Data Structures and Algorithms

XMUT-COMP 103 - 2025 T1

Priority Queues

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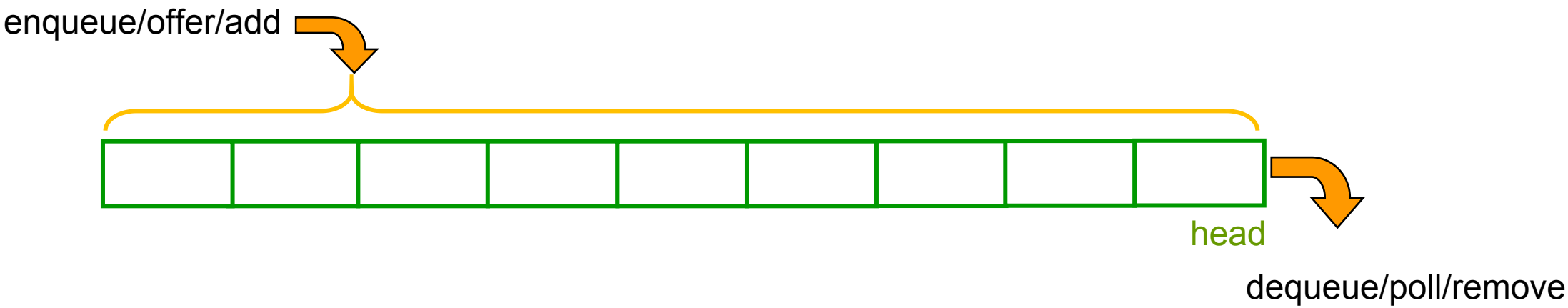
Priority Queues

- Priority Queues
  - Items ordered by priority, instead of arrival order
    - dequeue/poll: highest priority item (earliest in the ordering)



Priority Queues: ordering

Ordering:

- Highest priority = earliest in ordering.
- Typically high priority = 1, low priority = 10 (large number)

Specify ordering like with Collections.sort():

either

- use natural ordering of the items using compareTo (if they are Comparable)

```
Queue<Patient> waitingRoom = new PriorityQueue<Patient>();
```

or

- give the Priority Queue a compare(…) function when created:

```
Queue<Patient> waitingRoom =
    new PriorityQueue<Patient>((Patient p1, Patient p2) ->{
     if (p1.getPri()>p2.getPri()){ return -1:} else if (p1 …   }  );
```

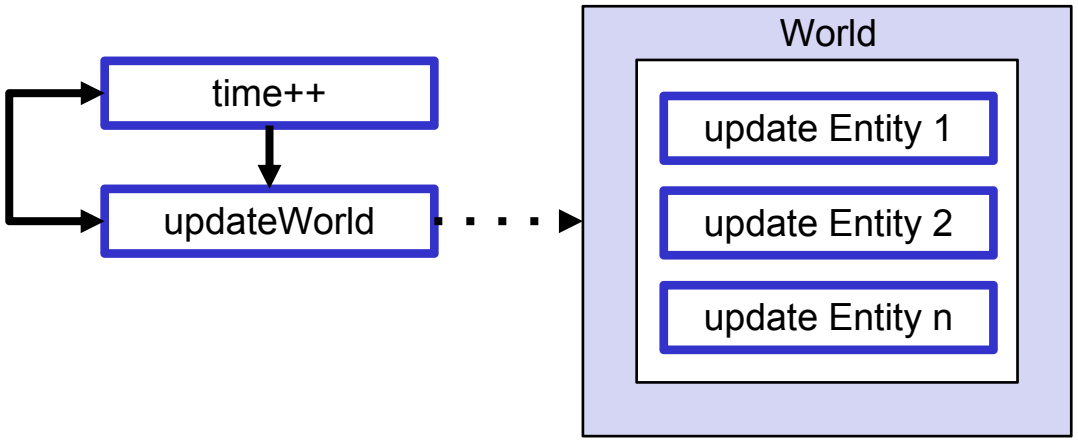
Applications of Queues and PriorityQueues

Many applications! (and many specialised Queue classes)

- Operating Systems, Network Applications, Multi-User Systems
  - Handling requests/events/jobs that must be done in order
  - (often called a “buffer” in this context)
- Simulations
  - Representing queues in the real world (traffic, customers, deliveries, ….)
  - Managing the events that must happen in the future
- Programs to control delivery of orders or manage customers/clients
- Search Algorithms
  - breadth-first search

