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Comparison of Complex Event Processing Techniques in Sensor Networks

Dr. M. Senthil Kumar[1], M.Sumithra[2]

Associate Professor, Department of C.S.E., Valliammai Engineering College, Chennai, India[1]

PG Scholar, Department of C.S.E., Valliammai Engineering College, Chennai, India[2]

Abstract: Complex event processing (CEP) combines information from different sources to infer events or patterns that recommend a lot of difficult circumstances. The goal of complex event processing is to search out significant events and reply to them as quickly as doable. Complex event processing may be integrated into 2 forms specifically Active-rule complex Event processing (ACEP) and In-Network Distributed complex Event processing (INDCEP). Active rules in ACEP enable us to specify a pattern query's dynamic condition and real-time actions. The technical challenge is to handle interactions between queries and reactions to queries within the high-volume stream execution. In-Network Distributed complex Event processing (INDCEP) is employed to perform the process inside the network by pushing complex event processing into network nodes. It focuses on distributed event detection via diffusing distributed plans into a network of sensing element nodes to perform complex event tasks. In this paper, we discuss about real time risks, tackle by active rule embedded CEP and processing by pushing CEP into the network nodes by INDCEP. By comparing these two integrated forms we conclude that In Network Distributed Complex Event Processing is more efficient since it meets both real time requirements and network characteristics.

Keywords: event processing, active rule, network node, AnduIN.

I. INTRODUCTION

Complex event processing is a well known technology used for event patterns processing. Complex events can capture exceptions, vulnerabilities or opportunities among various applications and domains. Complex event processing technology is used for processing scenarios based on patterns or queries. However processing during real-time is quite difficult. To tackle this unsolved problem of facing real time risk we can embed active rule support within the complex event processing paradigm. Embedded form of Active rule based Complex Event Processing is known as Active CEP (ACEP) [1],[2],[3].

Active rules in ACEP allow us to specify a pattern query's dynamic condition and real-time actions that in turn may affect the query results. A critical technical challenge is to handle the real-time mutual effects between queries and reactions for queries in the high-volume stream execution.

In ACEP we abstract such effects as interactions among continuous queries and active rules. the push-based execution for interactions among continuous queries and active rules leads to a variety of anomalies and thus erroneous results.

The second problem of CEP is to utilize an in network processing concept. The communication between sensor networks and entity (which is considered as central part) is expensive, whereas communication within a network is cheap [13]. Thus by pushing complex event into a network node aims to perform more processing within the network and it may result in significant improve energy consumption. Communication cost is reduced during communication among network nodes.

We describe the integrated form of CEP called In Network Distributed Complex Event Processing which pushes complex event processing into network nodes inorder to develop robust and high performance Distributed Complex Event processing Engine for Mobile Systems(CEPEMS).In this we combine new engine with AnduIN [12] in order to receive and validate query produced by user and generate CEP plans before disseminating them into network. When we compare Active rule based CEP with Distributed CEP we can come to conclusion that In Network Distributed is more efficient than Active rule Complex Event Processing since it can deal with both real time requirements and network characteristics whereas active rule CEP only deals with real time requirements. In Network Distributed CEP is also cost effective during communication among neighbouring nodes website.

II. COMPLEX EVENT PROCESSING

An In this section ,we explain about basic concept behind complex event processing without any integration. Complex event processing includes event instances, event types, event streams and pattern queries.

A. *Event Instances*

Each event instance denotes an immediate occurrence of interest. Input streams of events are called input events which are assumed to be primitive. Every event streams consists of two time stamps namely application time and system time. The application time for an event instance relate to the discrete moment of the occurrence of event enrolled by the event source.

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B. Event Types

Event instances which are similar is grouped under one type called event types. Event types are differentiated with the help of event names. An event type includes associated event schema that defines a set of attributes.

C. Event streams

The input to the ACEP system is a possibly infinite event stream that contains all events of interest. The event stream is heterogeneous, being populated with event instances of different event types.

D. Pattern queries

Pattern queries are a common feature among most of the event processing technologies. Sequence (SEQ) pattern specifies a particular order in which the events of interest must occur.

Complex event processing processes the event of streams by collecting them from various sources to produce output streams. Complex event processing consists of Complex event processing engine and stream processing engine. It is shown in fig 1.

