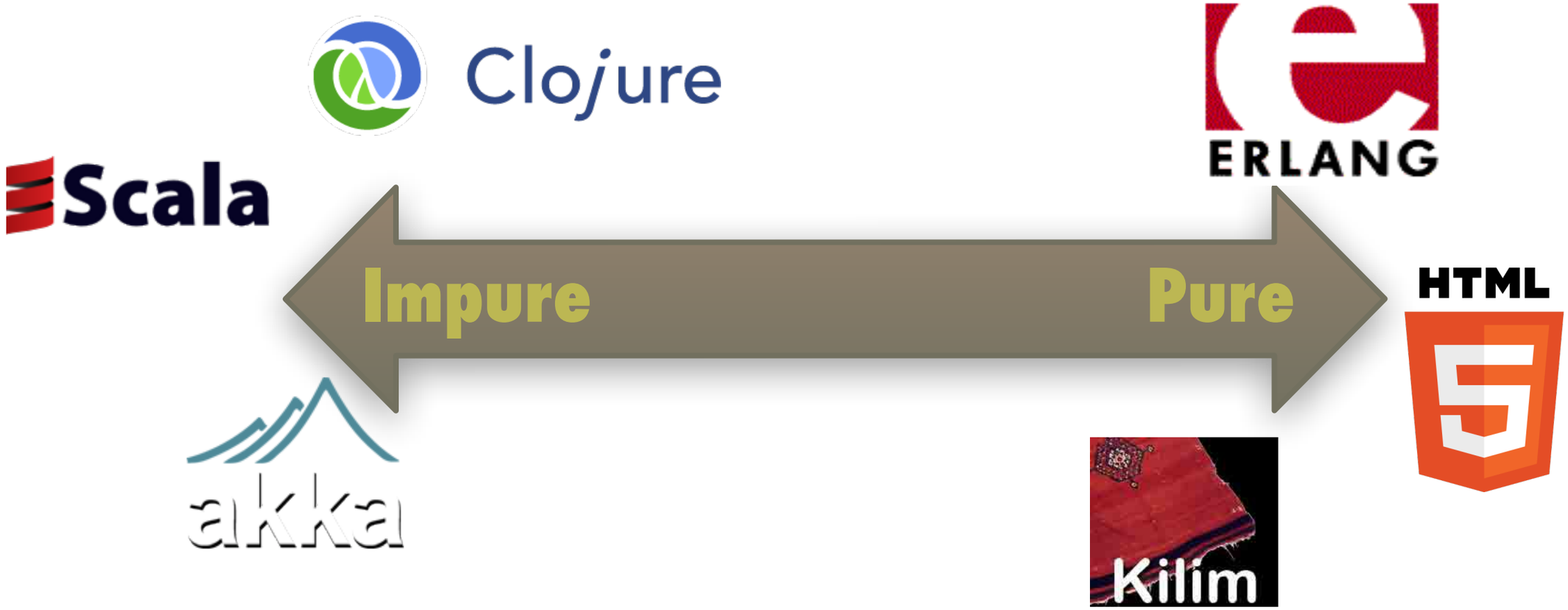
Domains: Safe sharing among actors

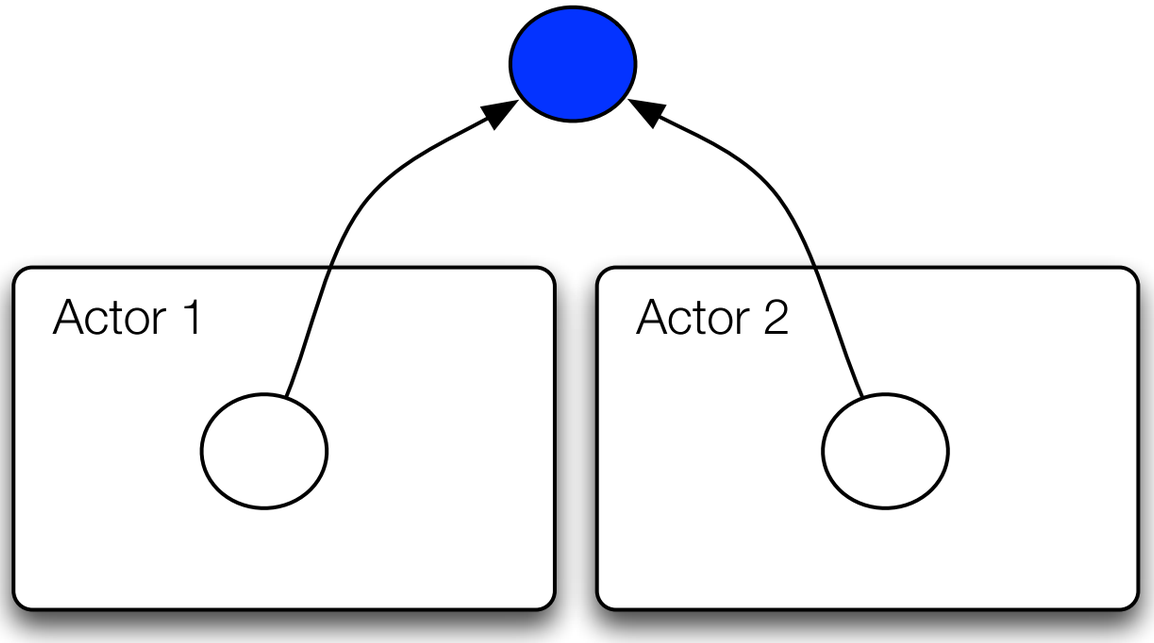
Joeri De Koster, Tom van Cutsem, Theo D'Hondt

Context



Impure

Synchronization?



Clojure

Scala

ERLANG

Impure

Pure

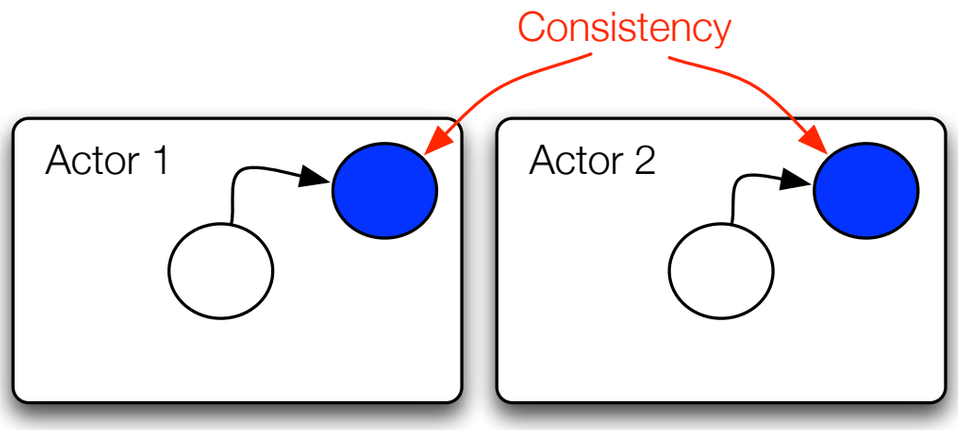
HTML

akka

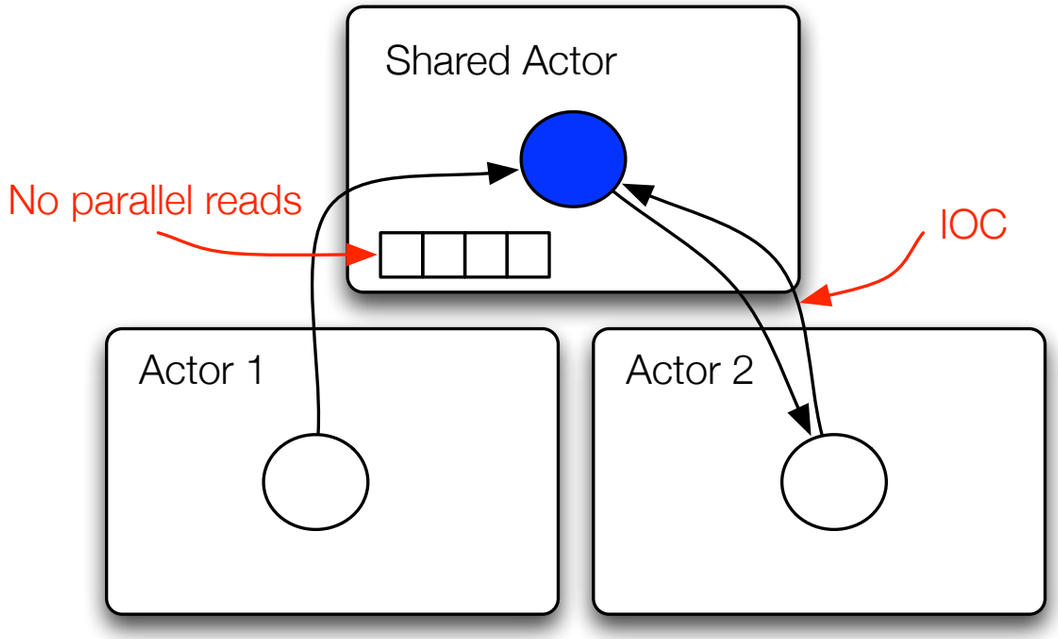
Kilim

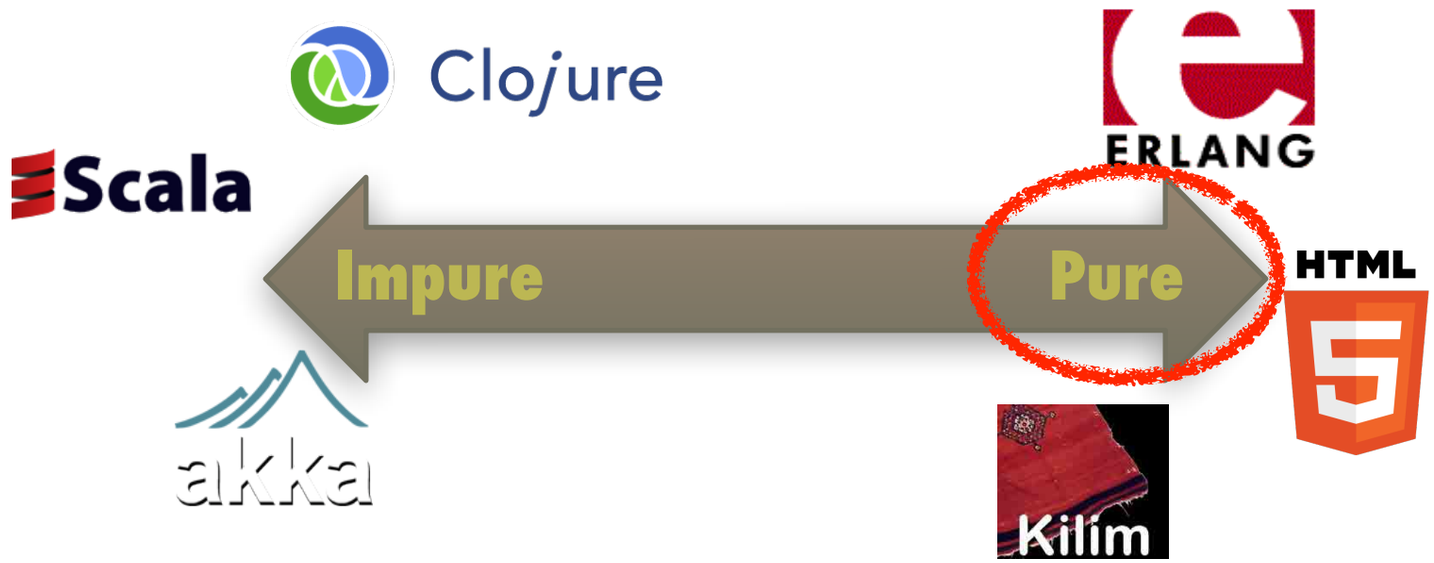
Pure

Replication

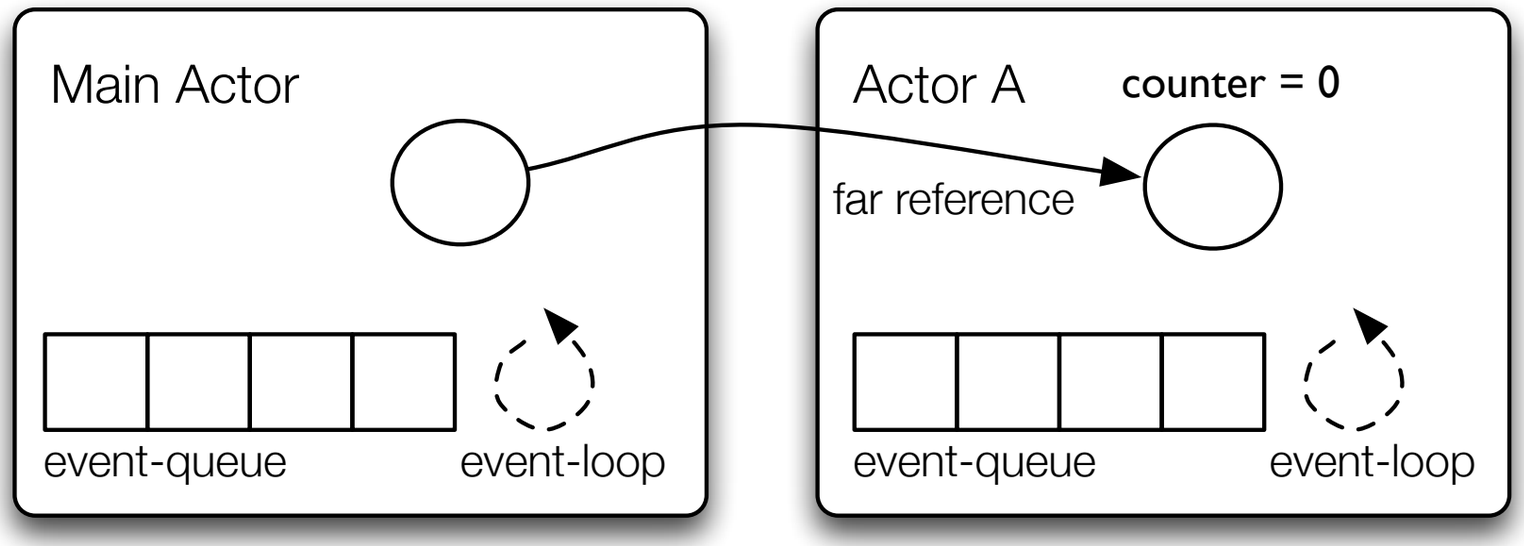


Isolation





Shacl: Event-loop actors

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  count := 0
  set(n) {
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  get() {
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  }
}

