SQL in Silicon

Query Processing on Specialized Hardware

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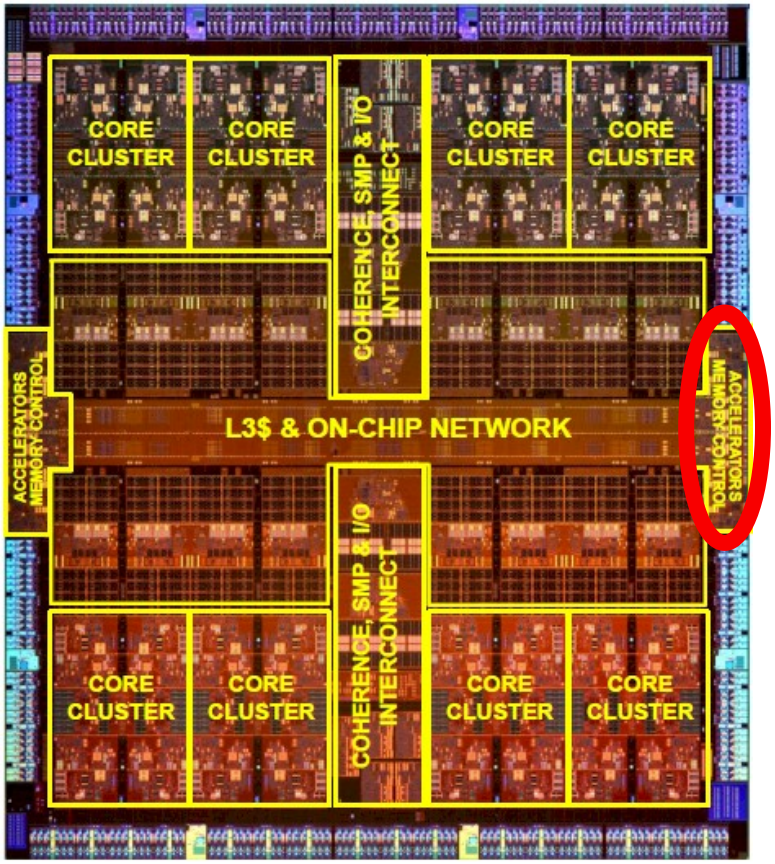
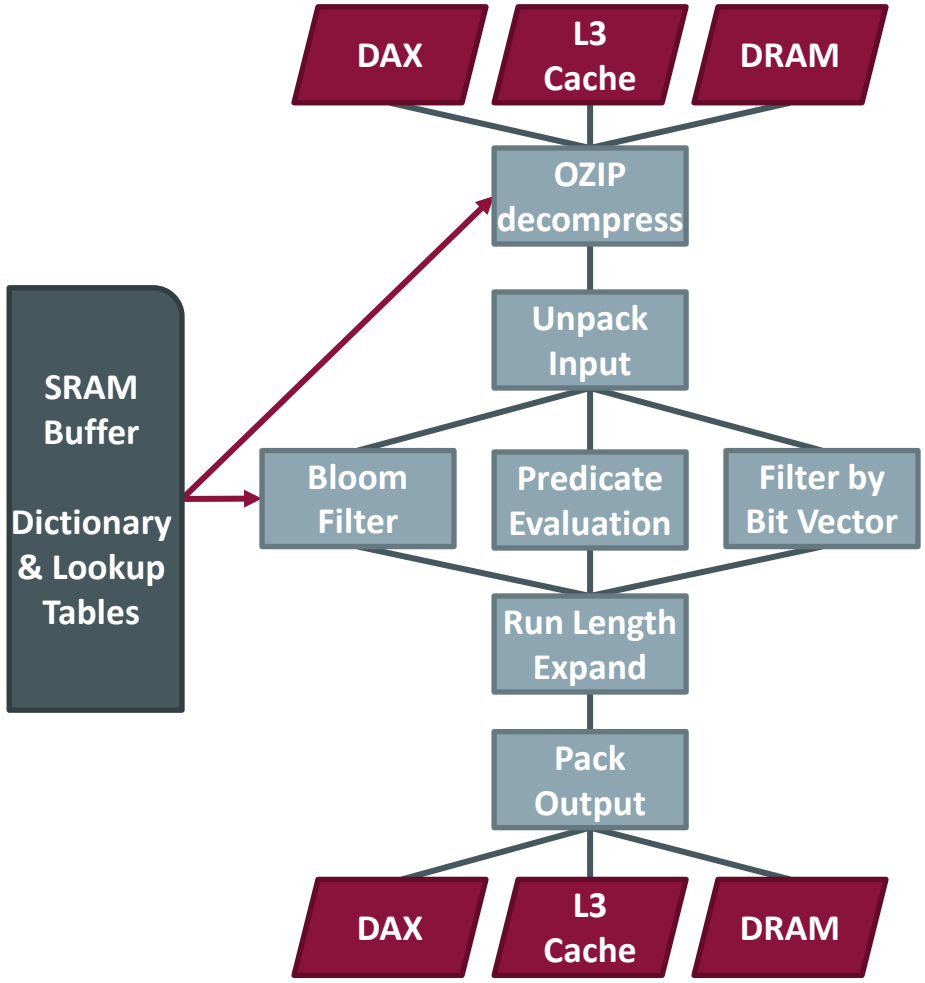
Hardware Software Co-Design

