



ORACLE
OPEN
WORLD

Your. Open. World.

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

Robin J. Smith

Oracle Product Management/Strategy Director

James Leary

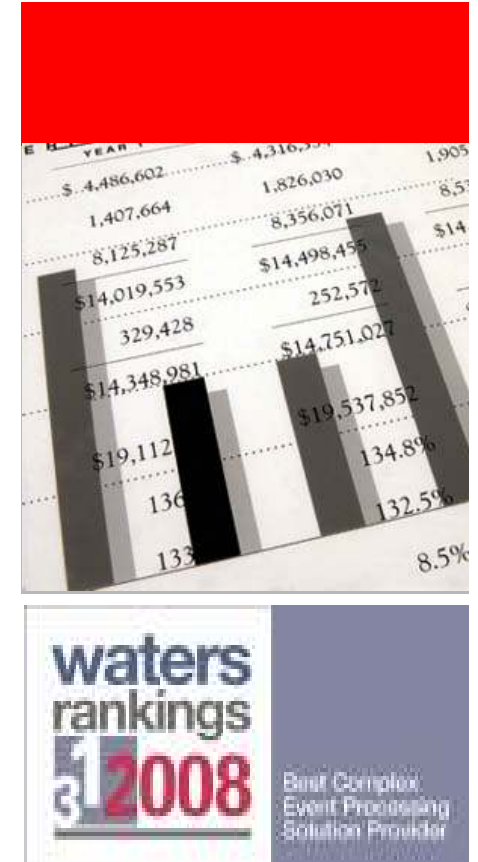
Tradeweb Vice President & Senior Architect, Data Mining Group

ORACLE®

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



ORACLE

Event-Driven Applications



Algorithmic trading



Asset management

Distributed order orchestration



Need to support one or more of:

- High volume
- Continuous streaming
- Sub-millisecond latency
- Disparate sources
- Time window processing
- Complex pattern matching



'Negative Working Capital' inventory management



- Intrusion detection systems
- Military asset allocation



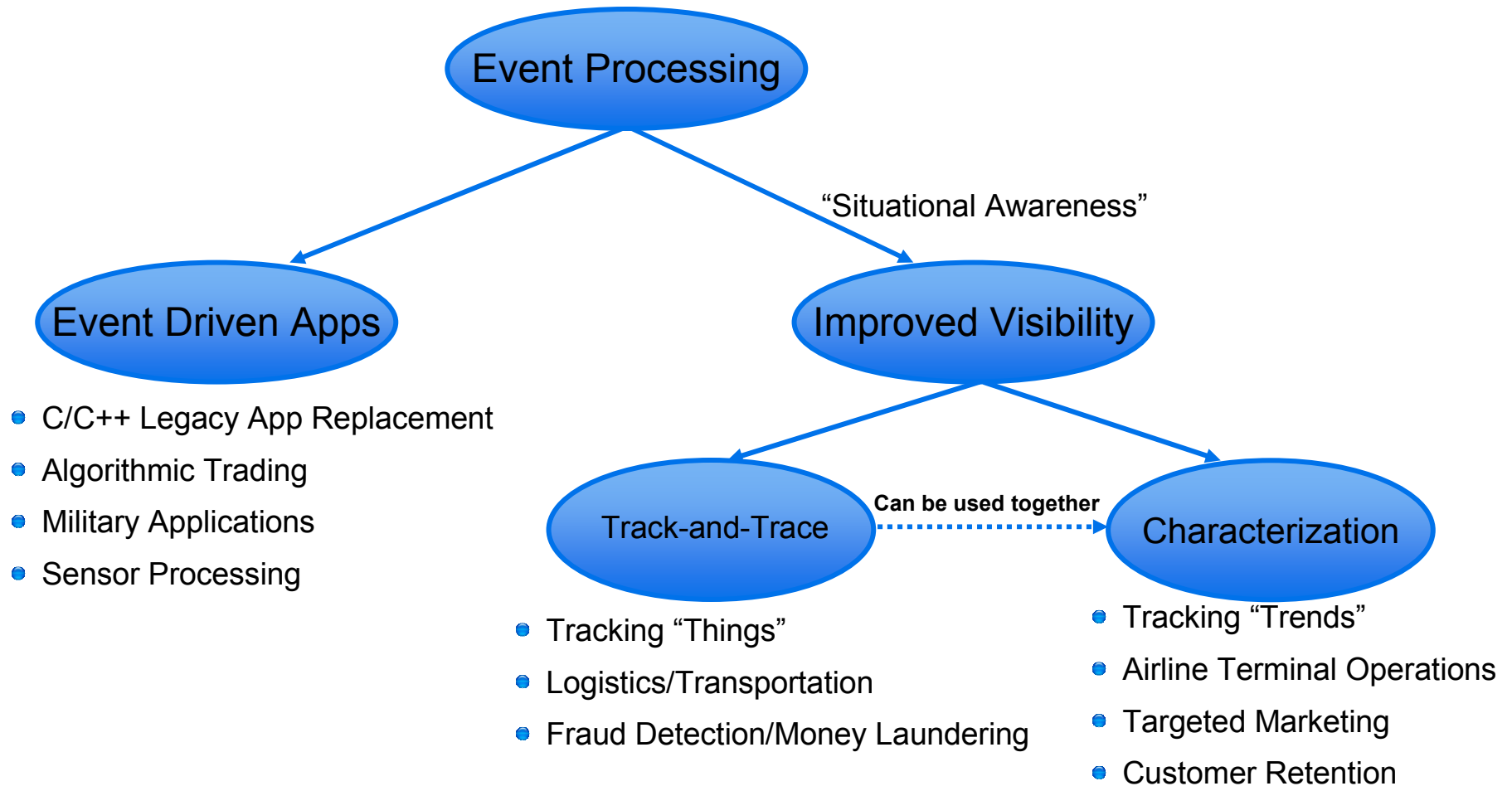
Reponses to calamities – earthquake, flooding



