Oracle Event-Driven Architecture Suite, CEP, SOA, and Web 2.0

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Event-Driven Architecture Suite, CEP, SOA, and Web 2.0

TODAY’S AGENDA

• Event Driven Application Platforms
  • Business as Events
  • Approaches to ED-SOA Solution Architectures
• Tradeweb’s Industry leading approach
  • A Production Implementation Overview
• Oracle EDA Technologies and Strategy
  • Oracle CEP, BAM
  • Future EDA Product Integration
• The Instantly Responsive Enterprise
  • Enterprise Strength – Scalable, High Available EDA Platform
    Demonstration integrating Oracle CEP and Coherence
• Summary
Event-Driven Applications

Need to support one or more of:
- High volume
- Continuous streaming
- Sub-millisecond latency
- Disparate sources
- Time window processing
- Complex pattern matching

- Algorithmic trading
- Intrusion detection systems
- Military asset allocation
- Distributed order orchestration
- Asset management
- Algorithmic trading
- Intrusion detection systems
- Military asset allocation
- Distributed order orchestration
- Asset management

Reponses to calamities – earthquake, flooding

‘Negative Working Capital’ inventory management

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Event Processing Implementations

Characterize the business problem, then identify the event processing model(s)

Event Processing

Event Driven Apps
- C/C++ Legacy App Replacement
- Algorithmic Trading
- Military Applications
- Sensor Processing

Improved Visibility

Track-and-Trace
- Tracking “Things”
- Logistics/Transportation
- Fraud Detection/Money Laundering

Characterization
- Tracking “Trends”
- Airline Terminal Operations
- Targeted Marketing
- Customer Retention

“Situational Awareness”

Can be used together

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Two CEP Implementation Patterns
Event-Driven SOA and Event-Driven Architecture (EDA)

Ticketing ➔ Service Bus ➔ Reservations

Flight Operations
- flight-open
- flight-boarding
- flight-closed
- flight-push-back
- flight-wheels-up

Baggage Handling
- bag-tracking
- bag-in-container
- container-on-plane

Service Bus
- check-in
- bag-check
- passenger-on
- passenger-off

Event Server
- “Situational Awareness”
  - missing-bag
  - flight-delay
  - statistics
  - lost-bag

Legend
- SOA Message ➔ Event

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Tradeweb Builds Markets

“Tradeweb is a leader in the over-the-counter multi-asset class online marketplace and a pioneer in the development of pre-trade liquidity discovery, electronic trading and trade processing.”

• Historically - Fixed Income & Derivatives online marketplace

• In 2004, Thomson Corp. bought TradeWeb

• In 2008, strategic partnership with 10 leading global broker dealers
The Challenge and Requirements

• High volume of incoming data delivered in bursts
• Low latency, high throughput message processing
• Ability to modify processing parameters on-the-fly
• Quickly distribute processing results to other systems
• Java-based, easy to configure and extend
• Minimal number of vendors to develop solution
• Many different applications and processes consuming the output data
The Solution

- JRockit Real Time JVM
- Oracle CEP (WebLogic Event Server 2.0)
- Standard JMS Implementation
- Third-Party Distributed Cache
- Oracle 11g Database
- Red Hat Enterprise Server 5.0 / 64 bit
- 20GB Heap Size
Production Implementation
Key Points of an EDA Implementation

- Know your inputs and the metrics involved
- The development cycle for the first EDA project is long
- Determine if events are synchronous, asynchronous, or both
- Design event objects to contain only what is required
- Spring is your friend; learn how to use to it to your advantage
- Become one with Eclipse
- Adapters are good, but POJO’s are better
- OSGi factories are only necessary if sharing bundles
- Minimize streams for improved performance
- Many less-complex EPL rule statements are better than one large one
- Build in additional monitoring points beyond what is provided
- Assume a distributed cache will be employed and design accordingly
- Simplify, simplify, simplify!
Oracle EDA Suite
Complete Suite for Industrial Event Processing

