Speculative Query Processing
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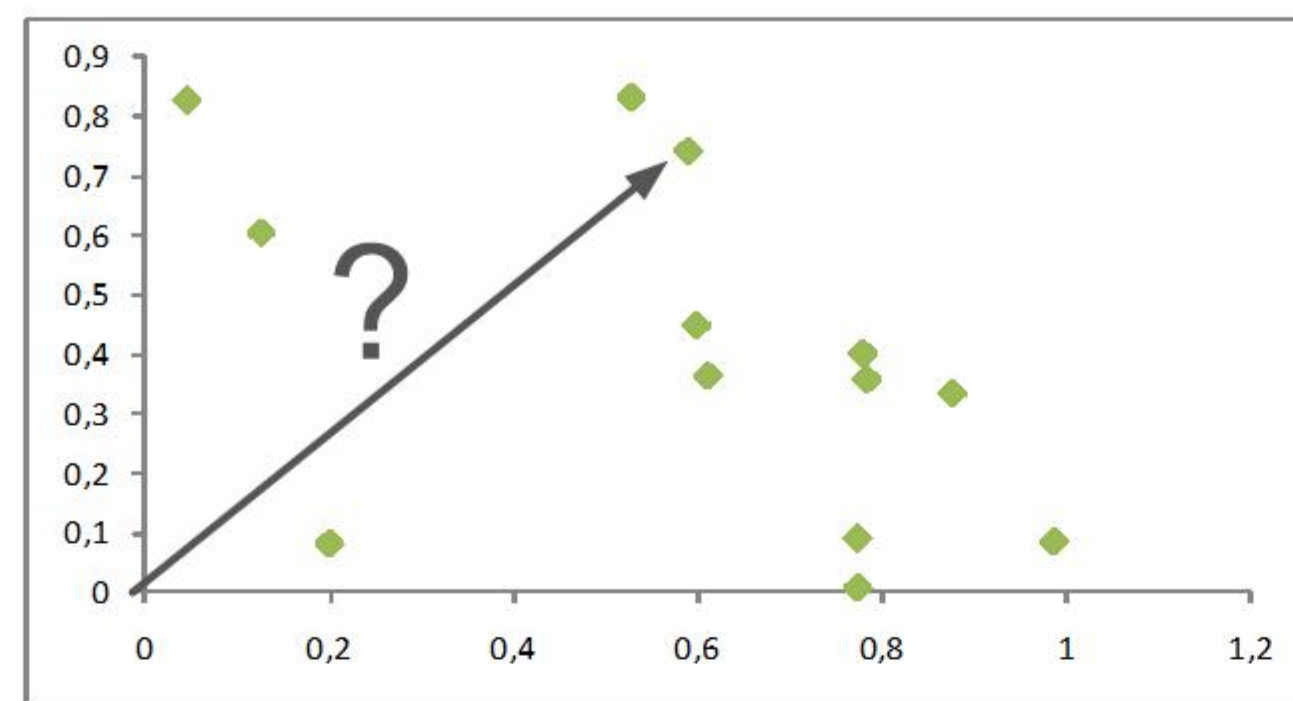**TECHNISCHE UNIVERSITÄT DRESDEN**

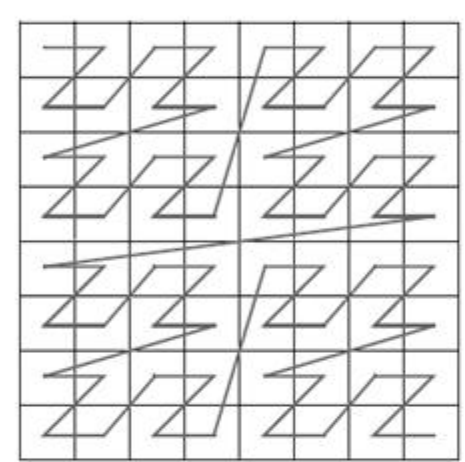## Goal: Use massively parallel hardware for core database operations