ORACLE

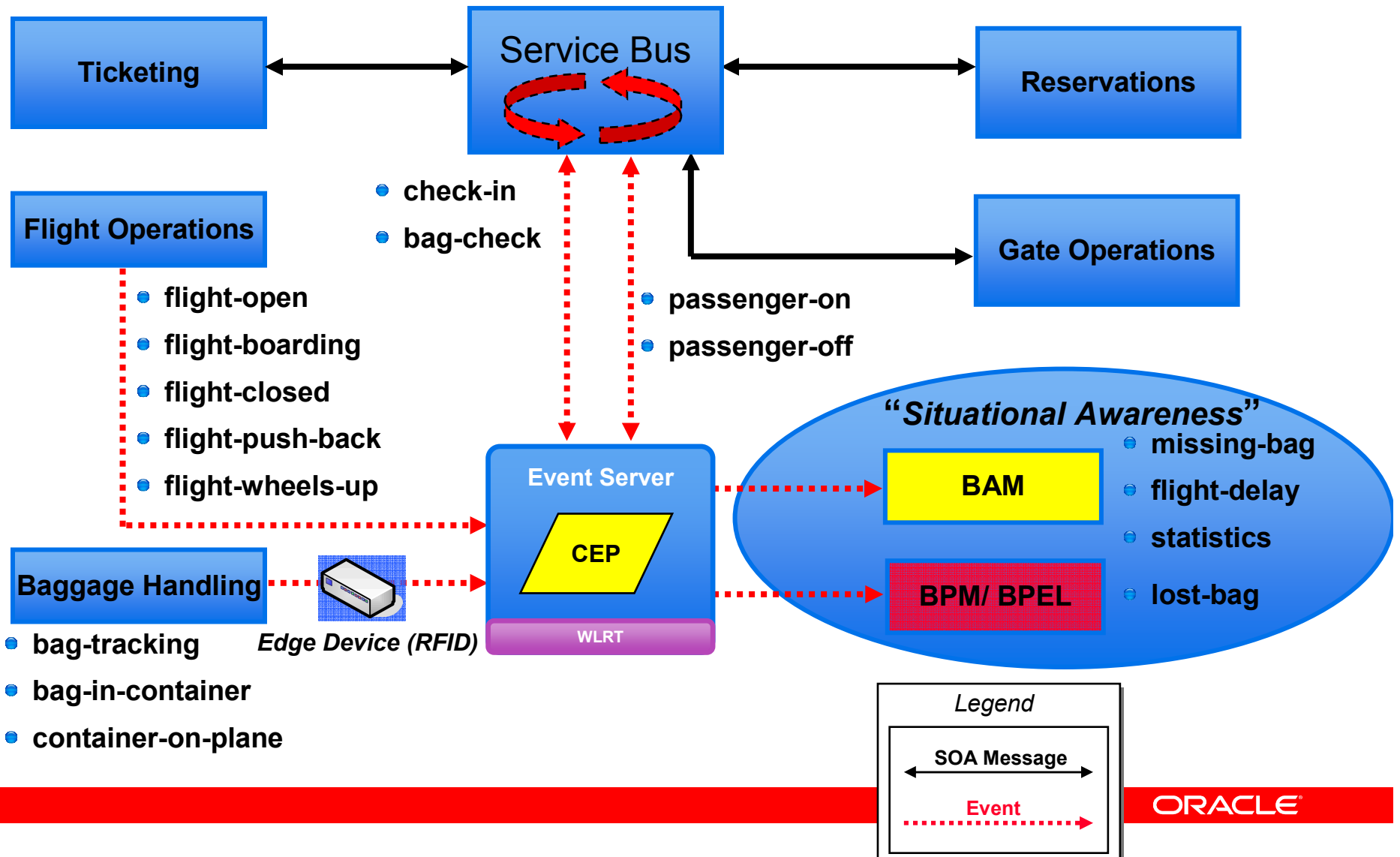
Event Processing Implementations

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



Two CEP Implementation Patterns

Event-Driven SOA and Event-Driven Architecture (EDA)



ORACLE



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



ORACLE®



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



ORACLE



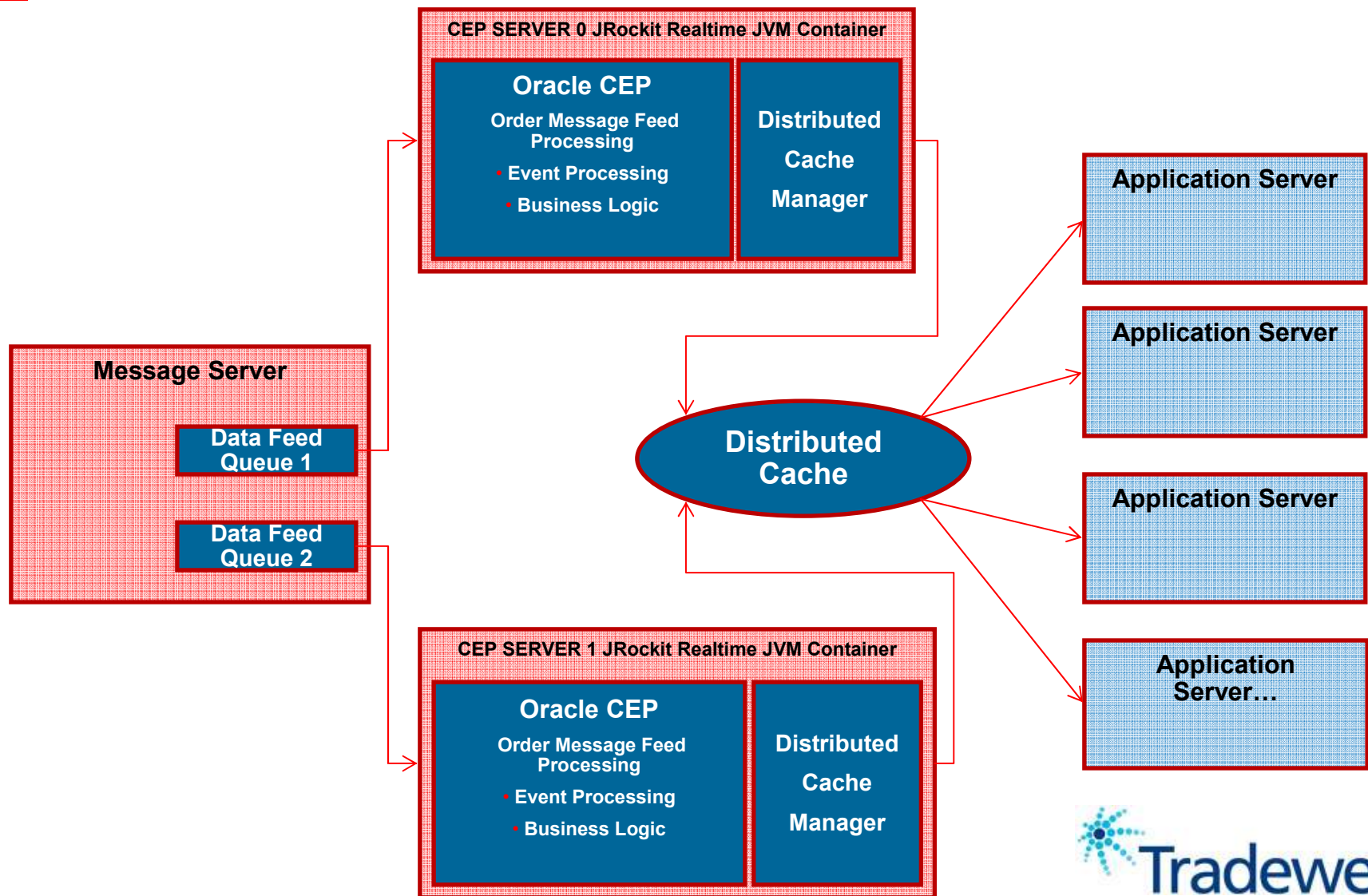
The Solution

- **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**



ORACLE

Production Implementation



ORACLE

Key Points of an EDA Implementation

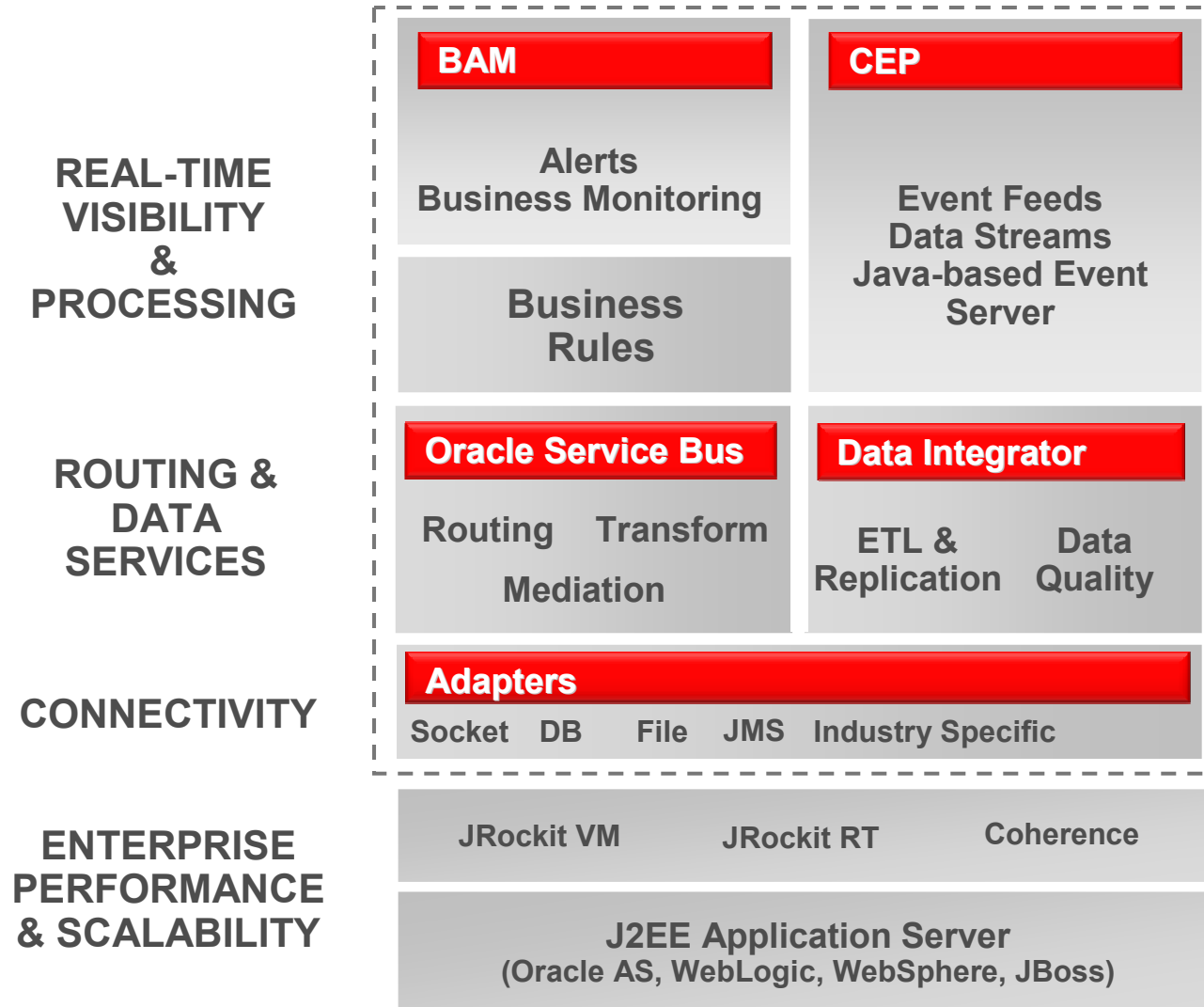
- Know your inputs and the metrics involved
- The development cycle for the first EDA project is long
- Determine if events are synchronous, asynchronous, or both
- Design event objects to contain only what is required
- Spring is your friend; learn how to use it to your advantage
- Become one with Eclipse
- 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