- ***Why*** bother?
  - process compressed and encoded data at memory bandwidth speed
  - specialized co-processor vs. general purpose processor
- ***Where*** does it fit?
  - in-core vs. on-chip vs. I/O bus
- ***Who*** should do it?
  - Oracle is vertically integrated
    - application, middleware, database, operating system, SPARC processor
  - customize SPARC to run the complete Oracle stack
- ***What*** are the benefits?
  - functionality: security, decompression, SQL acceleration
  - improvements: asynchrony, streaming, pipelining, bit parsing

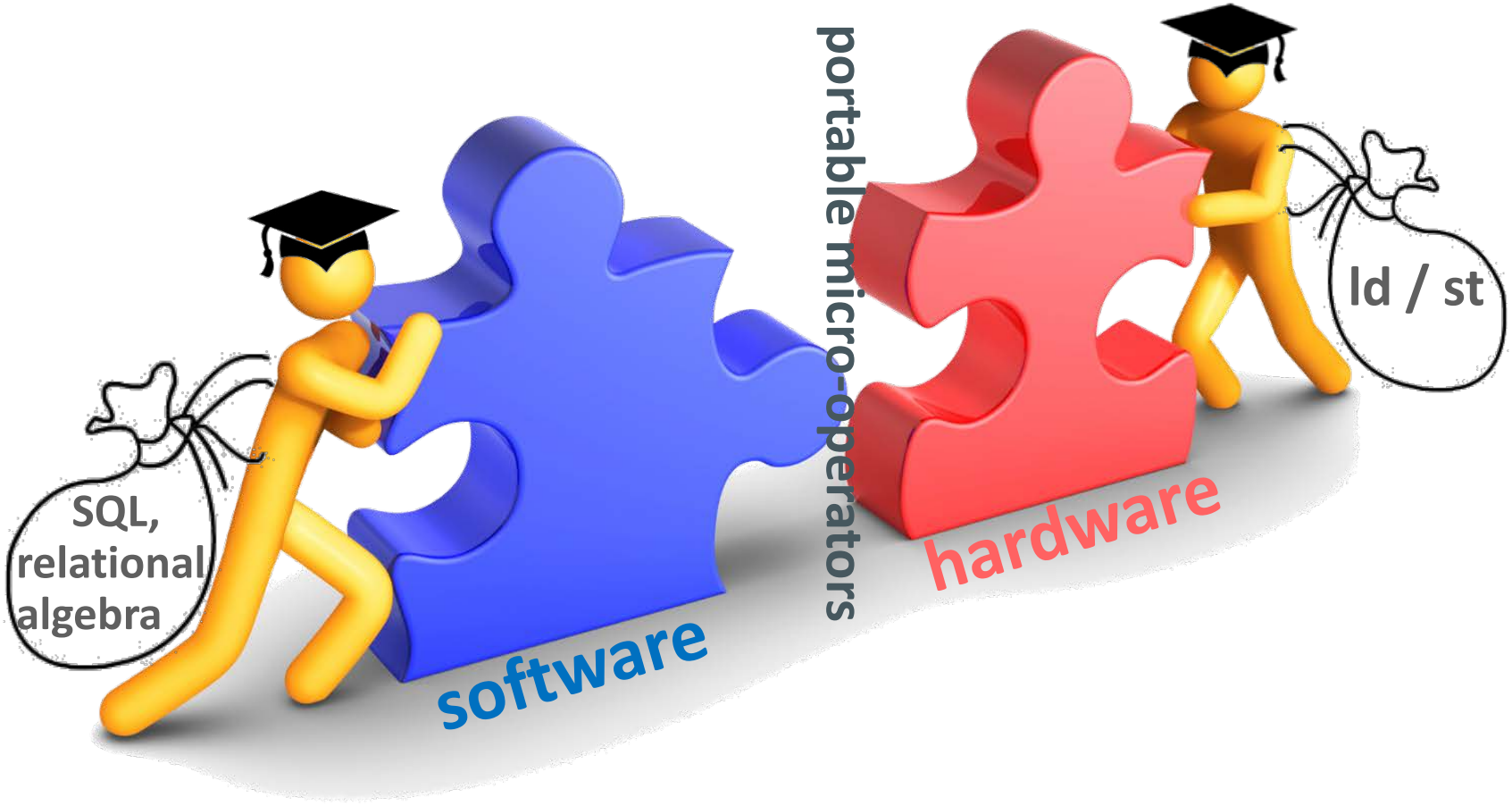
ORACLE

SPARC M7 Database Accelerator (DAX)





Synchronized Innovation



Compilation

From relational query to DAG of micro-operators

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SELECT dept_name, emp_name
FROM emp, dept
WHERE emp.dept_id = dept.dept_id;
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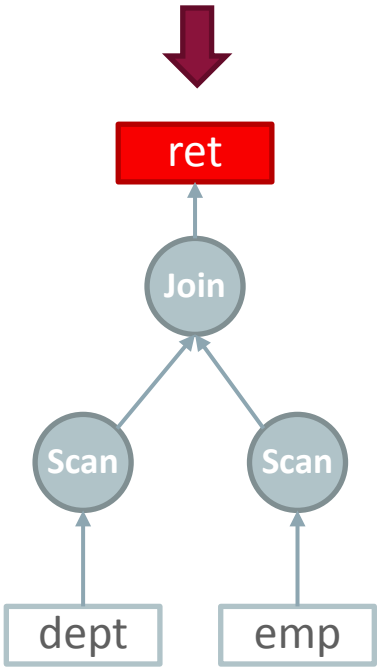