far_reference<-set(42)
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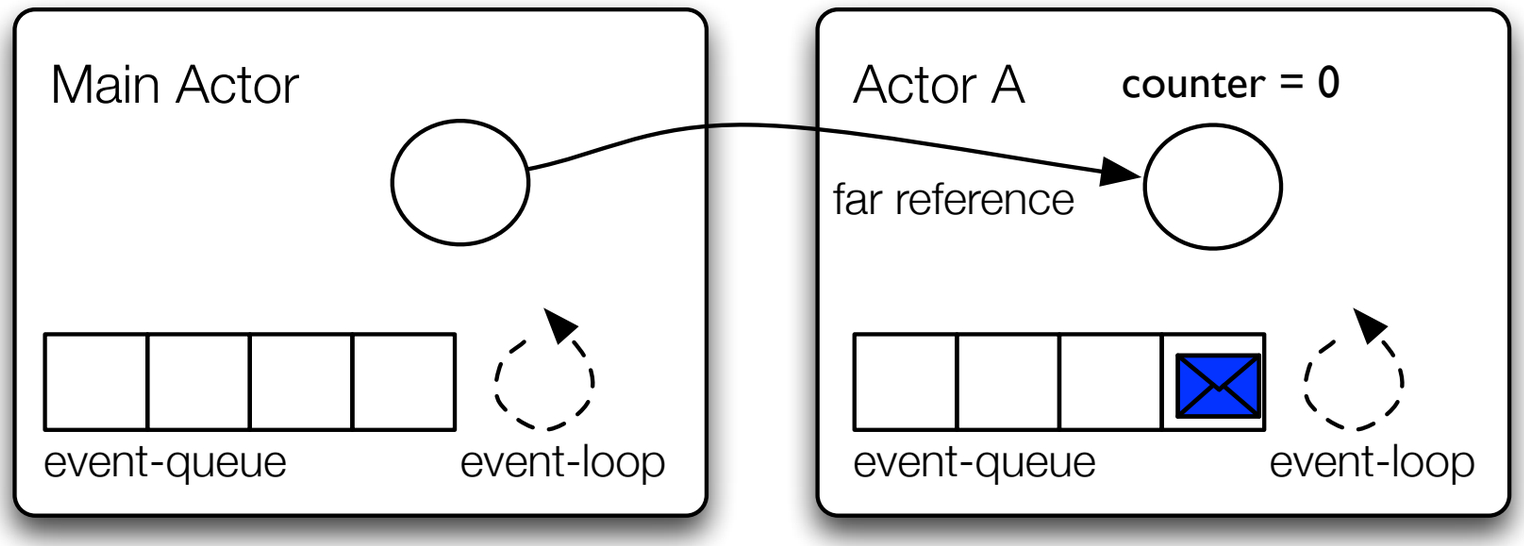


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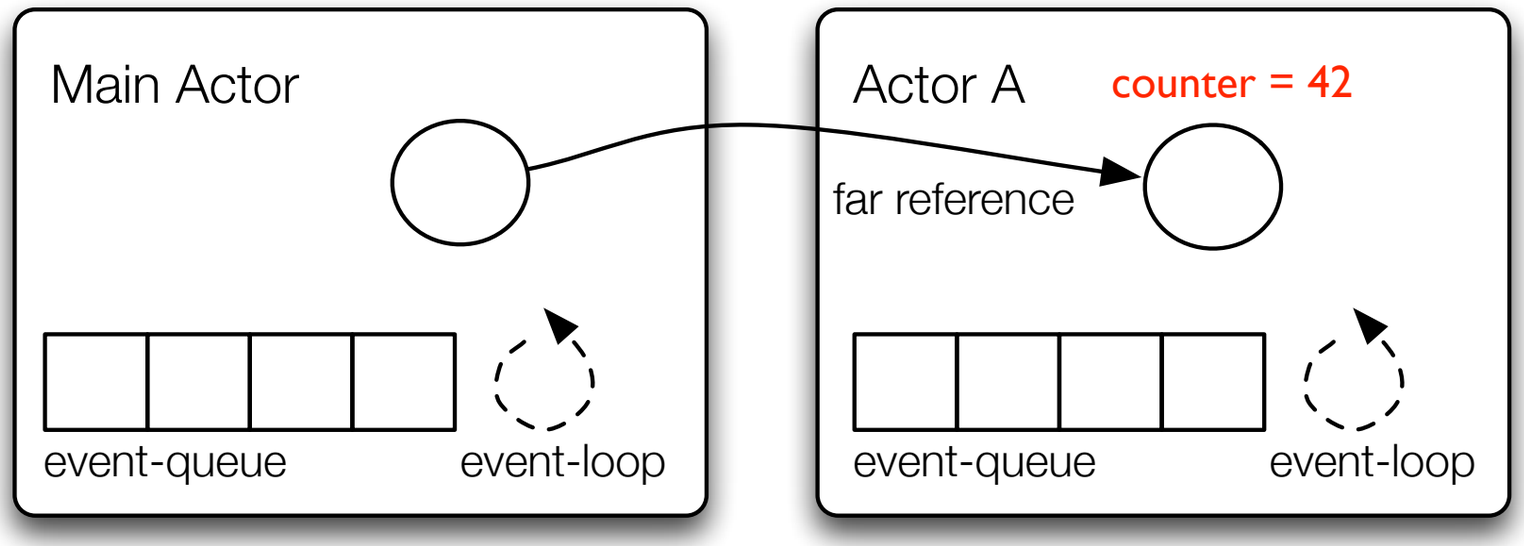


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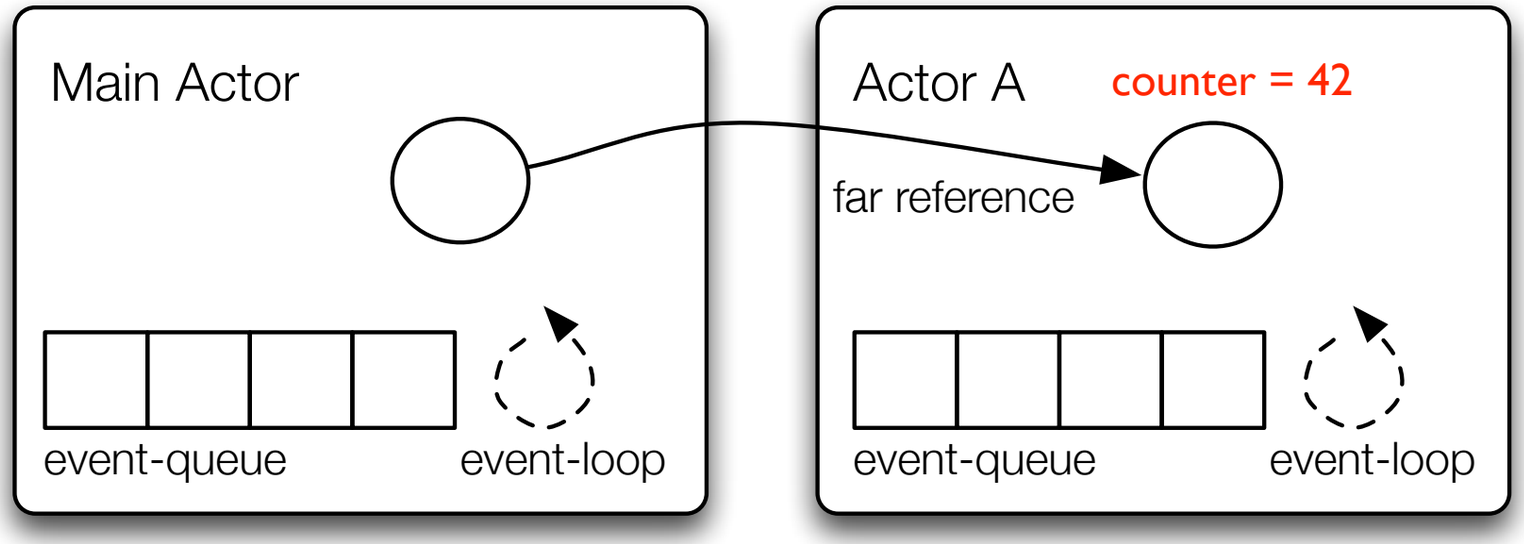


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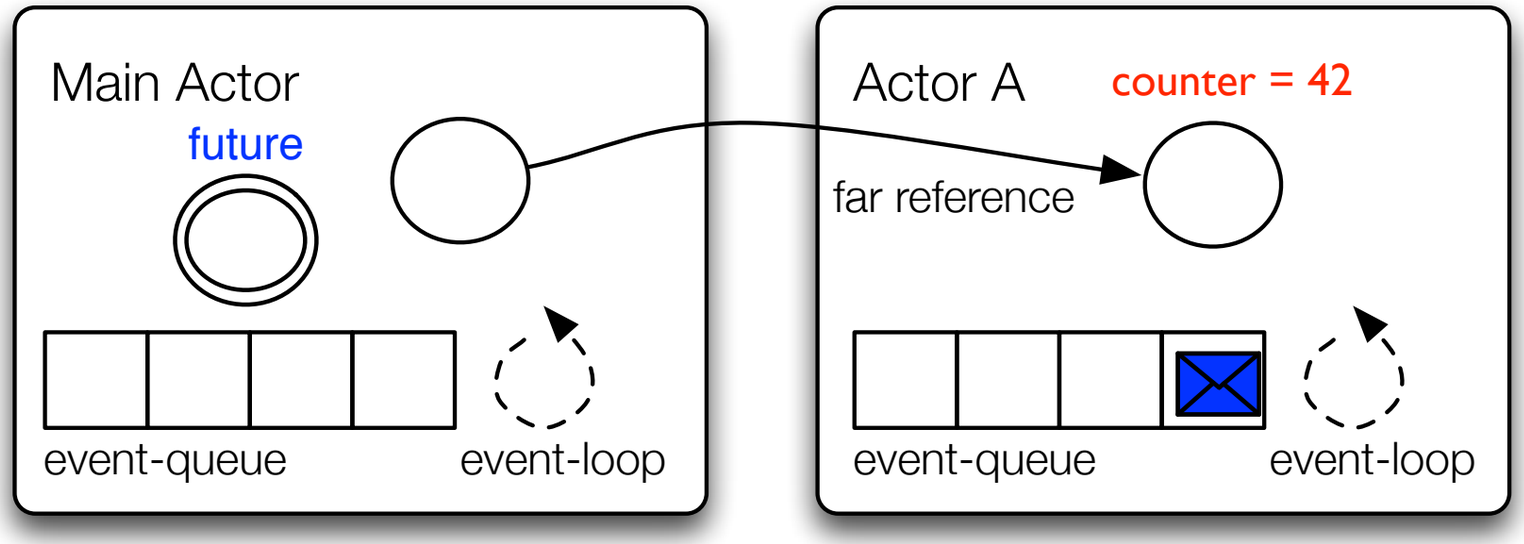


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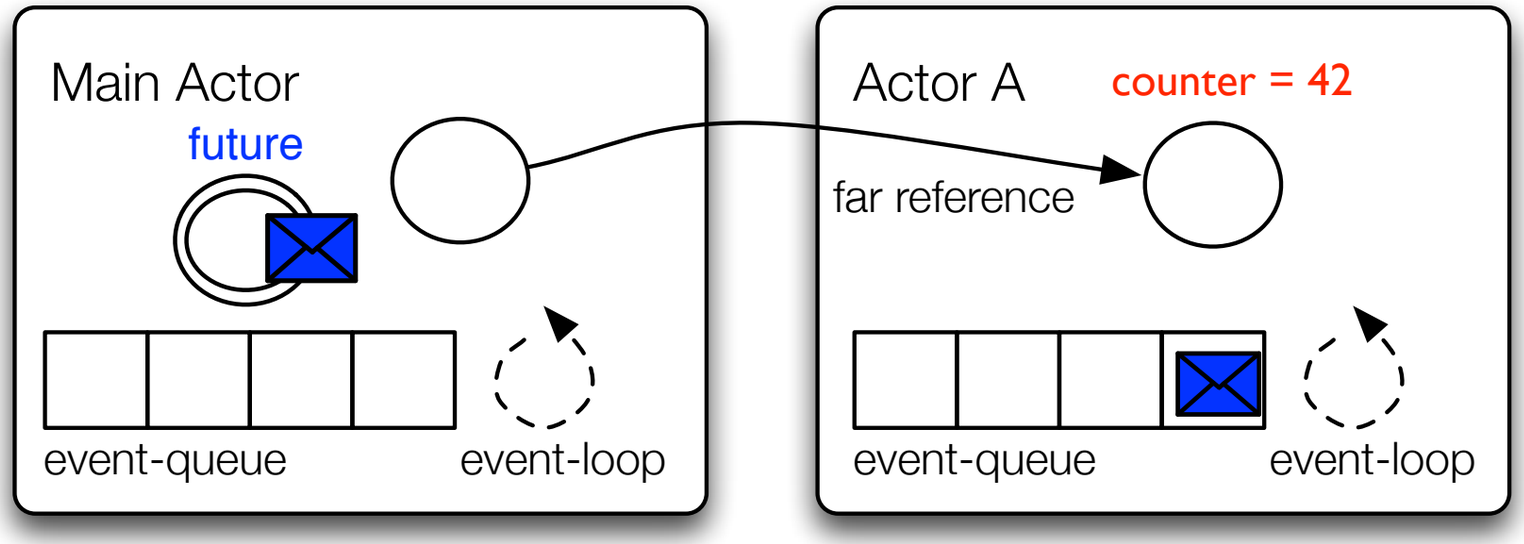