Oracle EDA Suite

Complete Suite for Industrial Event Processing



ORACLE

Focus on Event-Driven Architecture (EDA)

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

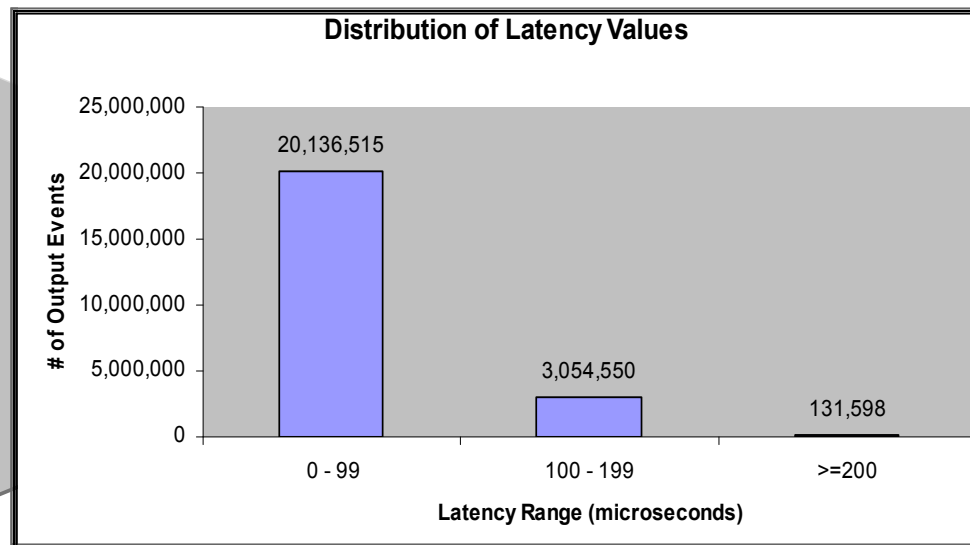
Oracle Complex Event Processor

▶ Enriched Streams

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

▶ Adapters

- Translate external events/data into java objects for processing



▶ Processors

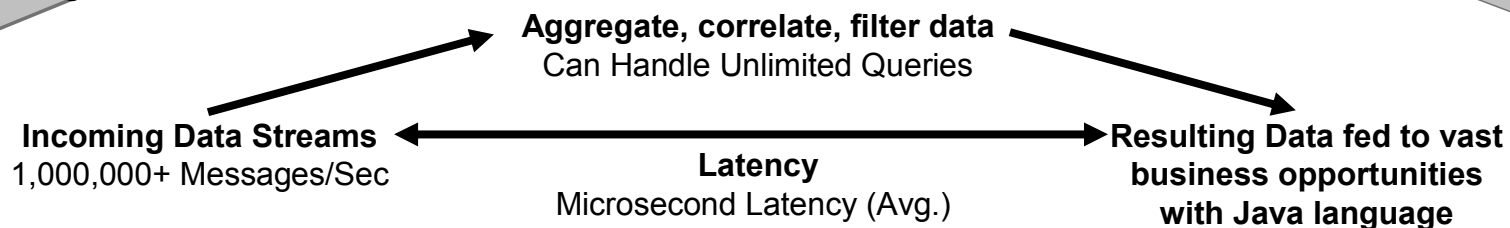
- Set of queries applied to the streams

▶ Listeners

- Handle triggers raised by the processors



▶ Events

- Implemented as JavaBean or Map



ORACLE

The Power Of Today's Event Processors



BA	BOEING	D	77.575	800	20080305 10:03:02.78
DD	DUPONT	D	41.575	3000	20080305 10:03:04.12
AA	ALCOA INC	D	20.125	1000	20080305 10:03:01.55
AXP	AMER EXPRESS CO	D	45.875	500	20080305 10:03:02.10
BA	BOEING	D	77.575	800	20080305 10:03:02.78
C	CTRGROUP	D	34.125	2000	20080305 10:03:03.05
CAT	CATERPILLAR	D	22.5	600	20080305 10:03:03.46
DD	DUPONT	D	41.575	3000	20080305 10:03:04.12
AA	ALCOA INC	D	20.125	1000	20080305 10:03:01.55
AXP	AMER EXPRESS CO	D	45.875	500	20080305 10:03:02.10
BA	BOEING	D	77.575	800	20080305 10:03:02.78
C	CTRGROUP	D	34.125	2000	20080305 10:03:03.05
CAT	CATERPILLAR	D	22.5	600	20080305 10:03:03.46
DD	DUPONT	D	41.575	3000	20080305 10:03:04.12
AA	ALCOA INC	D	20.125	1000	20080305 10:03:01.55
AXP	AMER EXPRESS CO	D	45.875	500	20080305 10:03:02.10
BA	BOEING	D	77.575	800	20080305 10:03:02.78

➤ Streams

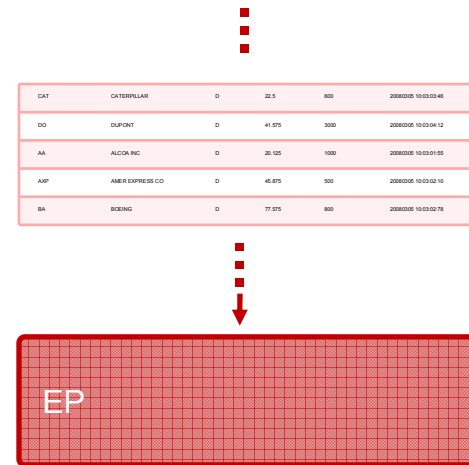
- Continuous input, often in high-volume
- Time ordered
- Does not end
- *Impossible to process / analyze in real-time with traditional relational database systems*

Event Processing provides a new data management infrastructure to support and analyze Streams in real-time