Multidimensional Search

```
SELECT *
FROM table
WHERE x = 0.6
AND y BETWEEN 0.6 AND 0.8
```
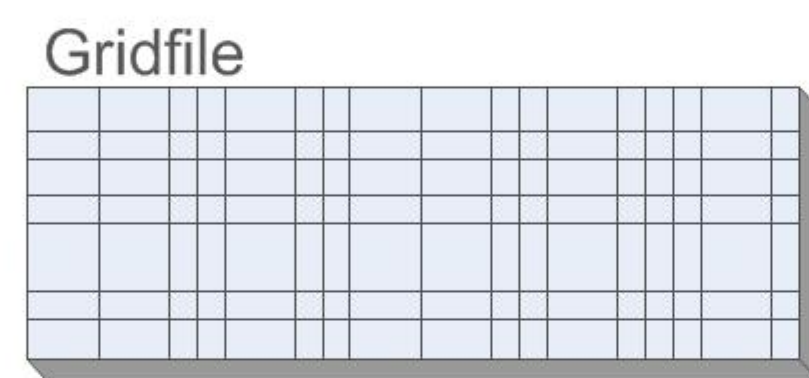
?

Methods

Room filling curves

Concatination of dimension

Multidimentional index

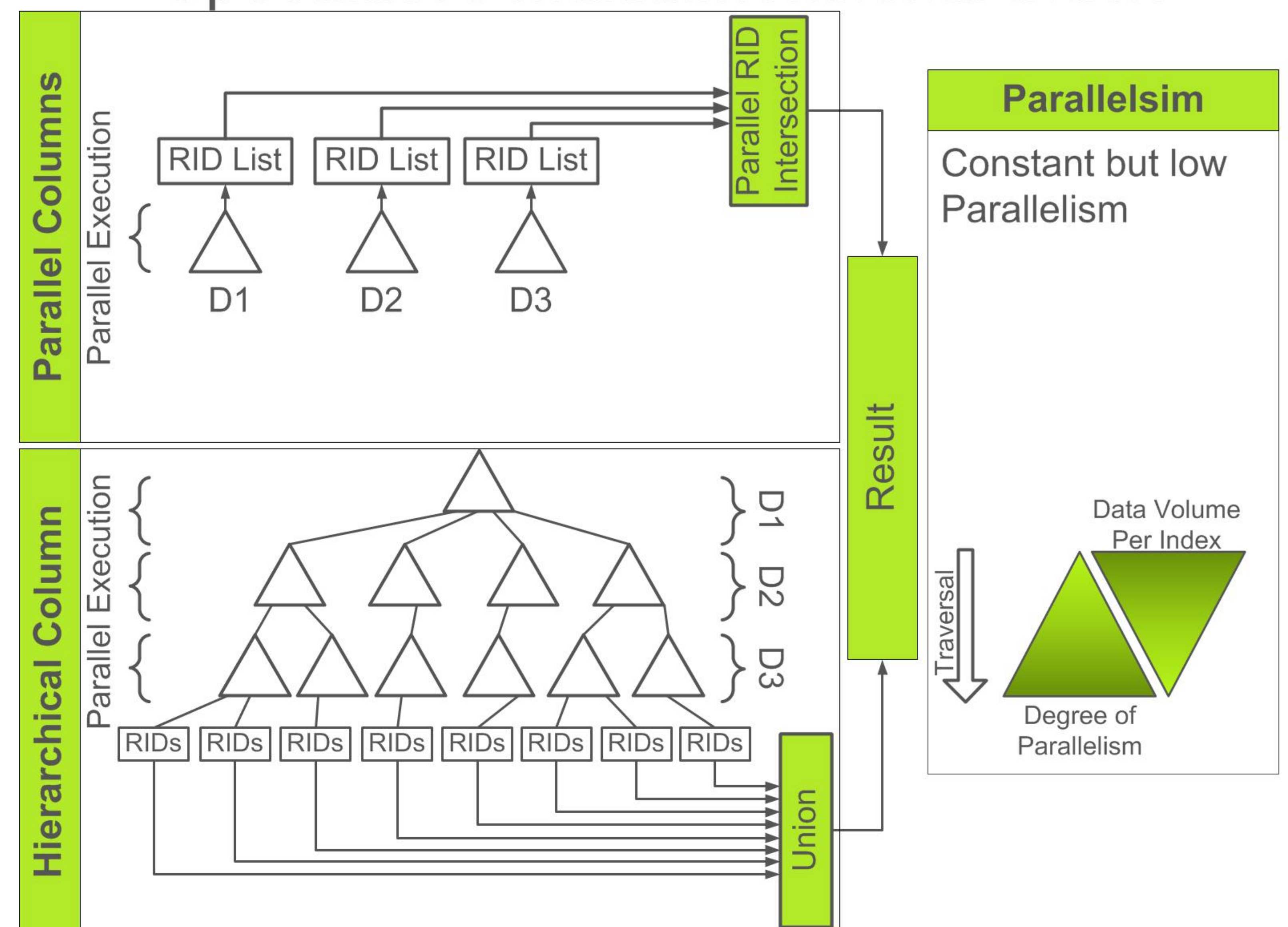Gridfile