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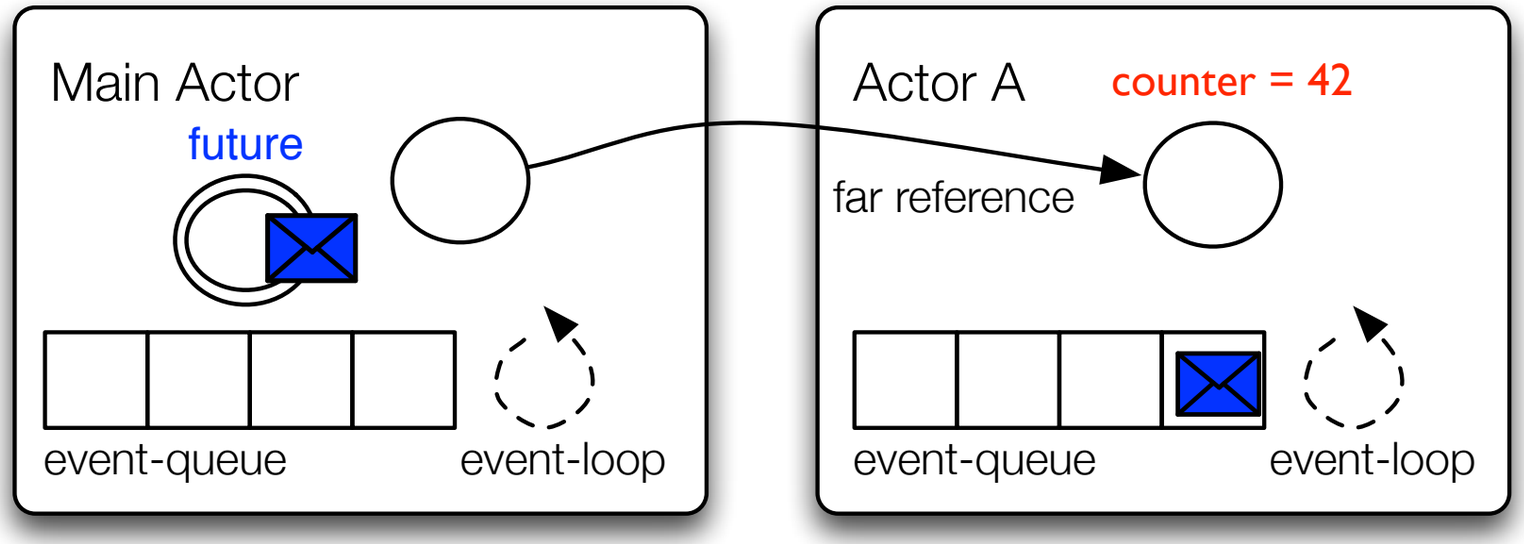


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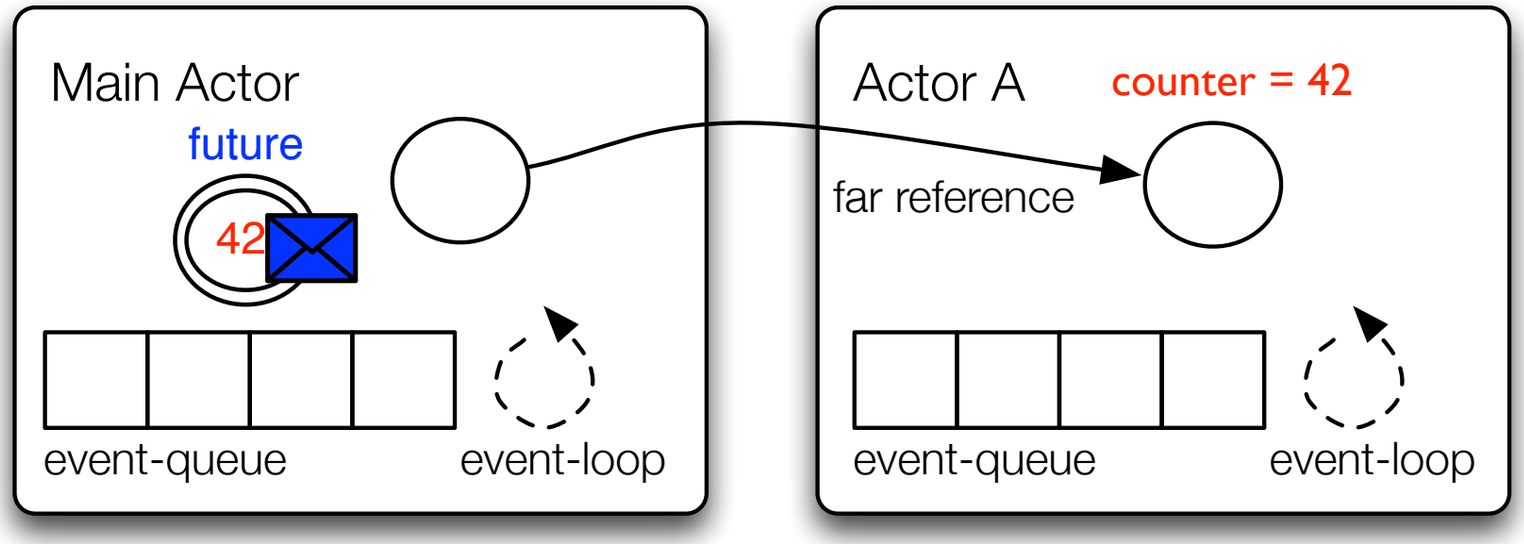


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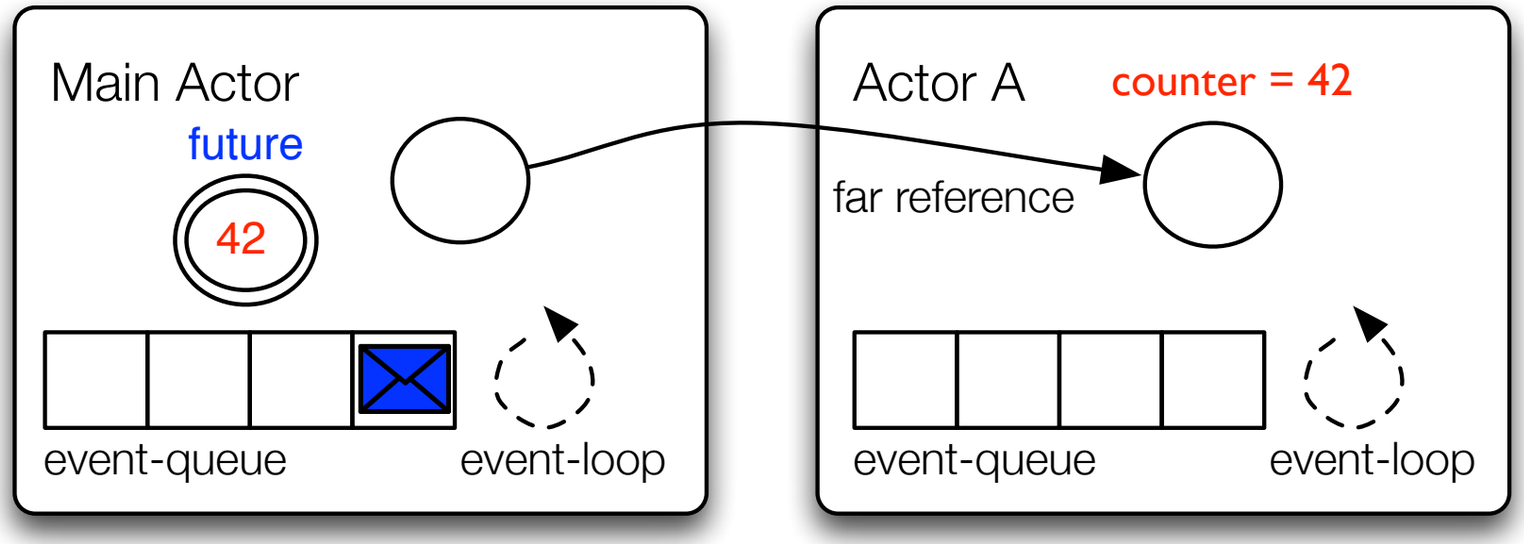


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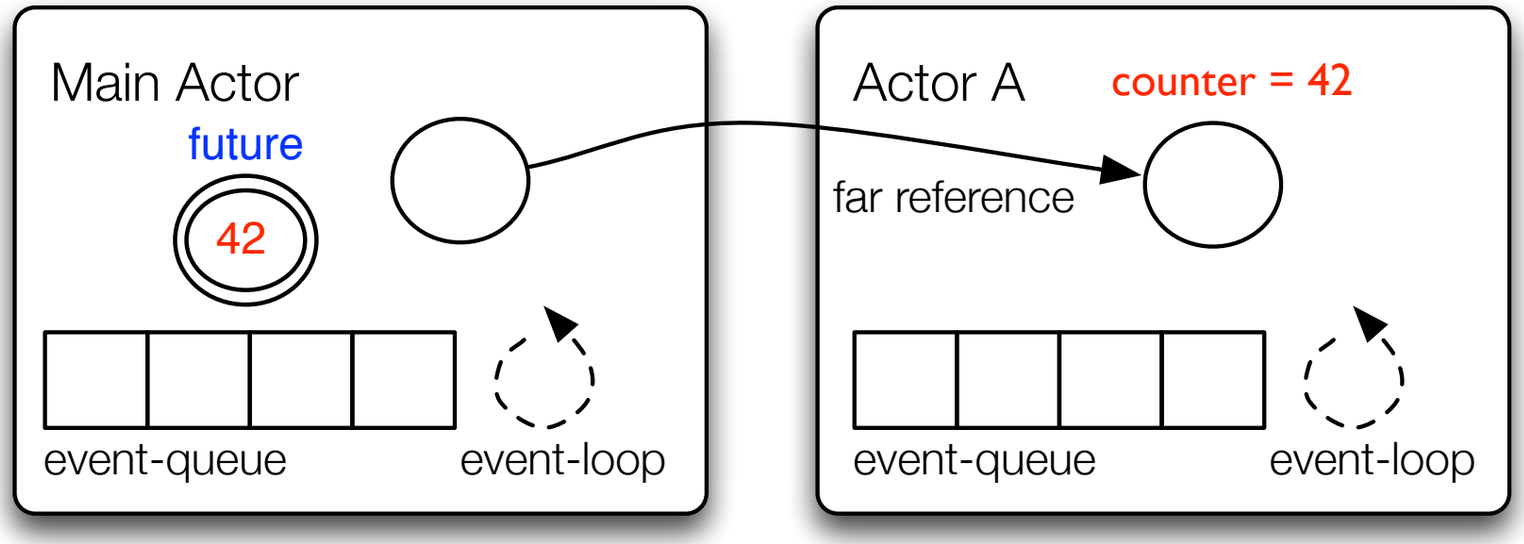


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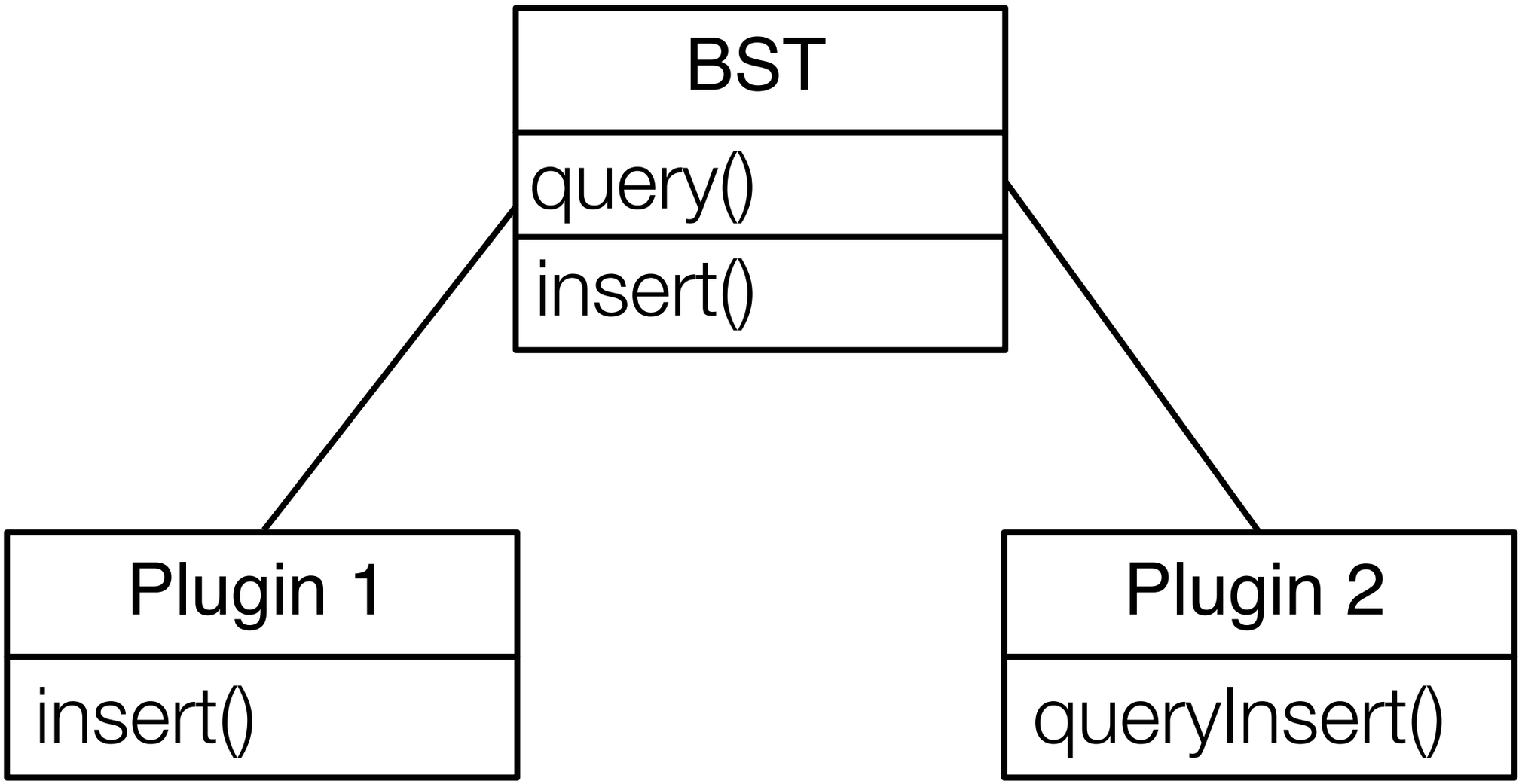
Motivating Example



