DRAFT
A Survey of Event Processing Languages (EPLs)

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Tim Bass, CISSP
Co-Chair Event Processing Reference Architecture Working Group

Principal Global Architect, Director
TIBCO Software Inc.

Disclaimer

This is a draft survey of event processing languages (ESLs) based on information provided to the author by various sources. Anyone who intends to use the information provided in this draft presentation should verify the accuracy of the information by contacting the company or organization surveyed.

This survey originated in a “call” in the CEP-Interest eGroup:

http://tech.groups.yahoo.com/group/CEP-Interest/

EPLs that were undocumented or unverifiable were not included in this draft survey.

Kindly email comments, suggestions or corrections directly to the author or post in the CEP-Internet eGroup.

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A Survey of Event Processing Languages

Commercial – Actively in Business

- TIBCO BusinessEvents™ Processing Language
- The TIBCO BusinessEvents Processing Language is a extensible, feature and grammar rich, object-oriented Java-like EPL that allows users to define business rules on events, systems, services, or a combination of all of these and execute tasks. Built in EPL functions include: Date and Date Functions, Engine.Locale Functions, Engine Functions, Event Functions, Instance.PropertyArray Functions, Instance.PropertyAtom Functions, Instance.StateMachine Functions, Instance Functions, Math Functions, Number Functions, String Functions, String.IO Functions, System Functions, Temporal.Calculus Functions, Temporal.History Functions, Temporal.Numeric Functions, Temporal Statistic Function, and XPath Functions.
- URL: http://www.tibco.com/software/cep/businessevents.jsp
- Proprietary. Copyright TIBCO Software Inc. All Rights Reserved.

A Survey of Event Processing Languages

Commercial – Actively in Business

- Progress Apama™ Event Processing Language
- Apama offers a rich Event Processing Language (EPL) optimized for the concise expression of business and temporal logic. Apama's EPL is optimized for the concise expression of business and temporal logic. Available natively and in Java, Apama’s EPL delivers a wide range of Complex Event Processing (CEP) functionality.
- URL: http://www.progress.com/realtime/products/esp_platform/index.ssp
- Proprietary. Copyright Progress Software Corp. All Rights Reserved.

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Commercial – Actively in Business

- StreamBase StreamSQL™ Event Processing Language
- StreamSQL is a next-generation query language for complex event processing (CEP) applications. StreamSQL extends the industry-standard Structured Query Language (SQL), to empower the processing of real-time data streams. Just as the inherent value of SQL is its ability to issue queries against stored data, this same querying capability must also exist for data streams. The development of StreamSQL was funded by StreamBase Systems.
- URL: http://streamsql.org/pages/faq.html
- Proprietary. Copyright StreamBase Systems. All Rights Reserved.

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Commercial – Actively in Business

- Coral8 CCL™
- Continuous Computational Language (CCL) is an SQL-based programming language. Basic complex event processing constructs, such as filters (SELECT/WHERE), correlations (JOINS) and Aggregators (SUM, AVG, etc.), are structured in the same fashion as standard SQL. CCL adds specific extensions such as windows, time series operations, and event pattern matching that tune the language for specific event processing tasks. When integrating data from relational databases, this programmer uses standard SQL in sub-queries.
- URL: http://www.coral8.com/downloads/public/Coral8CclReference.pdf
- Proprietary. Copyright Coral8, Inc. All Rights Reserved.

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Commercial – Actively in Business

AleriLabs

- <u>Aleri SQL and Aleri XML</u>
- The Aleri Streaming Platform offers two EPLs. Aleri SQL adds some extensions to standard SQL and Aleri XML is a set of elements and properties that can be defined in XML to define event processing. Continuous Queries can make use of any of the following elements: *Joins:* to correlate and combine data across multiple sources, *Filters:* to filter data according to complex criteria, *Data Aggregation and Data Analysis:* summarize and group data sets by computing statistics (e.g. sum, count, average, ...) across like elements, *Compute:* perform mathematical calculations, data transformation, etc, using a full range of operators and built in functions as well as the ability to register proprietary call-out functions.
- URL: http://www.alerilabs.com/technology/product_overview.html
- Proprietary. Copyright Aleri Labs. All Rights Reserved.

