A JIT for SQLite

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Motivation

- SQLite is an embedded database
- The most used database
- Commonly combined with a (dynamic) language
- Getting the data across the boundary is slow
- Can we improve it?

Meta-Motivation

- Language composition with actual use cases
- Understand a little bit about DBs

Hypotheses

H1 Optimisations which cross the barrier between a programming language and embedded DBMS significantly reduce the execution time of queries.

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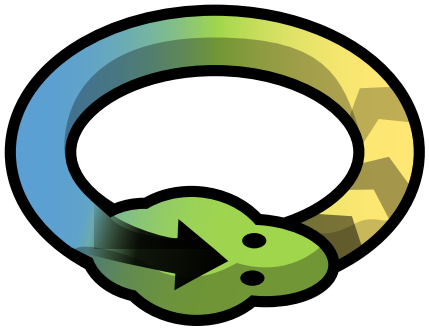
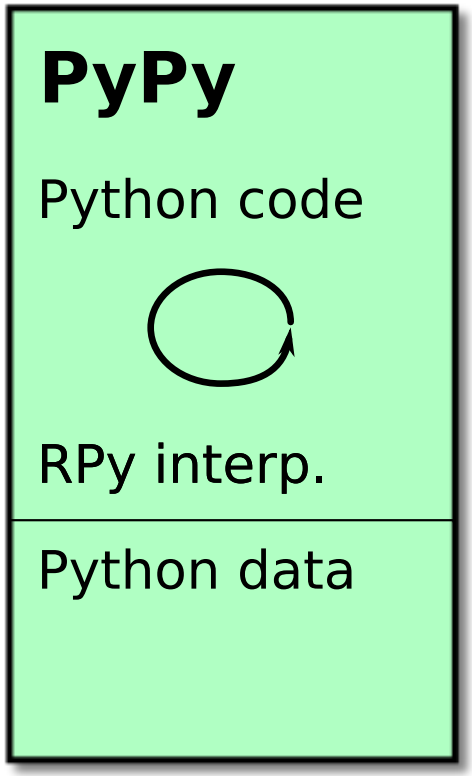
H2 Replacing the query execution engine of a DBMS with a JIT reduces execution time of standalone SQL queries.

- Small embedded SQL database
- dynamically typed
- used a bit everywhere (Mac OS, Android, ...)