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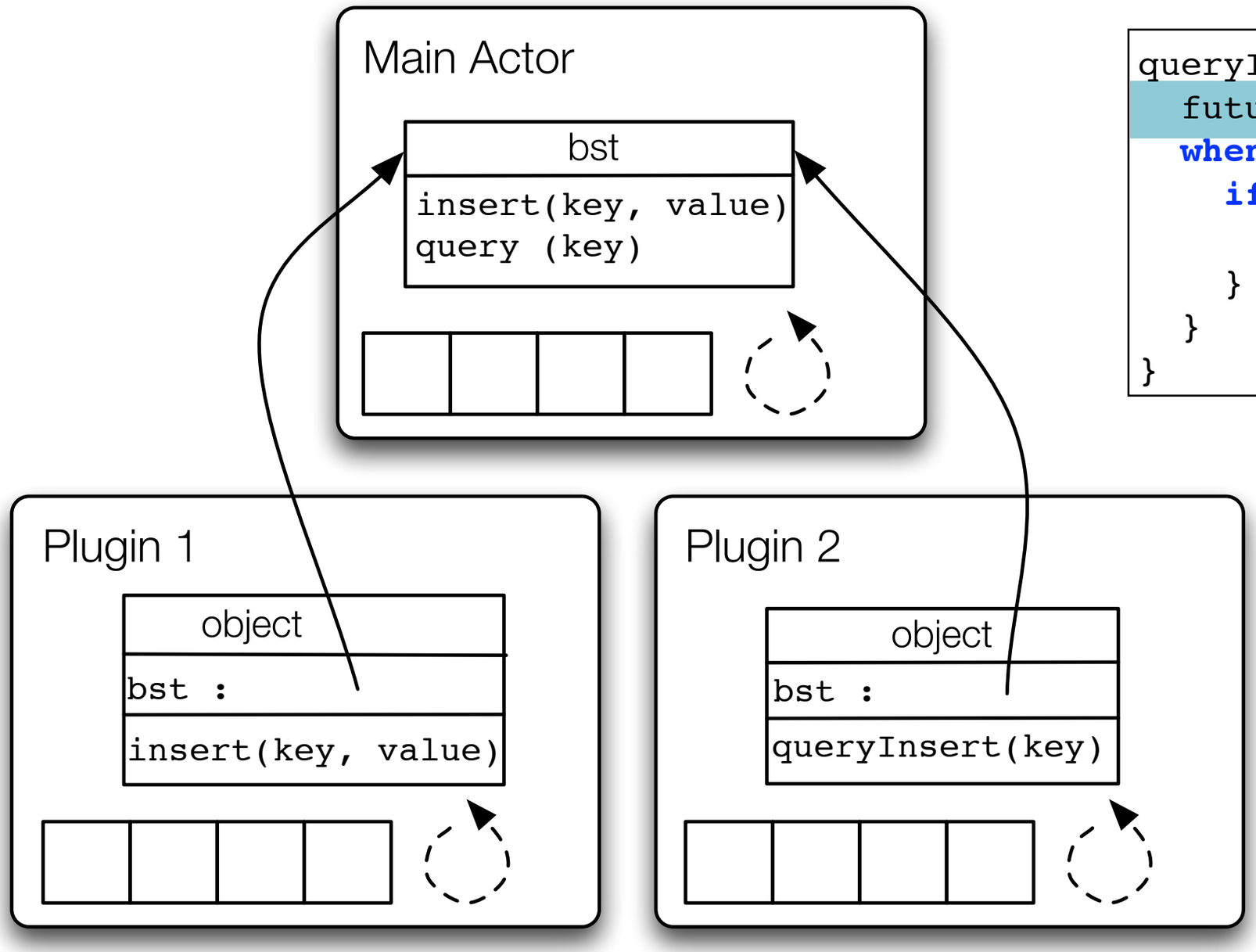


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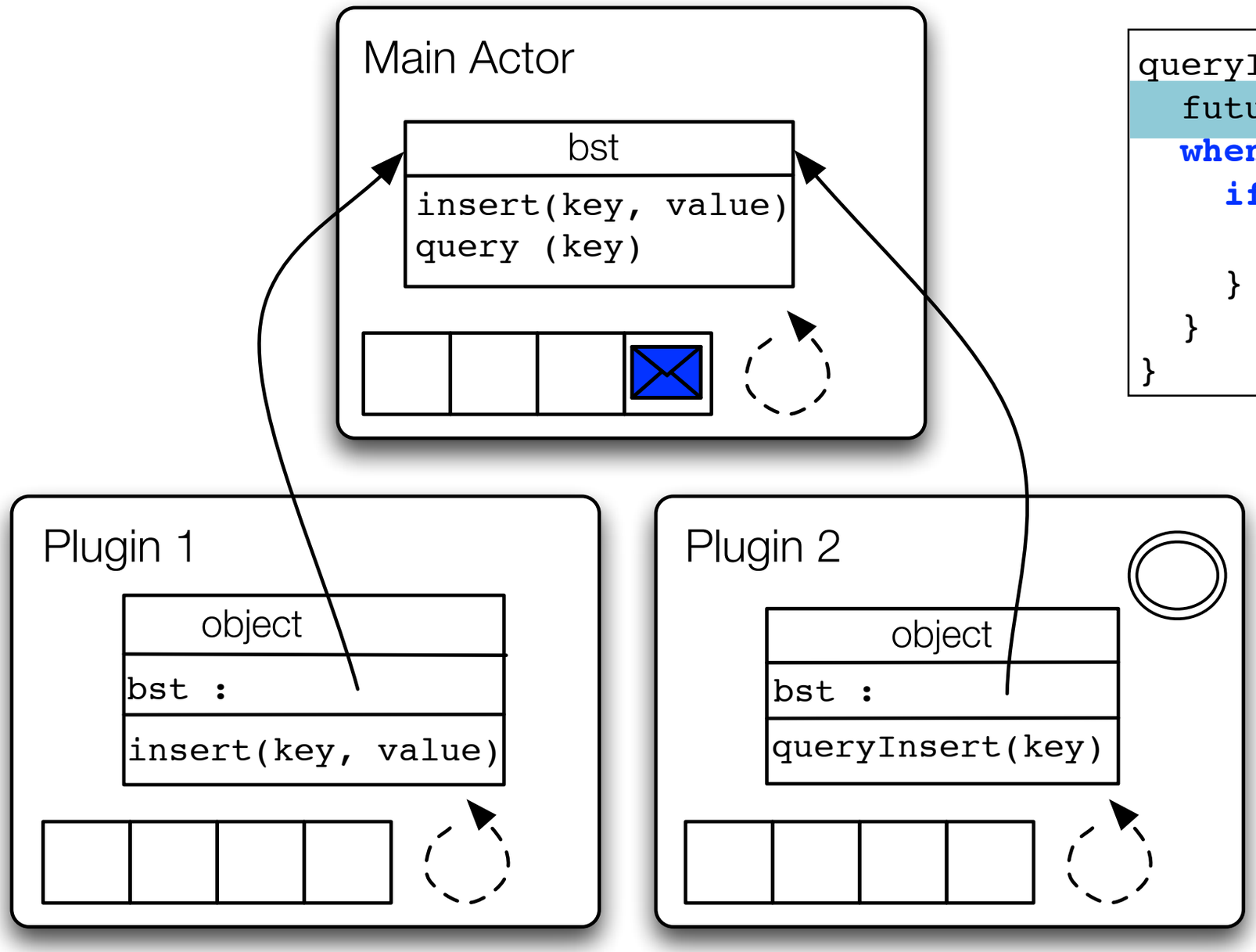


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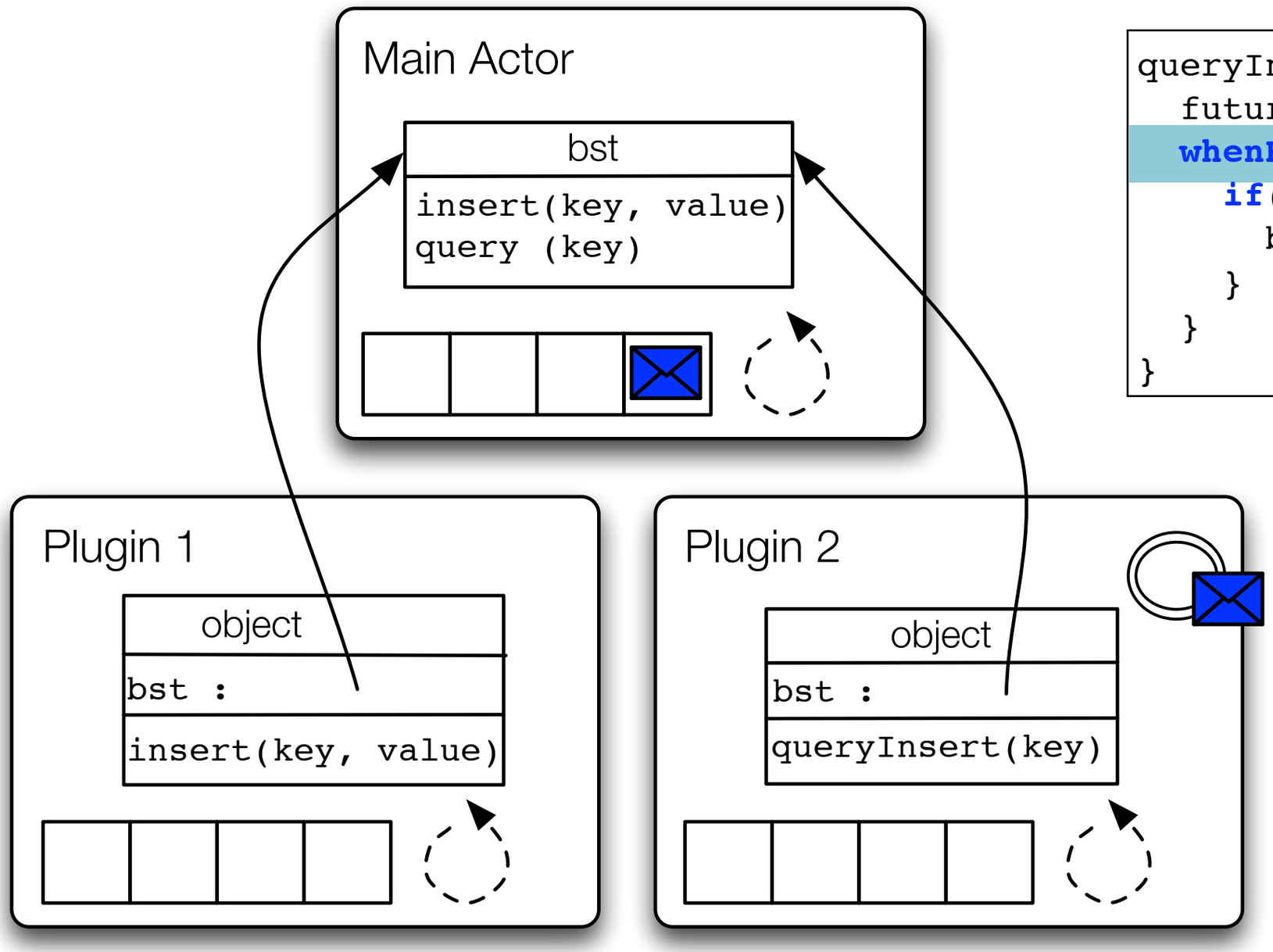


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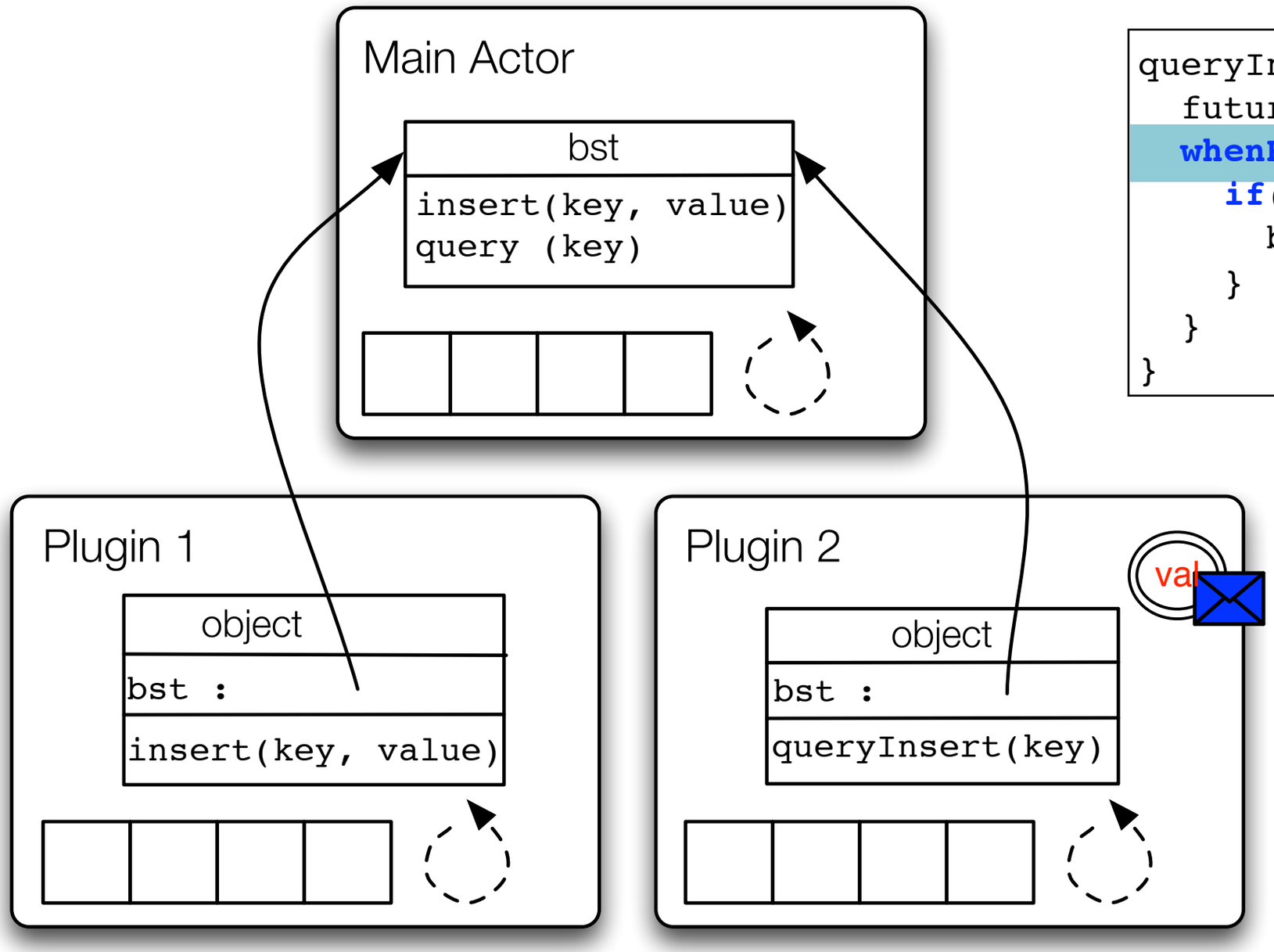