Sequential algorithms and data structures

Current principle: Save CPU Cycles

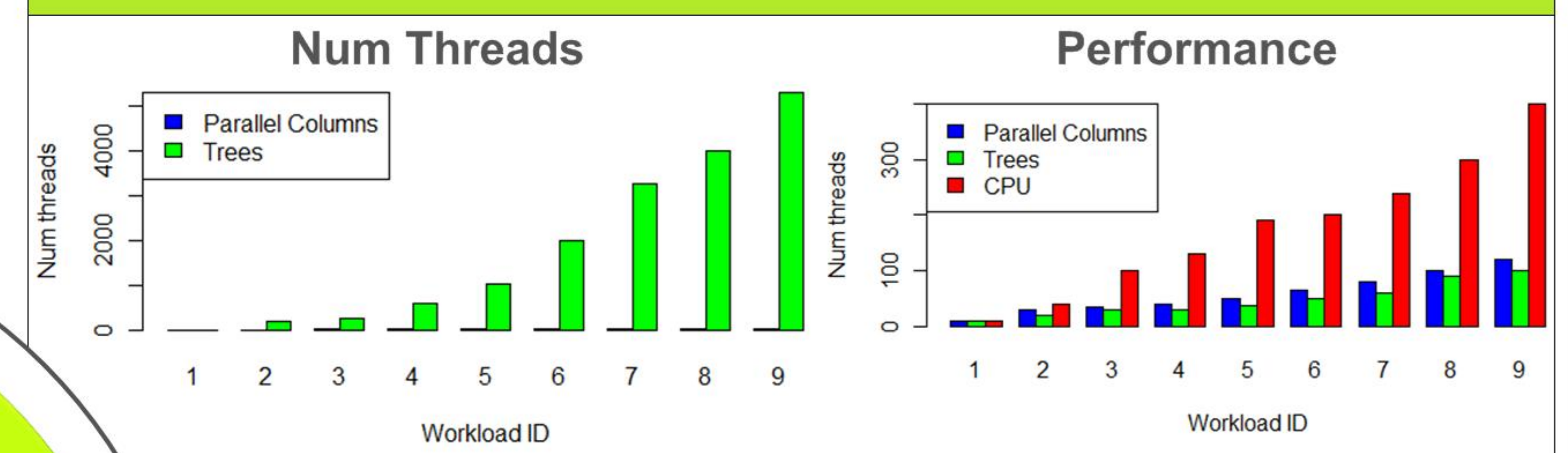Speculative Execution as more efficient approach for GPU based data management?

Idle Cores are the Devil's Tools
Don't wait for Work!