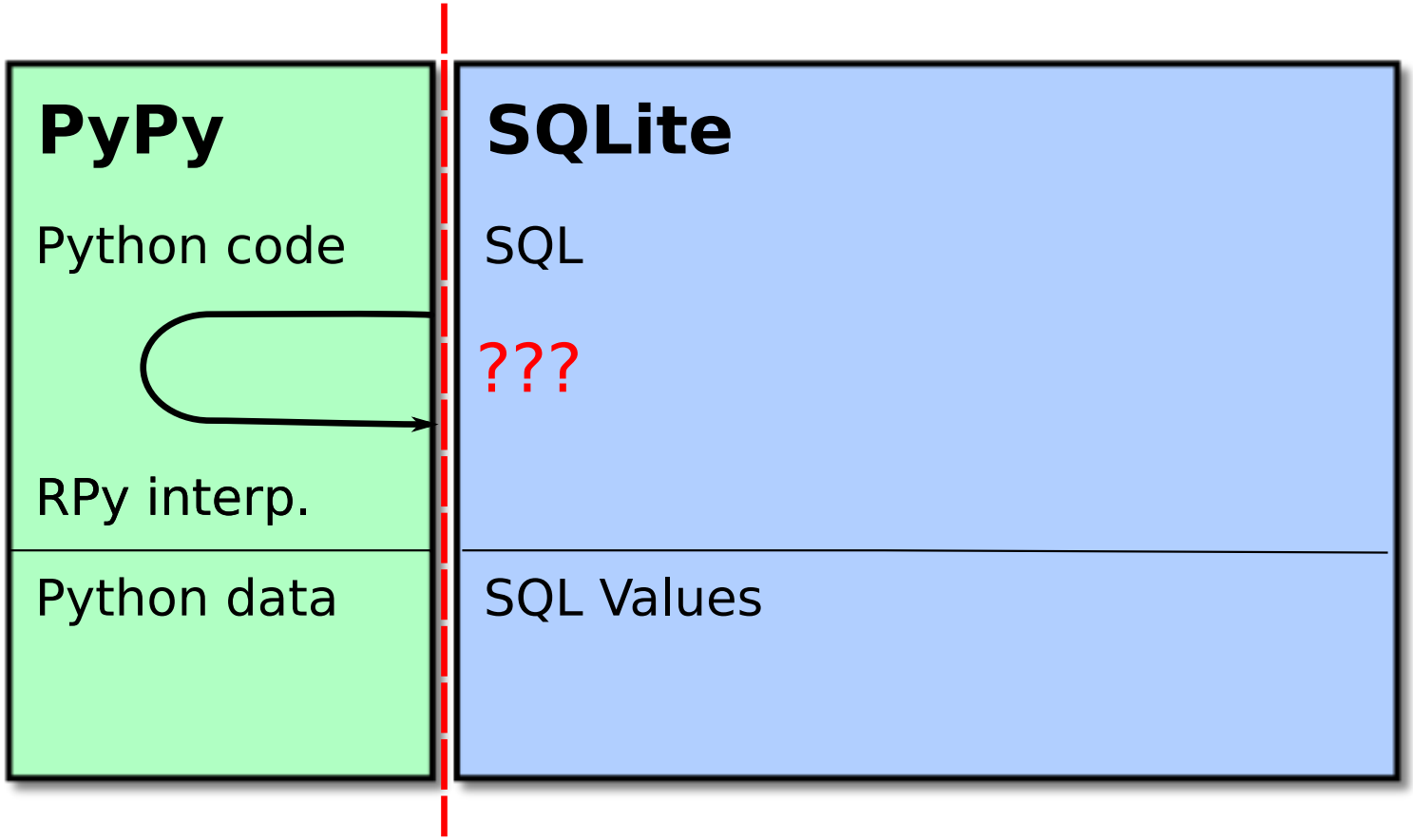


PyPy

- reimplementation of Python in RPython
- good JIT via the RPython JIT framework


PyPy
Python code
RPy interp.
Python data

```
def select():
    iterator = conn.execute(
        """select quantity, extendedprice, discount
           from lineitem""")