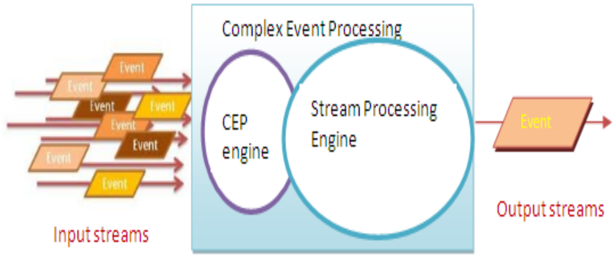

FIG 1: Complex Event Processing (CEP)

III.ACTIVE RULE BASED CEP

Active Rule Complex Event processing section includes models and architecture of Active rule CEP. Complex event processing provides effective pattern matching on event streams, whereas in real time opportunities and risk detection capability are limited. To overcome this, An integrated model of complex event processing to active rule is known as Active complex event processing (ACEP) is developed. ACEP provides fine grained and more efficient rule processing.

A. Model of Active rule CEP

Our Active rule based CEP focuses on core semantics followed by Event Condition Action (ECA) format. It includes following core semantics namely event triggering, condition and action.

In event triggering, SEQ operator is used for triggering the active rules during the process of Active rule Complex Event Processing system change.

Condition is a logical test based evaluation of pattern query qualification. If it is true, then action can be performed by the active rule otherwise no action is carried out by active rule.

Action in Active rule Complex Event Processing (ACEP) supports write operation on a shared store without affecting the successive pattern query execution.

B. Active rule CEP Architecture

The architecture of Active Rule Complex Event Processing (ACEP) considers loosely coupled and built in. In a loosely coupled system, CEP engine is considered as a black box for executing pattern queries. The kernel of the engine remains unchanged. Complex event processing technology only provides pattern matching service. Whereas several extensions are added in order to make to perform the full functionality of Active rule Complex Event Processing (ACEP). In Britain, a novel architecture is used. It directly realizes active rule, functionally as part of complex event processing instead of adding on top of CEP engine like loosely coupled software component.

A typical approach is enabled in ACEP to cope with interactions between coinciding accesses and updates is to enforce concurrency management. However, existing concurrency management schedulers square measure supported the notion of an info dealings the execution of a finite sequence of one-time knowledge manipulation operations on typical keeps knowledge sets.

Active Rule primarily based CEP includes question arrange and rule process techniques. A query process in ACEP includes knowledge flow pipeline of stream operators, which has SEQ, window, static-predicate, active-predicate, result construction. The state of ACEP is often modified in accordance with raw event data. The SEQ engage a non deterministic finite automata (NFA) for pattern recovery. This is shown in FIG 2.

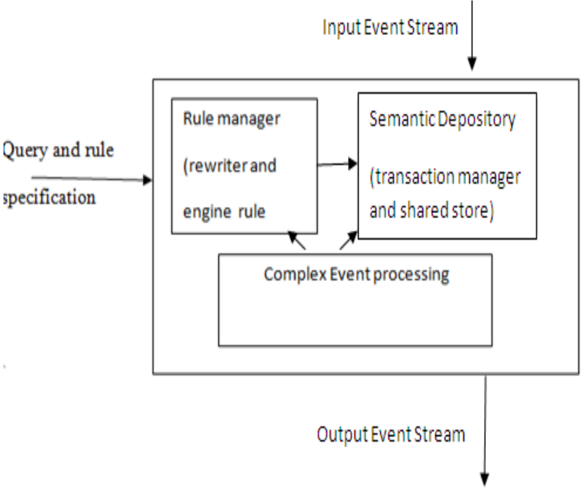

FIG 2: Active Complex Event Processing (ACEP)

In this work, we have a tendency to fill this void by introducing the notion of a dealings within the stream context. Moreover the transactional pattern question process deals with interactions among continuous queries and active rules. This process is particularly difficult as a result of concurrency management poses strict time-based constraints, whereas our algorithms got to work for high-volume streams nonetheless come through near-real-time responsiveness.

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IV. DISTRIBUTED BASED CEP

Mobile system which has sensing element network generates a dissimilar event streams which may be processed with efficiency by the employment of In-Network Distributed complex Event Processing(IN-CEP).INCEP performs event processing by pushing complex event processing into the network nodes. This leads to development of sturdy and high performance distributed complex event processing engine for mobile systems(CEPEMS) supported for mentioned technology. This technology performs distributed event process by dispersive distributed plans into a network of sensing element nodes to perform advanced event task.