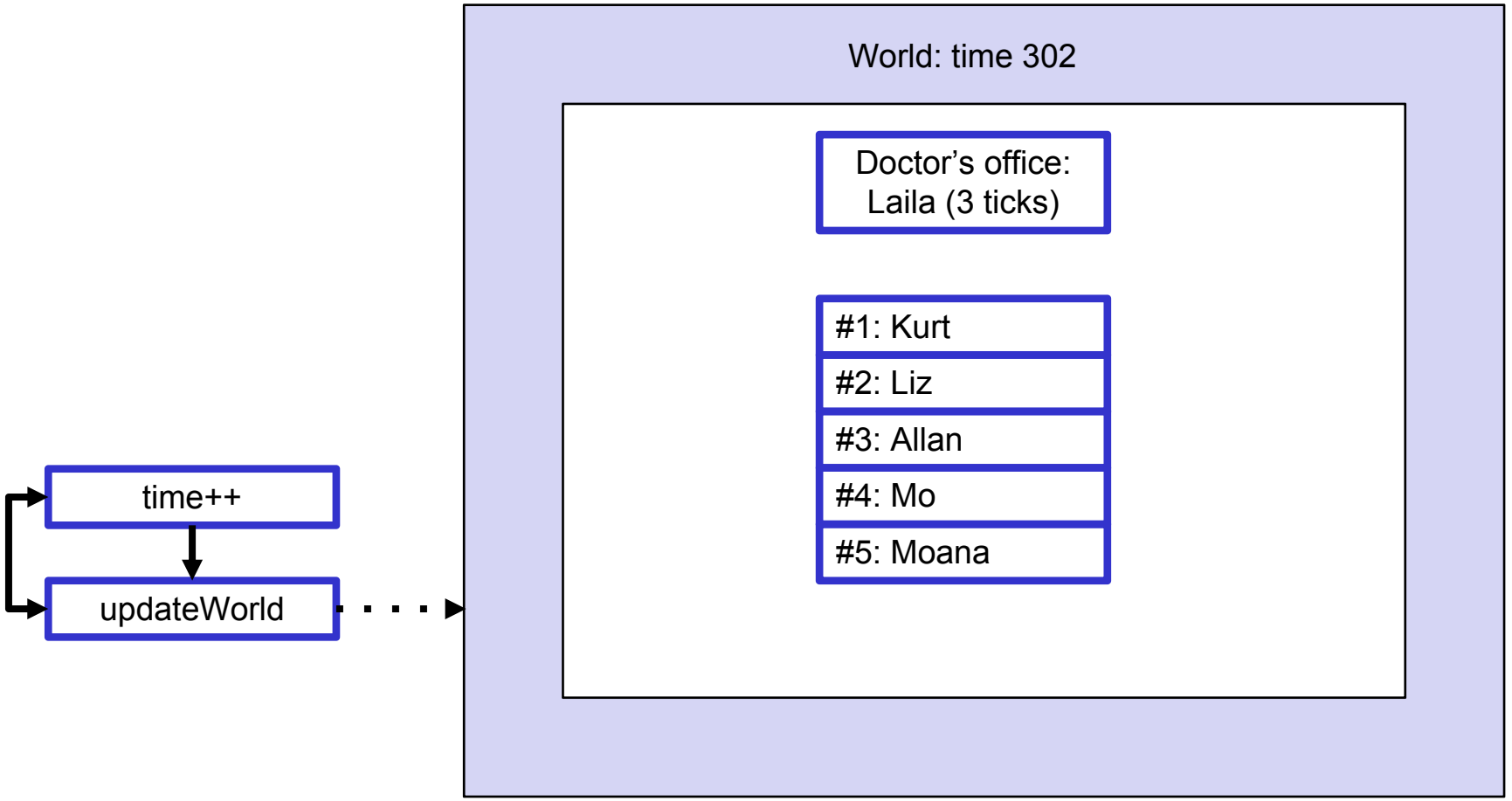
Simulation

- Tick-based simulation
  - Time is discrete
  - Main loop advances time by one tick for each iteration
  - Each tick, update the state of every entity in the world by one tick
  - Efficient if every entity changes every tick;
    May be inefficient if not very much happens most of the time
  - Often used in games



Simulation of Queues

- Doctor's waiting room



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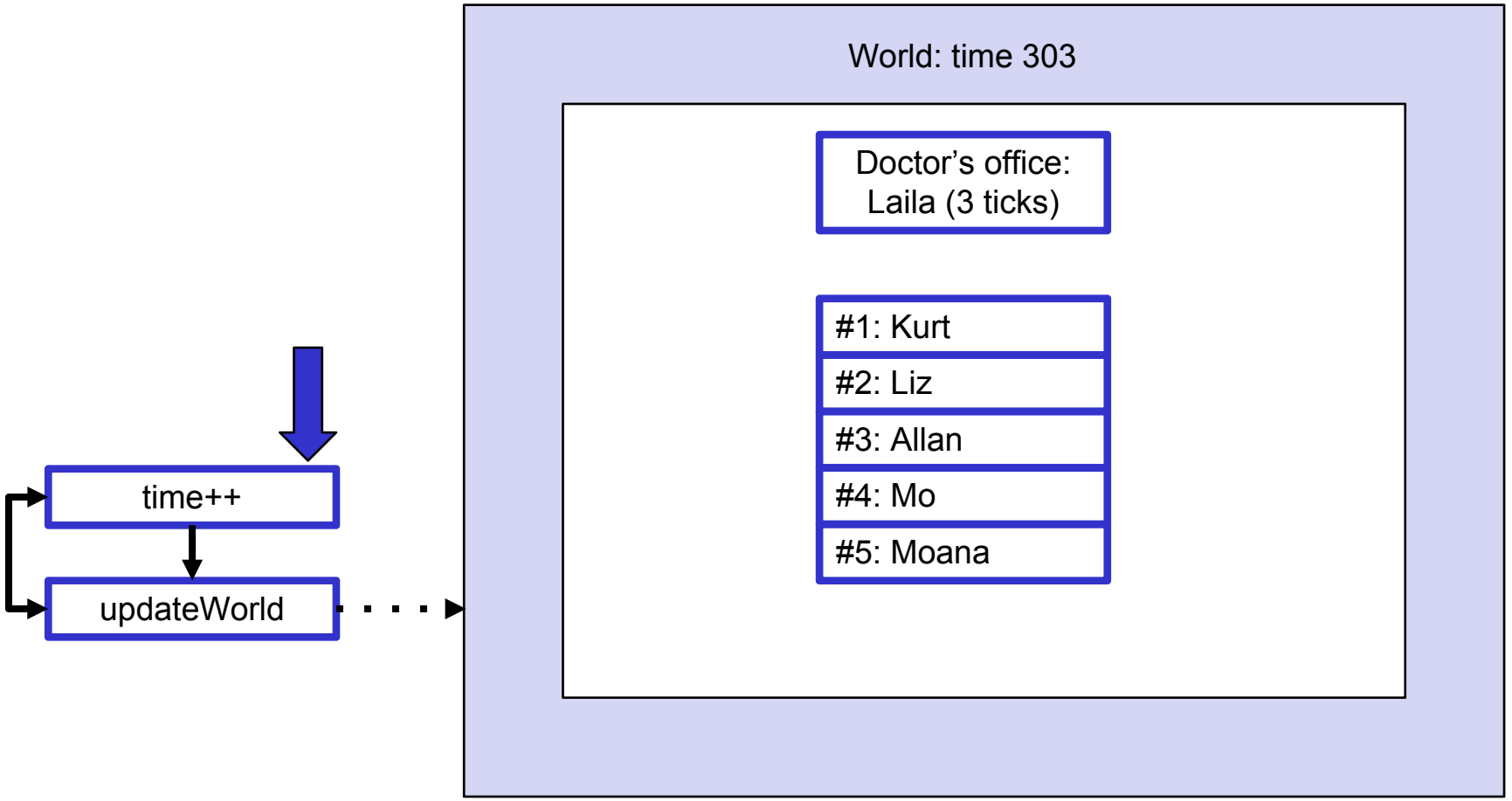

