Chapter 4

Foundation of XML Stream Processing Techniques

Weidong Yang
Fudan University, China

Hao Zhu
Fudan University, China

ABSTRACT

The problem of processing streaming XML data is gaining widespread attention from the research community, and various XML stream processing methods are put forward, including automaton-based methods, index-based methods, and so forth. In this chapter, the basic concepts and several existing typical approaches of XML stream processing are discussed. Section 1 introduces the background and current research status of this area. Section 2 focuses on the discussion of automaton-based methods, for example, X/YFilter, XPush, et cetera. In section 3, the index-based methods are given. In section 4, other methods such as Fist and XTrie are discussed briefly. Section 4 discusses some optimization technique of XML stream processing. Section 5 summarizes this chapter.

4.1 INTRODUCTION

4.1.1 Background

Nowadays, XML is considered as a standard of data representation and exchange, it is widely used in various fields such as SOAP and WSDL web services, business to business transactions and personalized content delivery. On the other hand, due to the demands from sensor network applications, information dissemination, content-based routing, and processing of scientific data, efficient processing of XML stream data has attracted lots of attentions in recent years.

A data stream is defined as a massive unbounded sequence of data elements continuously generated at a rapid rate. A data stream management system (DSMS) registers queries in advance because it should execute them continuously perpetually rather than once on demand. The registered query is called a continuous query. It produces its query result whenever an incoming tuple of a target data stream satisfies it. Accord-
For XML stream management systems, currently, most queries are expressed by some structured query languages such as XPath (XQuery 1.0, 2011) or (Su, Jinhui, & A. Rundensteiner, 2003). The core technical challenge in such systems is processing a large set of XPath queries over a continuously incoming XML stream. This challenge is related to, but different from, the more traditional stored XML data retrieval problem. XML stream is generated at a rapid rate and arrives continuously, therefore it requires the processing system has a better processing capability and lower memory used. XML streaming data are available for reading only once and are provided in a fixed order determined by the data source.

4.1.2 The State of Art

Several relational data stream management systems have been proposed since 2002, such as Aurora (Abadi et al., 2003), Telegraph (Madden, Shah, & Hellerstein, 2002) and STREAM (Motwani, et al., 2003). Similar to these systems, XML stream filtering is also based on the concept of continuous queries processing for streaming data. But XML data is ordered, recursive and hierarchical, mostly queried by XPath/XQuery language. The differences between XML data and ordinary relational data determine that the special techniques are needed for processing XML stream data.

Several studies have been concentrated on how to evaluate multiple and large amount of XPath queries over XML stream data. University of California at Berkeley proposed XFilter (Altinel & Franklin, 2000) at 2000 in the VLDB (one of most famous conference in the field of database), which builds a finite state machine (FSM) for each XPath query and employs a query index on all the FSMs. As the successor of XFilter, YFilter (Diao, & J. Franklin, 2003) combines all of the XPath queries into a single NFA(non-deterministic finite automaton), supporting shared processing of the common prefixes among all navigation