Progress Apama & Event Processing

Mark Palmer, Vice President of Event Processing
Agenda (based on Symposium Guidelines)

- Major Characteristics of the Progress Approach
- Usage Scenarios
- Major Trends & Roadmap for EP
- Major Challenges for Community
About Progress Apama

- **About Progress Software**
  - $400M+ software company
  - Based in Bedford, MA
  - Sonic Software, Actional, Neon, Apama

- **Apama + Progress Real Time**
  - Apama founded by Dr. John Bates and Dr. Giles Nelson in 1999
  - Combined with Progress data streams management team

- **Progress Apama Event Stream Processing Platform**
  - Event processing engine
  - Event data streams management
  - Event visualization
  - Event adapters
  - Event language development tools
  - Vertical solutions
3 Challenges for This Group

1) Characterize Event Processing (We Use ESP)
   - Customer / usage orientation; not pure technical
   - Define the Event Processing taxonomy & glossary
   - Start with Roy’s Model: Simple, Mediated, BPM-Enabled, Complex (?)

2) Define EP’s Relationship to BAM
   - Does the “M” stand for “Monitoring” or “Management”??
   - Dashboards + Event Rules + Event Data Management = SuperBAM

3) Reconcile Current EP Approaches and Standardize Language
   - SQL-based approach
   - Language-based approach
   - EAI-based approach
**Event Stream Processing (ESP)**

A New Computing Physics

**Static Data Processing:** “How many fraudulent credit card transactions occurred last week?”

**Event Stream Processing:** “When 3 credit card authorizations for the same card occur in any 5 second window, deny the request and check for fraud.”
Event Processing in Algorithmic Trading
Monitor Multiple Streams of Events, Analyze for Patterns and Act in Real Time

Monitor

Analyze

Act

Market data

News

IBM Acquires ...

IBM Trades

IBM Trades

IBM Trades
An ESP Algorithmic Trading Rule

Trading Rule

**WHEN**
- **MSFT** price moves outside 2% of **MSFT-15-minute-VWAP**

**FOLLOWED-BY** (  
  **S&P** moving by 0.5%  
  **AND** (  
    **HPQ**’s price moves up by 5%  
    **OR**  
    **MSFT**’s price moves down by 2%  
  )  
)

**ALL WITHIN**
- any 2 minute time period

**THEN**
- **BUY MSFT**
- **SELL HPQ**

- multiple data streams
- temporal constraints
- complex event sequences
- real-time constraints
- automated actions
- pattern abstraction
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Algorithmic Trading
Automated trading based on market movement

Within any 20 second window, when HP rises by more than 2%, and IBM doesn’t, buy IBM.
Real-Time Risk Mitigation
Calculate VaR in real-time and adjust real-time action to adjust

“When trading brings peso value-at-risk within 1% of risk level cap, lower offer prices for peso FX trading until risk level returns outside of 3% of today’s cap.”

ESP allows risk mitigation to shift to front office apps - pre-trade - so errors are eliminated before they occur.
Transportation: Security & Fraud Detection
Detect patterns among events to discover fraudulent activity

When a single ID card is used to gain entry twice in less than 10 seconds alert security for piggybacking
When 15 alarms are received within any 5 second window, and more than 10 alarms of the same type repeat in 4 subsequent 5-second windows, alert the operator!
When 15 alarms are received within any 5 second window, but < 5 similar alarms are detected within 30 seconds, then DO NOTHING
Anticipitory Flight Operations
Monitor, analyze air space conflicts and act on operational efficiencies

Monitor:
- Check vertical & horizontal separation by constantly monitoring flight position event streams

Act:
- 1. Suggest plane re-route
- 2. Rebook passengers
- 3. Call in stand-by crews

Analyze:
- 1. Analyze alternative flight paths
- 2. Analyze passenger impact (missed connections)
- 3. Analyze crew impact
Real-Time Digital Battlefield
Preventing casualties with real-time visibility

Warn NATO squad commander when any of his troops come within 1 mile a known mine field zone.
Emergency Response
Discover patterns of events and real-time and take preemptive action

When 20 emergencies occur within any 60 minute window and response capacity is over 50% within 100 miles, alert adjacent districts of stand-by state
Supply Chain: RFID Data Management
Automating supply chain and logistics

When truck arrives, and all expected pallets are **not scanned** within 60 minutes, send **SMS** to the operations manager.
Health Care: Patient Monitoring
Acting on patient vital sign data

