Becoming friends

— A common foundation for data processing —

Sebastian Ertel

Programming Languages vs. Databases

Analytical Queries
(TPC-H)

Data Processing Engine

Transactional Programs
(TPC-C)

Data Integration
(ETL, BI-Tools)

Data Streaming
(CQL, etc.)

Data Mining
(Machine Learning)

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- I/O optimizations
- dynamic software evolution

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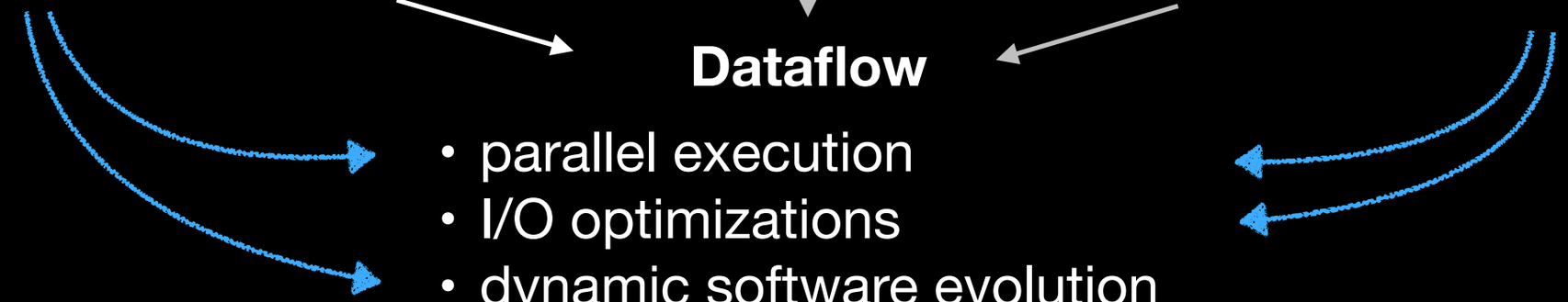

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Enter Ohua!

Algorithm:

(Stateful) function:

https://ohua-dev.github.io/ohua/

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Algorithm:

```
void mapAlgo(InputIterator recordsOnDisk) {
  var mapper = initMapper();
  var writer = initWriter();

  for(var chunk : recordsOnDisk){
    var (line, content) = chunk;
    var kvPairs = mapper.map(line, content);
    for(var kvPair : kvPairs){
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      writer.output(key, value);
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(Stateful) function:

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Writer initWriter(){
  return new Writer();
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class Writer {
  private Mapper$Context _ctxt; // state

  public Writer(){ /* code omitted */ }

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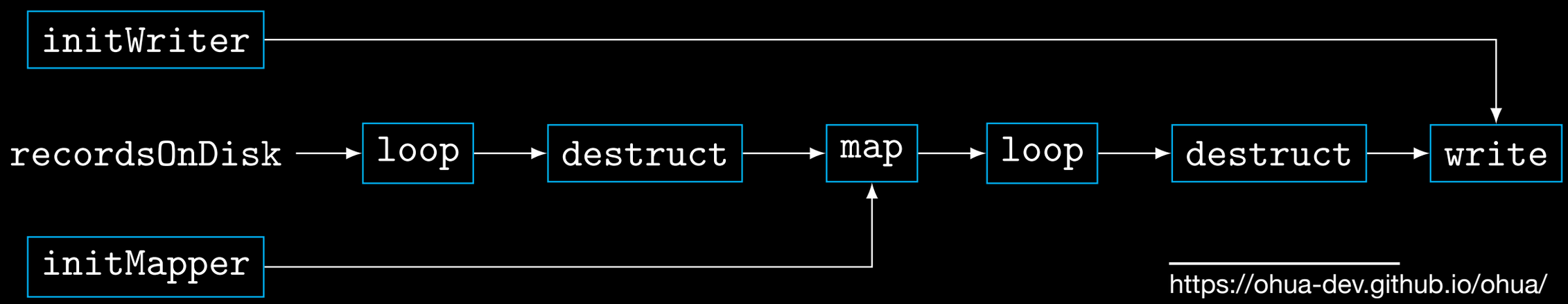

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lambda-calculus-based IR

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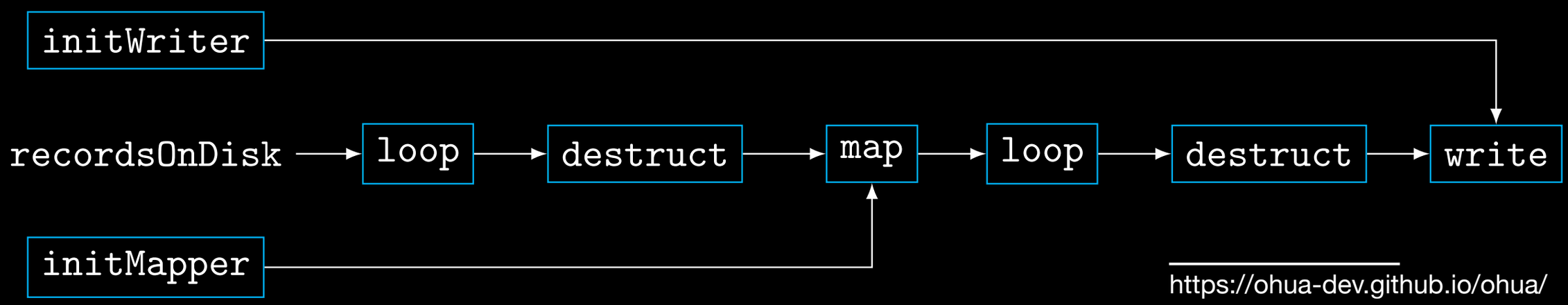

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Scala
C
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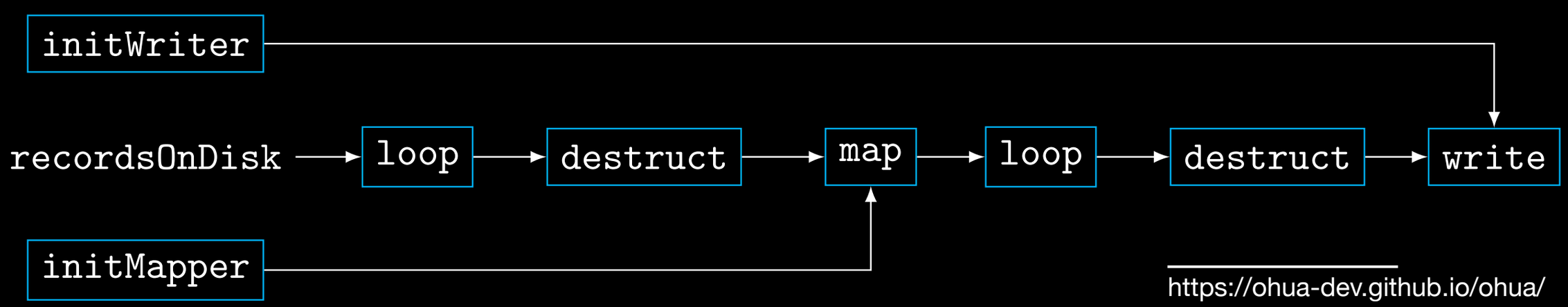

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lambda-calculus-based IR

generic optimizations

domain-specific optimizations

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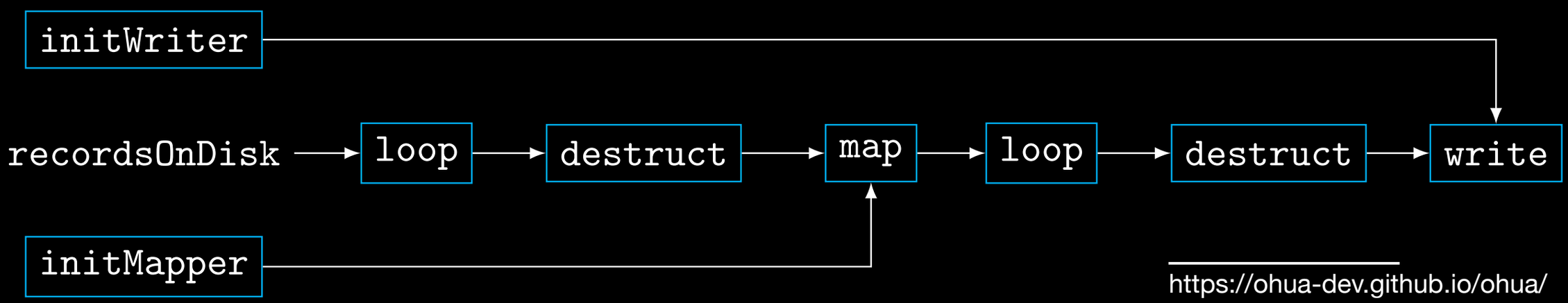

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Fully-integrated Dataflow Parallelism

Analytical Queries
(TPC-H)

SQL / JavaScript

✓ ✗

Transactional Programs
(TPC-C)

SQL / C/C++, Java, etc.

✓ ✗

<u>Challenge</u>: Speed is in SQL vs. rich JavaScript eco system!

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Dataflow

Example UDF:

```
function factorial(D) {
  if (D <= 0) {
    return 1;
  } else {
    var result = 1;
    for (var i = 2; i <= D; i++) {
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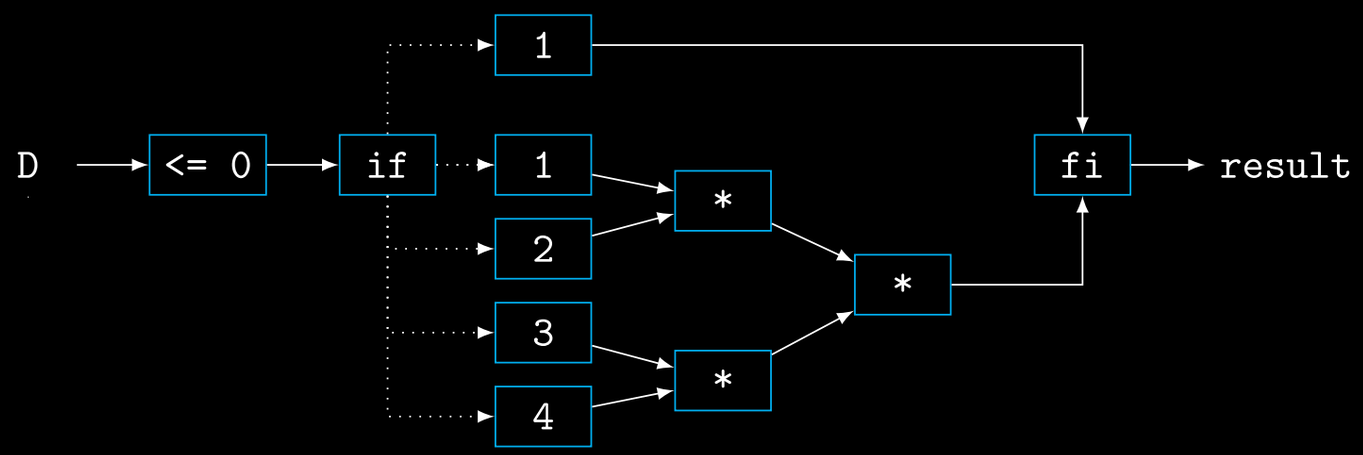

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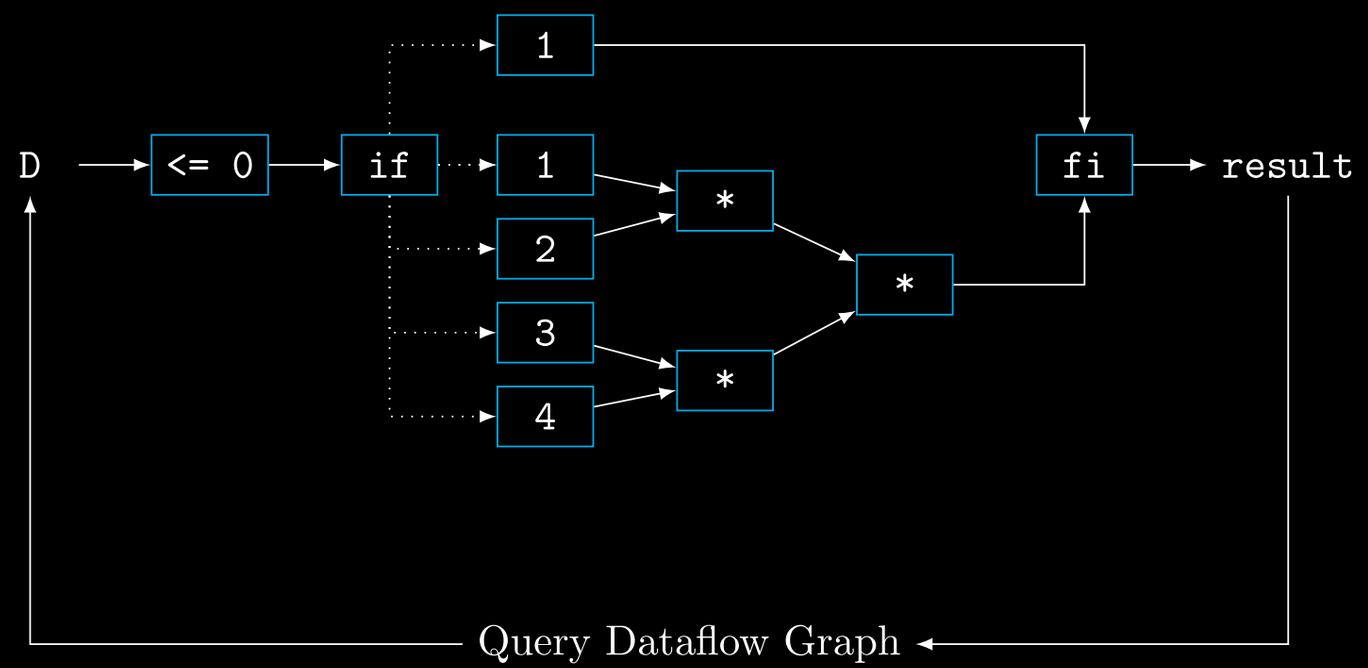