    sum_qty = 0
    sum_base_price = 0
    sum_disc_price = 0
    for quantity, extendedprice, discount in iterator:
        sum_qty += quantity
        sum_base_price += extendedprice
        sum_disc_price += extendedprice * (1 - discount)
    return sum_qty, sum_base_price, sum_disc_price
```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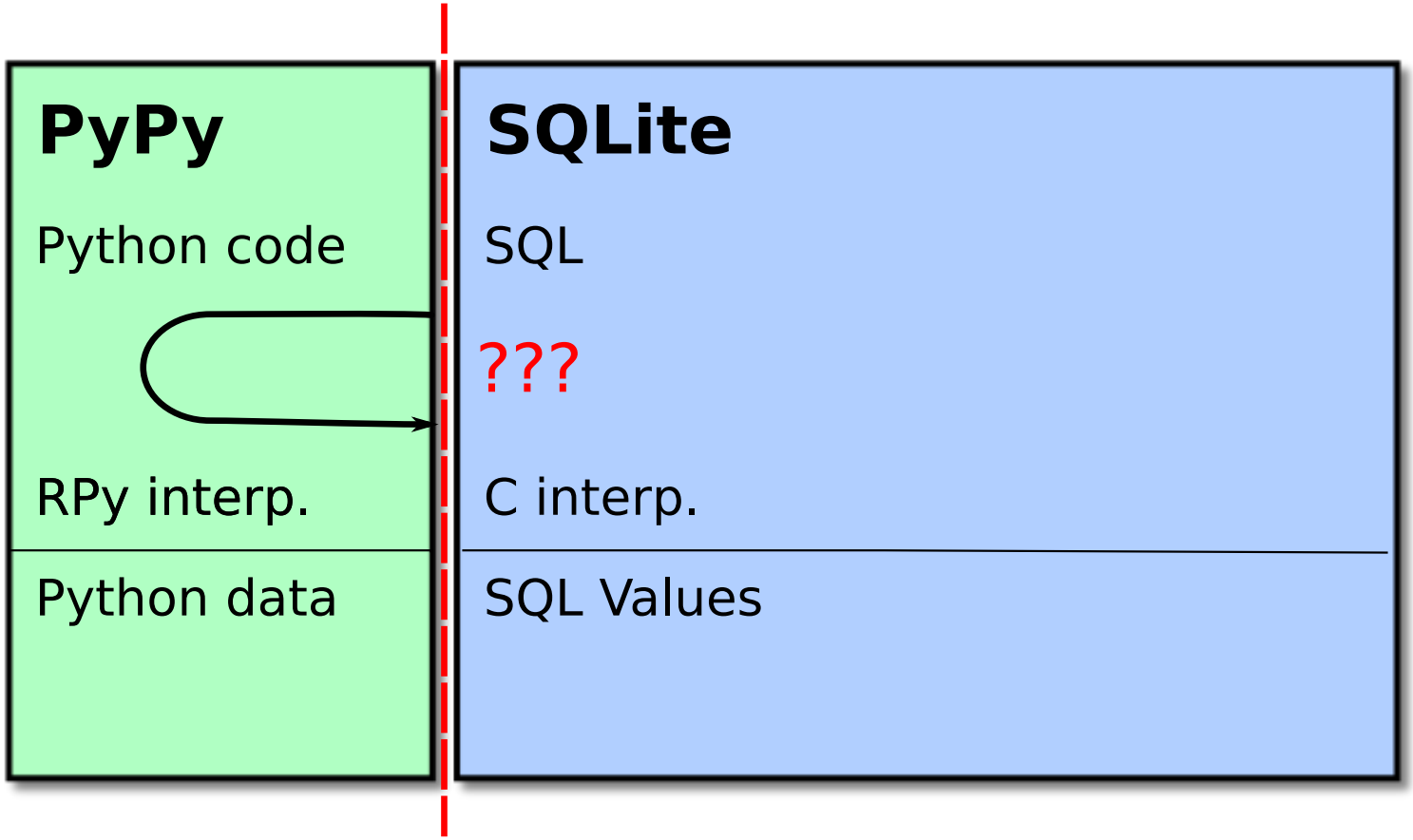
SQLite
SQL
???
SQL Values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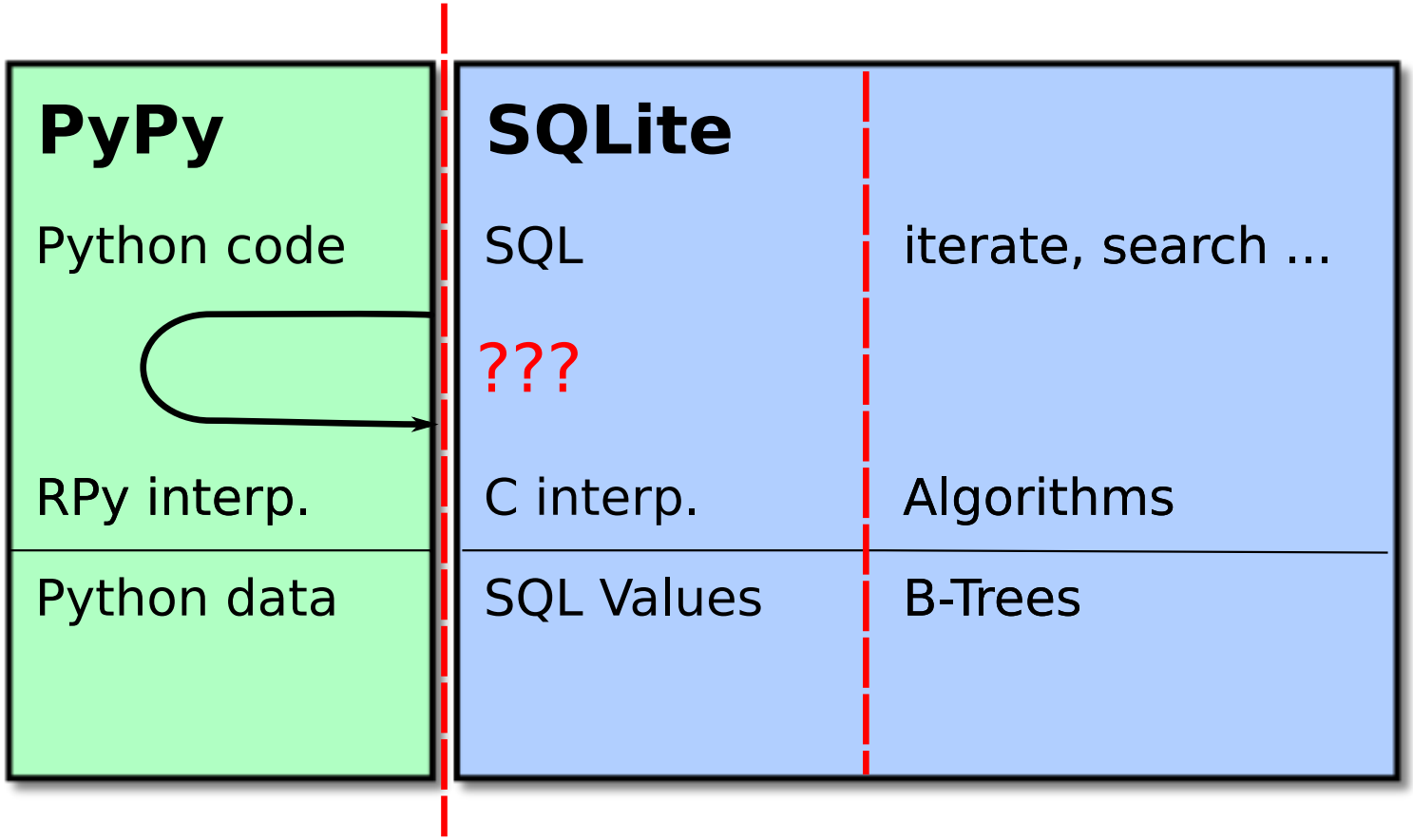
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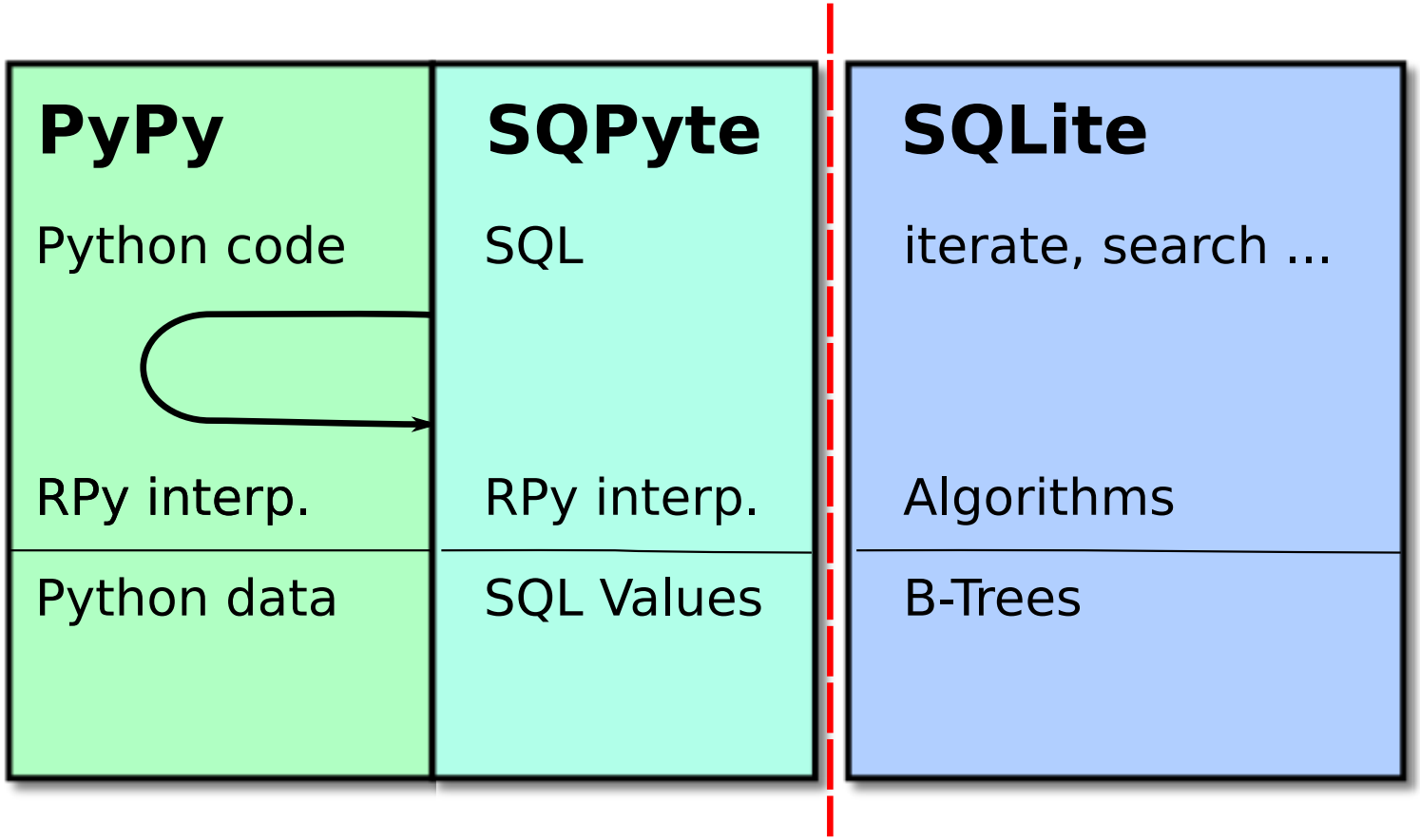
iterate, search ...