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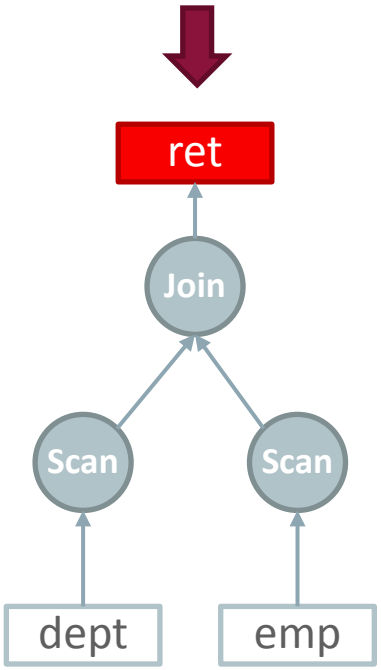
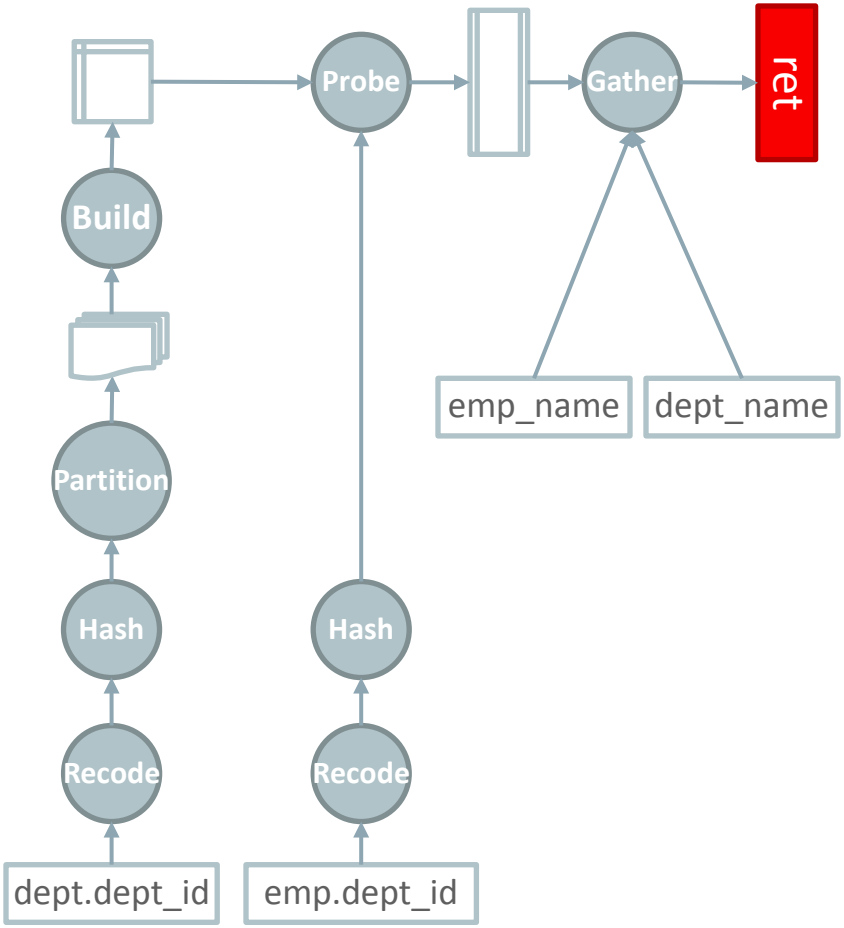
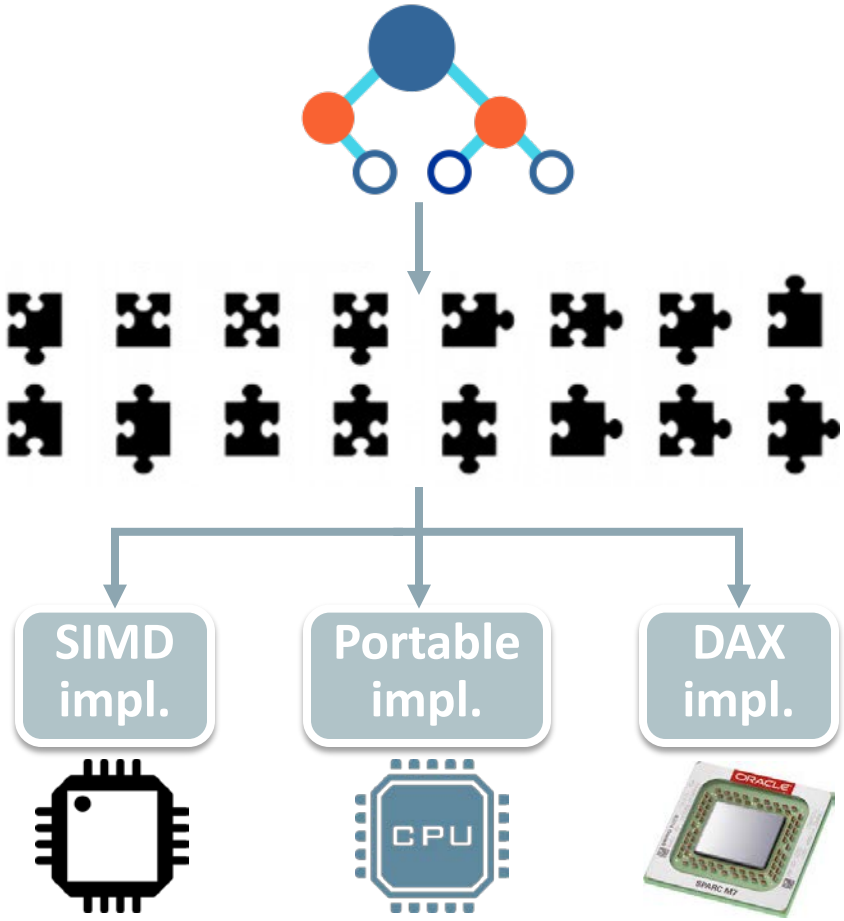




Execution

Per Platform Implementation



Optimization

Per Micro-Operator Cost Model

- Platform-Aware
  - cache size, core type / count, memory bandwidth
- Resource-Adaptive
  - choose the plan matches the current resource availability
    - e.g. bandwidth vs. CPU cycle minimizing
- Self-Evolving
  - improve model using measured execution time

Conclusion

Specialized Plan

Specialized Algorithm

Specialized Hardware

Hardware and Software
Engineered to Work Together