Spatial Outsourcing for Location Based Services

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Overview
- General Idea
- Framework
- VR-tree Vs MR-tree (data structure)
- MR-tree
- MR-tree Synchronized cache
- MR-tree ReduceVO algorithm
- MR-tree MergeVO algorithm
- MR-tree Vs VR-tree (performance)
- Discussion

General Idea

Location Based Servers

Framework

VR-tree Vs MR-tree (Data Structure)

<table>
<thead>
<tr>
<th></th>
<th>VR-tree</th>
<th>MR-tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signature Chaining concept</td>
<td>Creates one signature for each entry</td>
<td>Signature is only for root</td>
</tr>
<tr>
<td>Hash Value</td>
<td>Less space overhead as hash values are smaller than signatures</td>
<td></td>
</tr>
<tr>
<td>Client has a verification burden</td>
<td>Less verification effort for clients</td>
<td></td>
</tr>
</tbody>
</table>

MR Tree

Points and MBRs

Verification Object (VO)
MR Tree – Synchronized Cache

LBS

Client

MR Tree – ReduceVO algorithm

Query

MR Tree – MergeVO algorithm

Synchronized cache entry

MR-Tree Vs VR-Tree (Performance)

Cost

<table>
<thead>
<tr>
<th></th>
<th>MR-tree</th>
<th>VR-tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time for Computing Authentication Data</td>
<td>4 secs</td>
<td>2 hours</td>
</tr>
<tr>
<td>Index Size</td>
<td>57 MBps</td>
<td>511 MBps</td>
</tr>
<tr>
<td>Query Processing Time</td>
<td>2 sec</td>
<td>22 sec</td>
</tr>
<tr>
<td>VO slow (bytes)</td>
<td>300 Kbps</td>
<td>310 Kbps</td>
</tr>
<tr>
<td>Verification CPU time</td>
<td>41 sec</td>
<td>991 sec</td>
</tr>
</tbody>
</table>