Algorithms
B-Trees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```
case OP_Return: {
  pIn1 = &aMem[pOp->p1];
  assert(pIn1->flags == MEM_Int);
  pc = (int)pIn1->u.i;
  pIn1->flags = MEM_Undefined;
  break;
}
```

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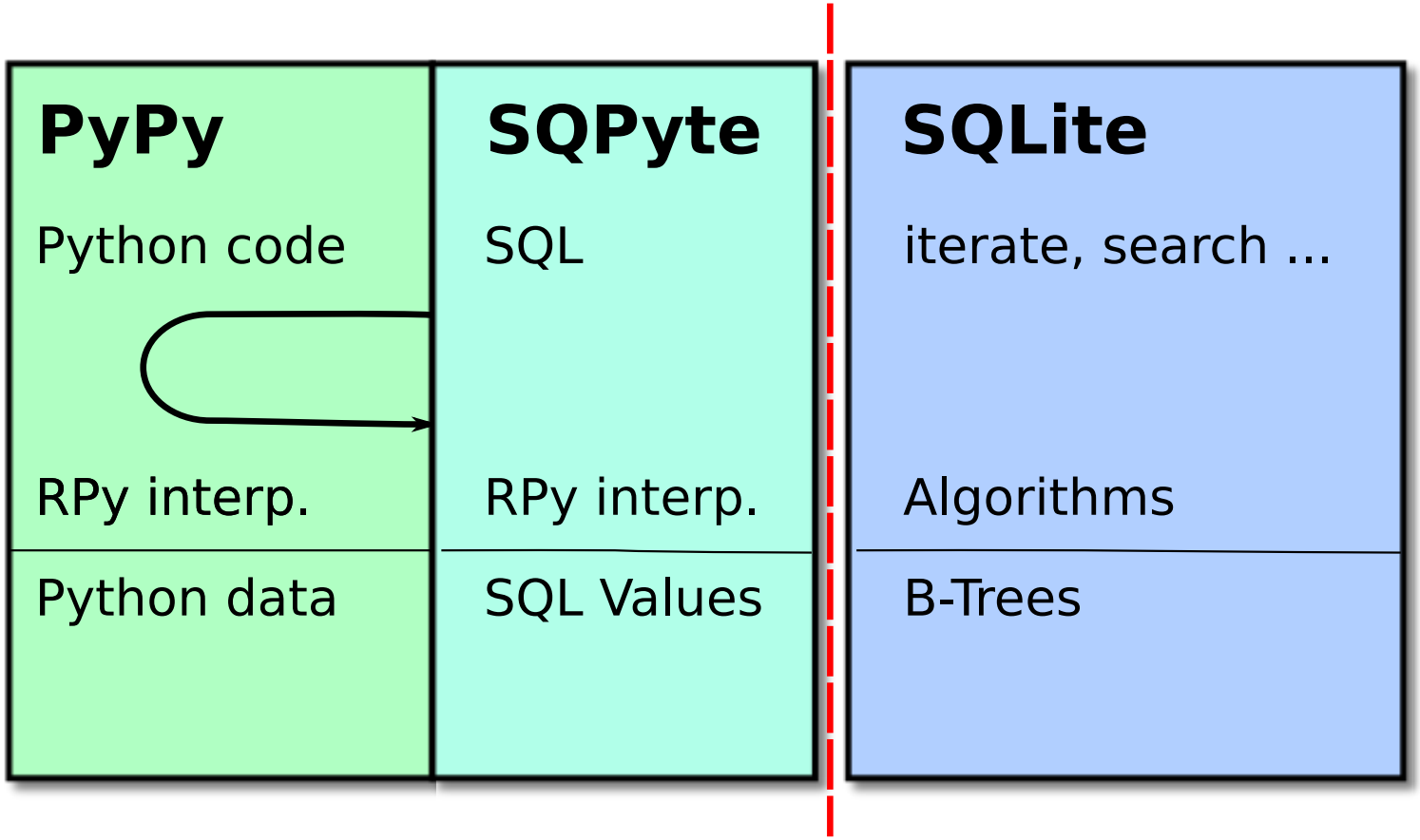