In-Memory, Continuous Queries

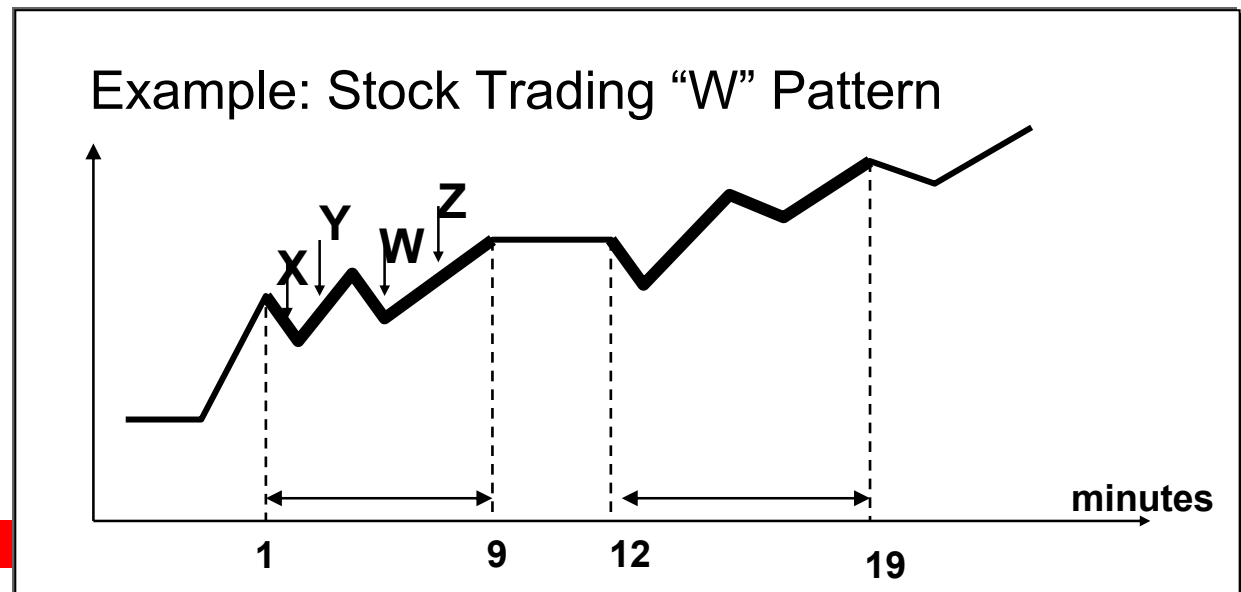
➤ Event Processing Output

- 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

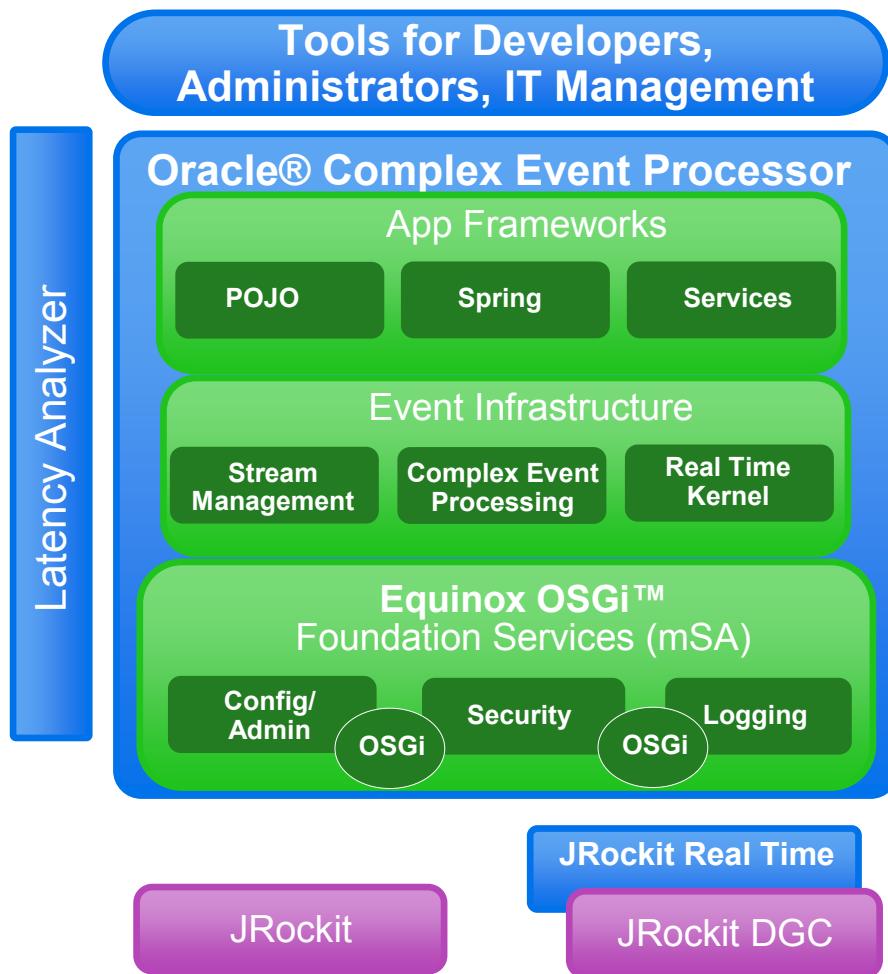


Runs In-Memory (not in Database)