REAL-TIME VISIBILITY & PROCESSING
- BAM
  - Alerts
  - Business Monitoring
- CEP
  - Event Feeds
  - Data Streams
  - Java-based Event Server

ROUTING & DATA SERVICES
- Oracle Service Bus
  - Routing
  - Transform
  - Mediation
- Data Integrator
  - ETL & Replication
  - Data Quality

CONNECTIVITY
- Adapters
  - Socket
  - DB
  - File
  - JMS
  - Industry Specific

ENTERPRISE PERFORMANCE & SCALABILITY
- JRockit VM
- JRockit RT
- Coherence
- J2EE Application Server
  (Oracle AS, WebLogic, WebSphere, JBoss)

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Focus on Event-Driven Architecture (EDA)

Lightweight, Low Latency, Extreme High Throughput, and Java-based Application Container

**Oracle Complex Event Processor**

### Enriched Streams
- From any source: data streams, web services, Java, Database

### Adapters
- Translate external events/data into Java objects for processing

### Processors
- Set of queries applied to the streams

### Listeners
- Handle triggers raised by the processors

### Events
- Implemented as JavaBean or Map

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- **Aggregated, correlate, filter data**
- Can Handle Unlimited Queries

- **Latency**
  - Microsecond Latency (Avg.)

- **Resulting Data**
  - fed to vast business opportunities with Java language

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The Power Of Today’s Event Processors

Streams
- Continuous input, often in high-volume
- Time ordered
- Does not end
- *Impossible to process / analyze in real-time with traditional relational database systems*

**Event Processing** provides a new data management infrastructure to support and analyze Streams in real-time.
In-Memory, Continuous Queries

- Event Processing Output
  - New stream filtered for specific criteria, e.g. stock price > $22
  - Scrolling, time-based window metrics, e.g. average # of stock trades in the last hour, updated every 5 minutes
  - Notification of detected event patterns, e.g. price changes A, B and C occurred within 15 minute window

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Runs In-Memory (not in Database)

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Logic is defined through Continuous Queries on the data

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Example: Stock Trading “W” Pattern

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The Next Generation Technology Platform

• **Lightweight Java Application Server**
  - Full environment for building and running Java applications
  - Services -- Security, Logging, User Mgmt

• **High Throughput**
  - Hundreds of thousands of events/second

• **Event Processing infrastructure**
  - CEP Engine
  - Event Processing programming constructs and services
  - Time-critical streaming
  - Well-known event processing language

• **Easy-to-Use Development Environment**
  - Spring Framework, POJO

• **Eclipse-based tooling**
  - Plugins for EDA Application Development

• **Multiple-choice JVM**
  - JRockit or WebLogic Real Time
    - Unique JVM Tools

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EDA Advanced Application Model

Service1
Export
<<OSGI Service>>

Service2
Import
<<OSGI Service>>

OSGI Bundle/Spring Application Context

Data Source
Adapter
Stream
Processor
Queries
Stream
Listener
<<Sink>>

<<Source>>

Queries

Streams

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Event Processing Networks (EPN)

EDA is composed of several processing steps intermingled with user logic.

This arrangement or network of event processing components is called an event processing network (EPN).
Eclipse plug-ins extend WTP, support OSGI development
Oracle CEP 10.3g (Visualizer)

Simplified Administration and Deployment Management,
Oracle CEP 10.3g (Visualizer)

Advanced EDA Event Processing Network Performance Tuning
Oracle CEP 10.3g (Visualizer)
Dynamic Continuous Query Event Processing Language Injection
Oracle Business Activity Monitoring
Event Correlation for Business Users

- **Monitor** business processes & services in real-time
  - Key Performance Indicators (KPIs)
  - Service-Level Agreements (SLAs)