  break;
}
```

```
def python_OP_Return(hlquery, op):
    pIn1 = op.mem_of_p(1)
    assert pIn1.get_flags() == CConfig.MEM_Int
    pc = pIn1.get_u_i()
    pIn1.set_flags(CConfig.MEM_Undefined)
    return pc
```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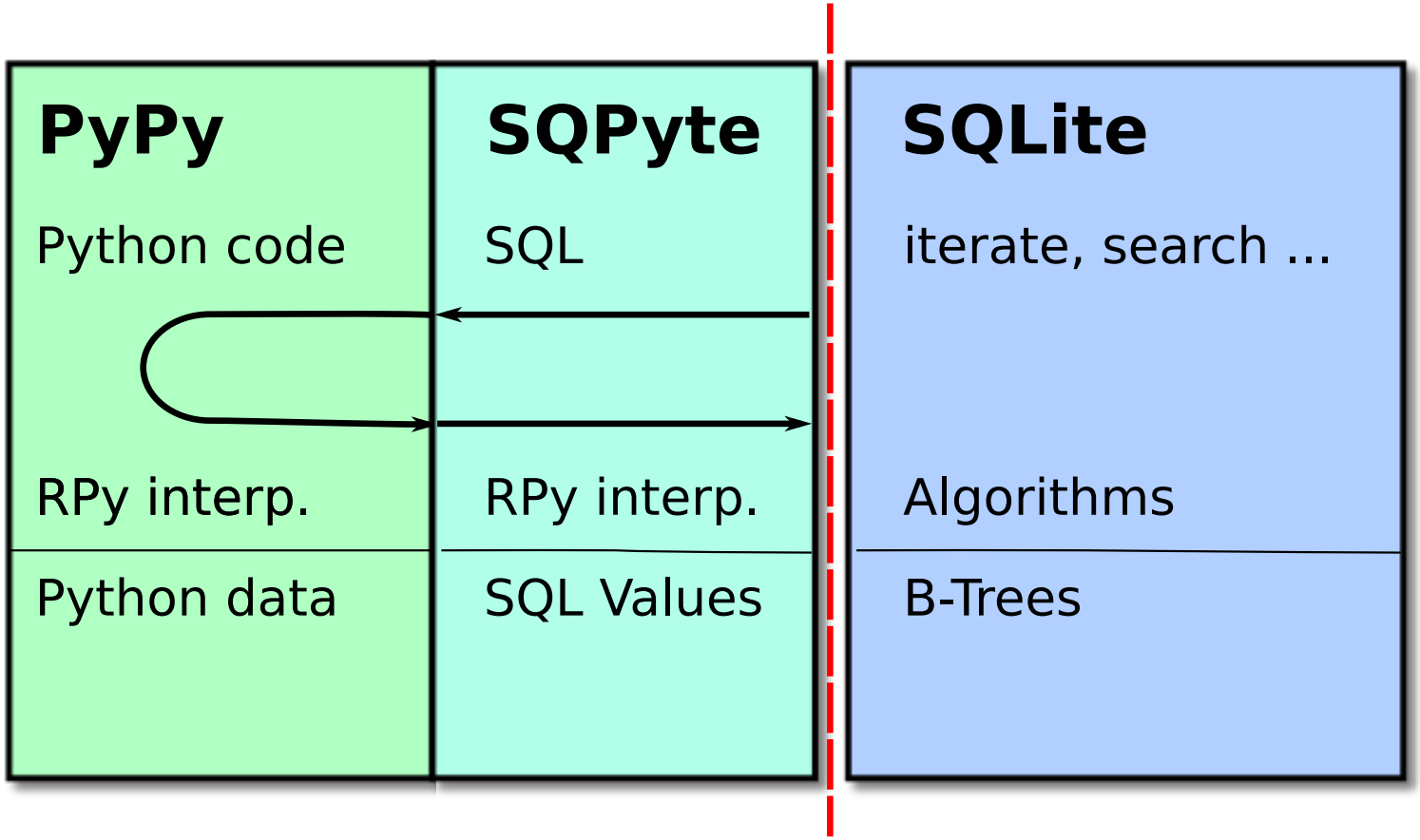
