A New Java Runtime for a Parallel World

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PARALLELIZABILITY ACCORDING TO COMPLEXITY THEORY

Serial Code

⋮

FOL + transitive closure

FOL + simple reduce (count, majority...)

FOL (First-Order Logic): parallel map

Our Goal: Ultimate Parallel Language

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  - "everything" efficiently parallelizable
  - only programs that are efficiently parallelizable
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                  find p: p in a.people && p.name == "Waldo";
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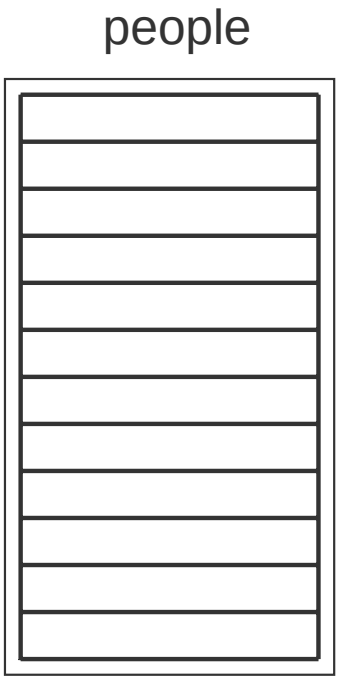
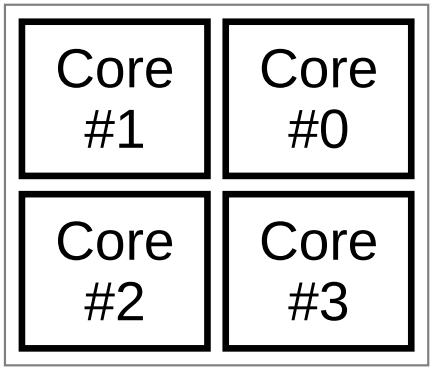
- Program consists of parallel and sequential "phases"
  - over same data

For Random-Access Structures, Parallelizing Is Easy

ArrayList<...> people;

... = ... **find** p: p **in** people ...