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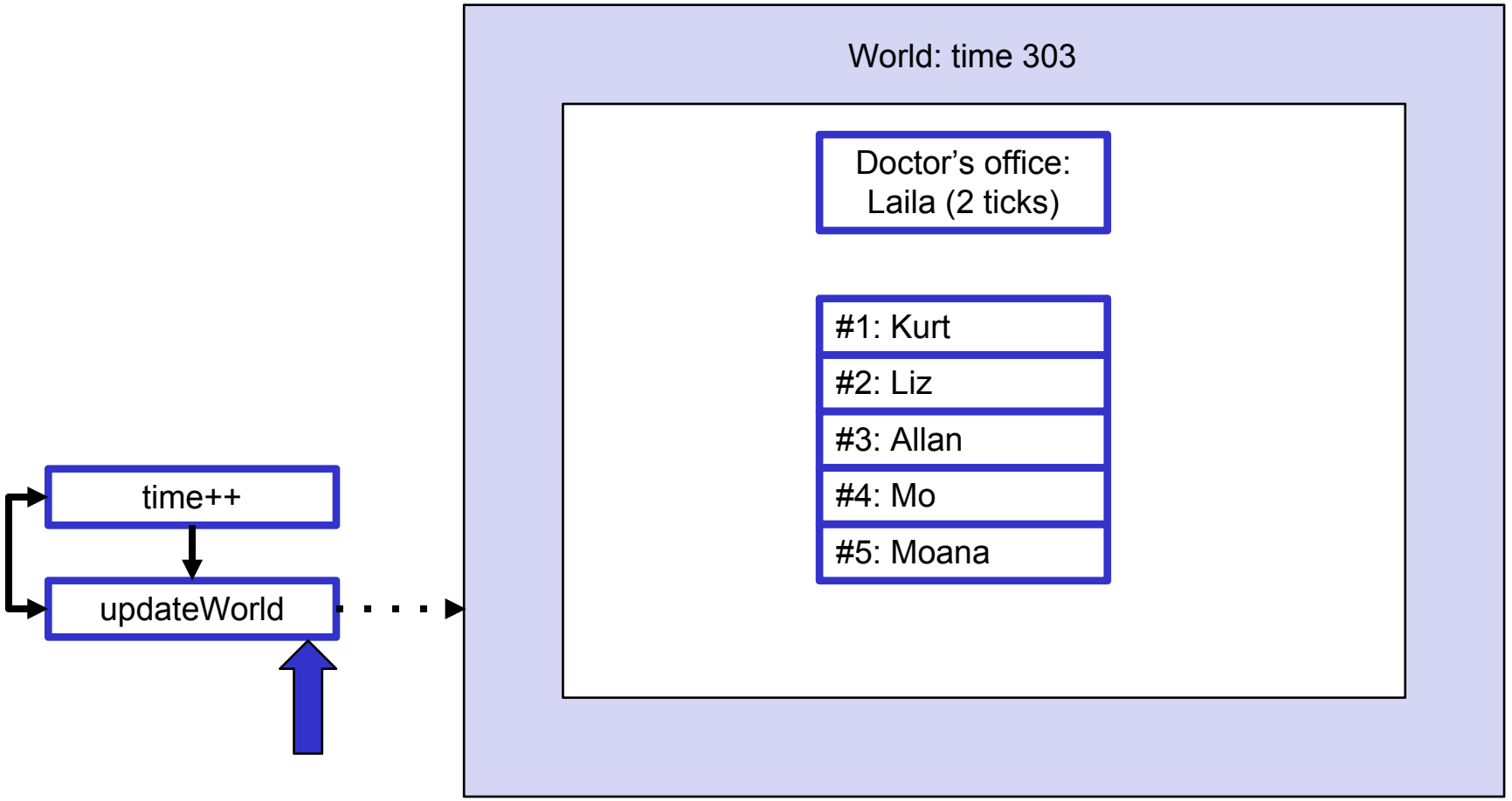