When a change in medication is followed by a rise in blood pressure within 20% of maximum allowable for this patient within any 10 second window, alert nearest nurse.
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The Elements of Event Stream Processing

- Management
- Real-Time Dashboards
- Event Programming Language (EPL)
- EPL Development Tools
- Correlation Engine
- Event Data Management

ESB, Reuters, ALE

ESB, Email, SMS, Portal
The Elements of Event Stream Processing
The EPL and Stream Processing Engines

- Real-Time Dashboards
- Event Programming Language (EPL)
- EPL Development Tools
- Correlation Engine
- Event Data Management
- ESB, Email, SMS, Portal
- ESB, Reuters, ALE

Management
An ESP Algorithmic Trading Rule

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- multiple data streams
- temporal sequencing
- complex event sequences
- real-time constraints
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The Elements of Event Stream Processing

Real Time Dashboards

- Management
- Real-Time Dashboards
- Event Programming Language (EPL)
- Event Development Tools
- Correlation Engine
- Event Data Management
- ESB, Reuters, ALE, IAF
- ESB, Email, SMS, Portal
Event-Driven, Real-Time Dashboards
Visualize Key Business Conditions and Actions in Real Time

- Provides real-time dashboards from business ➔ Operations ➔ IT
- Interactive, real-time graphs, charts, tables, and dials
- Dashboard Studio allows full dashboard customization; not a fixed application layout
The Elements of Event Stream Processing
Real Time Dashboards

- Real-Time Dashboards
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The Apama ESP Developer Studio
Enables Business Analysts to Design Powerful Real-Time Analytics

- Express time-based real-time rules with a high level development tool
- Each scenario, or group of rules, represents a “pattern” which can be adjusted by business users to specify conditions to monitor, analyze and act on.

Intuitive visual user interface designed for business analysts

“SmartBlocks” encapsulate pre-packaged modules made available to non-programmers.
SmartBlocks – Domain Specific “Abstractions”
Analytics Extend the Event Programming Environment

SmartBlock catalogs are available via Apama’s Scenario Modeler

- e.g., RFID SmartBlocks
- e.g., Algorithmic Trading / Risk

SmartBlocks abstract connectivity, event rules, and databases
The Elements of Event Stream Processing
Event Data Management

- Correlation Engine
- EPL Development Tools
- Event Programming Language (EPL)
- Real-Time Dashboards
- Management

ESB, Reuters, ALE
ESB, Email, SMS, Portal

Event Data Management
Event Storage, Replay and Analysis
David: “Data Streams Management”

- **Pre-Flight Test Real-Time Algorithms**
  - Test algorithms against historical conditions before they go live

- **Root Cause Analysis**
  - Investigate: “What Happened?”
  - Drill-down from dashboard

- **Genetic Tuning**
  - Run 10,000 instances of a strategy
  - Grow the successful/profitable branches

- **Event Pattern Detection**
  - Purchasing agent has signed 5 POs at 95% of his signing authority in the last day – monitor for PO splitting?
Event Data Management Architecture
Store, Replay, and Analyze the Event Driven World

- Capture raw events in a high-performance time-series data cache
- Real-Time Event Processing
- Capture derived events – action - created by EPL rules
- Historical Event Processing
- Event Store
- "What If" Analysis: Back Testing "Pre-Flight Tests" event processing strategies
- "What Happened" Analysis - Dashboards visualize real-time and stored events
- Business Intelligence
- The event database can feed static data warehousing and BI infrastructure

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Roy Schulte’s Event Processing Taxonomy

- **Simple Message-Driven Applications**
  - Sink triggered by 1 event, one stream
  - No pattern detection, no notion of causality
  - Benefits are for IT

- **Mediated Events: Stateless**
  - One stream split into multiple streams
  - Goal is message enrichment: filtering, CBR, transformation

- **BPM – Enabled Events: Stateful**
  - Message splitting and message combining
  - Flow of control governed by pre-defined BPM model of BP
  - Requires MOM + BPM engine

- **CEP Applications**
  - Multiple events, multiple streams (AGREE)
  - Sophisticated pattern detection (AGREE)
  - Non-IT benefit only via dashboard (DISAGREE)
  - Main benefit is business insight, not faster & easier software engineering (DISAGREE)
  - Complex events are often synthesized from primitive events – genetic info is often inserted (AGREE)
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Questions?