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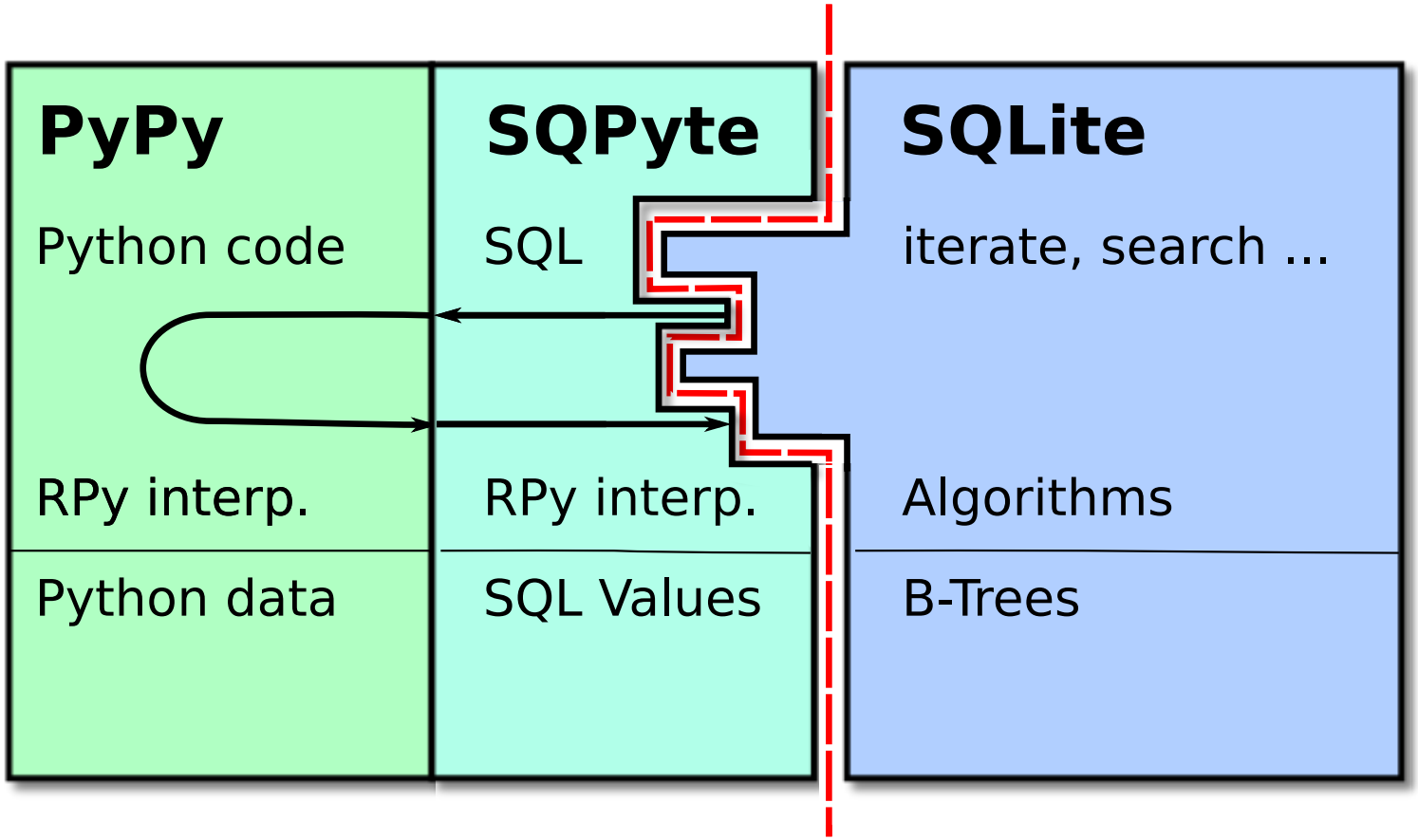
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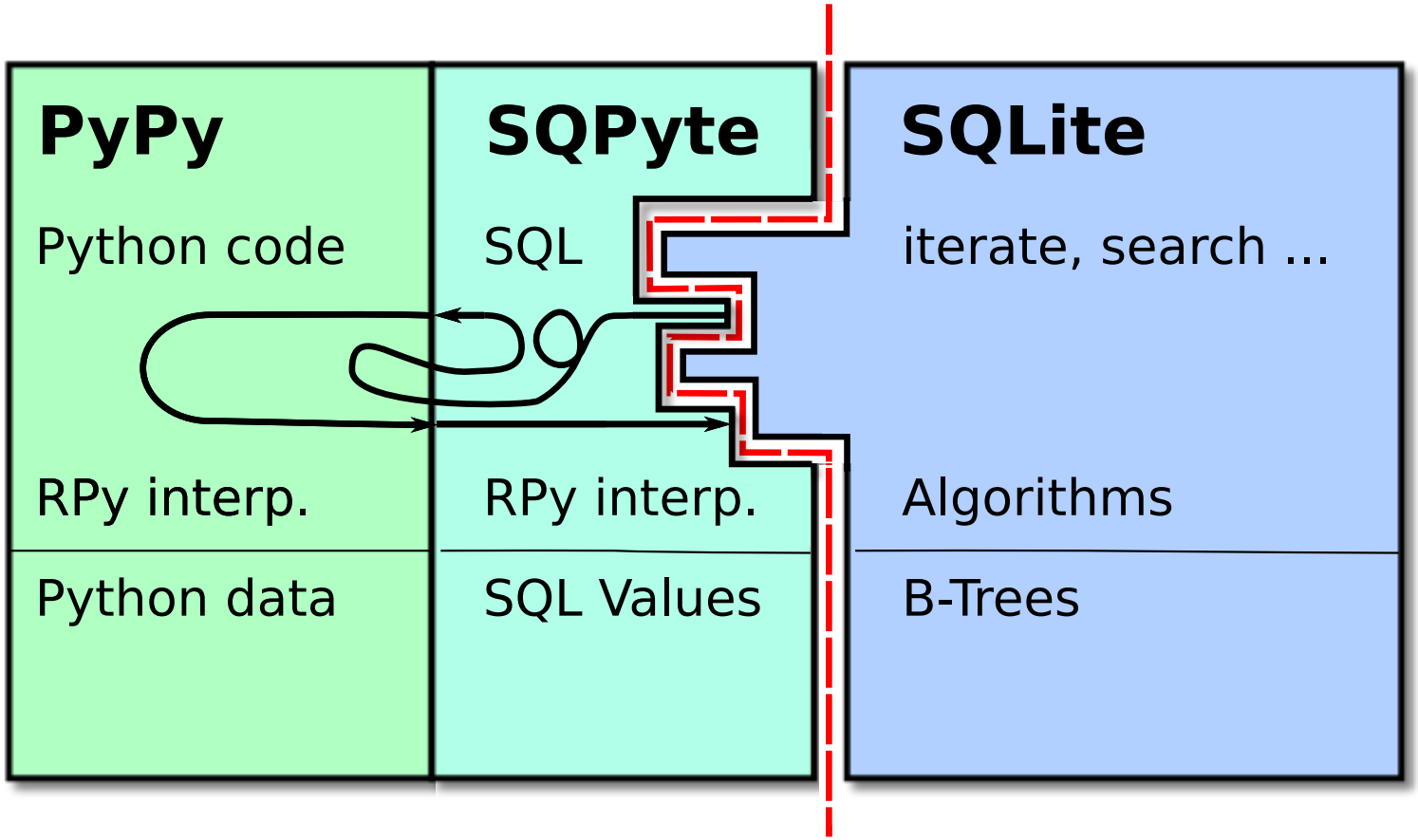
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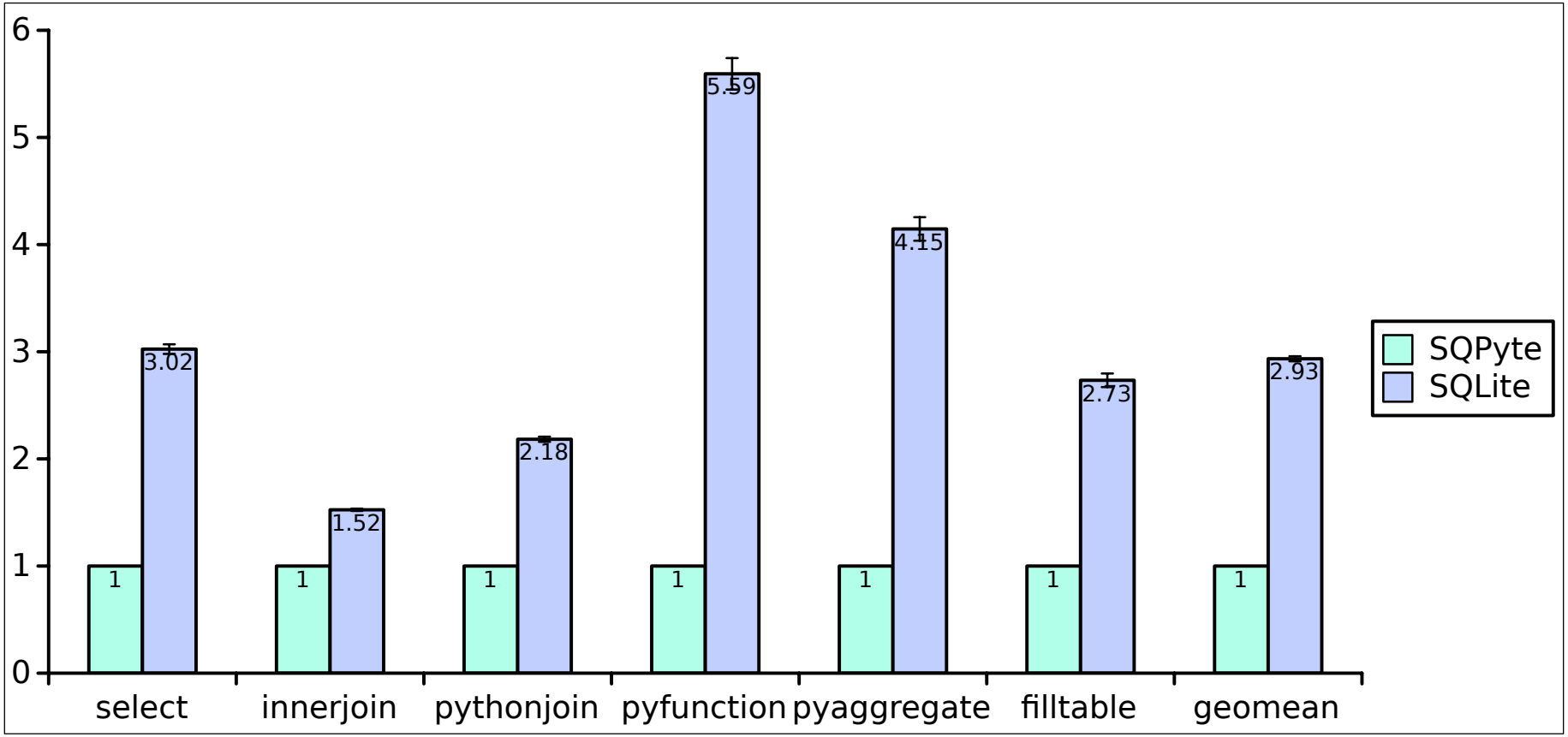
Optimizations

