Robust Data-Skipping with Adaptive Zonemaps

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Motivation

Fast Data Access Patterns enables Fast Knowledge Extraction

Zonemap: lightweight index that logically segments data into contiguous zones, or extents, keeping metadata for each extent.

Metadata informs database operations about what data are non-pertinent to a query - this is called Data Skipping.

Zonemaps may be ineffective for certain datasets and query workloads, but they can be improved.

Add Flexibility

How do we generally restructure zonemaps and underlying data for more optimal data skipping?

Do performance gains justify making zonemaps dynamic?

Adaptive Zonemaps opportunistically improve relevant extents by restructuring them while underlying data is being scanned.

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<th>Opportunity</th>
<th>Approach</th>
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<td>Outlier skew in extent</td>
<td>Change logical extent boundaries. Split extent into smaller ones if necessary. Isolate outliers from extent.</td>
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Adaptive Zonemaps

Opportunity Approach Intuition

Outlier skew in extent Change logical extent boundaries. Split extent into smaller ones if necessary. Isolate outliers from extent. 1,2,3,2,1,100,1 $\rightarrow$ 1,2,3,2,1 | 100 | 1

Two interleaved distributions in one extent Move underlying data within an extent to achieve eventual clustering effect. Split extent when necessary. 0,1,0,1,0,1,0,1 $\rightarrow$ 0,0,0,0 | 1,1,1,1

Neighboring extents have similar properties Aggressive consolidation of extents 1,2,3,2 | 1,2,3,1 $\rightarrow$ 1,2,3,2,1,2,3,1

Unwieldy amount of extents Hierarchical approach to keeping metadata on extents themselves. Improvement on linearly scanning extents for qualification. $[1,6]$ $\rightarrow$ $[19,41]$ $[1,3],[2,4],[2,3],[5,6],[19,25],[21,41]$

Analysis for Optimal Size of Extent (100m values)

Too much splitting into small non-cache-line multiples will cause metadata filtering step of a select to be bogged down