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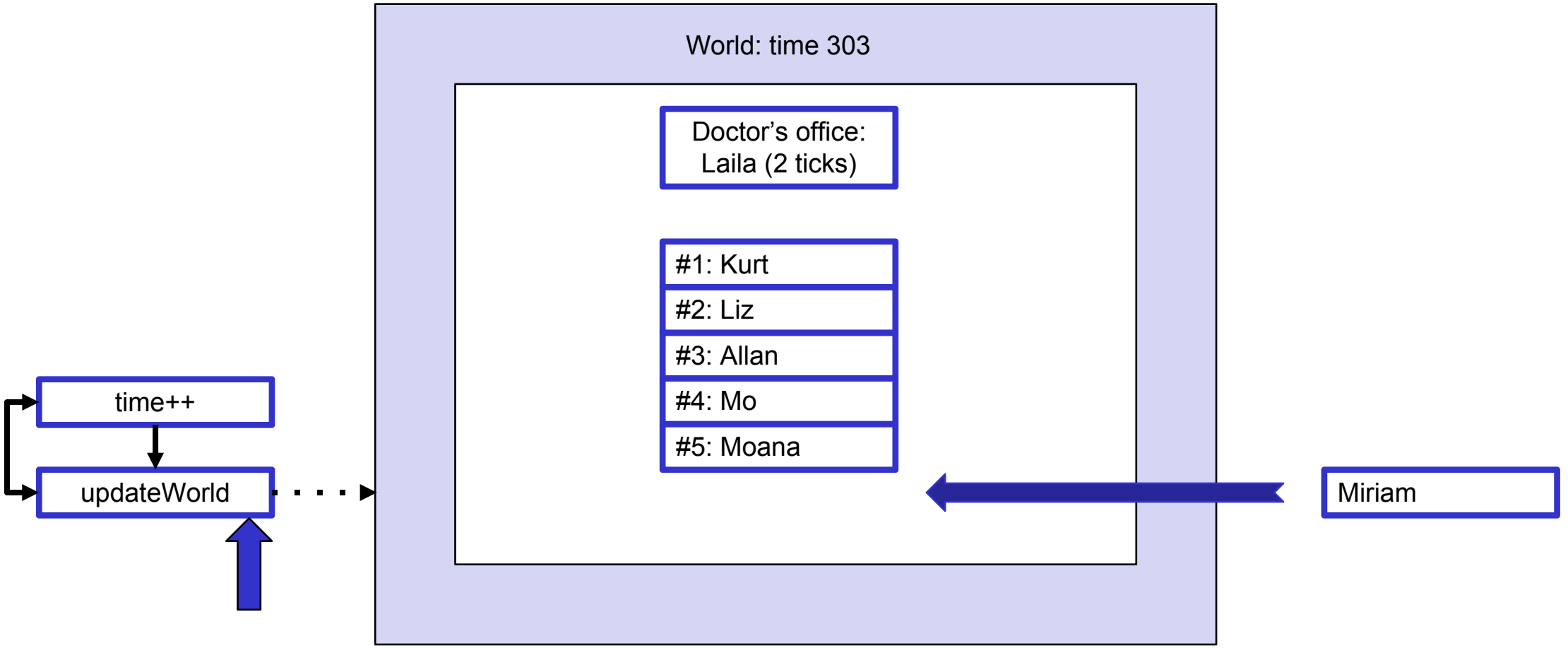

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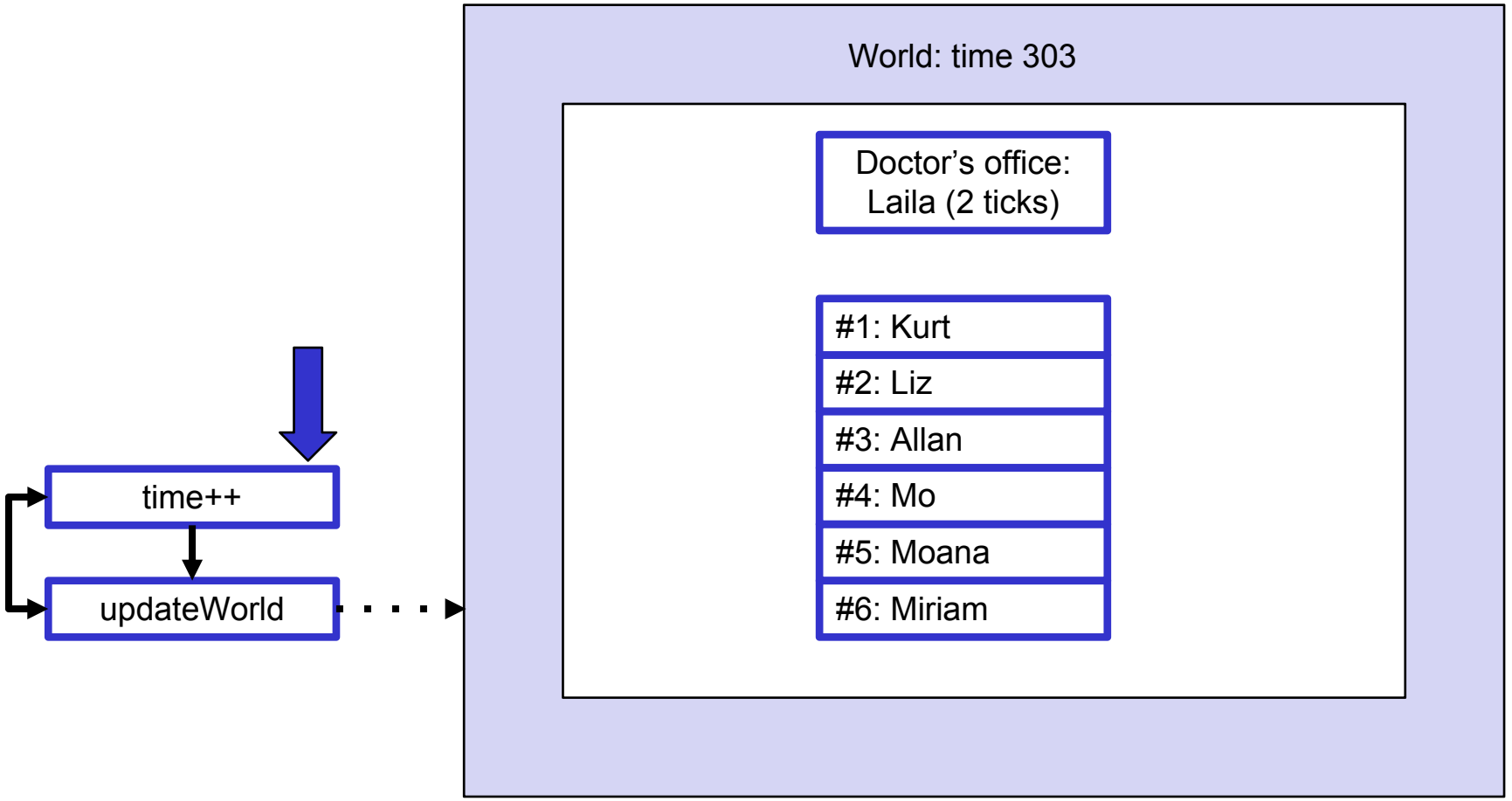

