Current Trends in CEP Research and Industry

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Introduction: CEP positioning

Business side

Research side
Event-Driven Awareness

Data
The light *was* yellow or it *will* turn yellow.

Event
The light *turned* yellow.

Used for insight and in planning

Used to alert (sense and respond)
Timely Sense-and-Respond Behavior Is Essential in an Event-Driven World

What's going on? Threats? Opportunities?

Opportunity

Threat

Threat

Threat
Event-driven businesses act when something happens.

An event is anything that happens, is thought to happen (an imagined, "virtual" happening) or could happen.

A business event is a meaningful change in the state of something relevant to the business, such as
- depositing or withdrawing money from a bank, trading shares of stock,
- submitting a customer order,
- hiring an employee,
- a competitor changing its prices.
A business that leverages event processing is using a computer to do what an athlete does — identify threat and opportunity situations and execute an appropriate response.

CEP is essential to strategies, such as the "zero-latency enterprise," "time-based competition" and "the agile (or adaptive) enterprise"
Performance information value erodes quickly.
Evolving Service-Oriented Architecture Brings Opportunities and Challenges

Zone of Competitive Leadership
- RESTian SOA (WOA)
- Event-Driven SOA
- Context-Aware SOA

Zone of Safe Following
- SOA

Zone of Decline
- Monolithic Architecture
- Client/Server Architecture

As of July 2006
- As of July 2008
- As of July, 2007

source: Gartner
Event processing vs. Service orientation

Business Process Chain: EDA

Command and Control: SOA

Data and Services Reuse Domain

Decoupling Borders
Introduction: CEP positioning

Business side

Research side
1. How does event processing change the way problems are detected, and future threats and opportunities are predicted?
2. Where will organizations derive the most tangible business benefits from EP and EDA?
Companies Have Always Been Event-Driven, but the Event Processing Was Done by People

Event Capture → Analysis → Response

What's going on? Threats? Opportunities?

- Manual Action
- Application, Automated Process
CEP Systems Automate Some Portion or All the Analysis Phase of Event Processing

**Event Capture**
- Sensors, IM, the Web, Applications, E-mail, Other

**Analysis**
- Filter out irrelevant events
- Calculate aggregates
- Detect patterns, trends, relationships among events
- Derive "complex" events

**Response**
- Manual Action
- Application, Automated Process

Decision Support for People

Digital Event Streams

BAM
The Business Value of CEP Systems:
1. Better Decision Quality

CEP systems can handle up to 100,000s of events concurrently; people can consider only a few events at a time.

**Traditional OLTP**
- Airline reservations
- ATM transactions
- Insurance claims
- Orders
- Inquiries

**Other Transaction Streams**
- Telco
- Financial trade "ticks"
- Credit card authorizations and transactions
- Micropayments

**Sensor Networks**
- Satellite, GPS readings
- Bar code scans
- Factory floor
- RFID readings

**Web and Net**
- Games
- Web auctions
- Click streams
- Poll Web page scrapes
- RSS, Atom feeds
- E-mail
The Business Value of CEP Systems: 2. Faster Response

Fully automated CEP systems can act in milliseconds; people require seconds or minutes.
The Business Value of CEP Systems:
3. Reduce Information Overload

CEP enables management-by-exception: Notify people only in situations that need human involvement.
- Introduction: CEP positioning
- Business side
- Research side
Event Processing in 2018

- Event Processing repeats (in 30-something years offset) the success of “Data Management”
- Part of the “main stream computing”
  - Wide coverage in term of applications that are doing some type of event processing
  - There are broadly accepted standards
  - Event Processing extensions to programming languages
  - Large amount of developers are familiar with the concepts
  - It is widely taught in universities with popular textbooks
  - Well-established Research community that contribute to the concepts and the engineering aspects
  - Other disciplines focused on extracting events and event patterns (image processing, information retrieval, search engines, data mining).

source: O. Etizion
Event Processing is now emerging as a research discipline.

The state is similar to the state of databases in the 1960-ies – some engineering models, low coverage, all proprietary, no theoretical basis.

The main challenges:
- Model (same role in EP as the relational model in DB)
- Standard Language (same role as SQL)
- Optimization on multiple criteria
- Methodology and software engineering challenge
Challenge one: conceptual model

- The “Event Processing Network” introduced by Prof. David Luckham from Stanford has wide acceptance in the industry.
  - However – it is not well-defined formally;
  - Most implementations are partial.

- Building such a model (the equivalent to the “relational model” in databases – but not extension to SQL!) has been designated as the number challenge for the research community.
Challenge Two: Programming Model

- Meta-Language that will include:
  - Programming in the large: declarative specification of the event flow (can change by optimization)
  - Programming in the small: declarative specification of each function (“event processing agent”).

- Translation of programming in the large to logical EPN
  - Includes context-based routing

- Translation of the programming in the small to a specific API of a certain run-time engine (e.g. Aptsoft, SQL, IPL).

- Meta-Language will be based for a standard proposal in this area
Challenge Three: Scalability and optimization

- Continuous self-optimization of an EP application based on multiple optimization criteria
- Items to optimize:
  - Mapping of the conceptual EPN to physical EPN
  - EPN topology (e.g. stratification layers)
  - Tuning options
- Based on goal function that may optimize:
  - Throughput
  - Latency
  - Local and E2E QOS criteria
  - Accuracy...
- Multiple scalability goals:
  - Number of events
  - Number of agents
  - Number of sources
  - Number of sinks
  - Complexity of computation…
Challenge Four: Getting closer to the business user

- Domain specific templates based on business vocabularies
- The direction: from template to language and not templates for the language.
Further challenges:

- Advance “Intelligent Event Processing”
  - Pattern mining
  - Predicted events and their handling
  - Handling of uncertain and probabilistic events
  - Automated decisions/actions.

- Software Engineering challenge
Why it succeeded?
("Business Rules Applied", Barbara Von Halle)

- It has a sound theory behind it.
- Software vendors understood the theory (well… to some extent), and delivered commercial products.
- There were some good books that eloquently explained the theory, the benefits, and the practicality, to the IT community.
- Practitioners developed methodologies for using it.
- The community was established.
- SQL enabled interoperability.
- A lot of R&D Investment to advance this area in engineering issues (transactions, query optimization, concurrency control)... happened since all contributed on the basis of the same model.
Thanks!