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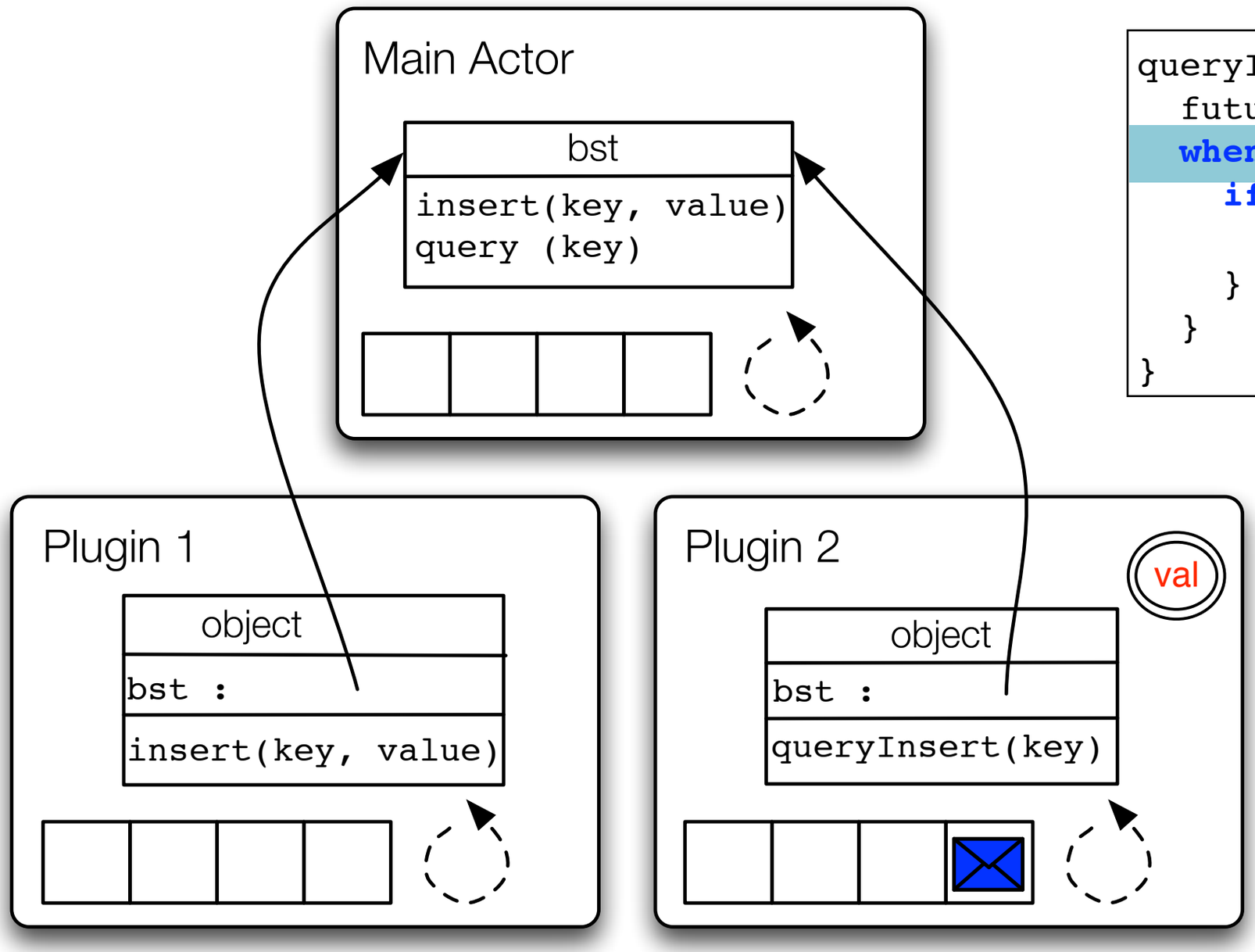


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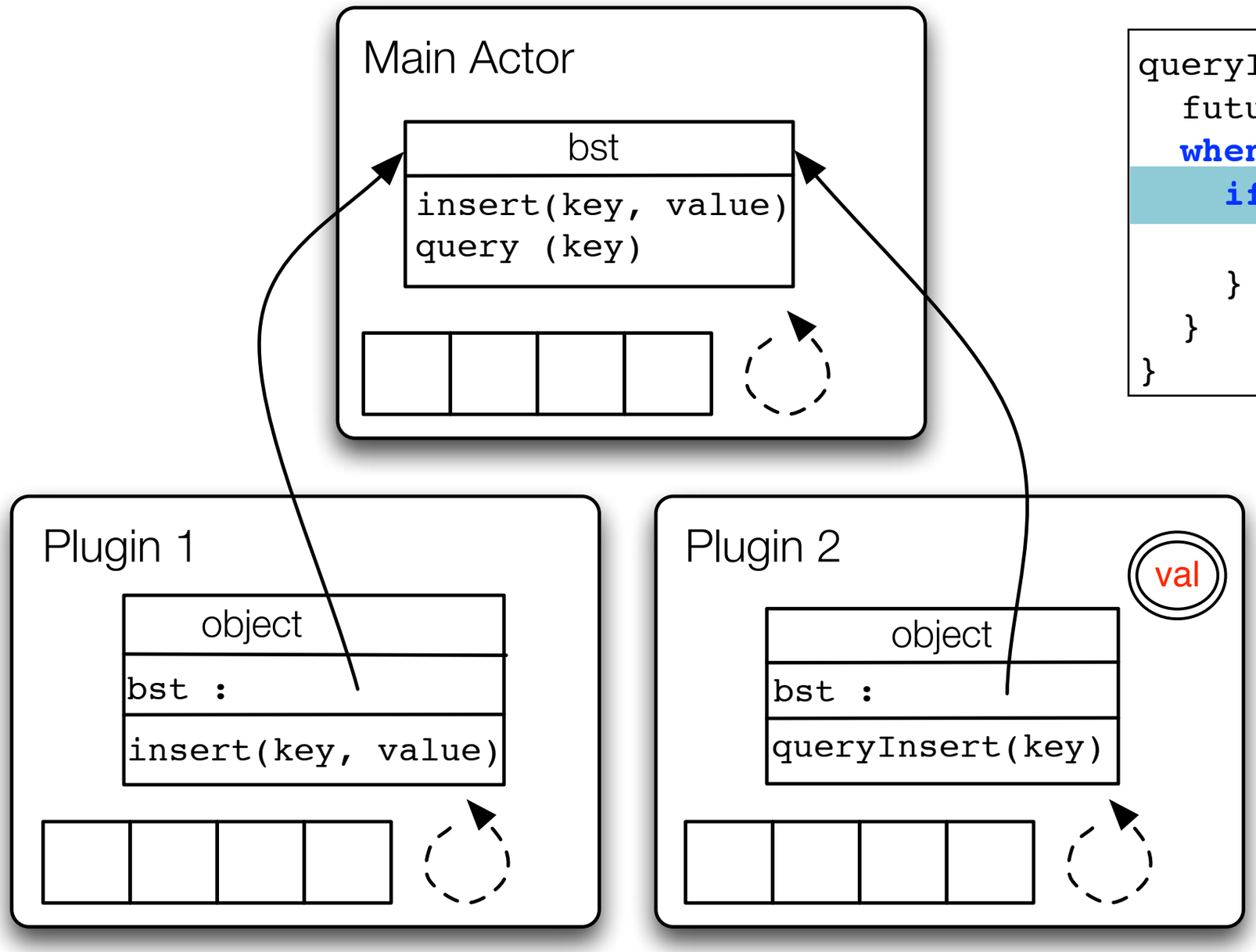


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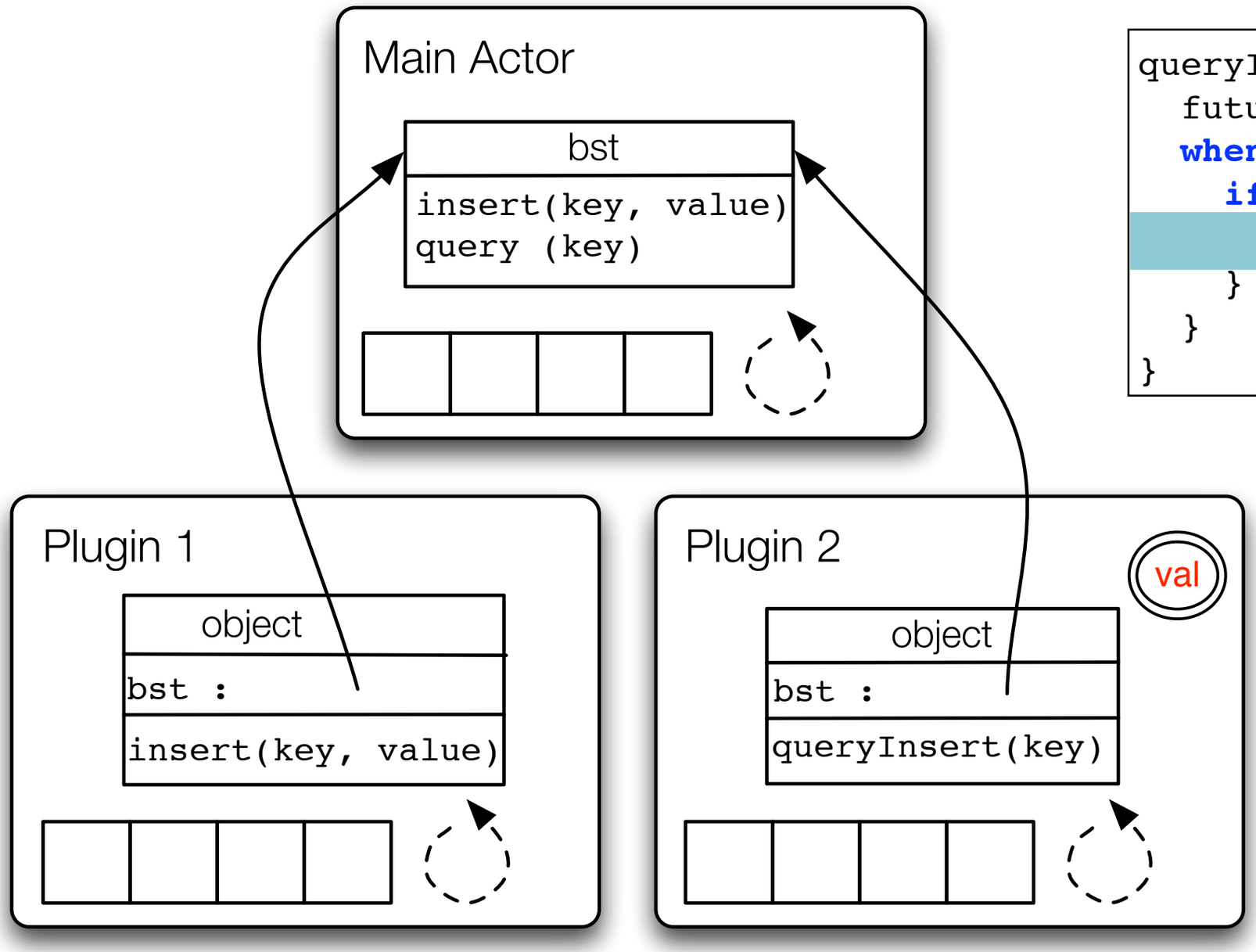


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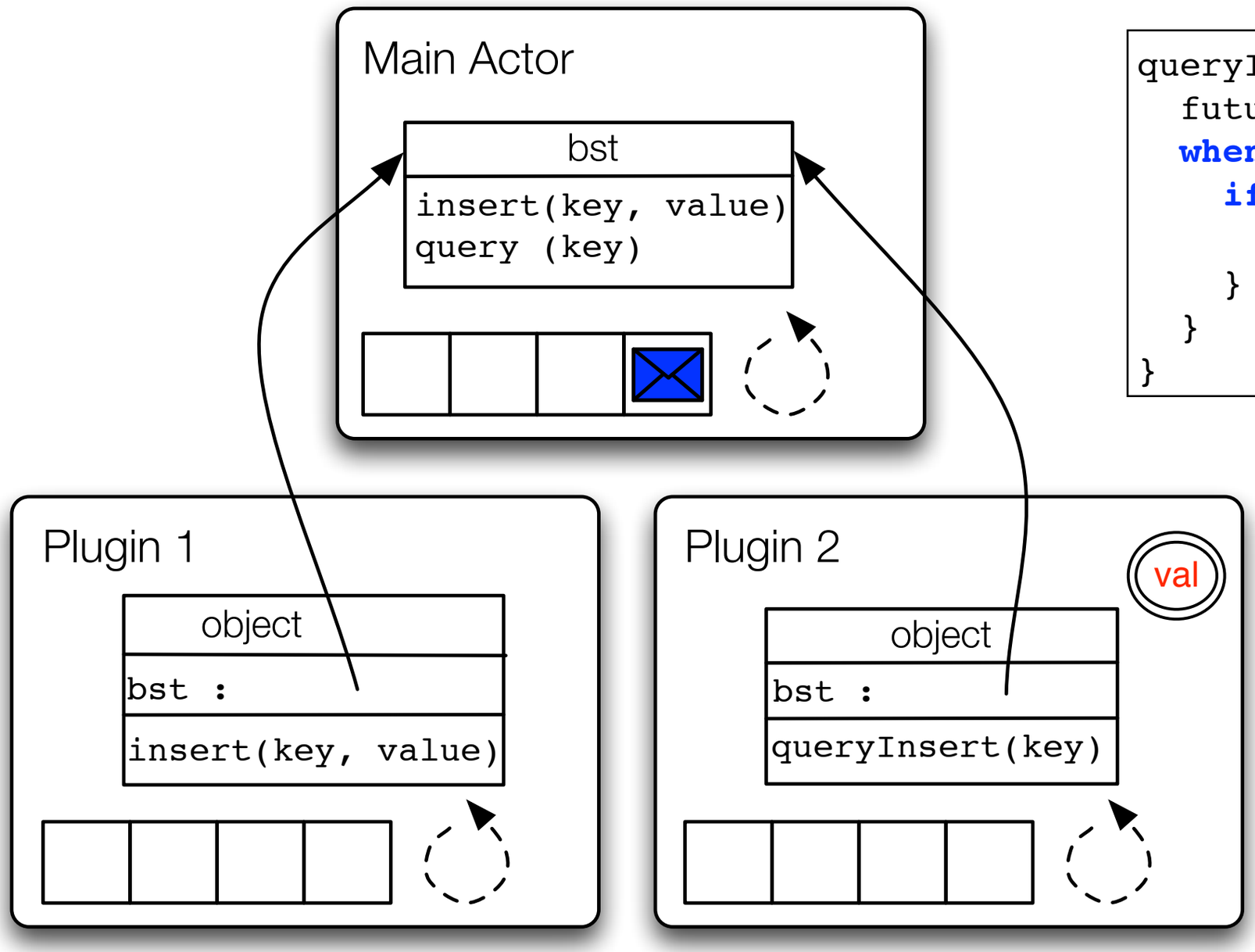


