On Indexing Mobile Objects

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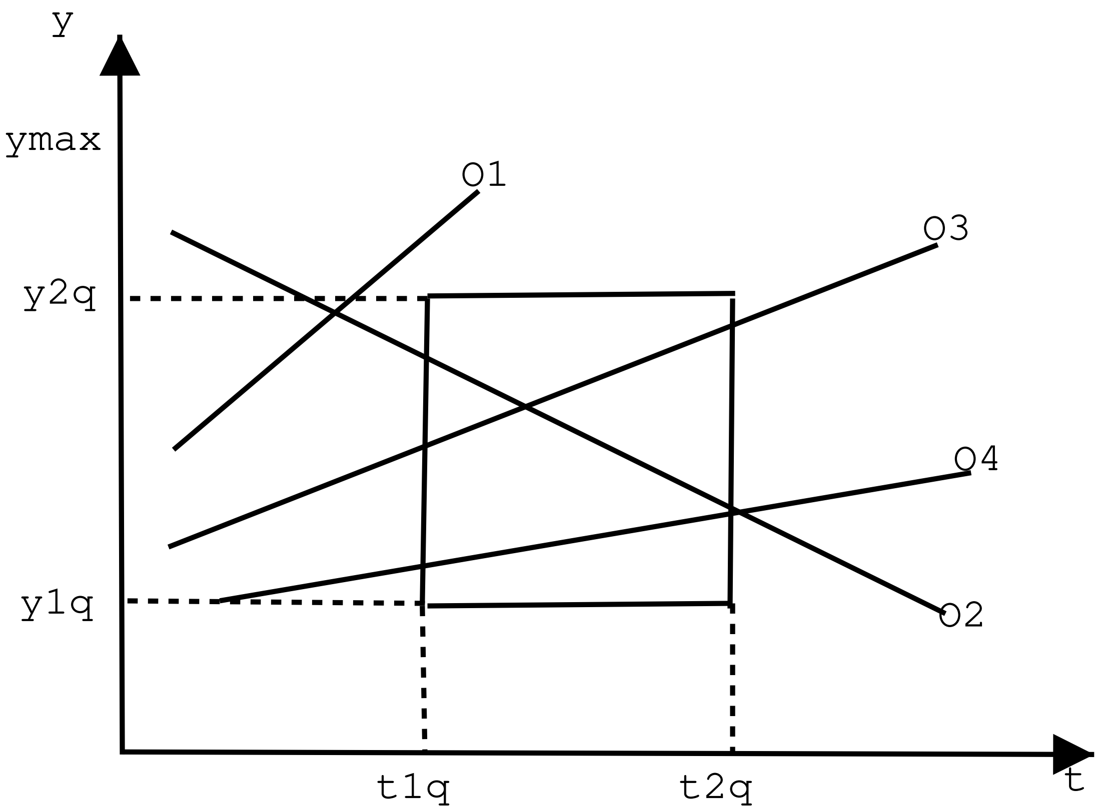
MOR Query

MOR Query: Mobile Object Range Query

Report the objects that reside in the interval $[y_1q, y_2q]$ at the time instants between time t_1q and t_2q, (where $t_now \leq t_1q \leq t_2q$), given the current motion information of all objects.

- Moving objects are partitioned into:
  - Objects with v ≈ 0
  - Objects with $v_min \leq v \leq v_max)$
- Objects move on y axis between o to y_max
- Updates whenever motion information changes
- Update = Delete + Insert

