Towards a REST-ful Visualization of Complex Event Streams and Patterns

Benjamin Kanagwa[1] **and Nasser Kimbugwe**[2]
Makerere University,P.O.BOx 7062, Kampala, Uganda
[1]bkanagwa@cis.mak.ac.ug, [2]nkimbugwe@cis.mak.ac.ug

Abstract— *This paper presents a scalable architecture for visualization of complex events, event hierarchies and relations. The goal is to support flexible, multi-level, multidimentional visualization of primitive and composite events to aid faster decision making. Our approach is to apply the concept of Representational State Transfer (REST) that focusses on design of large scale distributed systems. Different visualizations are first and foremost mapped to state representations of Complex Event Processing (CEP) systems. We show how RESTful design can be applied to common CEP visualization requirements such as root-cause analysis. Finally, we present a prototype implementation of the API using a case study of event streams in public procurement.*

Keywords: stream processig, complex event processing, visualization, Representational State Transter (REST).

1. Introduction

Diversity and responsiveness desired by users of complex event processing systems to explore large datasets in respect to different aspects has created a need for a more generic and scalable visualization infrastructure. We propose application of Representation State Transfer (REST)[12] to visualization in Complex Event Processing [16], [22]. REST is an architecture style designed for large scale distributed systems and has been applied in design of web services[8], [9], and other applications including twitter[1] and facebook[2] among others. The goal is to design an architecture that brings RESTâĂŹs advantages of loose coupling and good scalability to the discipline of CEP. The resulting uniformed interface provided by REST creates new opportunites including potential to integrated CEP systems across domains including mashups of CEP based systems. It has been noted by [21] that CEP is not yet fully exploited and is still establishing itself within the business world due to its lack of scalability and interoperability both within the event detection technologies as well as the visualization techniques. Current CEP visualizations do not provide the flexibility to alter, adopt and analyze the data from different perspectives.

[1]http://twitter.com
[2]http://facebook.com

CEP based systems continuously process events as they happen to infer complex relations based on context and temporal relationships. An event is any important occurrence that is worth noting and represents the instance of an activity [17]. Each organization has many events that happen at different times, some related and others not. Occurrence of events in time-space creates a continuous *flow* of events leading to the notion of *event streams*. An event stream has been defined as an infinite sequence of events [1]. Therefore, organisations have many event streams flowing into different information systems. CEP does not look at individual events but seeks to detect presence or absence of given event combinations (complex events) tied togehter by temporal relations. The event sources may be internal of external to the organization. External sources may indlude social media [3], [4] among others. The role of a CEP system is to continuously listen to incomming event streams and filter out desired combinations of events on which aggregation functions are applied to infer trends and instant insights for decision making.

Current users of CEP systems interact through dashboards with generic graphical representations for all users. However, users require personalized visualizations and appropriate access controls where a single user may be interested in different representations of the same event. It has been noted that visualization of these events in real-time is not yet scalable. Moreover current approaches make it impossible to integrate different CEP systems. This is largely due different event, pattern and visual representations. We note that provision of information is one aspect that must be complimented with appropriate representations that facilitate faster decision making. Personalized visual tools should allow browsing and exploration of events and related causes. We contend that each user at whatever level has some decision to make. Accurate, and current information is therefore required by users in varying level of detail and sophistication.

This problem is further compounded by large organizations and cloud environments, where thousands of users may be interested in observing different patterns. This requires the system to provide scalable mechanisms for serving such large number of patterns. Distributed scalable systems have been addressed by the Representational State Transfer (REST) design – a resource oriented architecture designed for scalable distributed systems. Through its uniform in-