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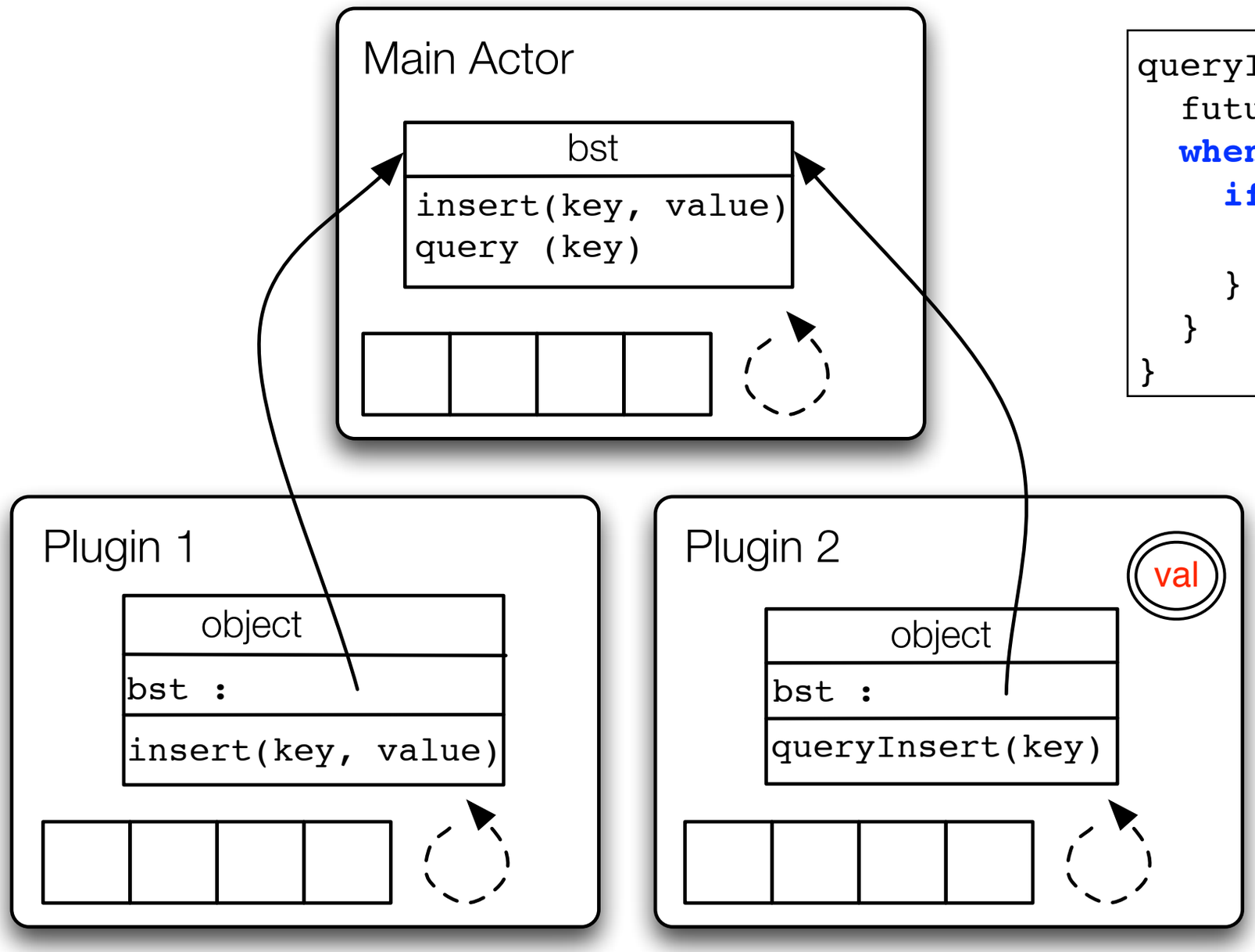


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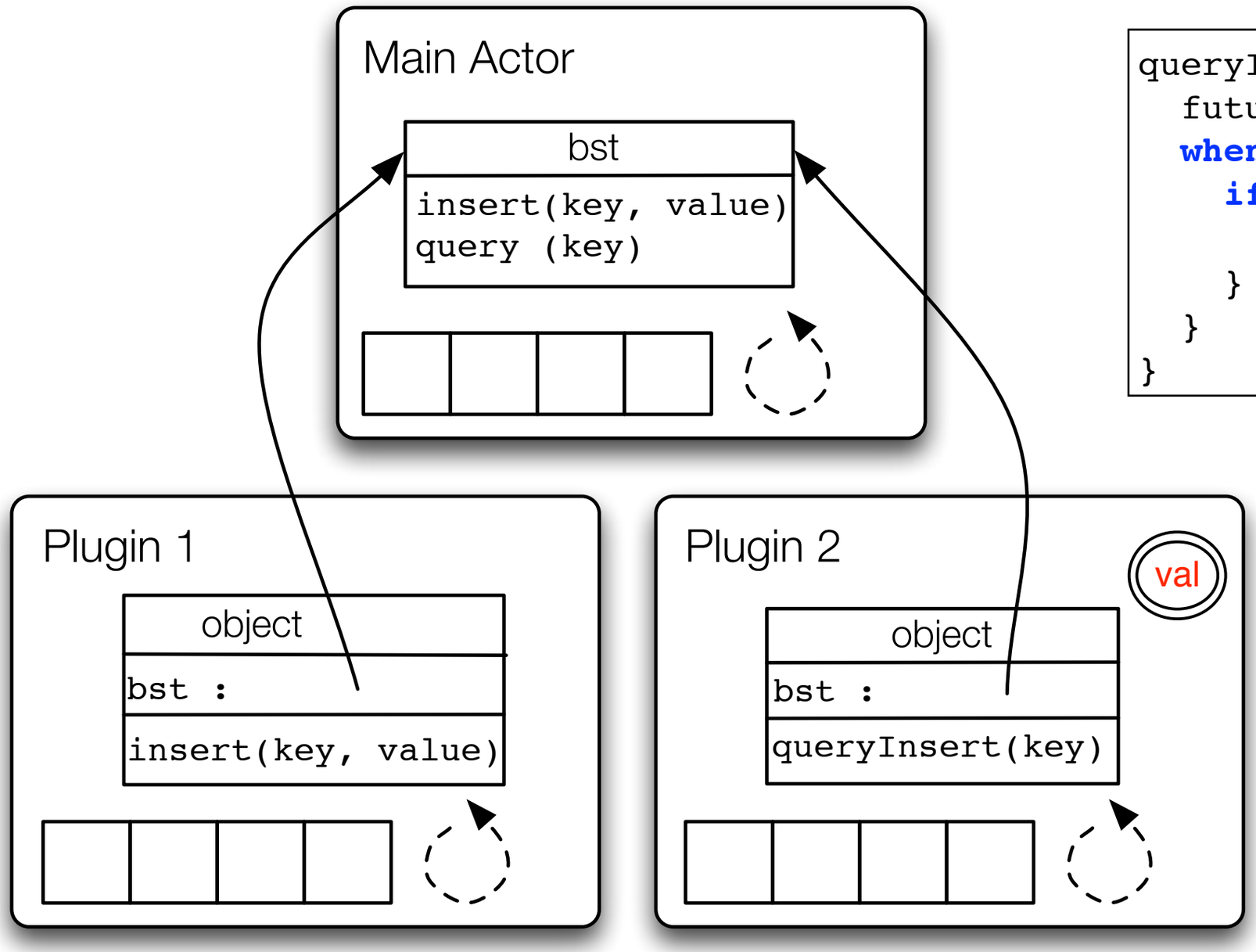


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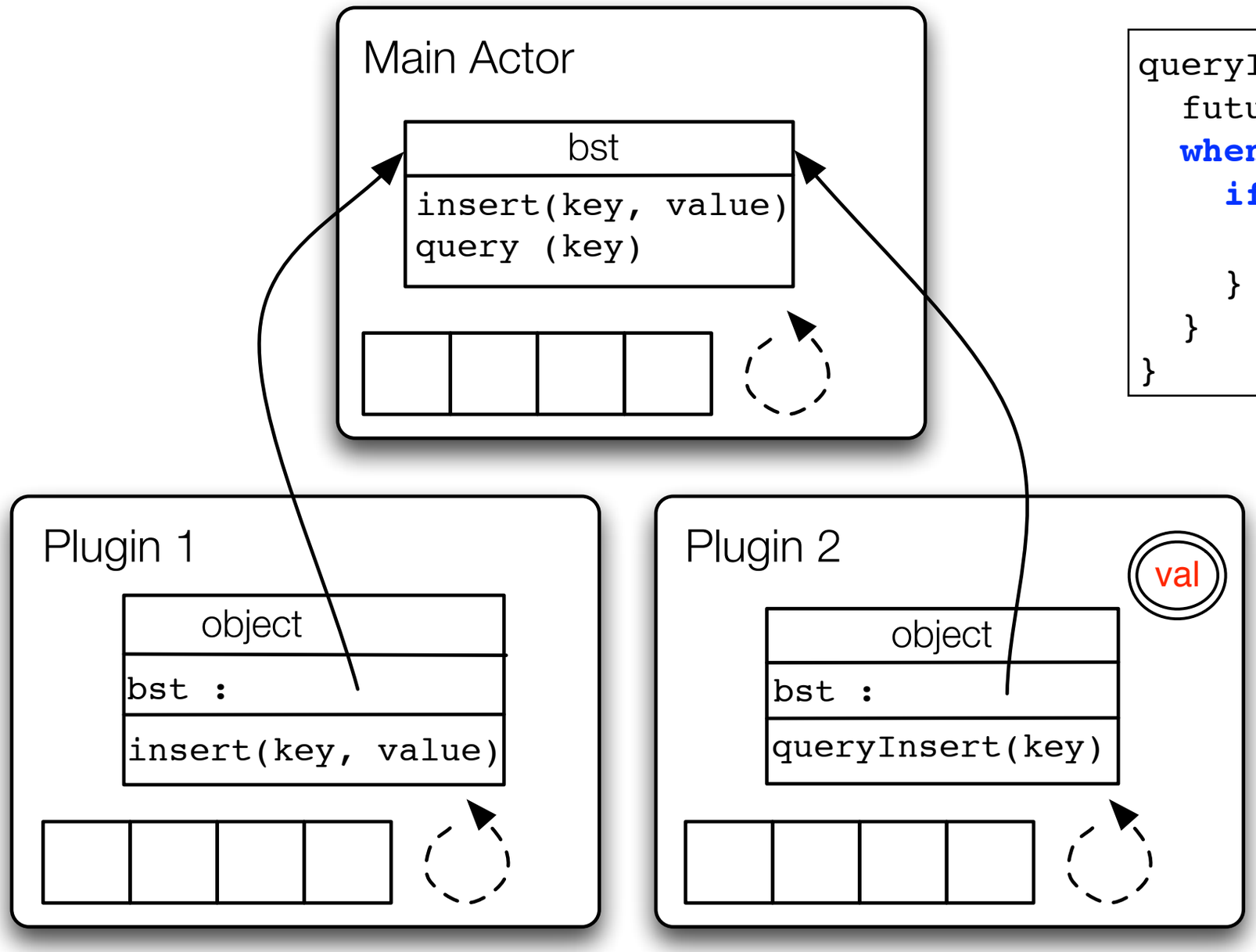
1. CPS code

Motivating example

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1. CPS code
2. No synchronization

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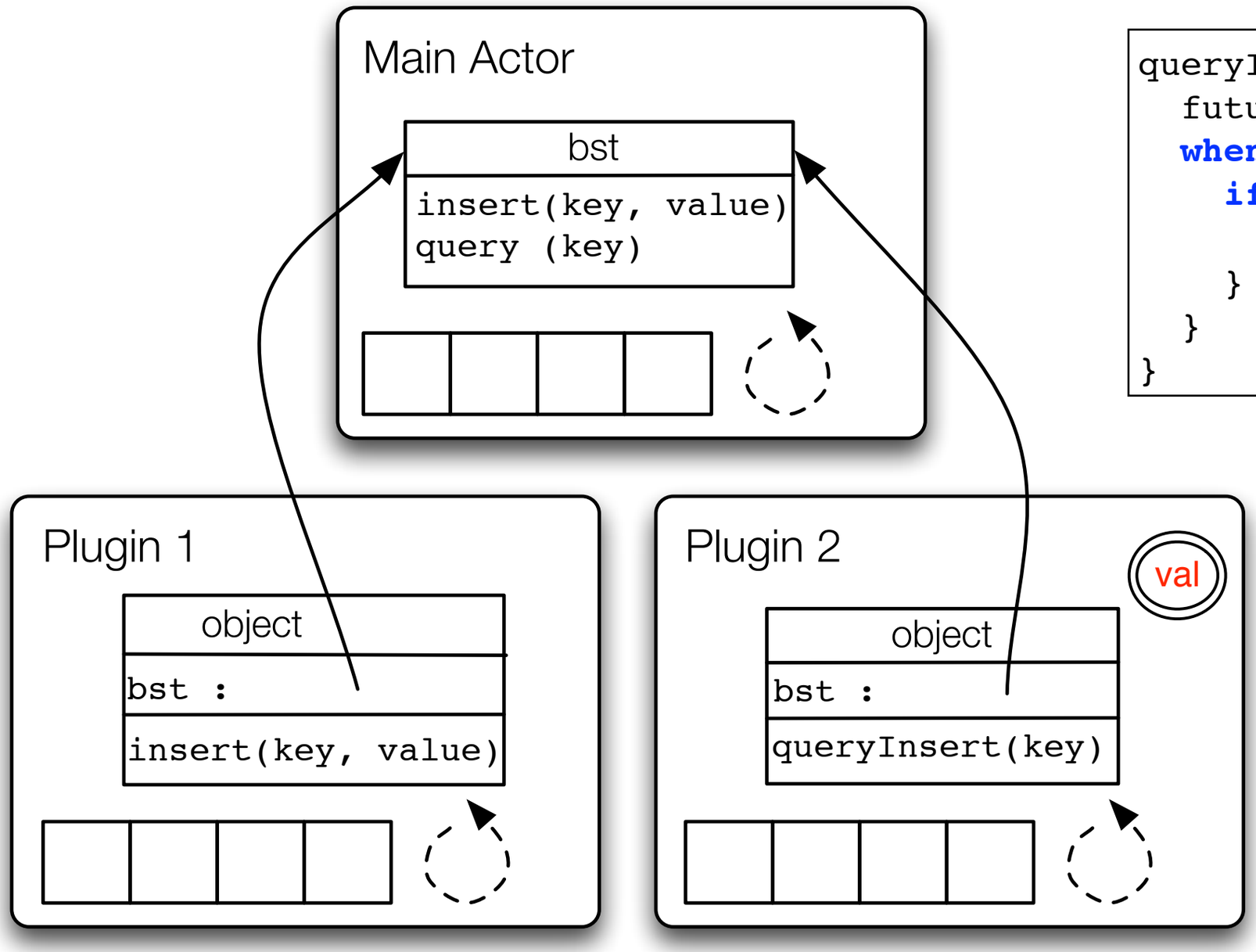


