based configuration management, and enterprise-grade YAML validation.

Quick Start

Interactive Playground (Recommended)

```
cd apex-playground
mvn spring-boot:run
# Access at http://localhost:8081/playground
```

REST API

```
cd apex-rest-api
mvn spring-boot:run
# Access Swagger UI at http://localhost:8080/swagger-ui.html
```

Run Demonstrations

```
cd apex-demo
# 🆕 External Data-Source Reference Demos (APEX 2.1)
mvn exec:java -Dexec.mainClass="dev.mars.apex.demo.examples.SimplePostgreSQLLookupDemo"
mvn exec:java -Dexec.mainClass="dev.mars.apex.demo.examples.PostgreSQLLookupDemo"
mvn exec:java -Dexec.mainClass="dev.mars.apex.demo.examples.ExternalDataSourceWorkingDemo"

# Bootstrap demos (complete end-to-end scenarios)
mvn exec:java -Dexec.mainClass="dev.mars.apex.demo.bootstrap.OtcOptionsBootstrapDemo"
mvn exec:java -Dexec.mainClass="dev.mars.apex.demo.bootstrap.CommoditySwapBootstrapDemo"

# Lookup pattern examples
mvn exec:java -Dexec.mainClass="dev.mars.apex.demo.lookups.SimpleFieldLookupDemo"
```

Key Features

🆕 APEX 2.1 - External Data-Source Reference System

- **Clean Architecture**: Separation of infrastructure and business logic configurations
- **Configuration Caching**: Automatic caching of external configurations for performance
- **Reusable Components**: Share data-source configurations across multiple rule sets

- **Enterprise Scalability**: Environment-specific infrastructure with shared business logic

Core Features

- **Interactive Playground**: 4-panel web interface for real-time rule development and testing
- **Scenario-Based Configuration**: Centralized management and routing of data processing pipelines
- **External Data Integration**: Connect to databases, REST APIs, file systems, and caches
- **YAML Dataset Enrichment**: Embed reference data directly in configuration files
- **Financial Services Ready**: OTC derivatives validation, regulatory compliance, risk assessment
- **Enterprise Features**: Connection pooling, health monitoring, caching, circuit breakers
- **100% Test Coverage**: Comprehensive testing with cross-browser UI support

🚀 External Data-Source Reference System

APEX 2.1 introduces a revolutionary **external data-source reference system** that enables clean architecture and enterprise-grade configuration management.

Clean Separation of Concerns

Traditional Approach (Mixed Configuration):

```yaml
# Everything mixed together - infrastructure + business logic
metadata:
  name: "Legacy Configuration"

data-sources:  # Infrastructure mixed with business logic
  - name: "customer-database"
    type: "database"
    connection:
      url: "jdbc:postgresql://localhost:5432/customers"
      username: "user"
      password: "pass"

enrichments:  # Business logic
  - id: "customer-lookup"
    type: "lookup-enrichment"
    # ... business logic configuration
```

Modern Approach (Clean Architecture):

```yaml
# Business Logic Configuration (Clean and Focused)
metadata:
  name: "Modern Configuration"
  version: "2.1.0"

# External data-source references (infrastructure configuration - reusable)
data-source-refs:
  - name: "customer-database"
    source: "data-sources/customer-database.yaml"  # External infrastructure file
    enabled: true

# Business logic enrichments (lean and focused)
enrichments:
  - id: "customer-lookup"
    type: "lookup-enrichment"
```

```
      lookup-config:
        lookup-dataset:
          data-source-ref: "customer-database"  # References external data-source
          query-ref: "getActiveCustomer"        # Named query from external config
```

```
# External Infrastructure Configuration (Reusable)
# File: data-sources/customer-database.yaml
metadata:
  name: "Customer Database Configuration"
  type: "external-data-config"

connection:
  type: "database"
  driver: "postgresql"
  url: "jdbc:postgresql://localhost:5432/customers"
  username: "${DB_USERNAME}"
  password: "${DB_PASSWORD}"
  pool:
    initial-size: 5
    max-size: 20

queries:
  getActiveCustomer:
    sql: "SELECT * FROM customers WHERE customer_id = :customerId AND status = 'ACTIVE'"
    parameters:
      - name: "customerId"
        type: "string"
        required: true
```
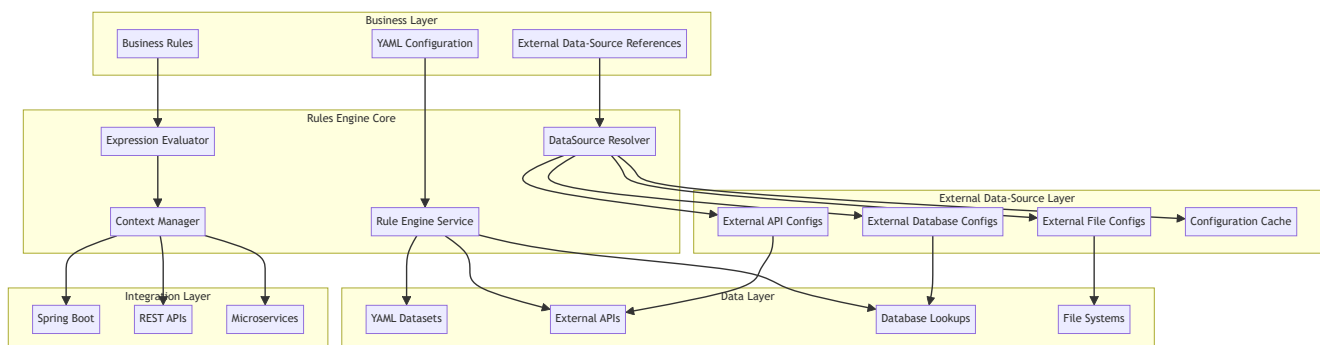
Key Benefits