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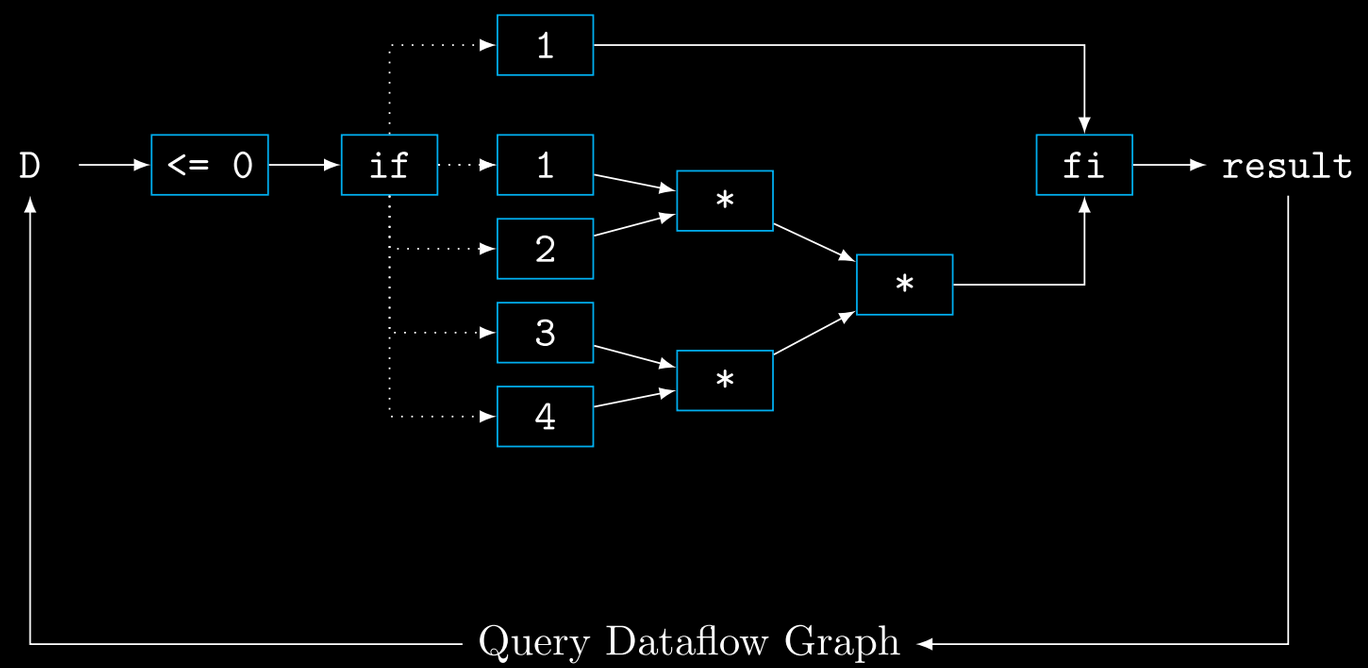

One data flow graph to rule them all!