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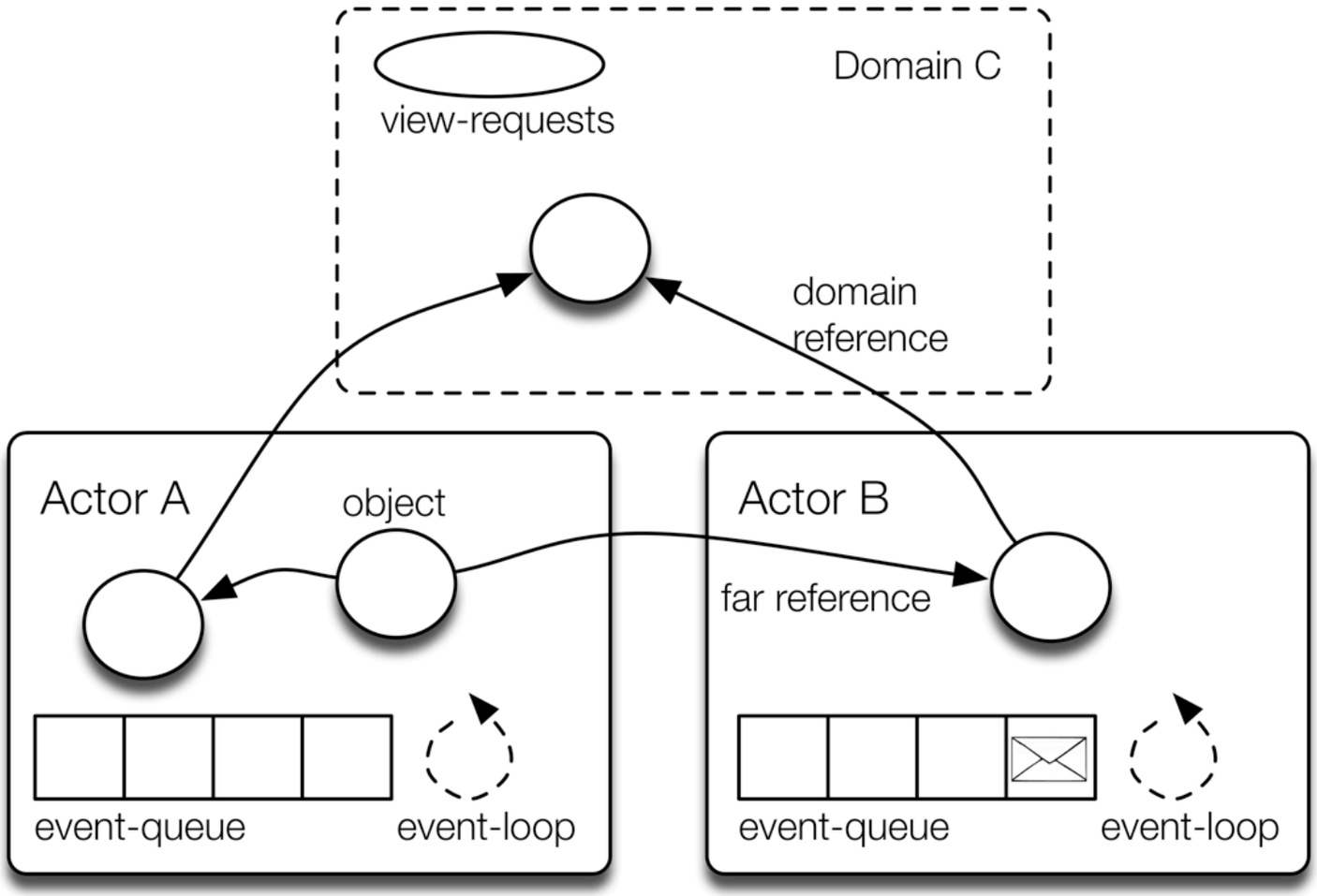
1. CPS code
2. No synchronization
3. No parallel reads

Domains




```
domain {
  <expression>+
}

whenShared(<domain>) {
  <expression>+
}

whenExclusive(<domain>) {
  <expression>+
}

when(<domain>+, <domain>+) {
  <expression>+
}
```

