TRANSFORMING BUSINESSES INTO EVENT ENABLED ENTERPRISES BY COMPLEX EVENT PROCESSING

From the days of its inception in the early 1990s by Dr. David Luckham at Stanford University, Complex Event Processing has evolved and is maturing as a real time event analysis, correlation and processing mechanism which seamlessly fits in with service oriented business process management solutions. Sajeev Nair investigates.

Customer Event Processing (CEP) technology enables low-latency filtering, correlating, aggregating and computing on real-world events data. It identifies and analyses cause-and-effect relationships among events in real time, allowing personnel to proactively take effective actions in response to specific scenarios. This is used in security policy development, business process management (BPM), risk management, customer relationship management (CRM) and application servers and middleware.

To start, let us look at how CEP solutions are relevant in service-oriented BPM implementations.

Relevance of CEP solutions in a Service oriented BPM

Scenario 1: Organisations where processes change frequently

Here dynamic process models can be used which are typically rule or plan-driven and both event-driven. Changes can be made at the rules levels rather than touching the core process model thus reducing rework. For example, TIBCO's CEP offering BusinessEvents uses rules and state models to define (event) processing, as well as managed decisions.

Scenario 2: Automate and monitor processes across the "value chain"

Monitoring capabilities may be built-in at the BPM level, but usually customers may want to monitor processes against external metrics (like service orientated architecture services and external events). That's a role for CEP. TIBCO BusinessEvents can model a value chain as a state model, and correlate events in various ways to support business activity monitoring — including monitoring BPM.

Scenario 3: Support cross-functional processes

In an enterprise BPM implementation, CEP tools can define and utilise the appropriate metamodel as concepts and enjoy full flexibility in how that interacts with events and rules and decisions.

Scenario 4: Allow monitoring of status of work in progress

CEP allows long-running stateful and self-monitoring processes as a basic feature. Many CEP products can query continuously the attributes of the entities it is processing and deliver the results, as they change, as events.

Scenario 5: Extend the life of legacy apps

While BPM can layer on existing applications and services, the same is true for CEP, which can invoke and control existing applications just as well.

Scenario 6: Improve inaccurate, inconsistent or laborious manual work

CEP is mostly about automated processes, or monitoring events from manual processes. One can implement a state model for workflow queue handling in TIBCO BusinessEvents, but most people prefer to use the out-of-the-box variant from a BPM tool.

CEP and SOA – How it is related?

Connecting services in a typical service orientated architecture (SOA) environment occurs in a linear, predictable sequence. Event driven architecture allows for multiple, unpredictable, asynchronous events to happen in parallel and trigger a single action. An event processing system senses and collects these events and correlates patterns which are disseminated to all interested parties (human or automated) optionally via services. The interested stakeholders evaluate the events and may respond by invoking a service, thus triggering a business process or publishing or syndicating further information.

CEP is an emerging technology that will help companies develop and manage business activity monitoring (BAM), enterprise application integration, network and systems security, and business processes. Through SOA and CEP, organisations can develop model-driven, agile "sense and respond" systems that can, in near real-time, detect events of business value and trigger services to manage those events.

The operational stack supports a distributed architecture in which the activities of client applications and partner services, both internal and external to the organisation, are coordinated by orchestration processes. Clients and partners communicate with these processes through the Enterprise Service Bus. Internal connections typically use message-oriented middleware queues to access the bus and external connections use simple object access protocol over HTTP. The orchestration process, besides coordinating partner activities, also interfaces with backend systems (databases, mainframes, and so on) and uses BPM to delegate manual work to human actors. The following figure illustrates this architecture.

