

Advanced CEP and EDA - Why the buzz on Wall Street?





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Presenter

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- Business Rules and Complex Event Processing specialist
- Contributor to relevant standards (OMG PRR, W3C RIF) and industry consortia (EPTS)
- Contributor to <u>http://tibcoblogs.com/cep/</u>

TIBCO Software

- Largest independent software integration company
- SOA, BPM and Business Optimization
 - SOACIMS/EMS/EDA, RV pub-sub/EDA ActiveMatrix / BusinessWorks, Adapters
 - BPM: iProcess
 - Business Optimization: portal, GI AJAX, BAM, CIM MDM, Spotfire BI
 TIBCO BusinessEvents or Complex Event Processing and Decisioning



Buzz!

2008 Outlook: The Buy Side Raises Issues With Fragmentation, Data Traffic and Execution Systems

"Sooner rather than later there will be public announcements, or proprietary announcements within firms, suggesting the use of a CEP engine," Bailey contends. "We are seeing some regulatory requirements driving interesting sill November 2007 risk, com; 1 November 2007



Low Latency Trading Platform To Options, Futures



Jan 28, 2008 at 05:48 PM ET

Complex Event Processing Moves Beyond Algorithmic Trading Risk Management is one of the areas in which firms are finding that CEP can help them gain a competitive edge By Melanie Rodier Wall Street & Technology November 26, 2007

CHALLENGE: Trading faster han the competition has become a necessity on Wall Street. But analyzing skyrocketing data volumes and simultaneously calculating risk positions in near real times an be difficult. Complex event processing technology is helping some firms gain a competitive edge.

Why it's important: Since the emergence of black-box trading, Wall Street has been under intense pressure to trade faster and faster. Now, with data volumes skyrocketing, firms are continually searching for low-latency solutions that can process the data streams in near real time and give them a competitive edge in electronic trading. As a result, many Walk Street firms have rapidly been adopting complex event processing (CEP) technologies that allow them to analyze unrelated data and events, detect patterns and relationships, and trade in milliseconds.







NYSE Euronext to Acquire Wombat Financial Software, a Global Leader in High Performance Financial Market Data Management Solutions

- > Wombat
 - > Electronic trading infrastructure provider
 - > 175 people globally
 - Ultra low latency ticker plants; high performance messaging; CEP, compliance
 - > Used in the top 12 global banks

New York, Jan. 14, 2008 \$200 million in cash





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Fraud Risk!

Risk of Customer Defection Customer CrossSell Opportunity Change in Product Sales Trend

Contract

Validated

Employee Over hours Cell phone Compliance fraud alert Limit Approached

Rental Contract Complete Customer now rated Gold Contract Valid









Simple EP is the default IT Model, 1950-now

Based on "human workflow": one thing at a time

- Processes handle cases 1 at a time
- Use database and refer to it where necessary
- Provide some service flexibility with middleware
- Use BPM to document / manage / automate processes
- Use SOA to distribute / manage / automate services

This model does NOT exploit ALL the information / data / events ALL the time

Behaviour (and intelligence) is silo'd

There is a better way!





Complex Business Problems

Fraud / Theft

- Thousands-to-millions of high-value small-size product items or transactions
- How do you identify known patterns of "suspicious" behavior?

Logistics / Scheduling

- Raw material, production & delivery scheduling and resources are complex and prone to change
- How do we reallocate resources to handle business and production changes?

Activity Monitoring

- Complex production and supply process with multiple actors
- How to measure and action Key Performance Indicators?

Relevant event of interest

Product location

change



Resource, requirement change





Associated Events

Positive Events

- Product item X arrives at Production station S from Store T
- Production worker Y arrives at Production station S
- Production contract for item Z by time T is posted

Negative Events

- Product item X has been in transit to Store T for >15 minutes
- Subcomponent Y hasn't arrived at the Production station by the ETA
- Delivery of contract Z has not taken place

Sets of Events

- 5+ items of Product item type Y failed to arrive at destination
- Supplier Y was 5 mins late for 1 delivery, but made it early to the next
- Return rate on component Z exceeds SLA %





Significant features of these Events

Time Sensitivity

- A thief may leave the building at the same time as stolen product
- A product should take 40 minutes to travel a given production line segment

Distributed Event Sources

- A series of produced items fails at various QA stages, and their common attribute was a storage location
- Multiple suppliers for a subcomponent are reporting delivery delays





The Event Cloud

- What meaning can we derive from the typical business' "cloud of events"?
- Can we infer "higher-level" business events by correlating events automatically + earlier, regardless of source / type?