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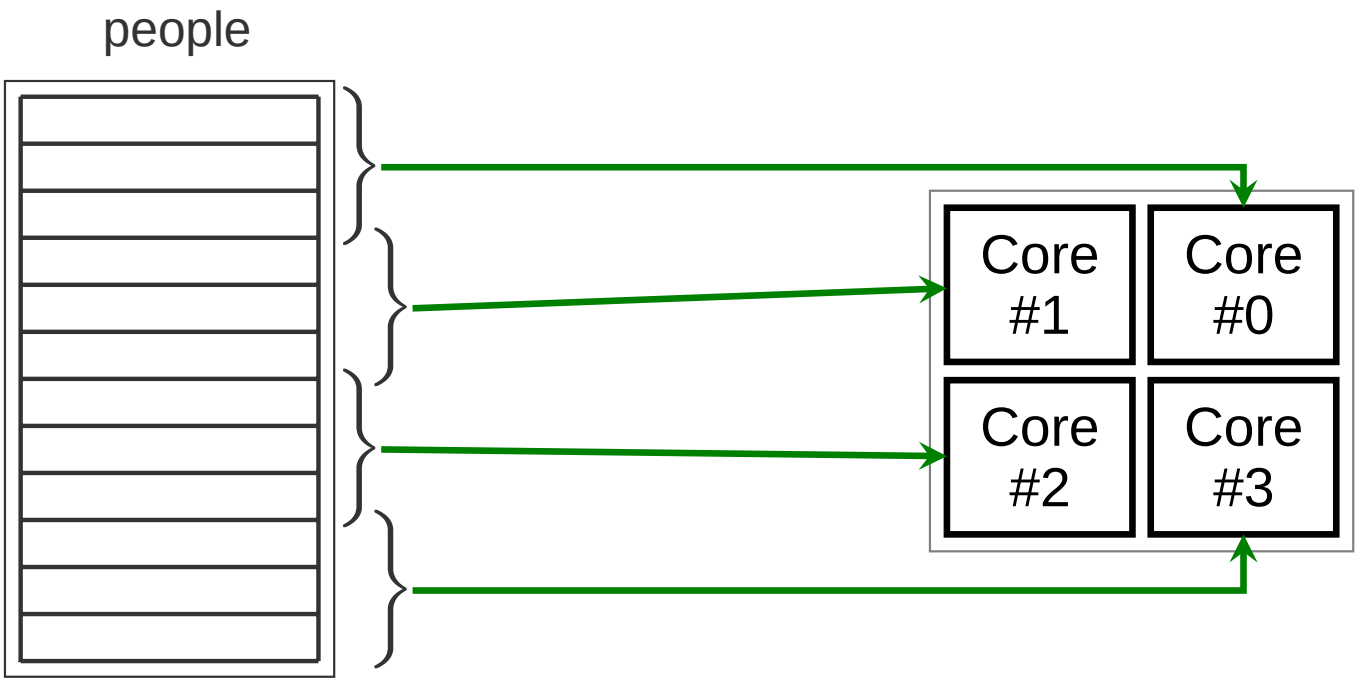
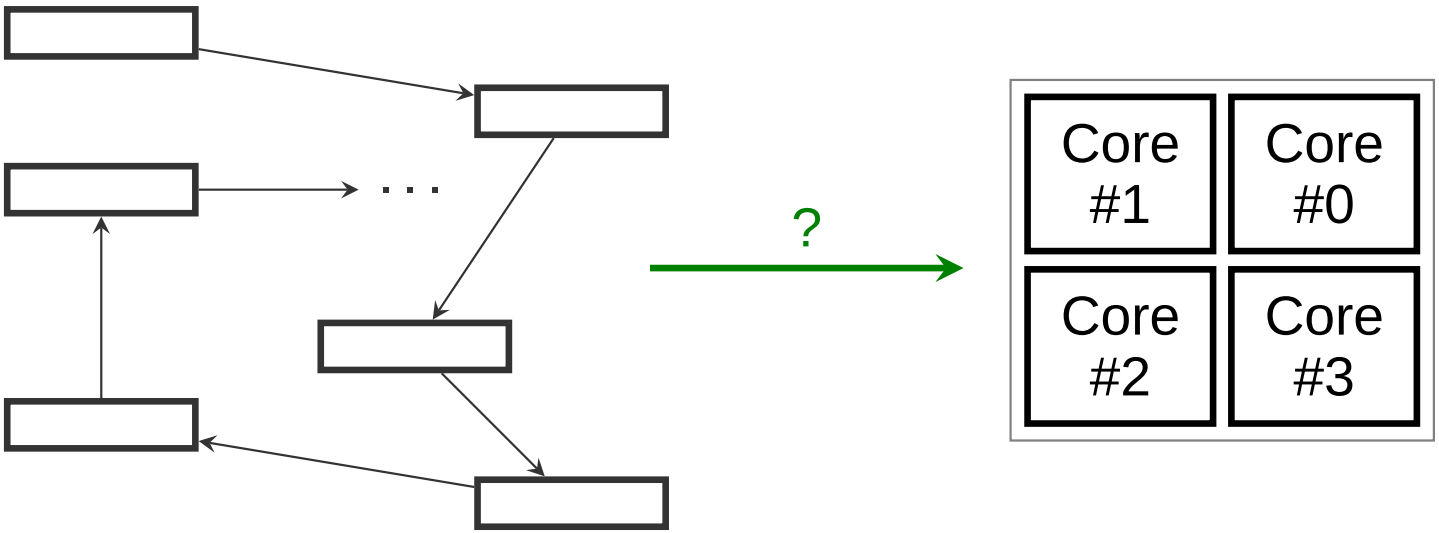


Challenge: Parellelize Processing of All Java Data

Support *any* user-defined data structure

- Arbitrary object references
- “Sequential” library structures (e.g., linked lists)



Idea: From OO Heap to Relational Heap

```
class E {
   String name;
   E boss;
   E partner;
}
```