- language crossing, type conversion
- dynamic typing in SQLite
- inlined user-defined functions and aggregates

Microbenchmarks



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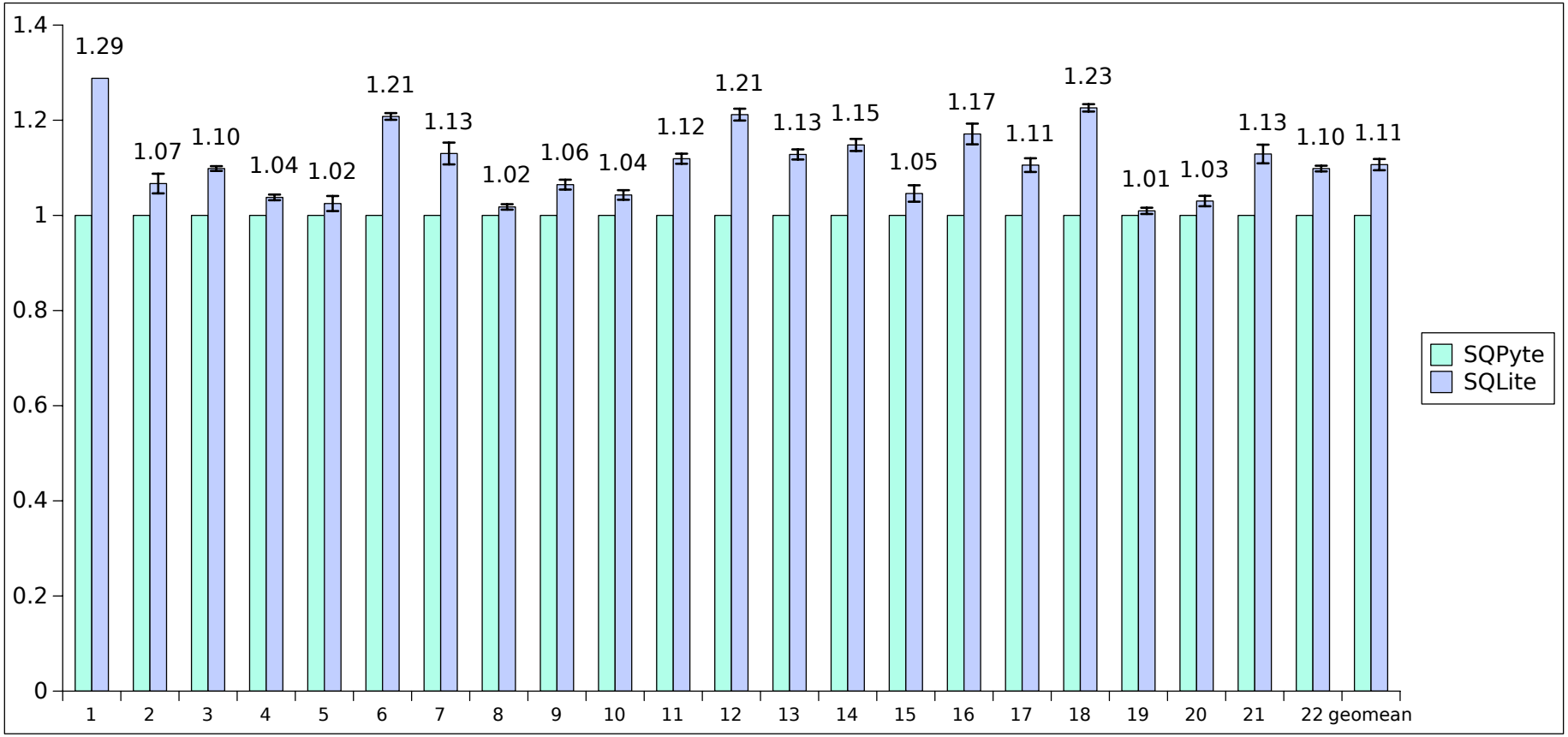
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Summary

- H1 confirmed
- H2 maybe
- Python-SQLite can be improved a lot

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Future Work

- Where exactly is the speedup coming from?
- Interaction with an ORM
- Try with "real" DB?