Oktober Rules Fest 2009

What’s Different About Rules in CEP?

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Asynchronous Events

Continuous identification of event patterns

Flexible to any event types

business events

CEP: complex event processing

State store

BPM: business process

SOA: IT services

Data Persistence (service)
CEP’s terminology

- Event Cloud = sum of all available events
- Event Streams

- CEP uses pattern detection to the event clouds & streams, and their histories
- Multiple modelling + execution paradigms available for pattern detection
- Problems solved: situation awareness, sense and respond, track and trace
What does CEP cover?

“CEP applies to a very broad spectrum of challenges in information systems”

- Business process automation
- Service routing and coordination
- SLA, Policy fulfillment and breach checking
- Security and fraud detection
- Activity Monitoring

Complex Event Processing

Automatic Adaptation
- Rules
- BPM

Human Interaction
- Portal
- Dashboard
- RIA

Impact Analysis

Situation Identification

Filtration

Events and Information

Flexible Service-Oriented Architecture

Underlying Applications and Infrastructure

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What does CEP Need? 1. Events

- Event is sourced from **Channel** via address **Destination**

- Events can be modelled hierarchically

- Event metadata includes **Time To Live**, **Payloads** like XML, etc

- Events are **immutable** (except when...)

- Expected events may not occur
Event examples

- **SOA service requests**
  - time, destination, payload

- **Scans (parcel, baggage, RFID, production line...)**
  - location, time, payload

- **Web requests**
  - source IP, destination, payload, frequency

- **Messages / packets (telco, smartgrid)**
  - source, destination, time, location

- **Data streams (data feeds)**
  - payload, time, source
... 2. Pattern Matching for events

- Filter events
- Join events
- Events can be across time
- Events can be aggregated
- Events can be ordered

- c.f. Rete
- Event Store, State
- State
- Collections
- OO paradigms / facts
- Queuing etc policies
... hence Rules for CEP

- **Join**
- **Decide**
- **React**
- **Filter**

Flexible Service-Oriented Architecture

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3. Stateful Support

Continuous identification of event patterns

CEP: complex event processing

State store

Guaranteed Delivery

Failover support for CEP engines

State persistence
 Rules Require: A. Temporal Awareness

- **General “patterns”:**
  - Event occurs in time T
  - Event doesn’t occur in time T

- **Event state “patterns”:**
  - Event time-out (via TTL)

- **State “patterns”:**
  - State time-out

- **Object history “patterns”:**
  - Prior values
- Rulesets contain, organize Rules
- Rules are made up of rule variables, conditions, actions
- Rules execution context is a Run To Completion cycle
- New events can expire after a single RTC, or on demand, or after some time
Example Rule Types

- Basic: Condition-Action
- Triggers: Event-Condition-Action
- Timers/schedulers: TimeUp-Action, TimeInterval-Action
- Event lifecycle: TimeToDie-Action
B. Low latency, scalability

Event performance is dependent on minimizing RTC times.
Example: fraud event processing

Source Event definition / transform

Event definition: Fire n’ forget
Example: fraud event processing rules

- Basic event processing
- Event history processing
- Real time analytics
Model for Rule-driven CEP: event lifecycles via states

- **State Model** for lifecycle modelling via states and state transition rules
- **State Machine** for state execution via rule engine
State Models in CEP

1. **Visual modeling metaphor**
   - State diagram is simple to follow
   - UML standard

2. **State / flow transitions are event or time-related**
   - Lifecycle is a set of states
   - Missing events modelled through time-outs

This yields significant savings by eliminating driver man hours wasted waiting at the border. When a truck is dispatched, a conveyance report is transmitted to an agent. The truck’s position is tracked via GPS events. When the truck is 20 minutes from the border, there must be a confirmation that customs has received the documents. If that hasn’t occurred, an alert is sent to the agent and the problem is remedied before it can cause a costly problem, incurring fines and wasting man hours.
State Models

- **States** defined per instance, by type, can be inherited
- State transitions are defined by **events**
- Arrival / departure state events drive actions
- Multiple **concurrent states** can exist
Example Rule Types (continued)

- Basic: Condition-Action
- Triggers: Event-Condition-Action
- Timers/schedulers: TimeUp-Action, TimeInterval-Action
- Event lifecycle: TimeToDie-Action
- State transition:
  Event-StateChange,
  Timeout-StateChange,
  StateEntry-Action,
  StateExit-Action
Example: state of rule management...
Basic Rule Types

Common Event Processing Models and Languages in 2009

Key:
- EP graphical model
- EP language
- Code level
- Transform

Notes: Imperative code/scripts subsumed into Production Rule or Engine concepts
- Production Rules are excellent for many types of event pattern matching
- Stateful, event-driven temporal rule processing can provide a common view of events, data, events, state
- Resources: www.ep-ts.com
  www.tibcoblogs.com/cep