Logic is defined through Continuous Queries on the data



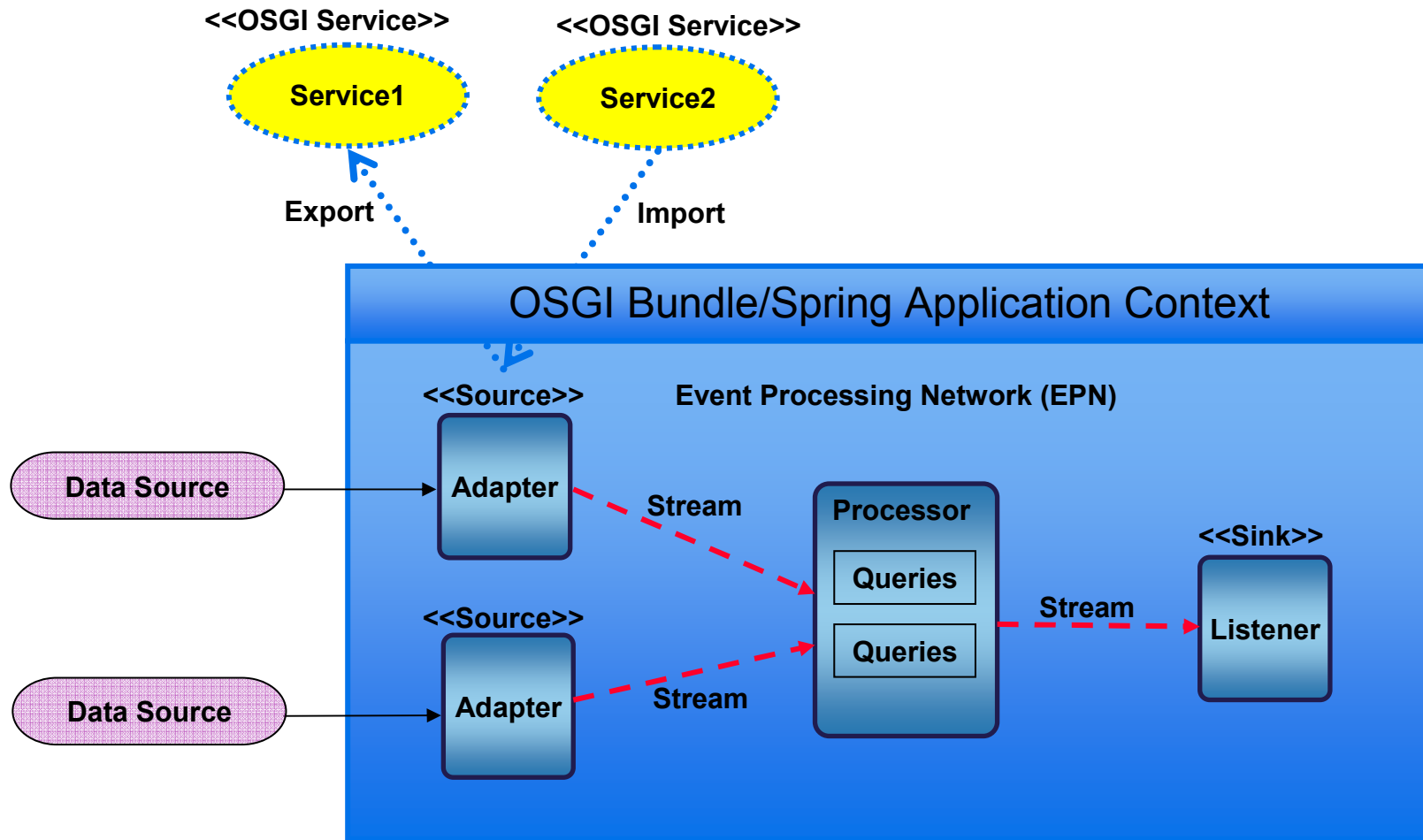
The Next Generation Technology Platform



- **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

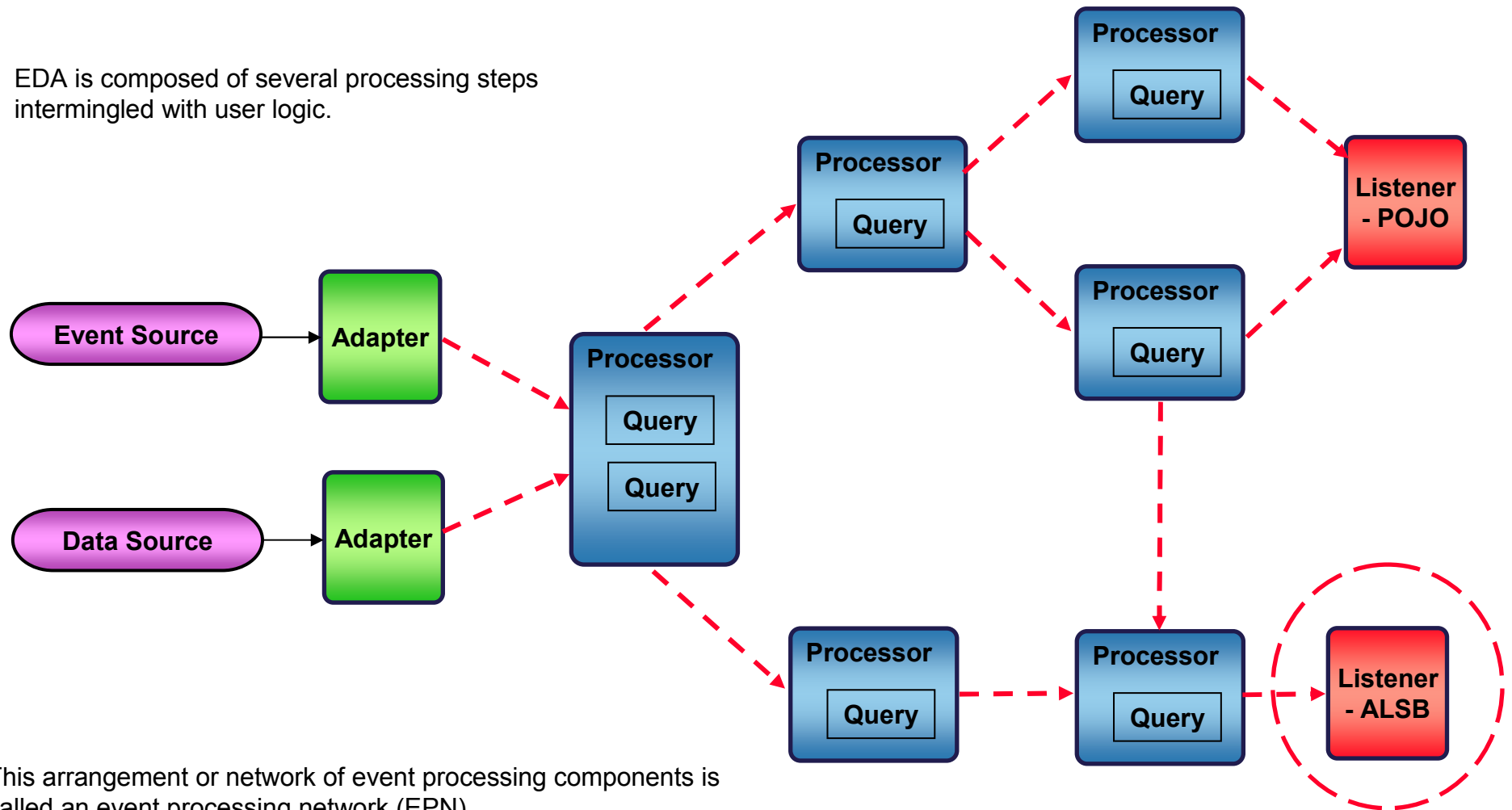
ORACLE®

EDA Advanced Application Model



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).

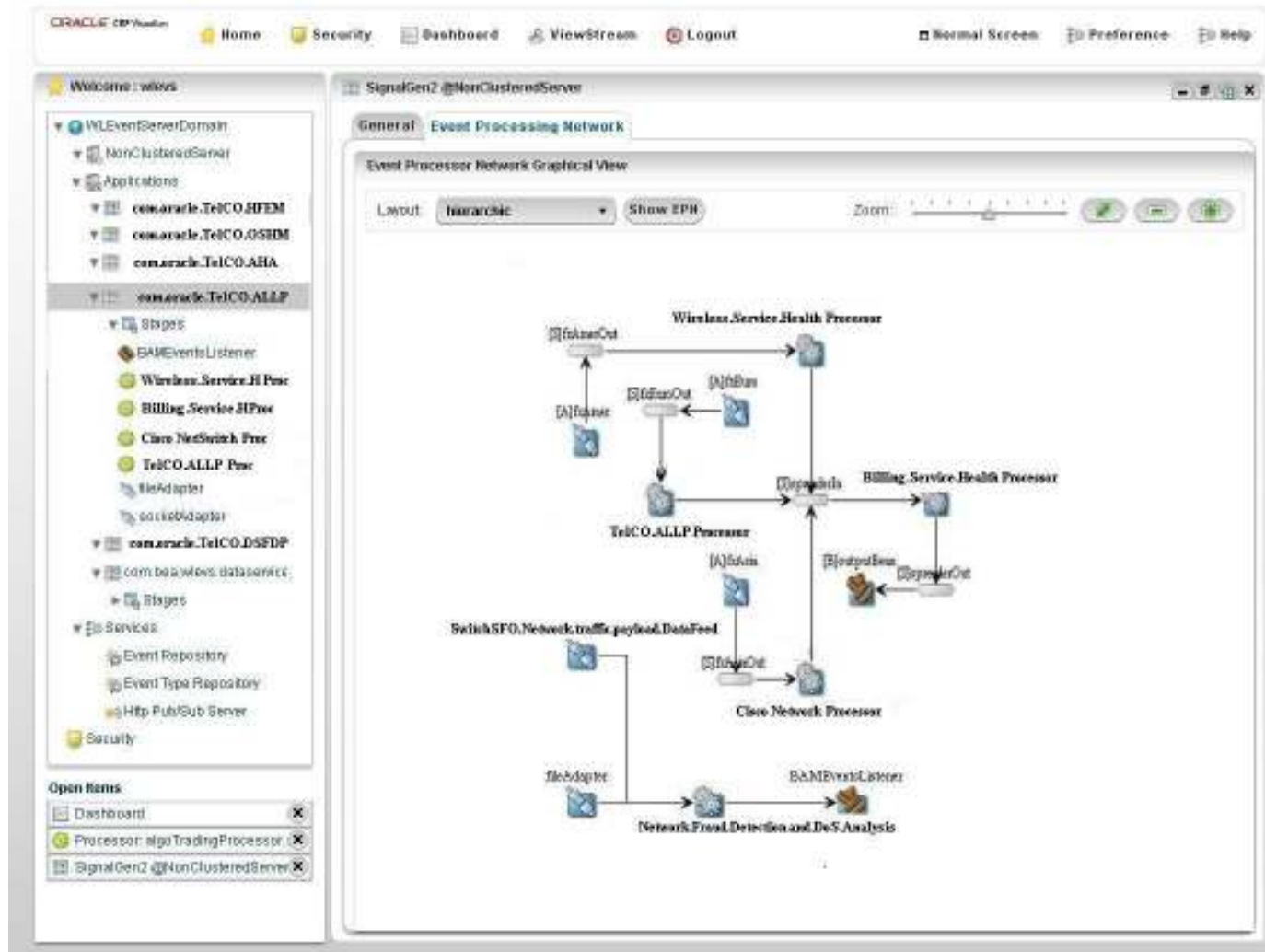
Eclipse plug-ins extend WTP, support OSGI development

The screenshot displays the Eclipse IDE interface for a Java project named 'algo_trading'. The Package Explorer on the left shows the project structure, including source code, dependencies, and build files. The main editor area shows a diagram of the OSGI bundle structure with components like 'fileAdapter', 'socketAdapter', 'algoTradingProcessor', and 'algoTradingBea'. A 'New Event Server Application Project' dialog is open, showing options for project name, location, and target runtime (WebLogic Event Server v2.0). The Servers view at the bottom shows the BEA Event Server v2.0 is started. The Console view displays performance metrics for the BEA Event Server v2.0.

