EFFICIENT XML QUERIES AND UPDATES ENCODING SCHEME IN THE PRESENCE OF ACCESS CONTROL USING FRACTIONAL NUMBERS
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By

MEGHDAD MIRABI NOOSHABADI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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DEDICATION

This thesis is dedicated to my lovely wife and my darling parents for their endless support, encouragement, and patience.
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Doctor of Philosophy

EFFICIENT XML QUERIES AND UPDATES ENCODING SCHEME IN THE PRESENCE OF ACCESS CONTROL USING FRACTIONAL NUMBERS

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March 2013

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As XML is emerging as a de facto standard for sharing and exchanging data over the internet, access control for XML data has become an important research topic. Several XML access control mechanisms have been proposed to enforce a fine-grained access control for querying XML data. However, only a few researches are proposed to update the structure of XML data in the presence of a fine-grained access control.

A way to accelerate the process of XML querying is to label the XML nodes in such a way that the structural relationships between two arbitrary XML nodes in the XML tree can be efficiently computed. However, if there is frequent demand for the XML data to be updated, most of the existing XML labeling schemes need to re-label pre-existing XML nodes in order to keep the order of XML nodes in the XML tree, which is rather time consuming.
In order to query and update XML data in the presence of a fine-grained access control, an accessibility map is required to determine the accessibility of XML nodes at runtime. Several researches have been done to compress the accessibility map in such a way that the accessibility of XML nodes can be rapidly determined but there is no effort to compress the accessibility map in dynamic XML environment where the accessibility of XML nodes can be updated frequently.

In this thesis, first we propose a novel XML encoding and labeling scheme based on fractional numbers to encode and label the XML nodes in the XML tree. Our proposed XML encoding and labeling scheme is able to determine the structural relationships between two arbitrary XML nodes in the XML tree and to eliminate the process of re-labeling pre-existing nodes during the process of XML updating. The experimental results demonstrate that our proposed XML encoding and labeling scheme is more efficient than existing XML encoding and labeling schemes for XML querying and updating.

Secondly, we propose a Dynamic Compressed Accessibility Map called DCAM to compress the accessibility map with rapid determination of accessibility of XML nodes at runtime in such a way that it needs minimum maintenance cost to be used in dynamic XML environment. In order to determine the structural relationships between XML nodes in the DCAM, we label the XML nodes in the XML tree as well as the XML nodes in the DCAM with our proposed XML encoding and labeling scheme. The experimental results demonstrate that the DCAM is more efficient than the CAM in compressing the accessibility map.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

SKEMA PENGKODAN PERTANYAAN DAN KEMASKINI XML YANG CEKAP DENGAN KEHADIRAN KAWALAN CAPAIAN MENGGUNAKAN NOMBOR PECAHAN

Oleh

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Disebabkan XML muncul sebagai suatu piawai de facto untuk perkongsian dan penukaran data melalui Internet, kawalan capaian untuk data XML telah menjadi satu topik penyelidikan yang penting. Beberapa mekanisme kawalan capaian XML telah dicadangkan untuk menguatkuasakan kawalan capaian terperinci untuk pertanyaan data XML. Walau bagaimanapun, hanya beberapa penyelidikan yang dicadangkan untuk mengemaskini struktur data XML dalam kehadiran kawalan capaian terperinci.

Untuk menanya dan mengemaskini data XML dalam kehadiran kawalan capaian terperinci, suatu peta kebolehcapaian adalah diperlukan bagi menentukan kebolehcapaian nod XML pada masa larian. Beberapa penyelidikan telah dilakukan untuk mempermudah peta kebolehcapaian dengan cara kebolehcapaian nod XML dapat ditentukan dengan cepat tetapi tidak ada usaha untuk mempermudah peta kebolehcapaian di dalam persekitaran XML yang dinamik di mana kebolehcapaian nod XML boleh dikemaskini dengan kerap.

Dalam tesis ini, pertama kami mencadangkan satu skim pengkodan dan pelabelan XML yang *novel* berdasarkan nombor pecahan untuk mengkod dan melabelkan nod XML dalam pokok XML. Skim pengkodan dan pelabelan XML yang kami cadangkan mampu untuk menentukan struktur perhubungan antara sebarang dua nod XML dalam pokok XML dan untuk menghapuskan proses pelabelan semula nod sedia ada semasa proses pengemaskinian XML. Keputusan eksperimen menunjukkan bahawa skim pengkodan dan pelabelan XML yang kami cadangkan adalah lebih cekap daripada skim pengkodan dan pelabelan XML sedia ada untuk pertanyaan dan pengemaskinian XML.

Kedua, kami mencadangkan *Dynamic Compressed Accessibility Map* dipanggil DCAM untuk mempermudah peta kebolehcapaian dengan penentuan cepat kebolehcapaian nod XML pada masa larian supaya ia memerlukan kos penyelenggaraan minimum untuk digunakan dalam persekitaran XML yang dinamik. Untuk menentukan struktur perhubungan antara nod XML dalam DCAM, kami melabelkan nod XML dalam pokok XML dan juga nod XML dalam DACM dengan skim pengkodan dan pelabelan XML yang kami cadangkan. Keputusan eksperimen
menunjukkan bahawa DCAM lebih cekap daripada CAM dalam memampatkan peta kebolehcapaian.
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I certify that a Thesis Examination Committee has met on 04 March 2013 to conduct the final examination of Meghdad Mirabi Nooshabadi on his thesis entitled “Efficient XML Queries and Updates Encoding Scheme in the Presence of Access Control Using Fractional Numbers” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

MEGHAD MIRABI NOOSHABADI

Date: 04 March 2013
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