Speculative Multidimensional Index

Parallel Columns

Parallel Execution

RID List   RID List   RID List

Parallel RID Intersection

D1   D2   D3

Hierarchical Column

Parallel Execution

D1 D2 D3

RIDs RIDs RIDs RIDs RIDs RIDs RIDs RIDs

Union

Result

Parallelsim

Constant but low Parallelism

Data Volume Per Index

Traversal

Degree of Parallelism

Evaluation

Num Threads

Num threads — Parallel Columns / Trees
Workload ID: 1 2 3 4 5 6 7 8 9

Performance

Num threads — Parallel Columns / Trees / CPU
Workload ID: 1 2 3 4 5 6 7 8 9

Execution on a c2050 vs. Intel Nehalem 3,5GHz

Conclusion and Outlook

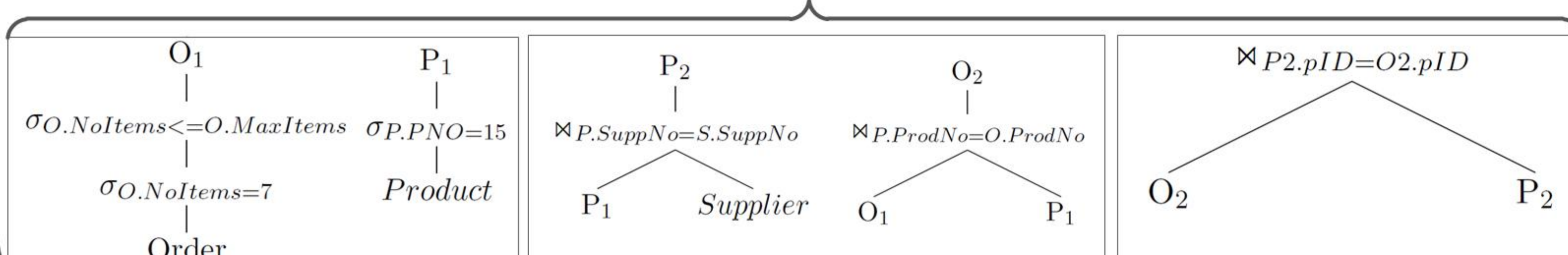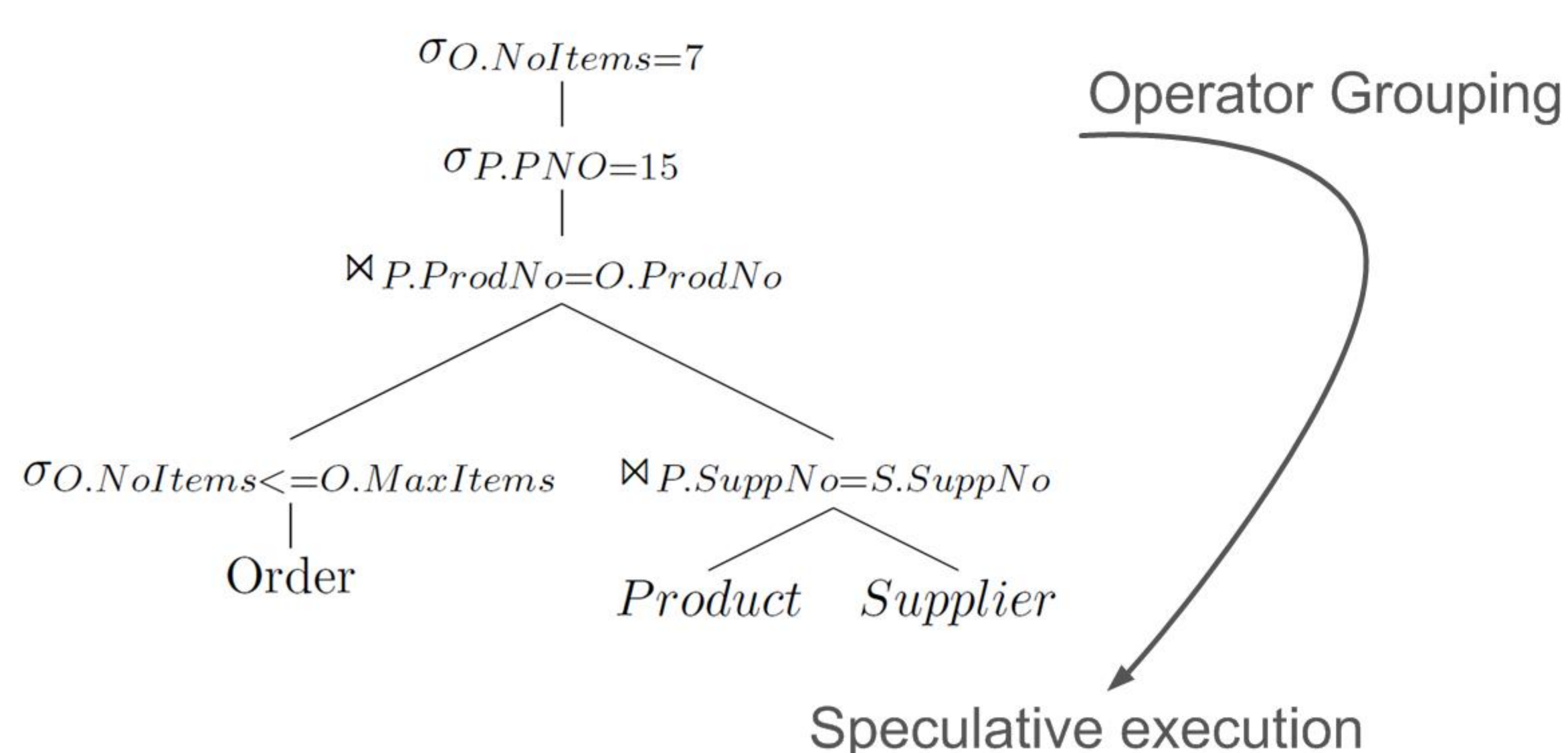**Speculative data management….**

....works on a fine grain level
….helps to search for data faster
….requires massively parallel hardware such as GPUs

Leverage speculative data management….