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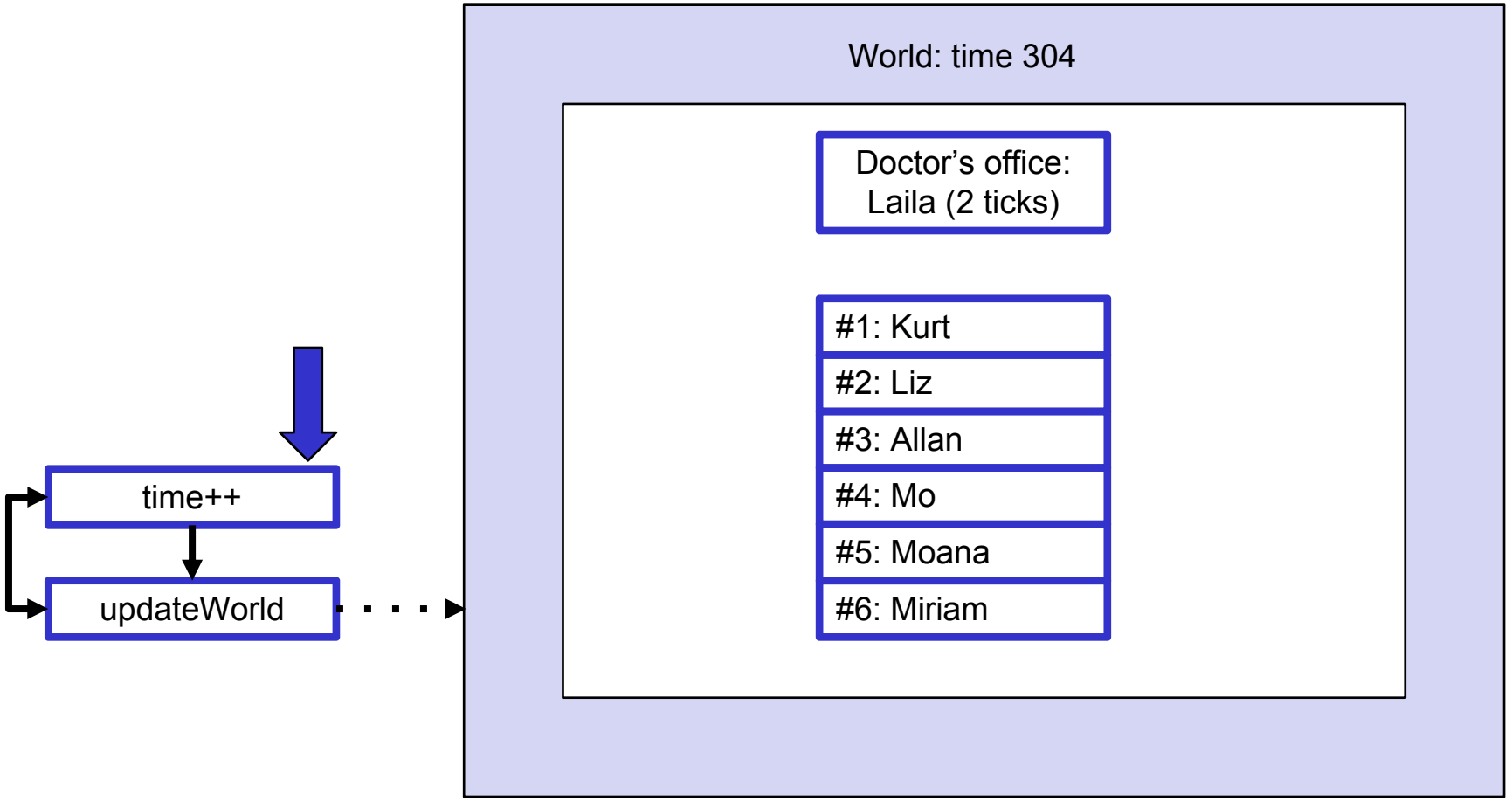