Space-Time representation

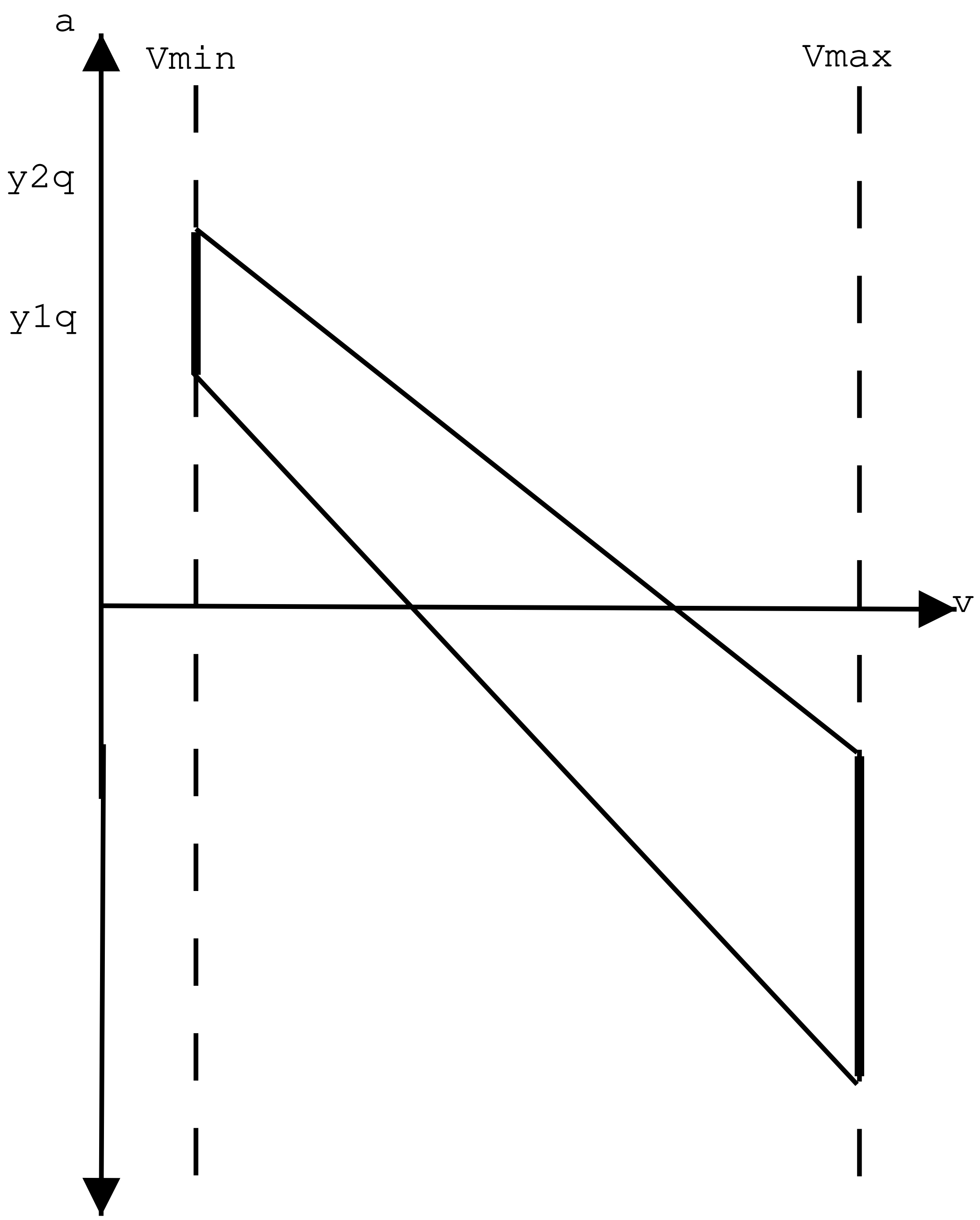


Trajectories and queries in *(t,y)* plane

Dual Representation of MOR query

- For v $>$ 0, the query is: Q:C1.C2.C3.C4, where
  C1 $= v \geq v_m in$,
  C2 $= v \leq v_m ax$,
  C3 $= a + t_2 q * v \geq y_1 q$,
  C4 $= a + t_1 q * v \leq y_2 q$

- For v $<$ 0, the query is: Q:D1.D2.D3.D4, where
  D1 $= v \leq -v_m in$,
  D2 $= v \geq -v_m ax$,
  D3 $= a + t_1 q * v \geq y_1 q$,
  D4 $= a + t_2 q * v \leq y_2 q$



Query in Dual plane

- Unbounded intercept if v_max is significant.

- Use of two index structures to bound intercepts

- Select $T_{period} = y_{max}/v_{min}$

- Intercept of first index computed using t=0 and
  that of second index using t=T_{period}. The intercepts are bounded between 0 to $v_{max} * T_{period}$.

- Index points within polygon using kd-tree.