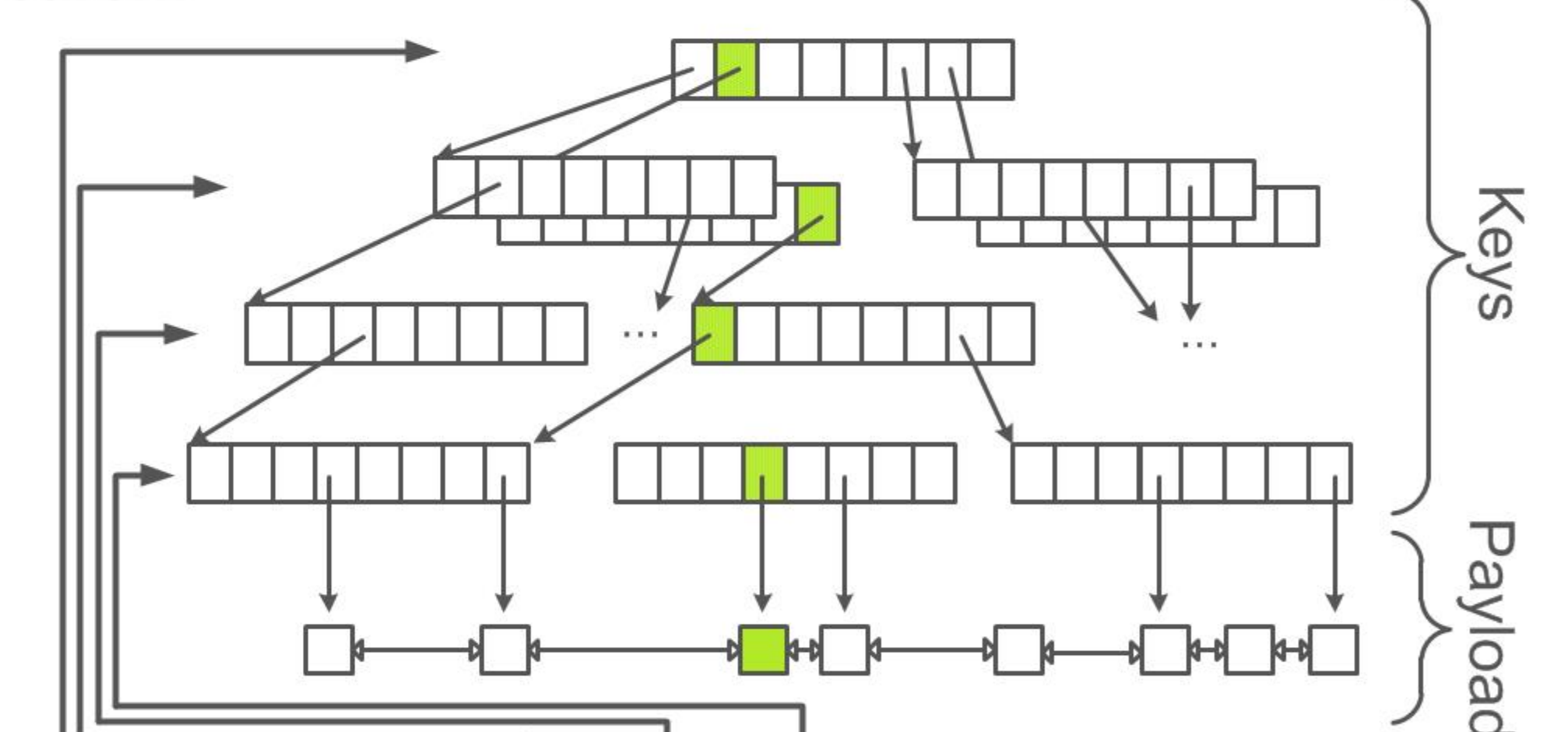….on a higher level (e.g. execution plans)
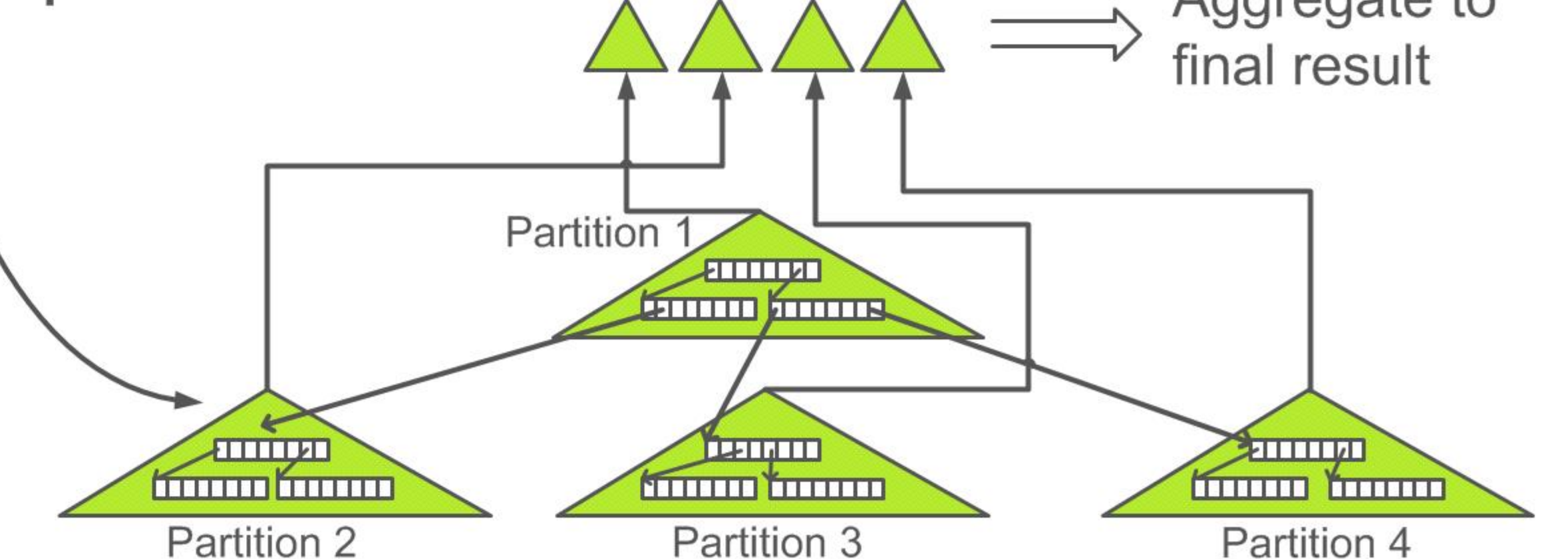….with multiple massively parallel devices