- **Analyze** events as they occur
  - Correlate events & KPIs
  - Identify trends as they emerge
  - Alert users to bottlenecks & solutions

- **Act** on current conditions
  - Event-driven alerts
  - Real-time dashboards
  - BPEL processes & web services integration
The Oracle BAM Solution

- Enables business operations workers and managers to
  - Monitor, analyze and act
- Provides IT with a set of web-based applications to:
  - **Capture** real-time data from any database, message queue or application
  - **Construct** data objects for analysis
  - **Define** metrics, dashboards, alerts & automated actions

BAM Architect & Administrator

BAM Active Studio

BAM Active Viewer
The Oracle BAM Technical Advantage

- **Business User Oriented**
  - Dashboards and alerts without writing a single line of code
  - Web-based AJAX application, with no downloads or installs

- **Real-time Active Data**
  - Applications don’t poll the server for updates
  - Streams delta changes on continuous hierarchical queries: Active Data
  - Updates are multiplexed over a single server connection for all open queries
  - Updates in dimensions create ActiveData in all of the rows of linked fact tables: Active Lookups

- **Action Framework**
  - Business users can access web services integration for actions directly from their dashboards/alerts

- **Event Driven Alerts**
  - Immediate evaluation when thresholds are crossed, *without* running periodic queries.
  - Alerts on non-events, for example alerts can detect sequences like: event A happened, and then event B happened, but event C did not happen within 10 minutes.

- **Seamless Wireless Recovery**
  - Automatic recovery from losing internet connectivity, without reloading the dashboard and without losing any messages

- **Scalability**
  - Supports thousands of events per second and hundreds of users on a 4x4 box

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Now for the Instantly Responsive Enterprise Advanced Technology (10.3g)
Oracle Coherence In-Memory Data Grid

- Coherence chosen to
  - provide reliable low-latency data management
  - Scale event model across massive data
  - plan for future data growth

- Coherence Delivers
  - Predictable Scalability
  - Low-latency
  - Reliability
  - Availability
Next for the Instantly Responsive Enterprise Advanced Technology (11g)

Rich Oracle Container Augmentation
- Rich SQL 99 Compliant continuous query language (*ANSII Standards*)
- SQL extensions for Pattern recognition
- 150+ Built in Maths & Stats functions
- Logging & Diagnostics
- Clustering through Coherence
- Caching through BDB
- Strong Integration to Oracle DB

Merging the Best of Breed Technologies
- Competitively Advanced
- Positioned to drive the EDA Market
Dynamic Trading Floor

Rahul Srivastava
Principal Solutions Architect
SOA/BPM/AITP Sales Consulting
Oracle’s Dynamic Trading Floor

Oracle on the Trading Floor

• Oracle Fusion Middleware is a low latency, high throughput platform that speeds up entry into new markets and opportunities.

Solution Components

– Oracle CEP
– Oracle Coherence
– Oracle JRockit Real Time
## Dynamic Trading Floor Value Propositions

<table>
<thead>
<tr>
<th></th>
<th>Challenges</th>
<th>Oracle Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low Latency</strong></td>
<td>Sustaining latency in trading execution application during high volume</td>
<td><strong>JRockit Real Time</strong> – provides consistent latency performance for any java based app</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Oracle CEP</strong> – Industry’s only low latency application container</td>
</tr>
<tr>
<td><strong>Pre-Trade Analytics</strong></td>
<td>Detecting and acting on ever complicated trading opportunities</td>
<td><strong>Oracle CEP</strong> – Industries low latency CEP and application container</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>JRockit Real Time</strong> – provides consistent latency performance so no opportunities is missed</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Coherence</strong> – provides scalable data for complicated analysis</td>
</tr>
<tr>
<td><strong>Risk Management</strong></td>
<td>Drive for real time visibility into risk requires increased access to data</td>
<td><strong>Coherence</strong> – Scalable data platform provides real time access to data for calculations</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Oracle CEP</strong> – Perform transaction by transaction risk calculations</td>
</tr>
</tbody>
</table>
Sellside Electronic Trading Architecture