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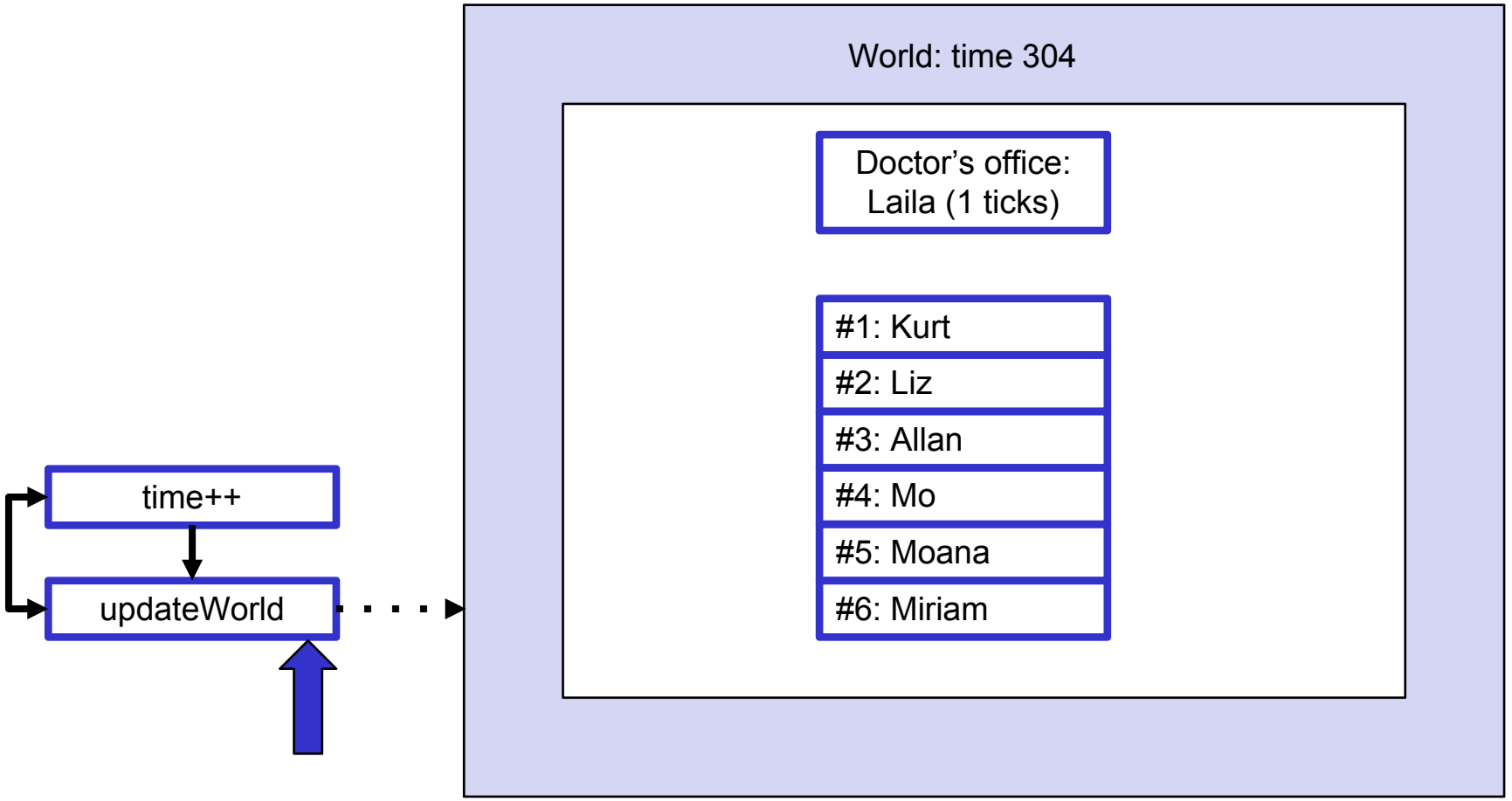

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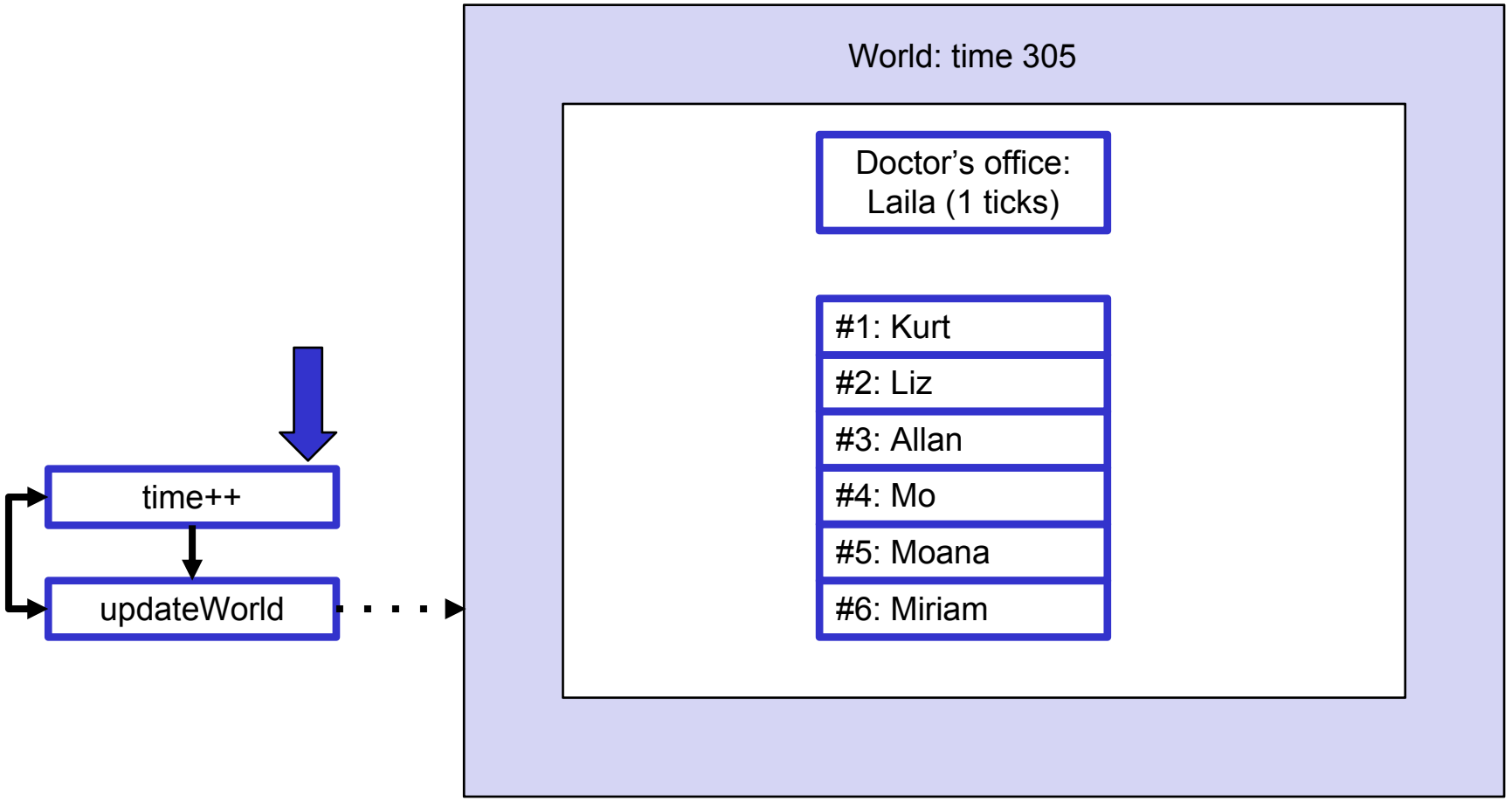

