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Geometric Range Search

Range Tree: Optimization

- Fractional Cascading

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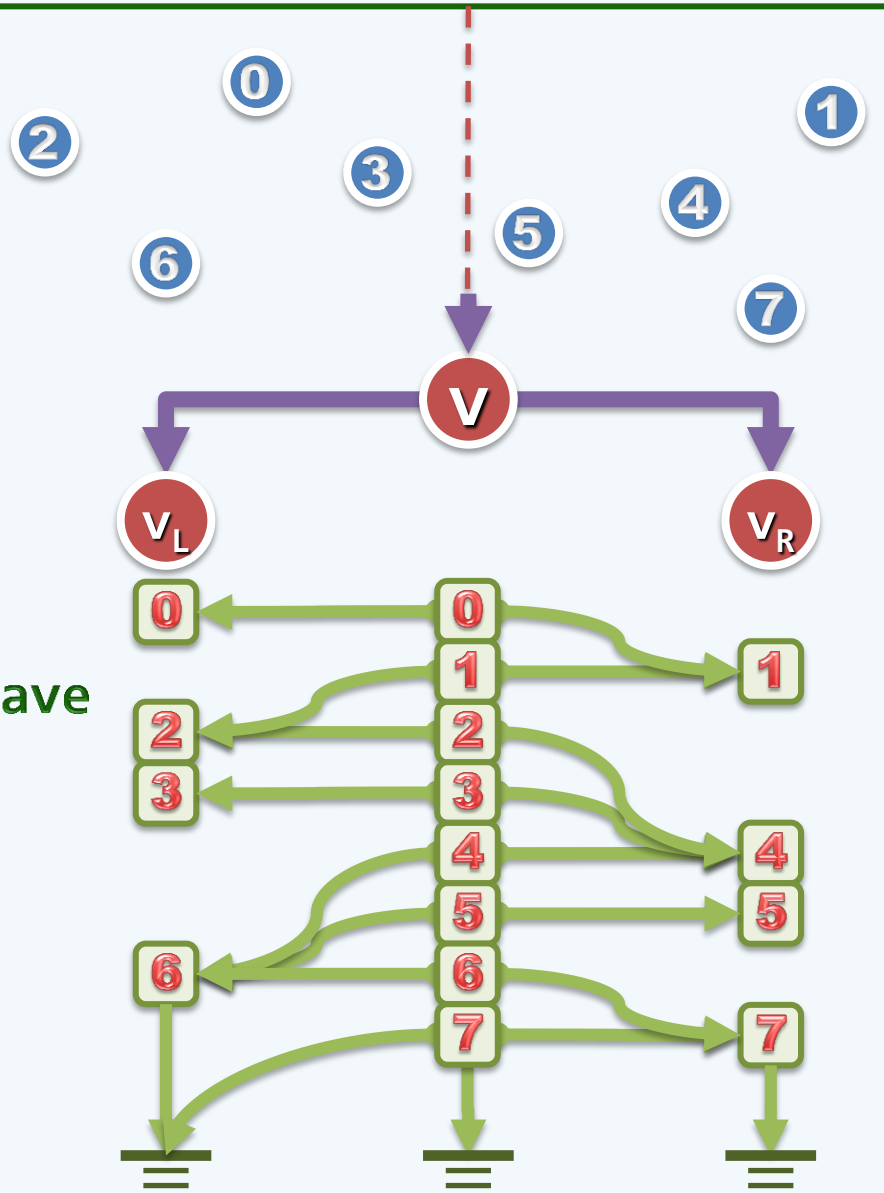
Merge/Split

- Let v be an internal node in the x-tree with v_L/v_R its left/right child resp.
- Let A_v be the y-list for v and A_L/A_R be the y-lists for its children
- Assuming no duplicate y-coordinates, we have
  - A_v is the disjoint union of A_L and A_R, and hence
  - A_v can be obtained by merging A_L and A_R (in linear time)



