STHITHIKA

COST-BASED QUERY DISTRIBUTION WITH QUERY RE-WRITING IN DISTRIBUTED COMPLEX EVENT PROCESSING SYSTEMS

Imiya Mohottige Thakshila Dilrukshi

(158211H)

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Department of Computer Science & Engineering

University of Moratuwa

Sri Lanka

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DECLARATION

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The above candidate has carried out research for the Masters of Science thesis under my supervision.

Signature of the supervisor: Date:

Name of the supervisor: Dr. Surangika Ranathunga

Abstract

Complex event processing (CEP) is very useful in analyzing event streams and identifying useful patterns from them. Due to the distributed nature of existing applications, high volume of event generation and complex queries, using a single node CEP became problematic. One way to overcome this problem is to introduce multiple complex event processing nodes and distribute the queries among them for load balancing. However, due to the stateful nature of events, distributing queries among CEP nodes is not an easy task. Query distribution across CEP nodes is an NP hard problem.

This research is focused on the problem of optimally processing a large number of different event streams using a large number of CEP queries in a distributed manner. Optimization of query processing and distribution is done in two aspects: optimizing the individual query by introducing query rewriting, and optimizing query distribution across multiple nodes by introducing new factors to the query distribution algorithm. Cost of individual queries, number of event streams common to queries, CPU and memory utilization of nodes that run CEP queries, type of queries, and the number of queries in each node are the factors considered for query distribution. Usability improvement is done in two ways: adding standard communication by introducing JSON messages for communication, and integrating firebase messaging service to standardize the event source.

Experiments show that with these optimizations, compared to existing systems, STHITHIKA is capable of providing a higher system throughput, without making an adverse impact on event duplication or process load variance across processing nodes. It has the ability to handle higher number of queries compared to existing system. It is also more robust to event bursts. Due to the changes in query distribution and re-writing, time taken for initial query distribution has increased. Usability improvement enabled the easy integration with other technology and decoupling event source from the system.

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LIST OF ABBREVIATIONS

CEP - Complex Event Processing

CN - Client Notifier

CPU - Central Processing Unit

DISP - Dispatcher

EP - Event Processor

EP-CTL - Event Processing Controller

HA - High Availability

NFA - Non-deterministic Finite Automata

NP - Non-deterministic Polynomial

PE - Processing Element

PEC - Processing Element Container

QP - Query Processor

QT – Query Type

RTL - Register Transfer Level

S4 - Simple Scalable Streaming System

SCTXPT - Scalable Context Delivery Platform

SOA - Service Oriented Architecture

SQL - Structured Query Language