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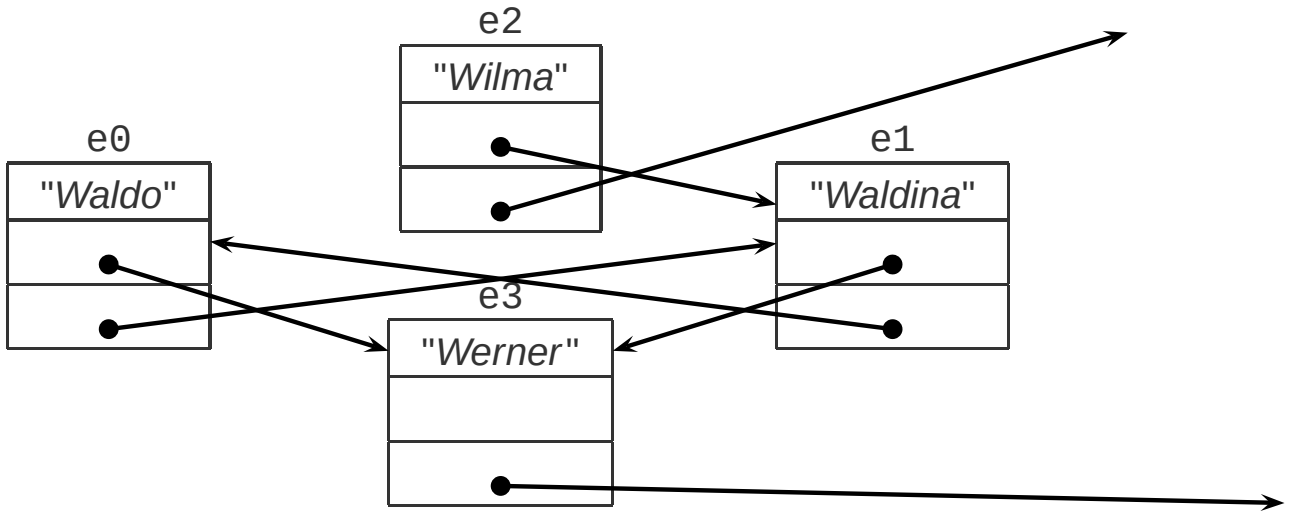


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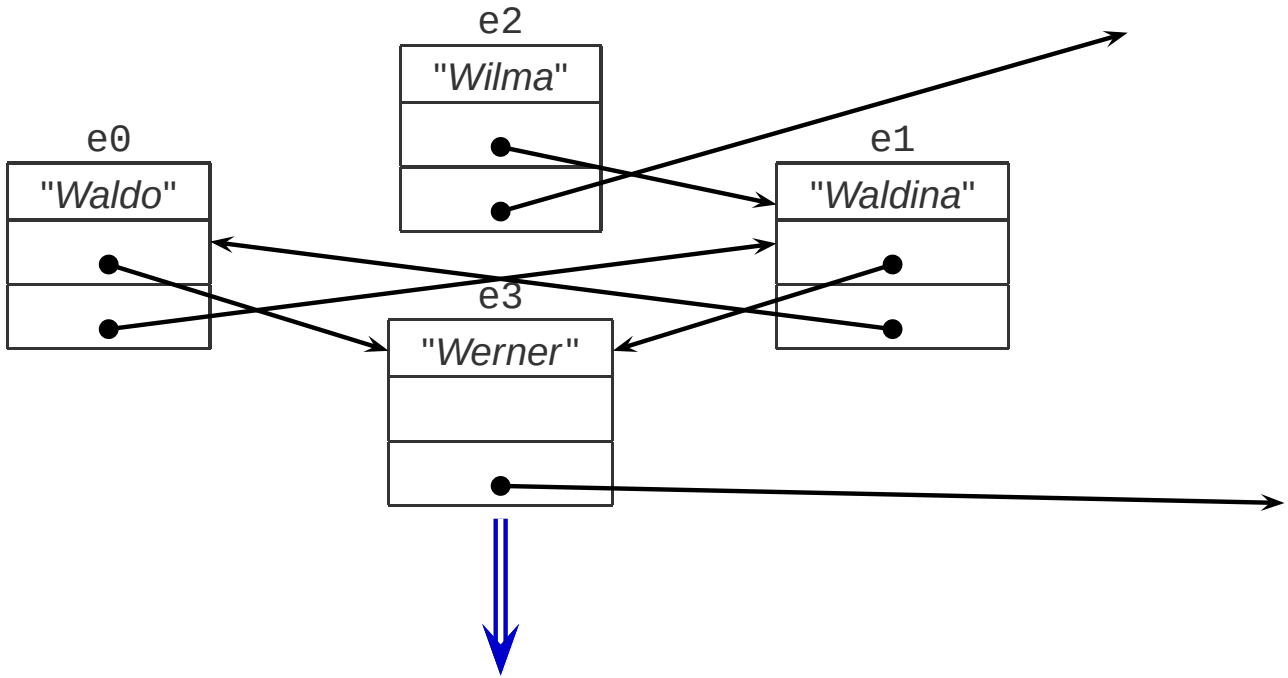