Structure

- For each item in A_V,

  we store two pointers to

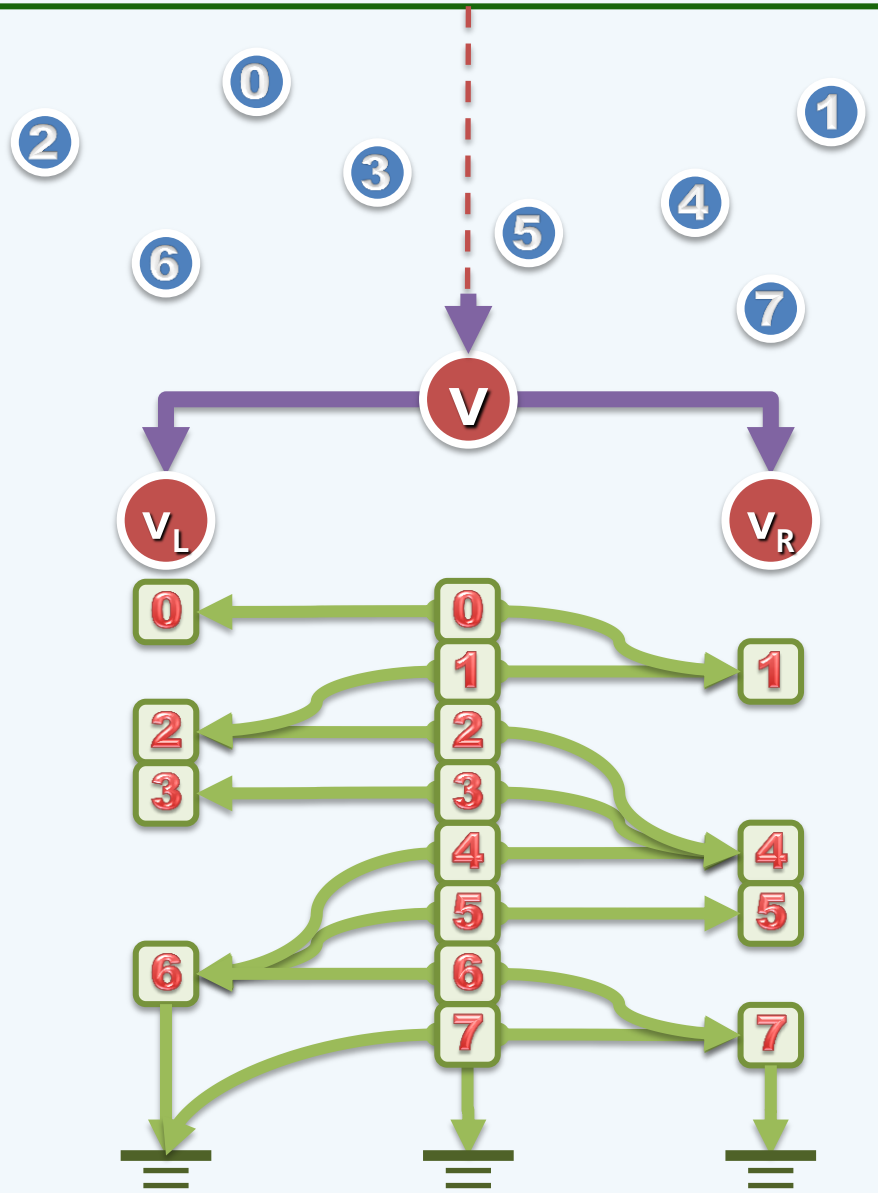
  the item of

  equal or **larger** value

  in A_L and A_R resp.

- When there is no such item,

  the pointer is NULL



Fractional Cascading

- For any y-query with q_y,

  once we know its entry in A_v,

  we can determine its entry

  in either A_L or A_R

  in $\boxed{O(1)}$ additional time