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Commercial – Not Actively in Business

- iSpheres EPL**
- iSpheres EPL was a declarative programming language. Instead of using SELECT-FROM-WHERE queries against a persistent data store (like SQL), iSpheres EPL employed a time-based persistent ON-WHEN-THEN query against asynchronous data flows and historical context data, The iSpheres EPL language has the following form:

  ON (triggers) WHEN (conditions) THEN (actions)

  The result was a real-time application that used event processing to monitor, correlate, detect and respond to actionable conditions.
- URL: http://www.adtmag.com/article.aspx?id=10121
- iSpheres is "out of business" iSpheres EPL was announced to be *".... copyright-free .... language for processing…"*

****Note: iSpheres' intellectual property was purchased by Avaya, Inc.**

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    - ruleCore Markup Language (rCML)
    - DEAL
    - STREAM CQL
- Appendix: Event Processing Definitions

****Note: There Are Many Academic Event-Condition-Action (ECA) Research Papers and Projects. We Include Only a Few of These.**

A Survey of Event Processing Languages
Academic & Open Source

STANFORD UNIVERSITY »

- Rapide™
- *Stanford's Rapide™ Language effort focused on developing a new technology for building large-scale, distributed multi-language systems. Rapide was based upon a generation of computer languages, called Executable Architecture Definition Languages (EADLs), and an innovative toolset that supported the use of EADLs in evolutionary development and rigorous analysis of large-scale systems.* Rapide offers a full range of structured programming statements, described in chapter 9 of the referenced Rapide 1.0 Executable LRM.
- URL:

  http://pavg.stanford.edu/rapide/examples/teaching/dtp/language.html#process
- Academic research at Stanford. No License Required.

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Academic & Open Source

- Formal Language for Expressing Assumptions (FLEA)
- *“FLEA stands for a Formal Language for Expressing Assumptions. Our original motivation was to use monitoring to notify a system's users / administrators / designers whenever assumptions underlying use of that system are violated [Fickas & Feather 1995]. There can be a multitude of uses for such information, for example, alerting users when they are using a system in a manner for which it is not intended, alerting administrators of changes in typical usage patterns (to which they might wish to respond by reconfiguring the system and/or its environment), or alerting designers of the need/opportunity to extend their systems in new ways which they had not necessarily predicted. We have come to realize that FLEA can be used to monitor for event-based conditions, whether or not they represent assumptions of expected system usage.”*
- URL: http://www.cs3-inc.com/flea_overview.html
- Open Usage, No License Required.

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Academic & Open Source

Esper

- Esper Event Query Language (EQL)
- EQL has been designed for similarity with the SQL but differs from SQL in its use of views rather then tables. EQL is based on the syntax of SQL but offers extensions for event stream processing, has a comprehensive complex-event pattern matching language, and has object-oriented event processing capabilities leveraging the Java type system and XML.
- URL:

  http://esper.codehaus.org/using/documentation/documentation.html

- Open, under the open-source Lesser GNU public license (LGPL)

A Survey of Event Processing Languages

Academic & Open Source (ruleCore is evolving to a commercial model)

ruleCore

- ruleCore Markup Language (rCML)
- rCML is an XML based language for definition of ECA style of reaction rules. Main focus for rCML is on composite event detection (a.k.a event patterns, situations, complex events or derived events). A number of composite event detection nodes (operators) are defined in the rCML. The goal is to have an extendable language with high expressive power when it comes to defining composite events out of primitive events with logical, sequencing, causal and temporal relationships. rCML consists of reusable blocks of items, most notably items for composite event, condition and action definitions. By reusable we mean that a block, an action for instance, can be used in multiple rules. The reusable items are connected together with XPath expressions. rCML is designed to provide a base for defining reactive services in an EDA/ESB/SOA like environment.
- URL: http://www.springerlink.com/content/k207xw3v22775157
- rCML is free to use for any purposes for both academic and commercial organizations. The ruleCore Engine, which implements rCML, is free for academic use, including source code