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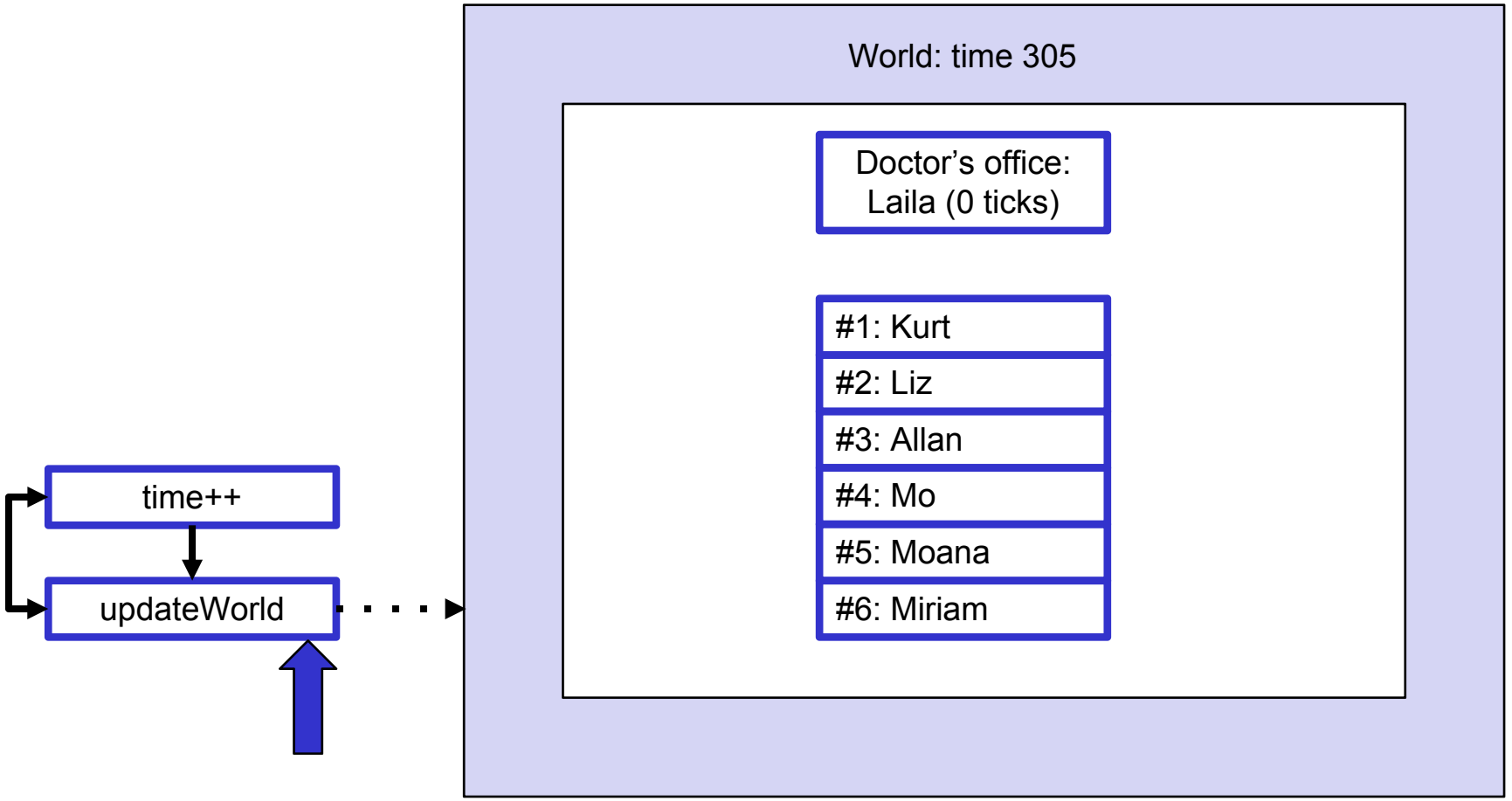