Throughput (msg per second)	Average latency (microseconds)
7725	76
6565	90
7953	72

Oracle CEP 10.3g (Visualizer)

Simplified Administration and Deployment Management,



Oracle CEP 10.3g (Visualizer)

Advanced EDA Event Processing Network Performance Tuning

The screenshot displays the Oracle CEP 10.3g Visualizer interface. The top navigation bar includes 'Home', 'Security', 'Dashboard', 'ViewStream', and 'Logout'. The left sidebar shows a tree view of the system architecture, including 'WLEventServerDomain', 'NonClusteredServer', and various 'com.oracle.TelCO' applications and stages. The main dashboard area is titled 'Management Events' and shows a message: 'The profile [PerApp] has been added.' Below this, there is a 'Warning' section and a 'Performance Monitoring' section with two line graphs: 'Average Throughput (Number of Events)' and 'Latency (Microseconds)'. The 'Latency' graph includes a 'Threshold: 180' indicator. At the bottom, a table lists diagnostic profiles.

Profile Name	Application	Stage	Throughput	Average Latency	Max Latency	Operation
PerApp	SignalGen2	algoTradingProcess06		66609	NaN	Remove

Oracle CEP 10.3g (Visualizer)

Dynamic Continuous Query Event Processing Language Injection

The screenshot displays the Oracle CEP 10.3g Visualizer interface. The top navigation bar includes links for Home, Security, Dashboard, ViewStream, and Logout. The main window is titled "Processor: algoTradingProcessor @NonClusteredServer" and features tabs for General, Record, Playback, and Test.

On the left, a tree view shows the system structure, including "com.oracle.TelCO.HFEM", "com.oracle.TelCO.OSSIM", "com.oracle.TelCO.AHA", and "com.oracle.TelCO.ALLP". Under "com.oracle.TelCO.ALLP", there are several stages listed, such as "BAMEventsListener", "Wireless_Service_H_Proc", "Billing_Service_H_Proc", "Clear_NetSwitch_Proc", and "TelCO.ALLP_Proc".

The main area displays a table of rules:

id	rule
DiagnoseNetworkFault_Query	insert into WMAPEvent select timestamp, symbol, price, volume, sum(price * volume)/sum(volume) as wwap, latencyTimestamp from (select a.symbol as symbol, a.timestamp as timestamp, a.price as price, a.volume as volume, a.latencyTimestamp as latencyTimestamp from MarketEvent a retain 1 event, BymboEvent b retain all events where a.symbol = b.symbol) retain all events group by symbol;
OptimizeApplicationLayer_Query	insert into TrendEvent select timestamp, symbol, price, trend(price) as priceTrend, latencyTimestamp from (select a.timestamp as timestamp, a.symbol as symbol, a.price as price, a.latencyTimestamp as latencyTimestamp from MarketEvent a retain 1 event where a.symbol = 'ORCL' or a.symbol = 'CSCO' or a.symbol = 'HCO') retain 2 events partition by symbol group by symbol having perc(price) > 1.00 or perc(price) < -1.00
MonitorNetworkDS_Query	insert into ChangeEvent select timestamp, symbol, price, perc(price) as percentage, latencyTimestamp from (select a.timestamp as timestamp, a.symbol as symbol, a.price as price, a.latencyTimestamp as latencyTimestamp from MarketEvent a retain 1 event where a.symbol = 'ORCL' or a.symbol = 'CSCO' or a.symbol = 'HCO') retain 2 events partition by symbol group by symbol having perc(price) > 1.00 or perc(price) < -1.00

Below the table, there is a "Working Area - for Modify and Delete Operation, select a rule from the table" section. The "Rule ID" is set to "OptimizeApplicationLayer_Query". The "Rule" text area contains the following SQL query:

```
insert into TrendEvent select timestamp, symbol, price, trend(price) as priceTrend, latencyTimestamp from (select a.timestamp as timestamp, a.symbol as symbol, a.price as price, a.latencyTimestamp as latencyTimestamp from MarketEvent a retain 1 event, BymboEvent b retain all events where
```

The "Parameters" section is currently empty.

At the bottom of the interface, there are buttons for "Delete Rule", "Modify Rule", and "Cancel".

ORACLE

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

ORACLE®



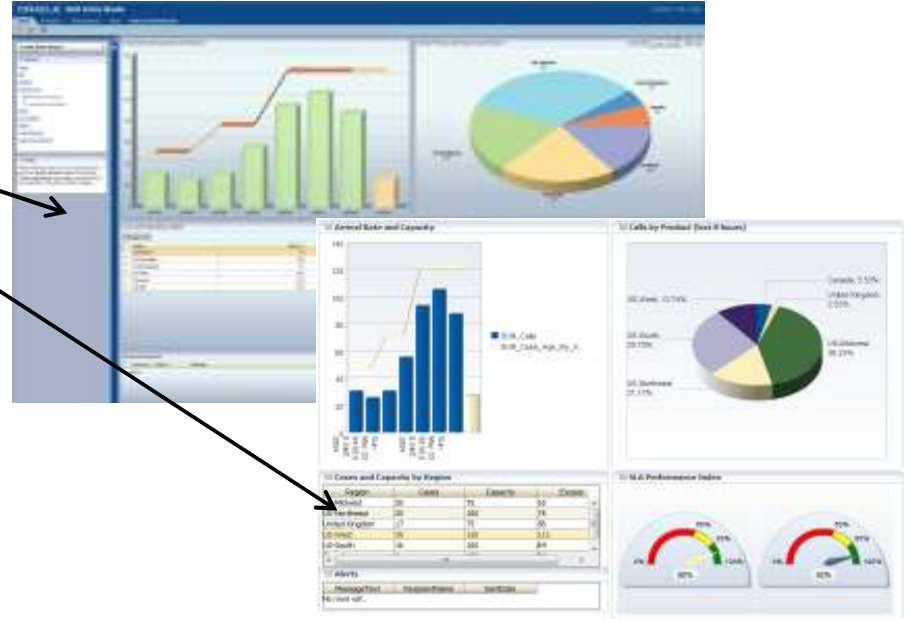
The Oracle BAM Technical Advantage

- **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

Now for the Instantly Responsive Enterprise Advanced Technology (10.3g)