A Survey of Event Processing Languages

Academic & Open Source

UCIrvine

- Distributed Event Awareness Language - DEAL
- DEAL is an event processing language and system designed to provide awareness information in a heterogeneous distributed system. The DEAL environment extends the basic functionality provided by event notification servers such as Khronika [9], CASSIUS [8], CORBA Notification Service [12], ELVIN [6] and SIENA to cope with the richer set of requirements of awareness applications. This is accomplished by the use of a powerful and usable event language that allows the definition, processing combination, filtering and routing of events coming from heterogeneous sources (programs, applications components, people, mobile devices and so on). The DEAL language syntax and resources were inspired in the features provided by event processing languages such as GEM [10], Yeast [2], EDEM [7] and READY [18] – See paper for references.
- URL: http://www.ics.uci.edu/~redmiles/publications/C043-SFS+02.pdf
- Academic research at UC Irvine. License status unknown.

A Survey of Event Processing Languages
Academic & Open Source

STANFORD UNIVERSITY »

- STREAM CQL
- Stanford’s concrete declarative query language, *CQL* (for *Continuous Query Language*), is defined by instantiating the operators of our abstract semantics. Syntactically, CQL is a relatively minor extension to SQL. CQL uses SQL constructs to express its relation-to-relation operators, and much of the data manipulation in a typical CQL query is performed using these constructs, exploiting the rich expressive power of SQL.
- URL: http://www-db.stanford.edu/stream
- Inactive academic research at Stanford. License status unknown.

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    - Tim Bass, TIBCO
    - Opher Etzion, IBM

Appendix: Working Definitions of “Event Processing”

1. *event processing* (n.) computational activities on events dealing with the association, correlation, and combination of event data and information from single and multiple event sources to achieve refined identity and situation estimates for observed event objects, and to achieve complete and timely assessments of opportunities, threats, and their significance. Event processing is characterized by continuous refinements of event estimates and assessments and by evaluation of the need for additional sources, or modification of the process itself, to achieve improved results. - Tim Bass, TIBCO Software Inc.

2. event processing (n.) a collection of computational activities over the life-cycle of events; each activity accept one or more event (or event stream) as an input, performs some computation and creates one or more event as an output or can trigger some action. The activities create an "event processing network". – Opher Etizon, IBM

Notes:

- See also:
- Event processing languages by Philip Howard , Bloor Research
- Complex Event Processing Beyond Active Databases: Streams and Uncertainties
  - References SNOOP and COMPOSE (EPLs)
- A Web-based Infrastructure for Awareness based on Events
  - Discusses DEAL. References GEM, Yeast, EDEM & READY (EPLs)
- Survey on event-based systems @ UC, Irvine (Older Information)
- Aptsoft Director™ does not have an EPL
  - Many commercial event processing (CEP or ESP) offerings have an IDE or Business User Interface (UI) for event process authoring.

A Survey of Event Processing Languages

Commercial – Actively in Business

- AptSoft Director™ (no EPL)
- AptSoft UI sets up parameters which the AptSoft CEP server then incorporates into a Java application (after going through version/source control and proper authentication of course) and executes. There is no CEP “event processing language” per-se in the AptSoft platform, according to AptSoft.
- URL: http://www.infoworld.com/AptSoft_Director_for_CEP/product_76131.html?view=1&curNodeId=22
- Proprietary. Copyright AptSoft. All Rights Reserved.

Please Send Comments and Suggestions!

Thank You!

Tim Bass, CISSP
Principal Global Architect, Director
tbass@tibco.com

http://tech.groups.yahoo.com/group/CEP-Interest/