The Need for Situation Awareness





Complex Event Processing



Business Role:

Sense and Respond Track and Trace Situational Awareness



Requirements for CEP Technology

Access and Monitor the "Event Cloud"

- JMS, RV, MQ, TCP/IP, etc...
- Timers to detect lack of events
- Determine event state changes

Match Patterns, Apply Business Logic

- Detect events
- Detect event patterns
- Maintain State and Facts over time
- Update Detection algorithms as events change





Example: TIBCO BusinessEvents

- Receives events and associated data via various channels via BW
- Matches events to concepts
- Manages temporal state of concepts
- Correlates events via rules
- Detects event patterns via rules
- Infers new facts from concept data
- Generates internal events (which could trigger more rules)
- Sends events for external system control



Different CEP Implementations





Example: Investment Banking





CEP Processing activity is automatic



- Order event arrives over JMS / EMS or RV on a particular channel
- 2. Order event classified into appropriate class, stored in cache for future reference
- 4. Comparison rules run against order by rule engine, new information inferred
- 5. State transition rules executed to check for any state change due to new inferred data.
- 6. If order can be completed, run FSA compliance rules



Advanced CEP Architectures





Bloor on CEP Applicability





Gartner Hype Cycle and CEP-related technologies





Future Convergence? Complex **Event** Event Processing Sources Simple Event Distributed Processing Event Event Consumers Cache **Event Bus Business Process** Management Services **Data Services**







RAD: Generic RealTime App Framework

Inference Rule Engine



- Built-in EDA adapters for multiple data feeds / interfaces
- Built-in data persistence mechanisms
- Historic data access

Rule-Driven CEP

State Model

Rulebase

- Pattern-detection mechanisms
- Links to reporting, analysis, dashboard tools
- (maybe) Declarative logic
- (maybe) Model-driven approach



Examples

Situation Assessment CEP example

Airline Gate Operations

- Problem: Airline operations manager has to react to situations after they have developed (gate clash, provisioning failure, early / late arrival, transfer issues, ...)
- Solution: monitor operational events as they occur to provide advice in real-time (/"predictive" advice) so operations managers can institute solutions before problems escalate
 - = => higher performance of airline operations
 - = >> higher customer satisfaction, reduced downtime



Examples

Track and Trace CEP example

Financial Division Contractual Data Monitoring

- Problem: documents (electronic, fax, etc) may not be routed efficiently due to workflow / operational problems. This can cause delays / poor service / SLA breaches / compliance issues.
- Solution: monitor incoming documents as they are received in various departments and alert management if any documents appear to be delayed
 - = > more resilient business tracking
 - = > avoid customer dissatisfaction, reduce business losses



Examples

Sense and Respond CEP example

Customer Interaction System for large Bank

- Problem: correlating information across channels to determine possible customer needs requires more integration and event intelligence to improve cross-sell / up-sell benefits.
- Solution: model customer behaviour across systems from web, CRM systems to deduce better intel on customer life events and thence needs
 - = => more and better information on customer behavior
 - => improved targeting of products and services, reduce pointless cross-sell/up-sell



The Need for Situation Awareness





Summary: Why CEP?

- Detecting event patterns across multiple event types + time is difficult for simple event processing solutions
- Computers can correlate across large volumes of events at high speed, identifying patterns that are not conventionally visible
- Examples in use:
 - Track and Trace of RFID data
 - Situation Assessment of airline operational delays (+ their causal events)
 - Sense and Respond to fraud indicators in internet transactions



Reading list



AN INTRODUCTION TO COMPLEX EVENT PROCESSING IN DISTRIBUTED ENTERPRISE SYSTEMS

DAVID LUCKHAM



Q&A: Military Origins of CEP



Steinberg, A., & Bowman, C., Handbook of Multisensor Data Fusion, CRC Press, 2001

