Spatial Indexes in Oracle Spatial

Indexes in Oracle

- R-tree (default), or
- linear quadtree

both implemented using extensible framework

- linear quadtree based on B-tree indexes
- R-tree: using tables/recursive SQL

```
select * from user_sdo_index_info;
```
Quadtree in Oracle

```
create index my_lake_qidx on my_lake(shape)
indextype is MDSYS.Spatial_INDEX
parameters ('sdo_level = 5');
```

Query Processing in Oracle Spatial

- primary filter (exterior, e.g. R-tree: mbb)
- intermediate filter (interior)
- geometry engine (computational geometry algorithms)
Primary Filter

- **R-tree:**
  - all shapes whose mbb overlaps mbb of query shape
  - implemented using recursive traversal of R-tree

- **B-tree:**
  - range query on query shape
  - need to create query shape tiling at same level as index

Intermediate Filter

- **quadtree:**
  - distinguish interior and boundary tiles
  - what would an "unknown" case look like?

- **R-tree:**
  - not for data, just for query shape
    - convex: split into 4 pieces, find largest rectangle in each piece
    - concave: level-4 (quadtree)-tiling of query and mbbs

Experimental Results: quadtree from Kothuri, Ravada, Abugov

- quadtree indexing (23982 geometries)
Experimental Results: comparison from Kothuri, Ravada, Abugov)

<table>
<thead>
<tr>
<th>Performance Criterions</th>
<th>Query Time (ms)</th>
<th>R-tree Time (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABI: 10M of data (point data)</td>
<td>0.12</td>
<td>0.08</td>
</tr>
<tr>
<td>USBG: 230K of data (polygons)</td>
<td>0.15</td>
<td>0.10</td>
</tr>
</tbody>
</table>

**Table 6:** Comparison of Query Times for Quadtree and R-tree Indexes on USBG data. Quadtree is better for ABI (point) data, and R-tree is faster for USBG. USBG data: R-tree need line appears in both cases.

Sources