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More optimizations apply:
pure function -> caching

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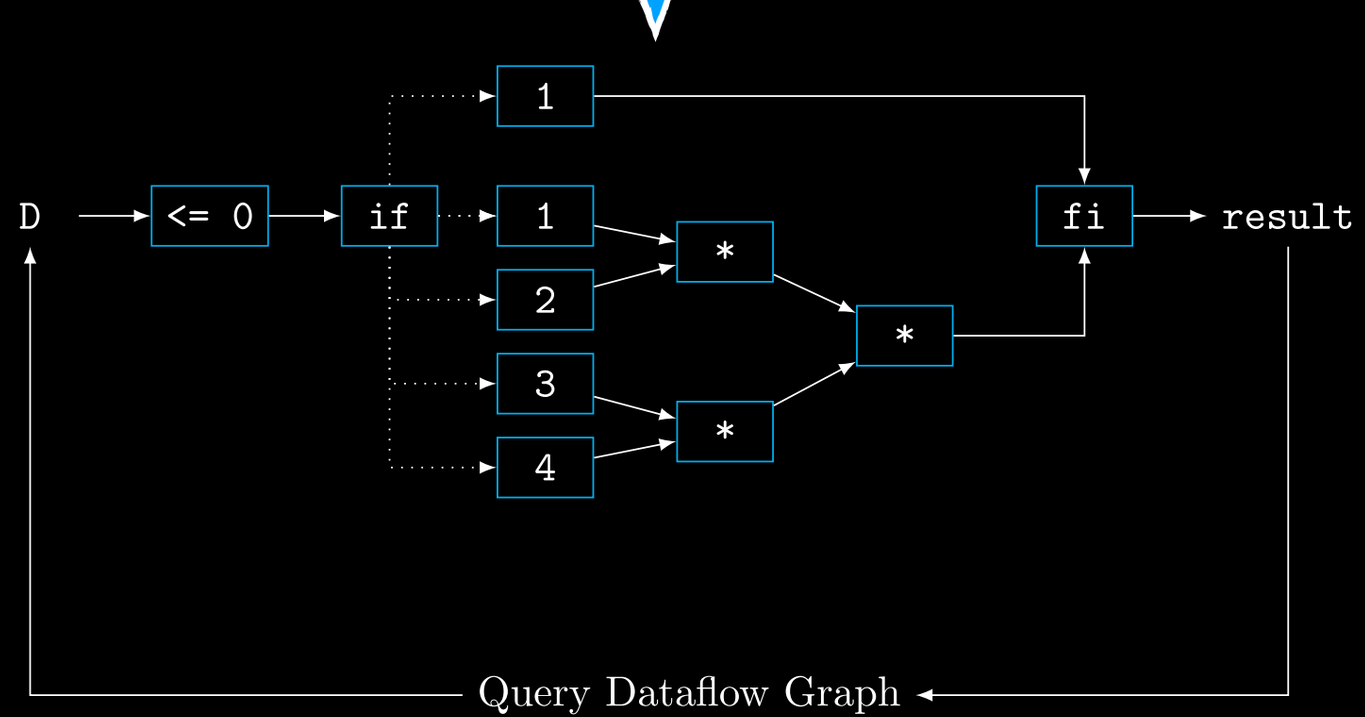

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Compiling for Efficient I/O

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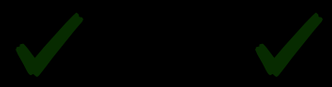

Transactional Programs
(TPC-C)

SQL / C/C++, Java, etc.


<u>Challenge</u>: Shipping computation vs. shipping data!

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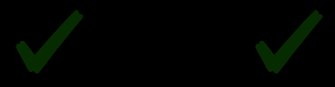

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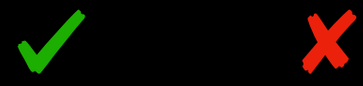

New Order TA (TPC-C):