- Market Data Providers
- Liquidity Pools
- Counterparties
- FIX Protocol
  - Proprietary
- FIX Engine
  - Proprietary
  - CameronFIX
  - Appia
  - TCM5
- Market Data Infrastructure
  - Proprietary
- Pre-Trade Applications
  - Proprietary
- Risk Management
  - Proprietary
- Trade Matching
- Order Management
- Back Office
- Sales/Traders
## Risk and Compliance Management

<table>
<thead>
<tr>
<th>Solution Description</th>
<th>A low latency, high throughput platform that speeds up entry into new markets and opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Case</td>
<td>Achieve real time exposure visibility of trade positions</td>
</tr>
<tr>
<td>Use Case</td>
<td>• Monitor Risk Profile (total of outstanding positions) of traders</td>
</tr>
<tr>
<td></td>
<td>– “Alert when John Doe’s positions exceed $20 Million”</td>
</tr>
<tr>
<td></td>
<td>– “Calculate average position for each trader for the last 60 minutes”</td>
</tr>
</tbody>
</table>
Solution Architecture (look familiar?)

CEP SERVER 0 JRockit Realtime JVM Container

Oracle CEP
- Order Message Feed Processing
  - Event Processing
  - Business Logic

Data Feed 1

Data Feed 2

Distributed Cache

CEP SERVER 1 JRockit Realtime JVM Container

Oracle CEP
- Order Message Feed Processing
  - Event Processing
  - Business Logic

BAM
Demonstration
Why Oracle is leading the EDA Market

• Deterministic, Real Time EDA Java Application Server

• Event-oriented Application Programming Model

• Business Analyst Oriented Development

• Pre-packaged Templates

• Low latency Real Time JRockit JVM, In-memory Coherence Data Grid

*Industries First and Only Enterprise Strength, Massively Scalable, Highly Available Event Driven Application Platform*
EDA at Open World

• S299460 – (Retail Track) Oracle SOA Suite in Retail: Event Processing in the Store, Distribution Center and Central Office
  • Monday 5:30PM - Palace Hotel Twin Peaks

• S298904 – (SOA and BPM Track) Oracle SOA Suite Process Monitoring: Oracle Business Activity Monitoring Implementation Best Practices
  • Tuesday 5:00PM - Marriott Salon 08

• S299462 - (Financial Services Track) Oracle SOA Suite in Financial Services: Complex Event Processing and Event-Driven SOA
  • Wednesday 1:00PM - Westin SF Market Street, Metropolitan II

• S298906 - (SOA and BPM Track) Event-Driven SOA: Real-Time Business Intelligence Situational Awareness Solutions Leveraging the Power of EDA
  • Thursday 1:30PM - Marriott Salon 14/15

DEMOgrounds

Mon. – Thurs.  Event Driven Architectures: Complex Event Processing and Business Activity Monitoring - A33
EDA at Open World

• S298974 – Oracle Business Activity Monitoring, Java Edition: What’s New in Oracle Business Activity Monitoring 11g
  • Sunday 2:30PM - Marriott Nob Hill CD
• S299013 – Oracle Event-Driven Architecture Suite, CEP, SOA, & Web 2.0
  • Sunday 3:45PM - Marriott Salon 07
• S299043 - Hands-on Lab: Oracle Business Activity Monitoring: Java Edition -- New to Business Activity Monitoring?
  • Monday 11:30AM & Tuesday 1:00PM - Marriott Golden Gate C2
• Oracle Continuous Query Language for Complex Event Processing
  • Tuesday 2:30PM - Marriott Golden Gate C2
• S298920 TradeWeb: Revolutionizing the Financial Front Office with Oracle Event-Driven Architecture Suite
  • Tuesday 4:00PM - Marriott Salon 06