- 🏛️ **Clean Architecture**: Infrastructure and business logic cleanly separated
- ♻️ **Reusable Components**: External data-source configurations shared across multiple rule sets
- ⚡ **Performance**: Configuration caching and connection pooling
- 🌍 **Environment Management**: Different infrastructure configurations for dev/test/prod
- 📈 **Enterprise Scalability**: Production-ready configuration management

Architecture

Project Structure

- **apex-core**: Core rules engine and **external data-source reference system**
- **apex-demo**: 16+ comprehensive demonstrations including **external data-source reference examples**
- **apex-playground**: Interactive web-based development environment
- **apex-rest-api**: Complete REST API with OpenAPI/Swagger documentation
- **docs**: Comprehensive documentation and guides including **external data-source reference guide**

Learning Paths

Quick Start (30 minutes)

1. **APEX Playground** (15 minutes) - Interactive experimentation
2. **Simple PostgreSQL Lookup Demo** (5 minutes) - External data-source references
3. **OTC Options Bootstrap Demo** (10 minutes) - Complete workflow

Developer Path (3-4 hours)

1. **External Data-Source Reference Demos** (45 minutes) - Modern clean architecture
2. **All Lookup Pattern Examples** (60 minutes) - Master data enrichment
3. **All Bootstrap Demonstrations** (120 minutes) - Complete financial workflows
4. **Advanced Feature Demos** (60-90 minutes) - Technical deep dive

NEW External Data-Source Reference Path (1-2 hours)

1. **SimplePostgreSQLLookupDemo** (20 minutes) - Basic external references
2. **PostgreSQLLookupDemo** (30 minutes) - Advanced multi-table lookups
3. **ExternalDataSourceWorkingDemo** (30 minutes) - Production-ready patterns
4. **Documentation Review** (30 minutes) - APEX YAML Reference and Data Management Guide

Production Implementation (4-6 hours)

1. **Complete Demo Ecosystem** (180 minutes) - All 16 demonstrations
2. **Documentation Deep Dive** (120-180 minutes) - All 6 guides
3. **Custom Implementation** (varies) - Build your own configurations

Documentation

Essential Guides

- **APEX Playground** - Interactive development environment
- **Rules Engine User Guide** - Complete user documentation
- **Technical Reference** - Architecture and implementation
- **Financial Services Guide** - Domain-specific patterns
- **Bootstrap Demos Guide** - 16 comprehensive demonstrations
- **REST API Guide** - Complete HTTP API reference
- **Data Management Guide** - Data integration and management

Quick Reference

- **Configuration Questions**: Rules Engine User Guide

- **Implementation Questions**: Technical Reference
- **Financial Services Questions**: Financial Services Guide

Use Cases

Perfect For

- **Currency Reference Data**: ISO currency codes with metadata
- **Regulatory Compliance**: MiFID II, EMIR, Dodd-Frank reporting
- **OTC Derivatives Validation**: Multi-tier validation framework
- **Trade Settlement**: Post-trade processing and auto-repair workflows
- **Risk Assessment**: Credit, market, and operational risk scoring

Data Integration

- **Static Reference Data** (< 100 records): Use YAML Datasets
- **Transactional Data**: Use **External Database References** (PostgreSQL, MySQL, Oracle)
- **Real-time Data**: Use **External API References** with caching
- **Batch Data**: Use **External File References** (CSV, JSON, XML)
- NEW **Clean Architecture**: Use **External Data-Source References** for separation of concerns

Requirements

- Java 21+
- Maven 3.6+
- PostgreSQL (for database demos)

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Getting Help

NEW External Data-Source Reference System

1. **APEX YAML Reference Guide** - Complete external data-source reference syntax
2. **APEX Data Management Guide** - Section 16: External Data Source Integration
3. **External Data-Source Reference Demos** - SimplePostgreSQLLookupDemo, PostgreSQLLookupDemo, ExternalDataSourceWorkingDemo

General Documentation

1. Start with the **APEX Playground** for hands-on experience
2. Review the **Bootstrap Demos Guide** for practical examples
3. Check the **Rules Engine User Guide** for comprehensive documentation
4. Explore the **16+ demonstrations** in the `apex-demo` module