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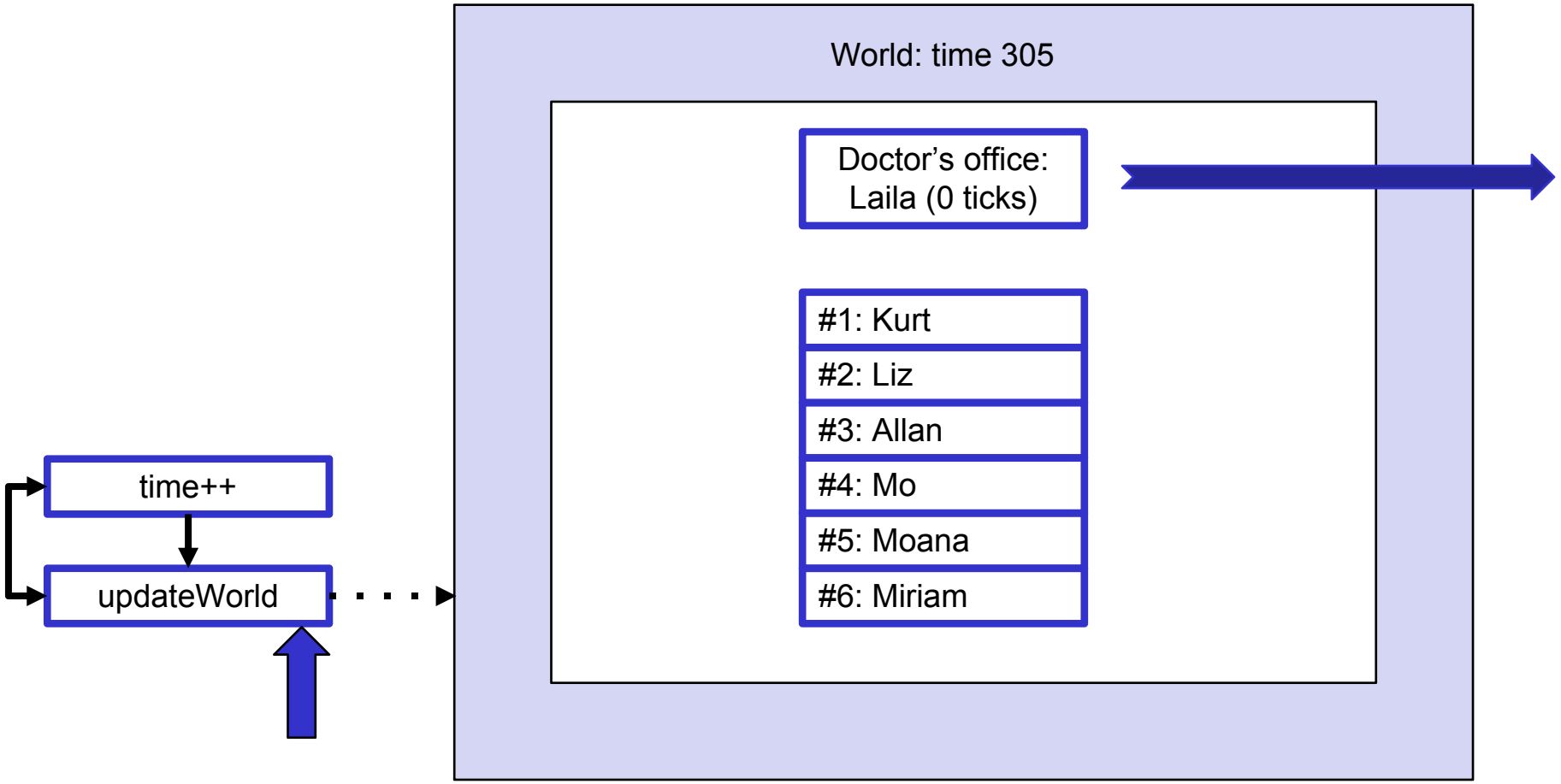

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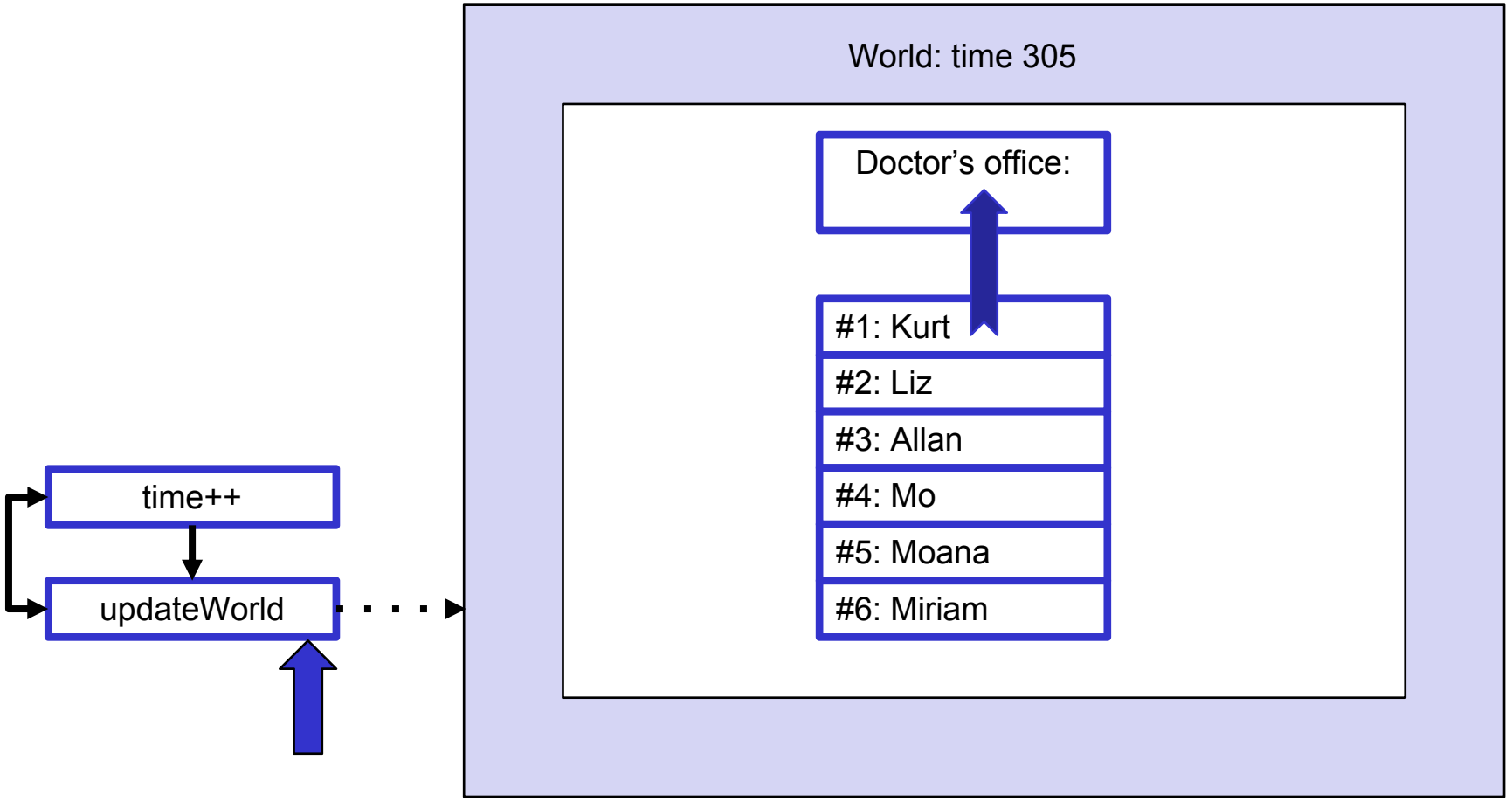

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