In Network Distributed complex Event processing is accountable for correlating primitive events from completely different node to spot higher level complicated events and also the event patterns from event streams. furthermore, it detects complex events and valuable data for a event sequences with logical and temporal relationship by using the idea of distributed computing. This concept authorizes system to communicate solely with neighbouring nodes once it's definitely necessary or investigating a complex event to minimize internal information traffic for sensing element networks. Therefore, it avoids the energy consumption bottleneck by reducing the use of communication, especially when there are relatively few events satisfying complex event conditions. It is shown in fig 3.

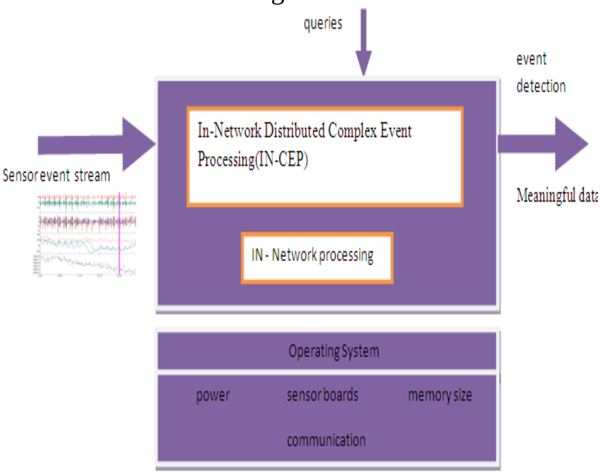

FIG 3: In-Network Distributed Complex Event Processing (IN-CEP)

INDCEP ought to support many CEP operators such as disjunction, sequence, conjunction and a few of negation. When one or a lot of events out of a group of events would occur then it satisfies Disjunction of events whereas conjunction of events is achieved once all the events turn up. However, they can happen in any order. The sequence operator determines a particular order during which the events ought to occur consecutive. the negation operator is employed to point the non-occurrence of specific events.

Additional functions are pushed into a large set of abstraction and temporal operators besides complex event processing to perform extra tasks such as sampling, filtering and pre-processing the data mining.CEP relies on non-deterministic finite state automata(NFA).Query plan helps us to implement the node process performance. It corresponds to Associate in Nursing acyclic directed graph of functions. these performs follow publish subscribe mechanism to transfer sensing events from function to a different.

The main aim of In Network Complex Event Processing is that a large NFA expression can be built and then spitted into smaller NFA's according to some rules. Each sub-expression contains a query plan which has CEP function and other functions. These plans can be matched independently on distributed nodes. In case of existence of plan dependencies between nodes, intermediate events can be sent between these nodes.

V. INTEGRATION OF CEPEMS AND ANDUIN

AnduIN is a data stream engine which performs processing and analysing of dynamic data. It is developed by Ilmenau University of Technology. It also includes standard query operators such as projection , filter, aggregation and join. User can register the query which is expressed by using a simple SQL-like interface (CQL), in the system to process incoming data continuously.

AnduIN combines sensor-local in-network processing, a data stream engine and also decides which sensor network query portion can be carried out inside the sensor network .It also determines the portion to be processed at the engine which is based on multidimensional cost model with energy consumption as a factor.New functionalities are added for supporting internal, generic and scalable complex event processing which is provided by local powerful instance of CEP operators which identifies complex events and pattern matching.

VI. DISCUSSION

Active Rule Complex Event Processing provides concurrency control and reliable interfaces to read and write the shared store for the EP engine and the rule engine whereas In network Distributed Complex Event Processing provides real time requirements by pushing network nodes. Active Rule Complex Event Processing can be effectively used for business processes due to its ability of facing real time risks.

INCEP focuses on distributed event detection via dispersing distributed plans into cluster of sensor nodes which enables us to perform complex tasks.In Active rule CEP, rule event detection is carried out which is based on logical test. Using Active rule CEP in distributed network leads to more complex processes whereas INDCEP can push network nodes into CEP engine resulting in distributed event processing. From these analysis we conclude that In Network Distributed Complex Event Processing able to satisfy both real time requirement and network characteristic whereas Active Rule CEP only capable of facing real time risks.

VII. CONCLUSION

This paper briefly discussed about Active rule based complex event processing and In Network Distributed

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Complex Event Processing. Active Rule CEP provides efficient processing of queries in real-time whereas IN Network Distributed CEP provides efficient processing of real time requirements and also satisfies network characteristics. We believe that INDCEP and its engine are of vital importance for detection valuable data from sensing element networks, and sending them instead of exhausting the energy for transferring low level sensing element data to the destination. This ends up in programming language nodes and network period of time.

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