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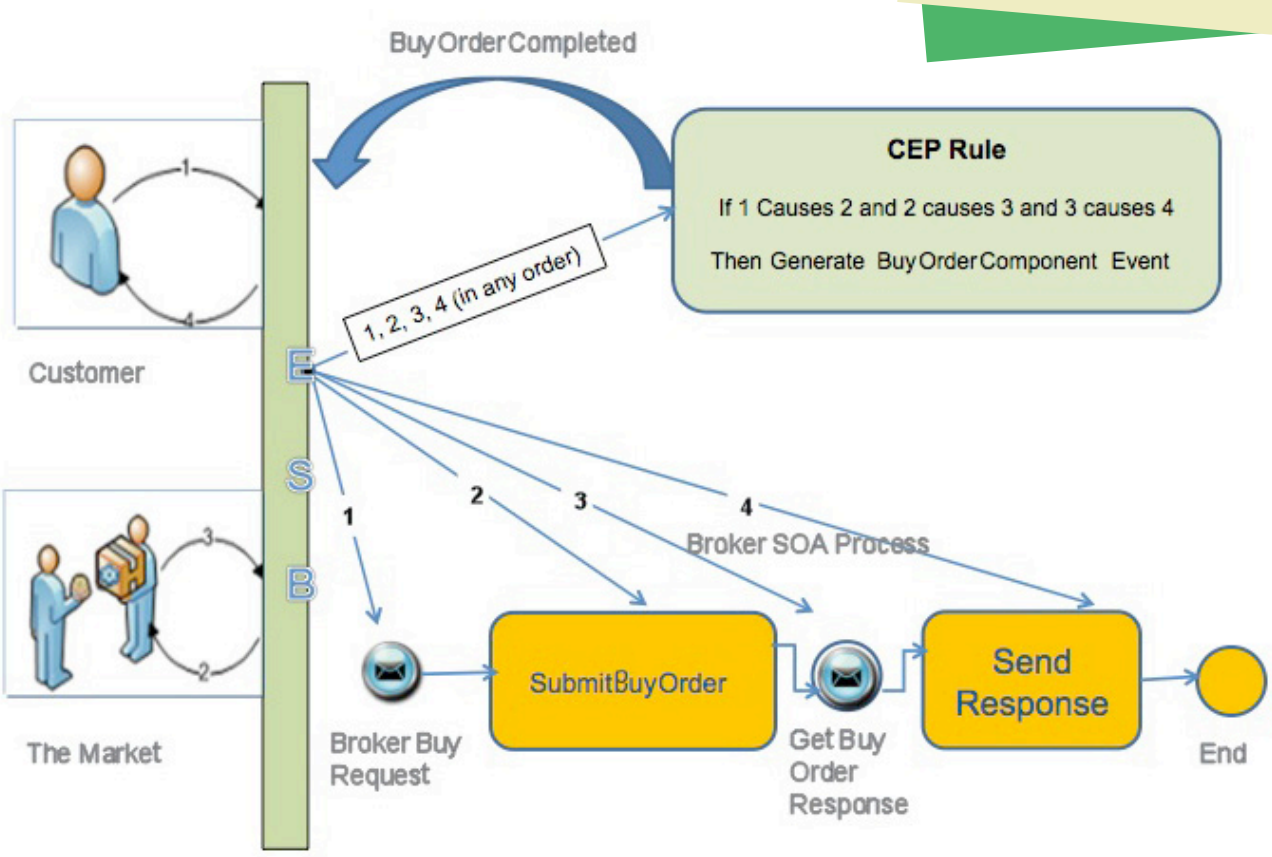


CEP consists of a set of rules that listens for events from the bus. A publish-subscribe messaging infrastructure allows CEP to get these events without disrupting the operational processes. And CEP rules, as we discussed above, infer complex events from these operational events. They send complex events back on the bus on orchestration queues, where, as we discuss further below, they are picked up and handled by CEP-aware orchestration processes.

CEP must be sufficiently scalable to handle the high volume of events on the bus. There is more to this than sheer processing speed. CEP, like most rule-based systems, is stateful and it keeps its state (i.e. its current set of asserted facts) in a datastore called Working Memory.

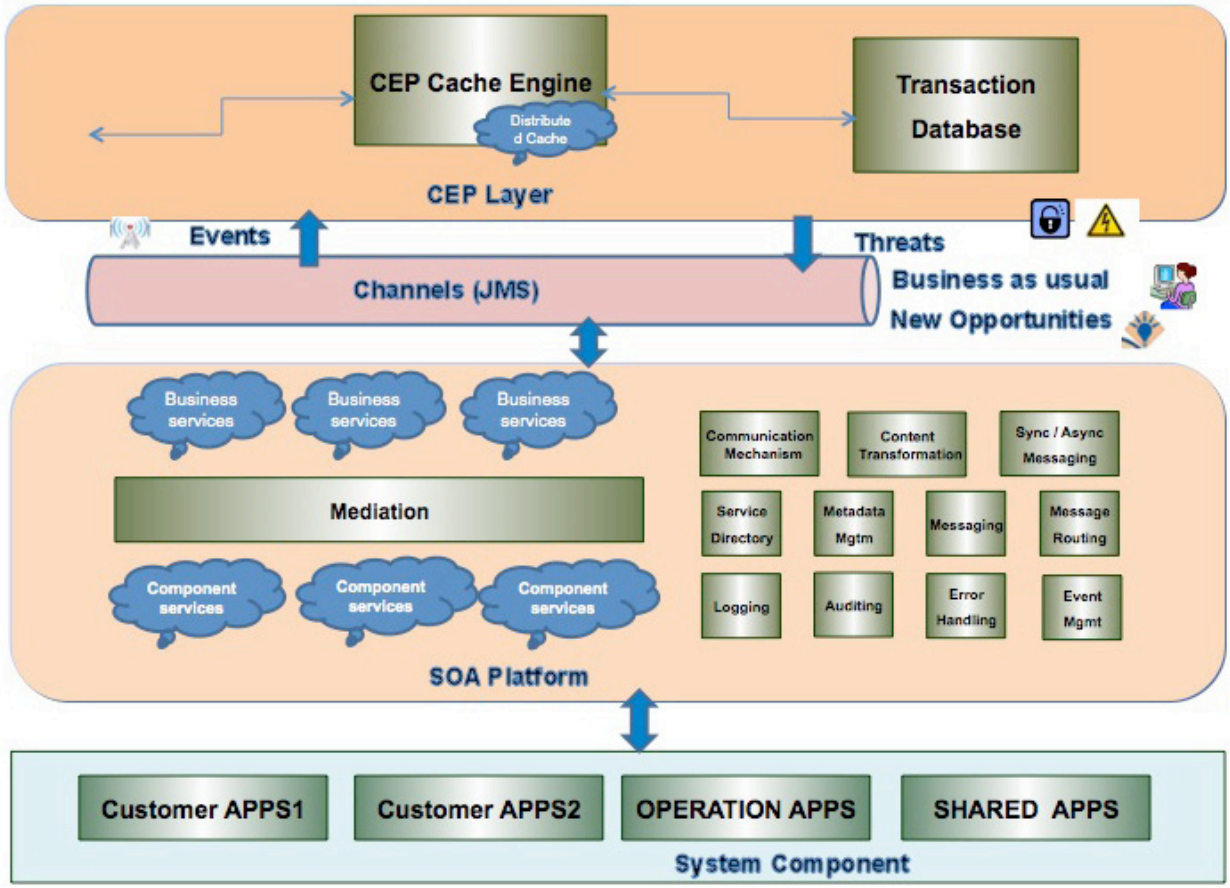
What CEP and SOA have in common is events. Both technologies use events, but for different purposes. SOA processes use events to drive control flow. An SOA process is started by an event and, during the course of its execution, waits for further events to propel it forward. Events in SOA, in effect, force process transitions. Most SOA processes not only receive events but also send events and when a process sends an event, another process receives it. Elaborate choreographies arise when the processes of multiple organisations engage in conversations of events.