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name

e0	"Waldo"
e1	"Waldina"
e2	"Wilma"
e3	"Werner"
⋮	

boss

e0	e3
e1	e3
e2	e1
e3	—
⋮	

partner

e0	e1
e1	e0
e2	e5
e3	e17
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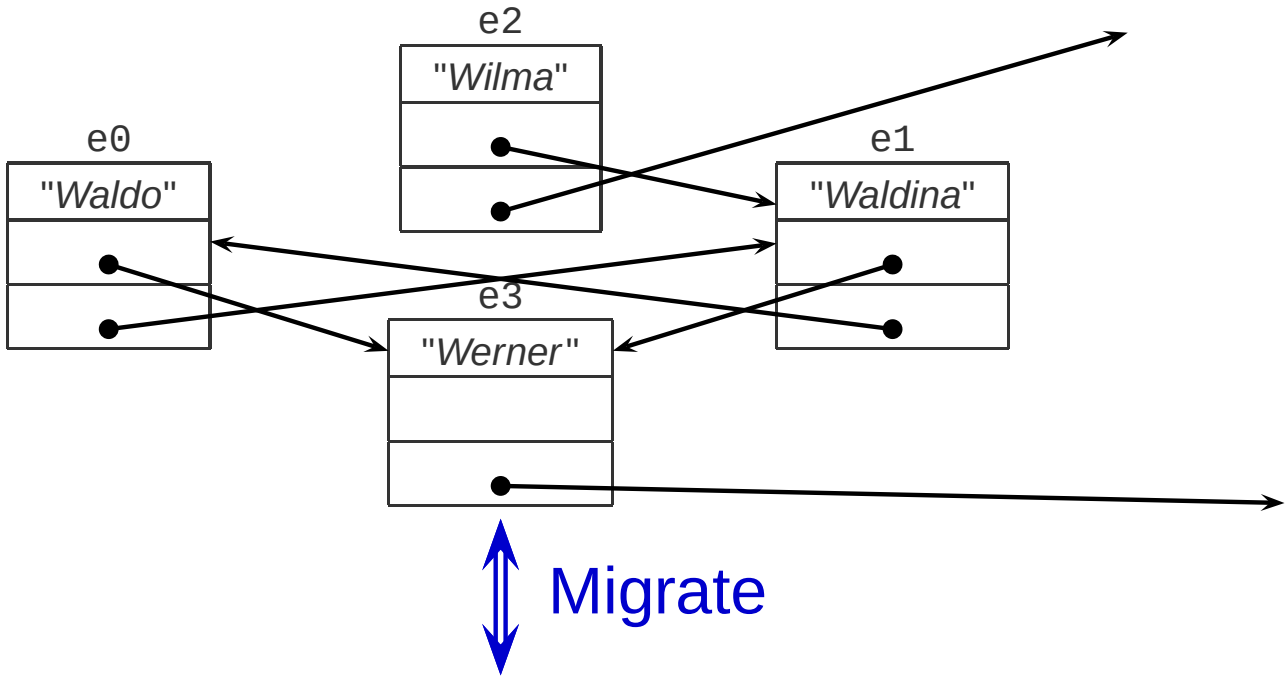


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Migrate

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- Hybrid + incremental migration (write barrier)

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Ask us for our preliminary numbers!

CONCLUSION

- The relational heap is a great basis for parallelism
- Relational and traditional heaps can coexist in many ways