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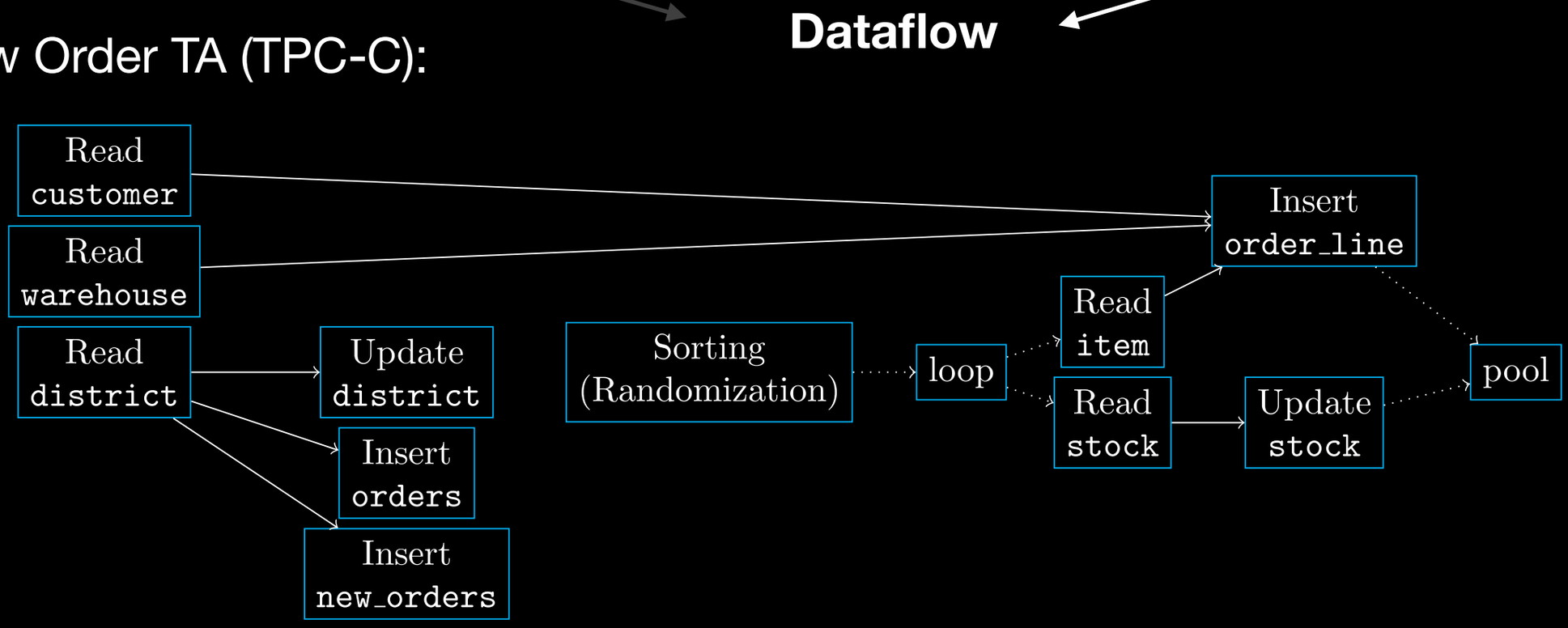

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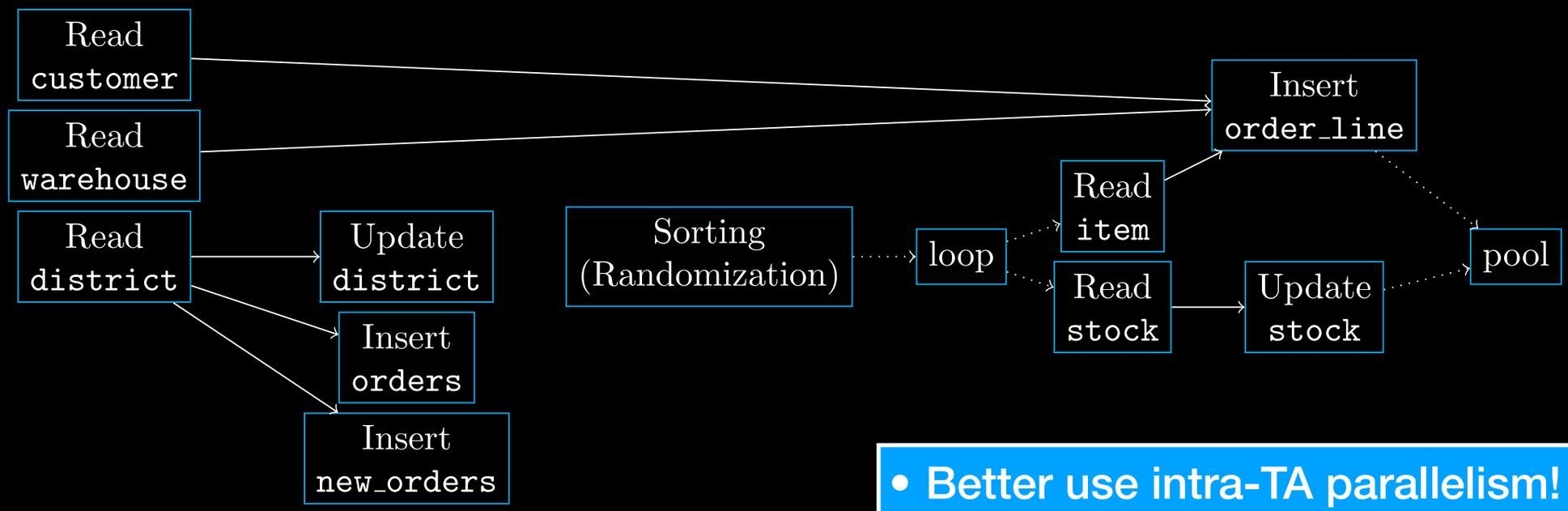

