Improving Network Management by XML to Relational Data Translation

Mahabubul Alam, Department of Computer Science, California State Polytechnic University, Pomona, CA, USA

Salam Salloum, Department of Computer Science, California State Polytechnic University, Pomona, CA, USA

Mohammad Husain, Department of Computer Science, California State Polytechnic University, Pomona, CA, USA

ABSTRACT

Network management is a critical component in both wired and wireless network. In wireless networks, the network dynamics changes rapidly and the network management information needs to be updated frequently. Due to its structured form and ease of usage in communication, eXtensible Markup Language (XML) is preferred as a configuration and logging tool in network management. However, it is convenient to use relational databases such as SQL to store and process data of wireless network management where frequent updates are necessary. In this paper, the authors show an automated method of converting XML documents to store in relational. We have implemented a proof of concept and compared performance to existing approach.

Keywords: eXtensible Markup Language (XML), Network Management, Network Management, Simple Network Management Protocol (SNMP), Structured Query Language (SQL), XQuery

INTRODUCTION

Over the years different technologies are developed and used for managing data in real world. Some of them solve similar problems where others are totally independent. Since XML is considered as a standard for exchanging data, a lot of related technologies are being developed around it. XML schemas are used to validate the XML data integrity by XML Parsers. This key concept can be applied to a wide range of network management aspects.

The use of XML has been growing at a tremendous rate in the recent years. Also, several technologies supporting the storage and usage of XML have been evolved by providing their proprietary functionalities. Common applications using XML include document transmission in Business to Business (B2B) systems, message format construction for integration of Internet

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applications with legacy systems, binding of XML data to visual and non-visual controls, data storage and retrieval, and various data manipulation activities within applications. The benefits most often associated with the utilization of XML include platform independence, low cost of entry, and the ability to seamlessly share data (Goldfarb et al., 2002).

As the web has matured, it has become more than a medium to present electronic documents to a wide audience. It has become a medium of communication not just for humans, but also for applications. Over time, applications have changed from standalone programs to a collection of related but independent components. Communications between these components has become more and more difficult as each has grown on its own terms, without standard interfaces leading to semantic interoperability problems. XML (eXtensible Markup Language) is an attempt to mitigate some of these problems.

XML can be used to exchange network data. As XML is stored in plain text format, it provides many software and hardware independent ways of sharing data. Converting data to XML can reduce greatly the complexity caused by incompatible data formats by creating data that can be read by many different types of applications. As a “database” format, XML has some advantages. For example, it is self-describing (the markup describes the structure and type names of the data, although not the semantics), it is portable (it represents data in Unicode format), and data can be described as a tree. In addition to provide a suitable data exchange format, XML also represents a more flexible semi-structured data model than the relational model. Relational database systems enforce an explicit and rigid schema on all stored data. A simple xml document has shown in Figure 1 as an example.

Network management data can be stored and processed as XML documents. Most existing network devices are already designed and embedded with simple network management protocol (SNMP) agents and SNMP managers. SNMP framework is appropriate for managing devices on IP network and monitoring to manage small items of data. It has serious issues to retrieve big chunks of configuration data. Besides, it lacks the scalability, efficiency, and security. It is also a poor management information model. On the other hand, data as XML is much better to transfer, receive, and process using TCP/IP or HTTP than the poorly structured message data. To support the transfer of XML data, DOM and SAX based APIs can be implemented through XML parsers in management applications. Furthermore, XML query languages, like XPath or XQuery, can be used to query the device’s data. Stylesheet language like XSLT can be used to filter, generate statistics, report, or to correlate data from several documents. Moreover, XML schemas can be used to preserve the data integrity. Also, web services are available for high level management operations using Simple Object Access Model (SOAP) (Cisco Systems) (Shafer et al., 2002; Strauss et al., 2003).

The Relational Storage Manager can be used to store and process the XML documents and it implements the storage structures, such as the page files, etc. and the index structures to speed up the process of accessing data. It also manages the interaction between the underlying secondary storage and main memory buffers. Again, there are two approaches within relational approach classification which are schema-based and schemaless. In generic (predefined)

Figure 1. A sample XML document

```xml
<WLAN id="1001">
  <SSID>Linksys</SSID>
  <Hex>ED344644QA</Hex>
</WLAN>
```
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