Parallel Query Plan:

$\sigma_{O.NoItems=7}$

$\sigma_{P.PNO=15}$

$\bowtie_{P.ProdNo=O.ProdNo}$

Operator Grouping

$\sigma_{O.NoItems<=O.MaxItems}$ $\bowtie_{P.SuppNo=S.SuppNo}$

Order

$Product$ $Supplier$

Speculative execution

O_1 P_1

$\sigma_{O.NoItems<=O.MaxItems}$ $\sigma_{P.PNO=15}$

$\sigma_{O.NoItems=7}$ $Product$

Order

P_2 O_2

$\bowtie_{P.SuppNo=S.SuppNo}$ $\bowtie_{P.ProdNo=O.ProdNo}$

P_1 $Supplier$ O_1 P_1

$\bowtie_{P2.pID=O2.pID}$

O_2 P_2

Speculative Index Search*

Serial search:

Keys

Payload

$Key = \underline{110}\ \underline{111}\ \underline{110}\ \underline{001}_2 \Leftarrow INT = 3569_{10}$

Partition Tree

Speculative search:

1 2 3 4

Aggregate to final result

Partition 1

Partition 2   Partition 3   Partition 4

Evaluation

Time in ms — Speculative / Serial / Hierarchical
Distinct items: 0 20000 40000 60000 80000 100000 120000