

ORACLE

Citation:

Z-ordering is one of the few spatial access methods that has found its way into commercial database products. In particular, Oracle [1995] has adapted the technique and offered it for some time as a product.

from

<https://dl.acm.org/doi/10.1145/280277.280279>

There is currently a system Oracle Spatial:

"Spatial uses an index scheme based on a linear quadtree method" (corresponds to interleaving with 2 dimensions).

<http://www.imn.htwk-leipzig.de/~kudrass/Lehrmaterial/Oberseminar/2000-01/SpatialDB.pdf>

Section 2.6

HITACHI

Spatial search processing in embedded devices

Focusing on applying a spatial database management system to embedded devices, we propose a spatial index tree We propose an efficient algorithm based on the range search algorithm

<https://dl.acm.org/doi/abs/10.1145/1653771.1653858>

TRANSACTION SOFTWARE

Transaction Software, founded by *Prof. Bayer, Munich*, markets a relational database management system supporting data warehouse functions ("Transbase Hypercube") relying on Bayer's UB-tree which is basically a B+tree (information in the leaves) with records stored according to Z-Order. For range queries, a function "GetNextZ-address" is used which is identical to BIGMIN.

<https://web.archive.org/web/20160304202943/http://www.misral.in.tum.de/results/publications/RMF+00.pdf>

RAIMA

„Commercial Off The Shelf (COTS) Solution“

The US company RAIMA offers the method for local area queries in mobile databases for variable content.

(Explanation follows the Tropf/Herzog article)

<https://raima.com/wp-content/uploads/Raima-POI-1.pdf>

The simplicity of setting up on an existing ("off the shelf") database and the possibility to extend not only the database content, but even the set of possible types of objects to be found without software modification at runtime are emphasized:

„you can efficiently index any gas stations, any restaurants or any other type that you may discover at runtime without needing to ship the software with a predefined set of types.“

AMAZON

The company Amazon uses and markets a database system called DynamoDB. It is not a relational database system, but a so-called key-value system. In

key-value systems, the main information is contained in the keys, which may have a complex structure. With key-value systems it is not possible to query for multiple keys. Amazon offers the following extension: For multi-dimensional range queries, the user can combine several key values into a single one via bit interleaving (Z-curve); for the required Litmax/Bigmin calculation (called NextJumpIn/NextJumpOut there), the user is offered a ready-made function.

For details see:

<https://aws.amazon.com/de/blogs/database/z-order-indexing-for-multifaceted-queries-in-amazon-dynamodb-part-1/>

<https://aws.amazon.com/de/blogs/database/z-order-indexing-for-multifaceted-queries-in-amazon-dynamodb-part-2/>

see also

Tweet Tim Gosset: This is an incredible 2-part read that explains a very valuable concept that anyone working with DynamoDB should have in their arsenal. I'm looking forward to a Part 3 that explains how to implement the is Relevant and nextJumpIn functions.

Tim Gosset Dec. 10, 2020

Awesome! My own research got me as far as a research paper from 1981 describing an algorithm for LITMAX and BIGMIN, the latter being the same thing nextJumpIn would return.

<https://twitter.com/mrgossett/status/1336823147698458625>

(please copy the URL into the browser address field)

see also

<https://aws.amazon.com/de/blogs/database/amazon-aurora-under-the-hood-indexing-geospatial-data-using-z-order-curves/>

MOVIES

Database for fast changing content

Capture over time intervals, prediction

<https://www.cs.purdue.edu/homes/aref/papers/STAccessMethodsPart2-2010.pdf>

Other systems for NAVIGATING

A Distributed Throwing Spatial Index Structure for Dynamic Location Data

<https://ieeexplore.ieee.org/document/7478627>

Distributed location-based services in mobile environments.

<https://ieeexplore.ieee.org/abstract/document/7876253>