CEP in Action – Sample Scenario

In stock trading, a customer's purchase of shares is (in straightforward terms) the combination of four events:

- The customer's request to the broker to buy the shares
- The broker's placement of the order
- The result of the order, including the price at which the shares were bought
- The broker's response back to the customer.

When CEP detects these four events, it publishes a complex event — Buy/Order/Completed, let's call it — back to the bus, where interested listeners may pick it up. The following figure illustrates the sequence of steps.



CEP can also detect breakdowns in the buy order. If, for example, the broker fails to respond back to the customer in a timely fashion then CEP can easily spot this and publish a 'BuyOrderBrokerResponseLate' event. CEP can also spot any anomalies that span multiple orders. It can detect suspicious broker activities like a buy-ahead, in which the broker, when directed by a customer to buy shares, buys his own lot of shares first, and sells them after placing the customer's order. It would be difficult to build a detection mechanism for buy-aheads into SOA processes and CEP, as a watchdog off to the side, is much better equipped.

Another sample CEP use is in fraud detection checking for anomalies in transactions on an account. Here the fraud detection rules must understand the structure of the account events and the protocol governing how they are exchanged.

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CEP Platforms – Adoption Trends

Real time event correlation capabilities of CEP have got widespread adoption especially in handling the rapid evolution in financial markets. It has not only become a means of coping with change, but also generating higher returns because it enhances a firm's competitiveness and efficiency. In 2011, when technology decision-makers from major financial services firms were asked in a Bloomberg survey regarding which infrastructure investment areas have yielded the most return on investment in the previous year, 33% of the respondents chose low-latency trading and 23% mentioned complex event processing. CEP is thus being perceived as an important revenue generator by financial firms.

CEP is also adopted in the entertainment industry especially in the gaming and media planning areas. In gaming, real-time correlation of defined events (e.g. player activities) and the subsequent prediction of eventual winners have been received enthusiastically by users. CEP technologies are also found in airline disruption management systems, which will enable smooth scheduling of flight take-offs and landings and the energy and utility sector CEP is also widely adopted for "Smart Metering" process.

CEP Products in Market

Initially the most established commercial implementations came from small vendors, such as Coral8 and Streambase. But within the past few years the major SOA vendors have started to incorporate CEP into their stacks. IBM acquired Coral8 and came up with their CEP offering; TIBCO sells its CEP tool, BusinessEvents, in its SOA and BPM deals and Oracle offers a product called "Oracle" CEP.

Conclusion

Based on our implementation experience in EAI and BPM transformational technology areas, enterprises want to go up the value chain in terms of customer experience, multi-channel enablement and real-time monitoring of stringent service level agreements which have a direct bearing on customer satisfaction. CEP technologies will surely play a huge role in changing an enterprise from being 'reactive' into an 'adaptive' one by the real-time event analysis, correlation and subsequent remedial actions.

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Sajeev is General Manager & Practice Head for BPM & EAI in Mindtree. With over 17 years of industry experience, Sajeev is a technical authority in the transformational technologies of BPM, SOA and CEP (complex event processing). His areas of specialisation are Agile BPM, BPM and Social Media Synergies, BPaaS (Business Processes as Service). He is a regular contributor in technical forums and also a speaker at SOA & BPM vendor events.