Advanced Tooling for Developers, Administrators, and Business Users

Oracle Business Activity Monitoring



Oracle Complex Event Processing

App Frameworks

POJO

Spring

Services

Core Event Infrastructure

Oracle Event Stream Processing

Real Time Kernel

Extended Event Infrastructure

Data Caching

Cluster Management

HTTP Pub/Sub Engine

Event Repository

Foundation Services

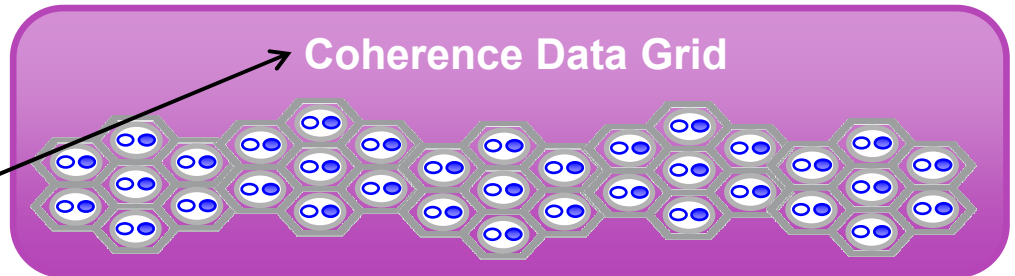
Logging & Administration

Config/Admin

Coherence

Latency Analyzer

Coherence Data Grid



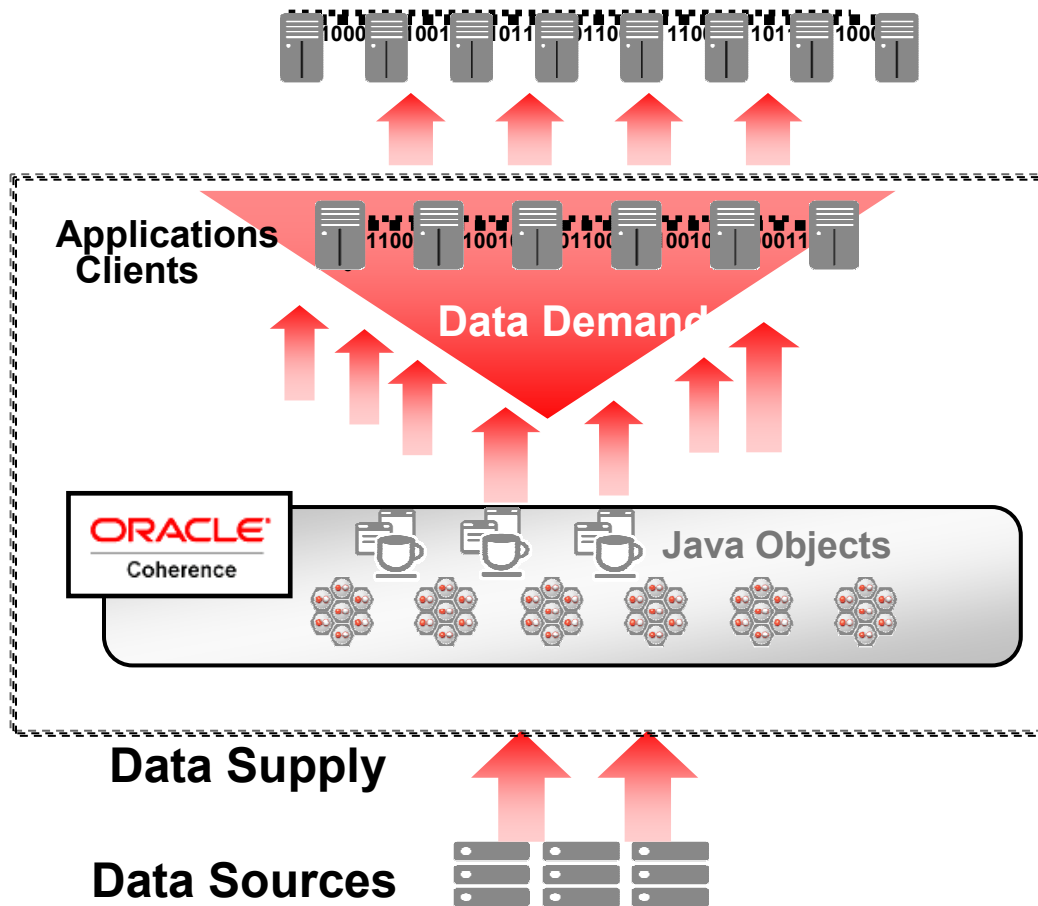
JRockit

JRockit Real Time

JRockit DGC

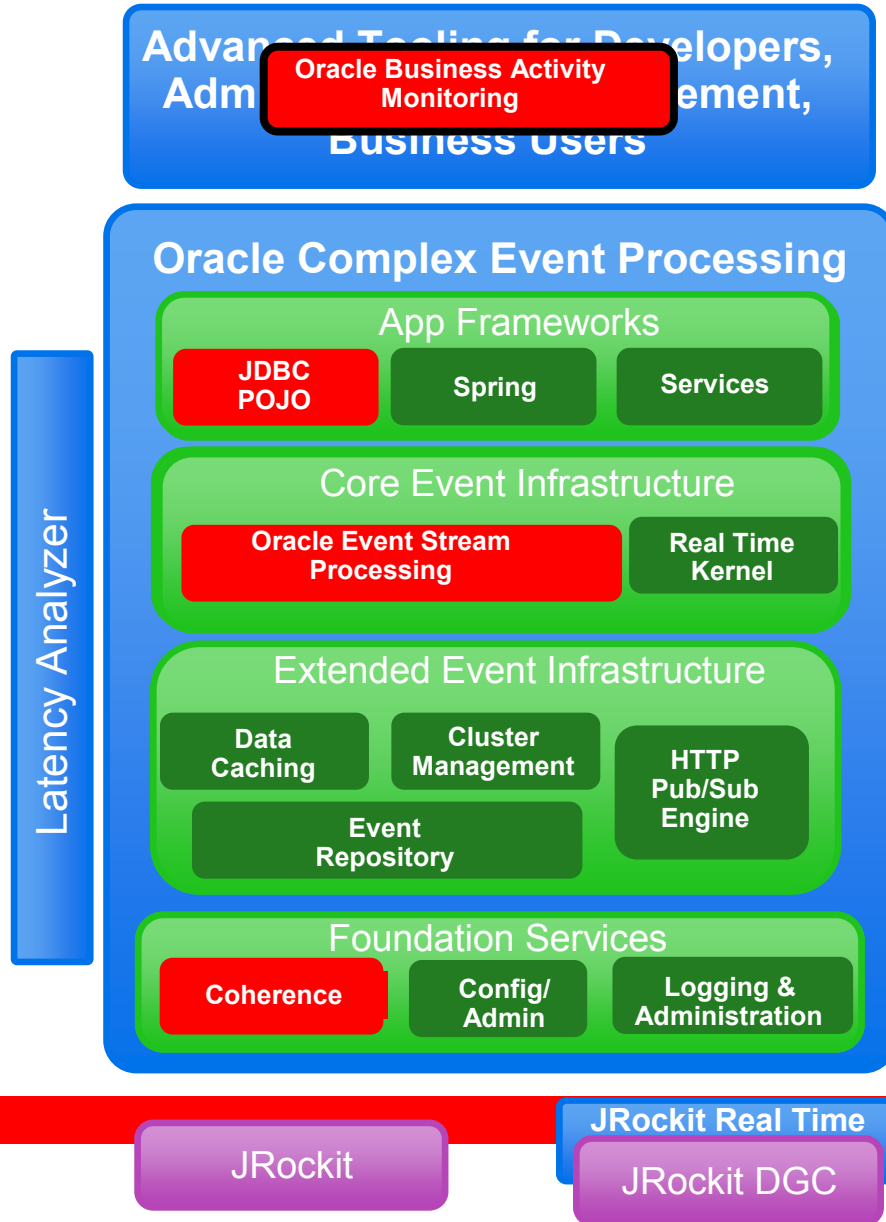
ORACLE

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 (*ANSI 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