- **Better use intra-TA parallelism!**

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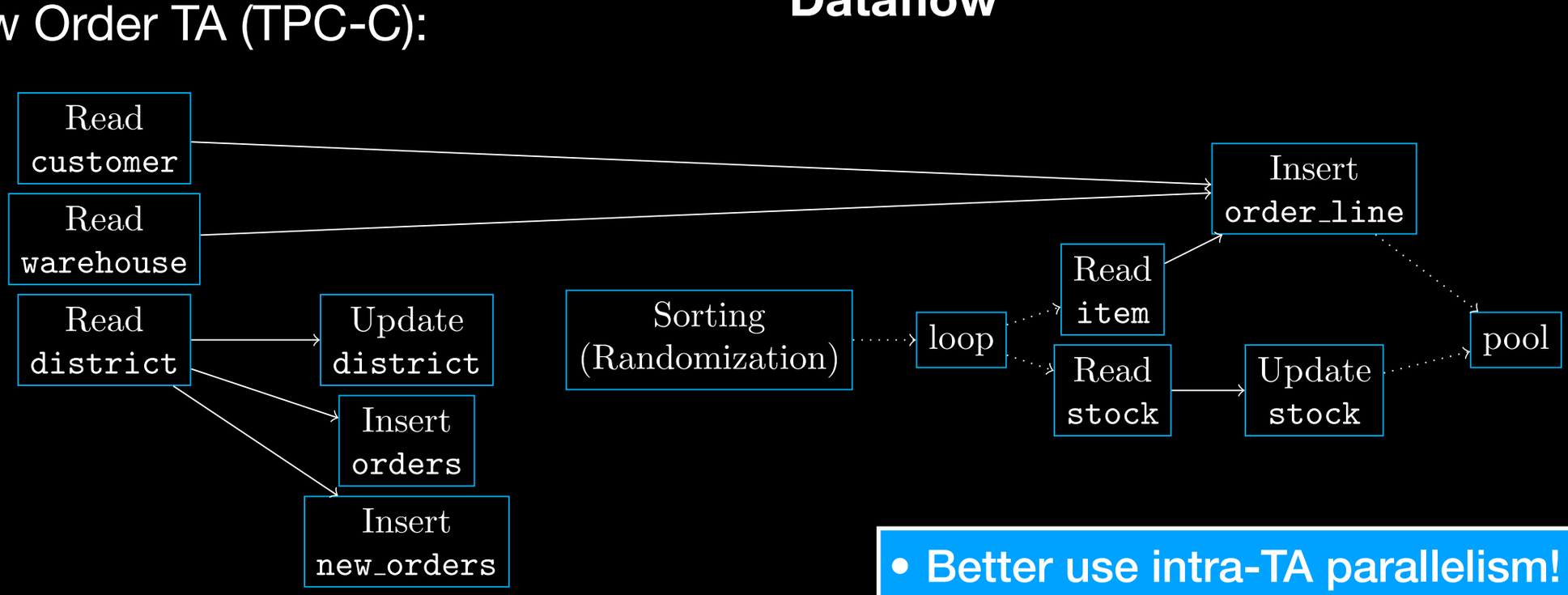

- **Better use intra-TA parallelism!**
- **Migrate not only query but computation!**

Key Insight

Instead of SQL *vs.* Java, C/C++ etc. better have a *common* foundation!

Thank you!