ORACLE



ORACLE®

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

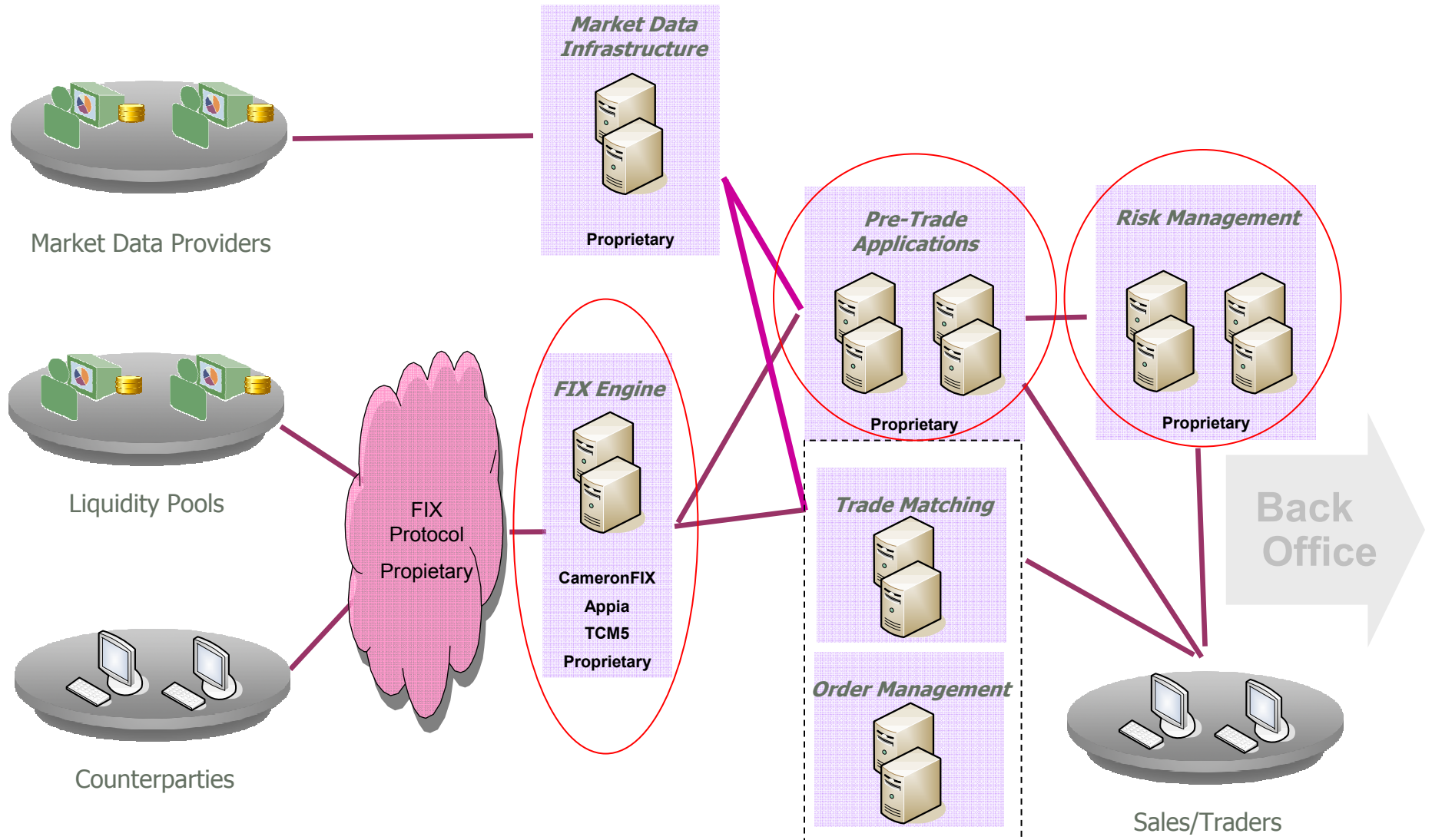
- Oracle CEP
- Oracle Coherence
- Oracle JRockit Real Time



Dynamic Trading Floor Value Propositions

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

Sellside Electronic Trading Architecture

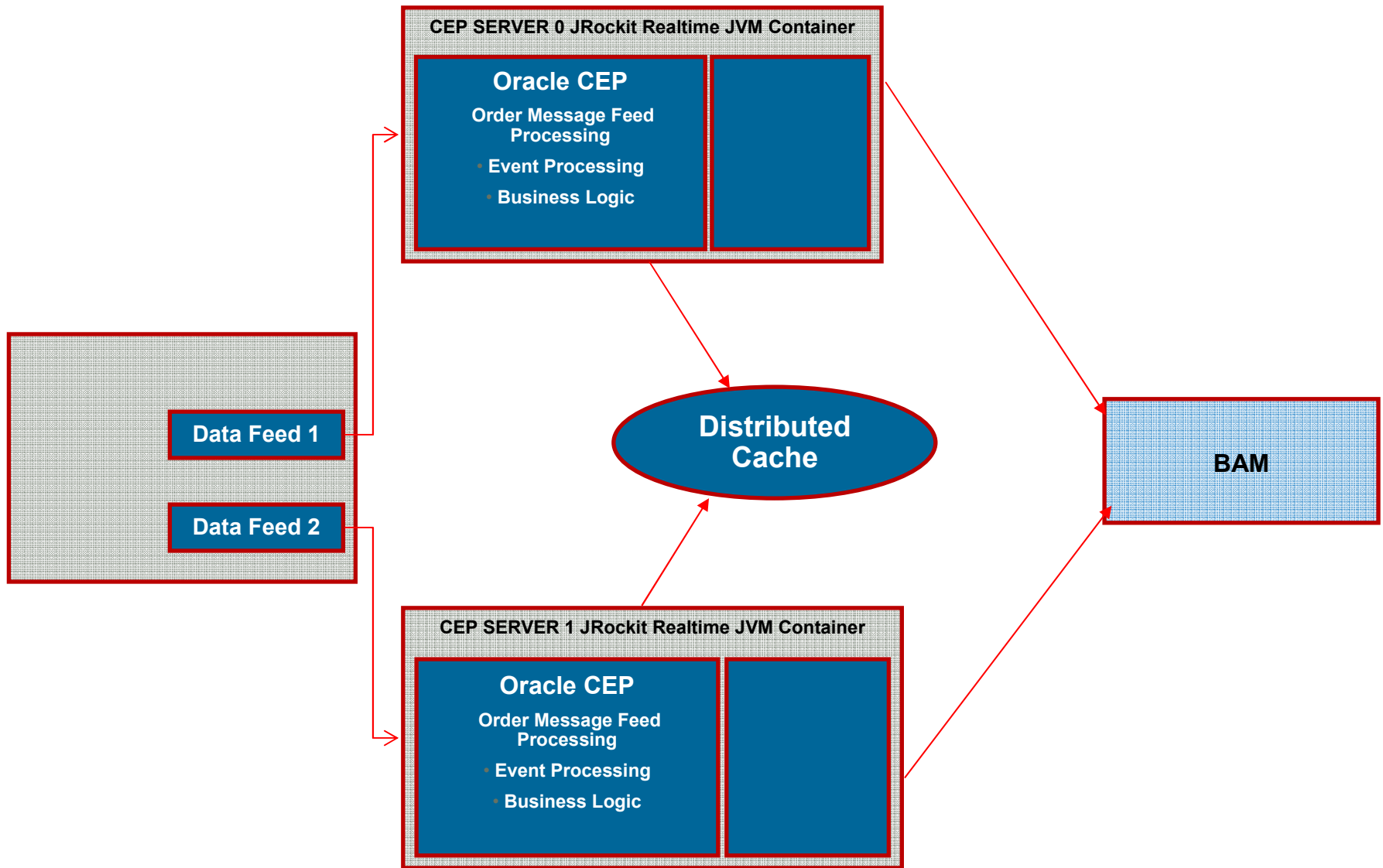


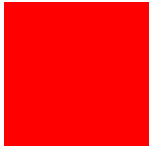


Risk and Compliance Management

Solution Description	A low latency, high throughput platform that speeds up entry into new markets and opportunities
Business Case	Achieve real time exposure visibility of trade positions
Use Case	<ul style="list-style-type: none">• <i>Monitor Risk Profile (total of outstanding positions) of traders</i><ul style="list-style-type: none">– <i>“Alert when John Doe’s positions exceed \$20 Million”</i>– <i>“Calculate average position for each trader for the last 60 minutes”</i>

Solution Architecture (look familiar?)





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

ORACLE®



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**

ORACLE®



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**

ORACLE®

<http://www.oracle.com/technologies/soa/eda/eda-suite.html>

<http://www.oracle.com/technology/products/event-driven-architecture/index.html>