Motivating example

```
let bst = domain { ... }

let plugin1 = actor { ... }

let plugin2 = actor {
  queryInsert(bst, key) {
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      value := bst.query(key);
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    }
  }
}

plugin2<-queryInsert(bst, 42)
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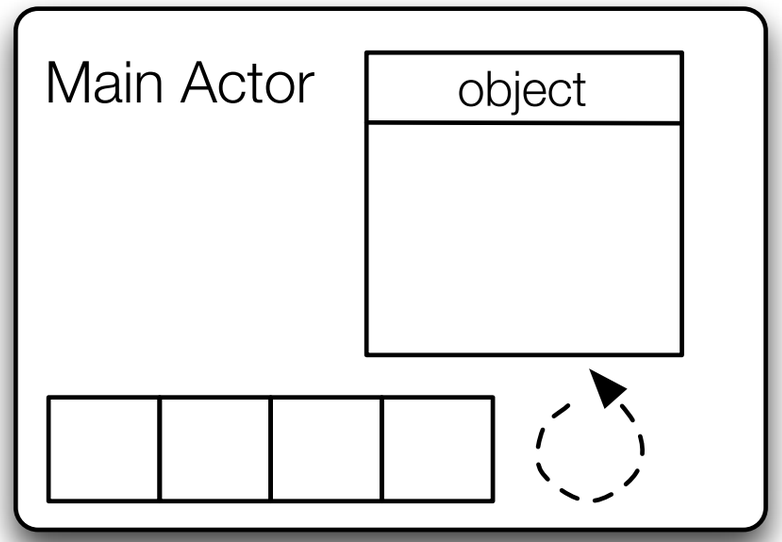

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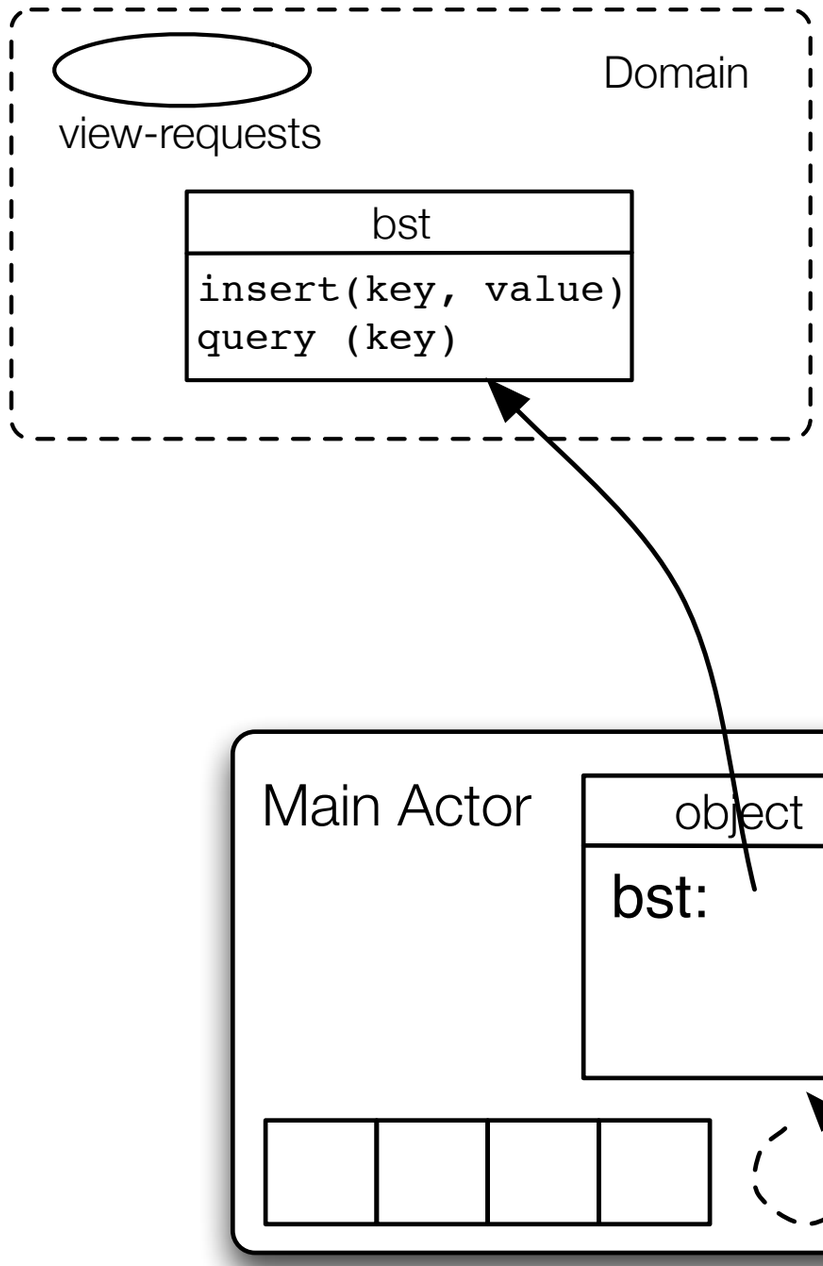


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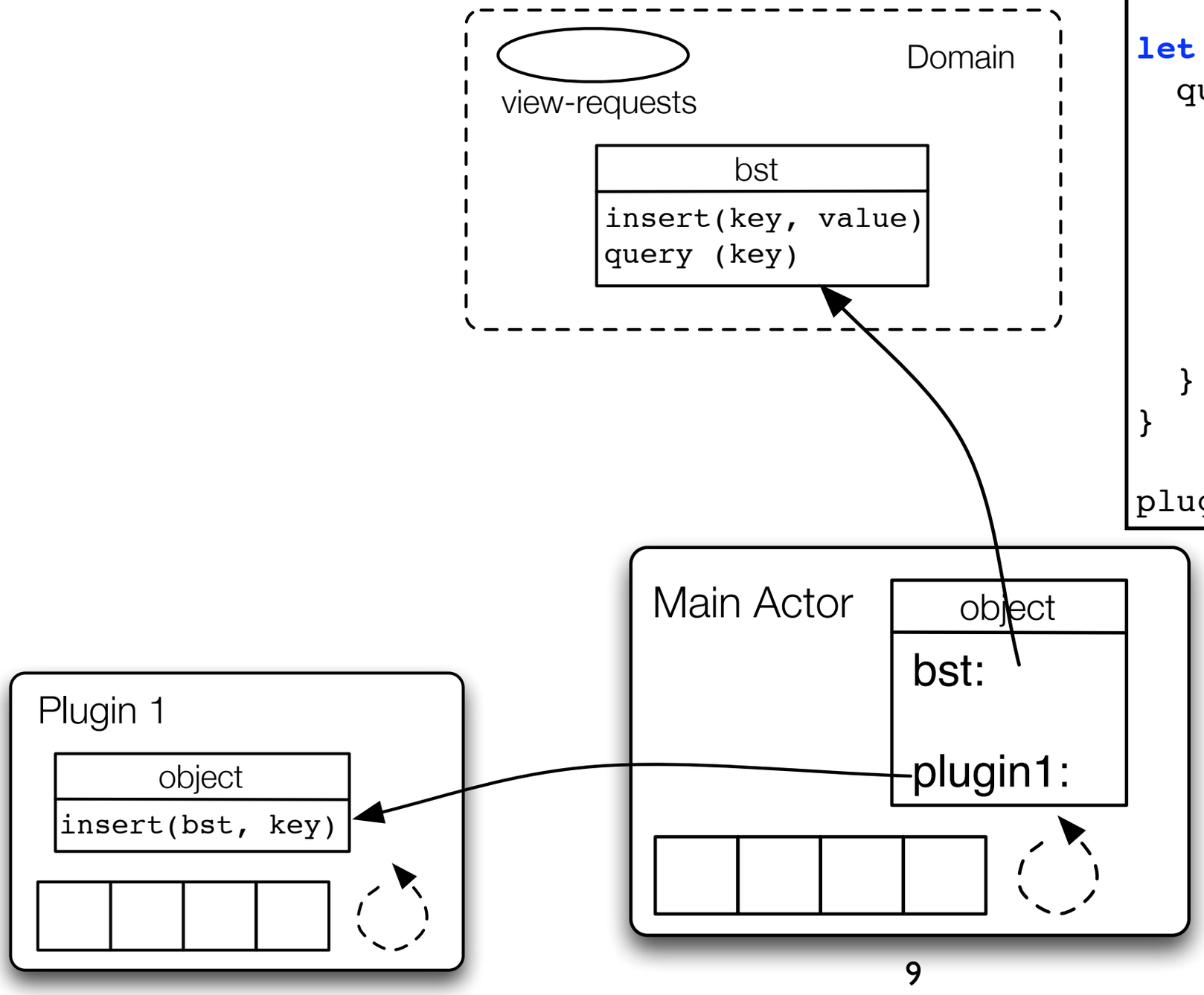

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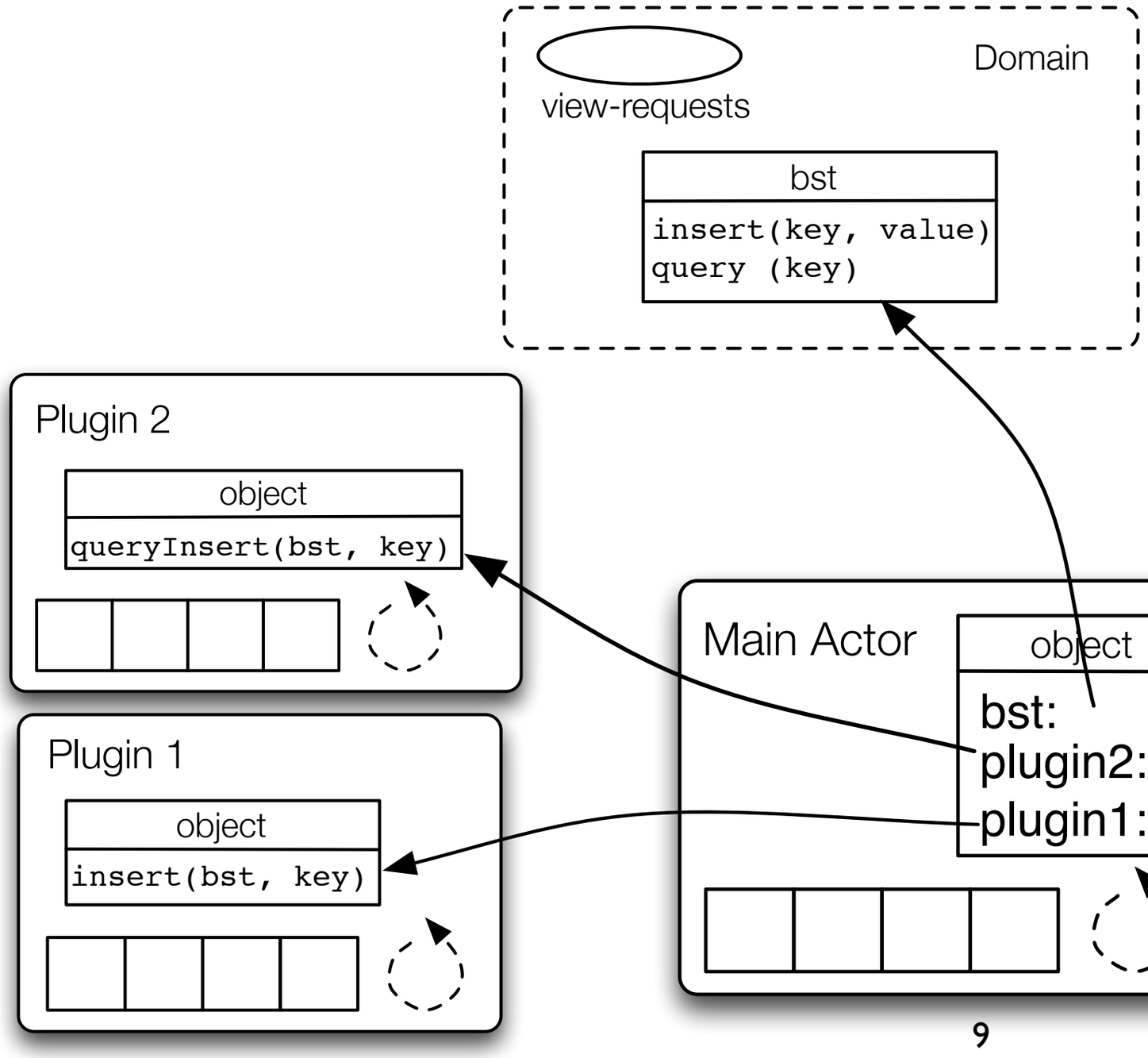


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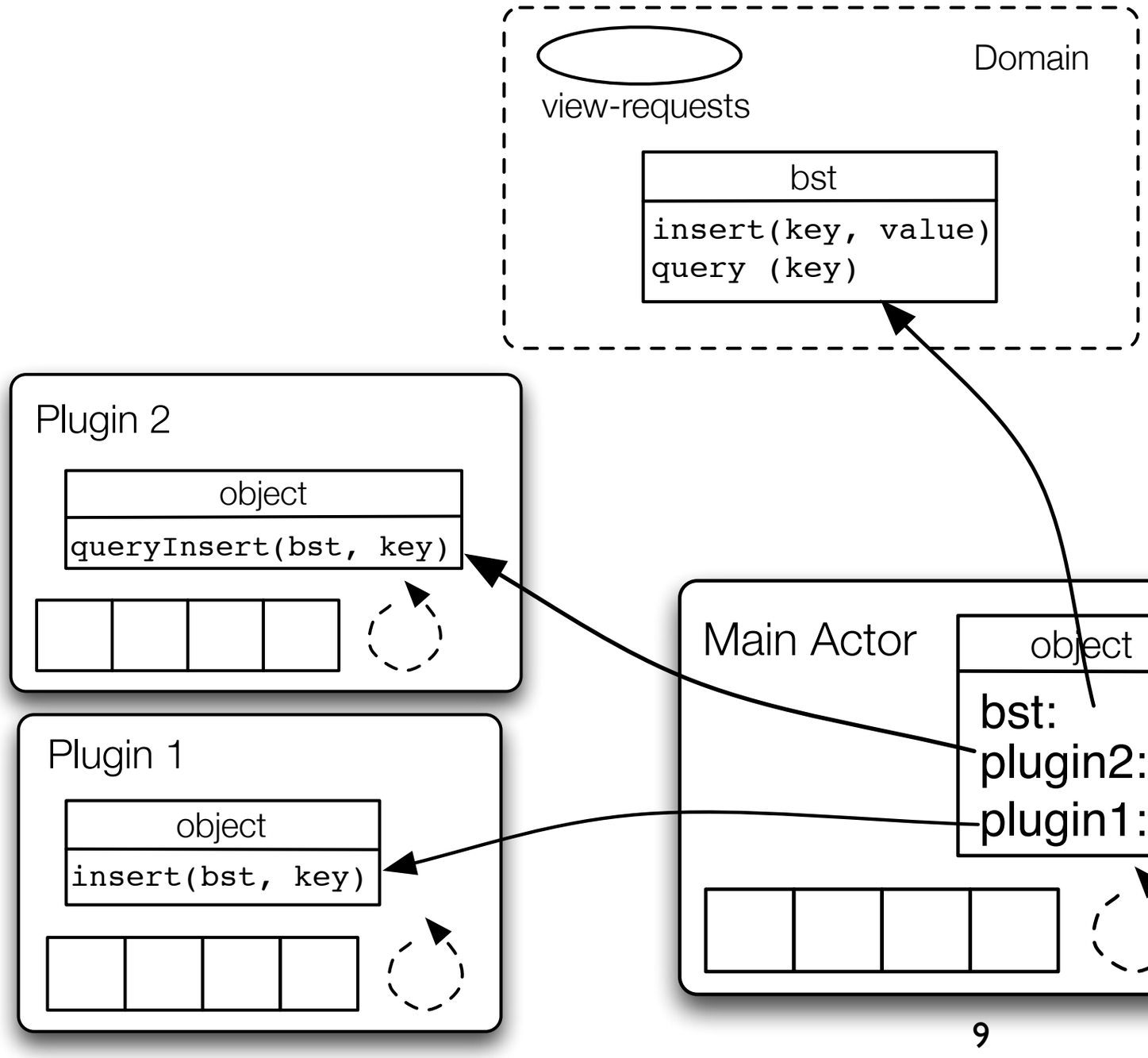


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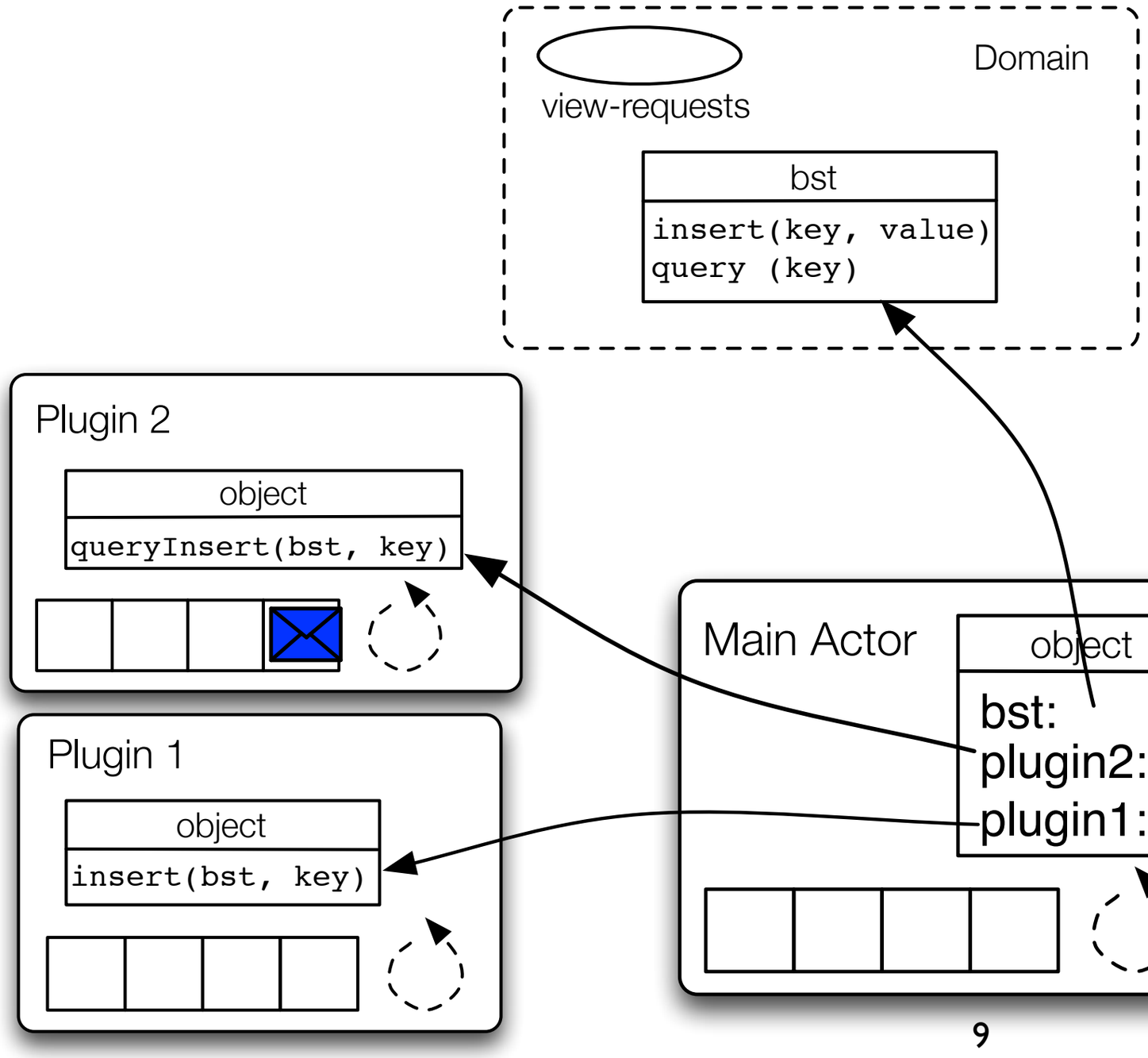


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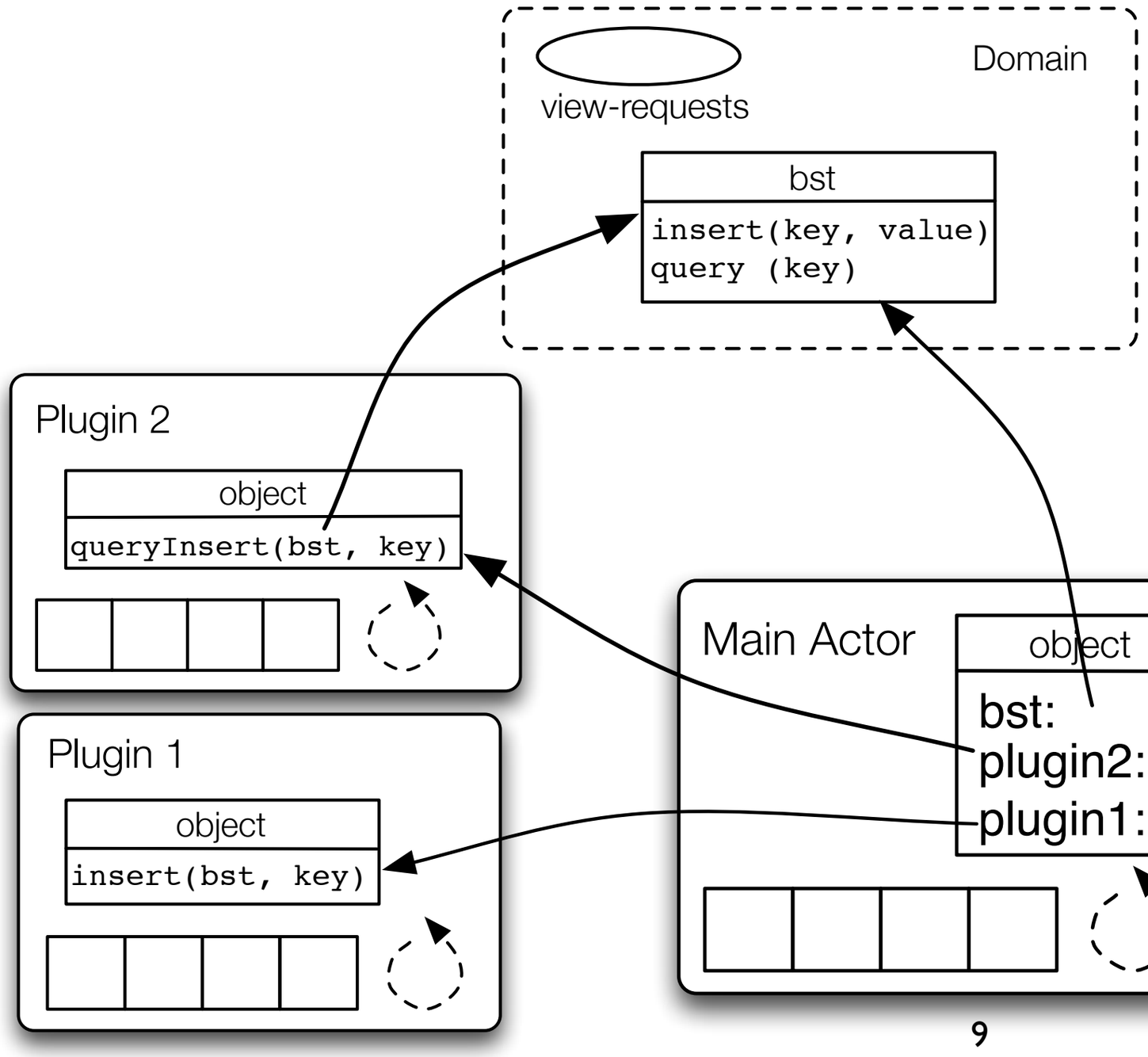


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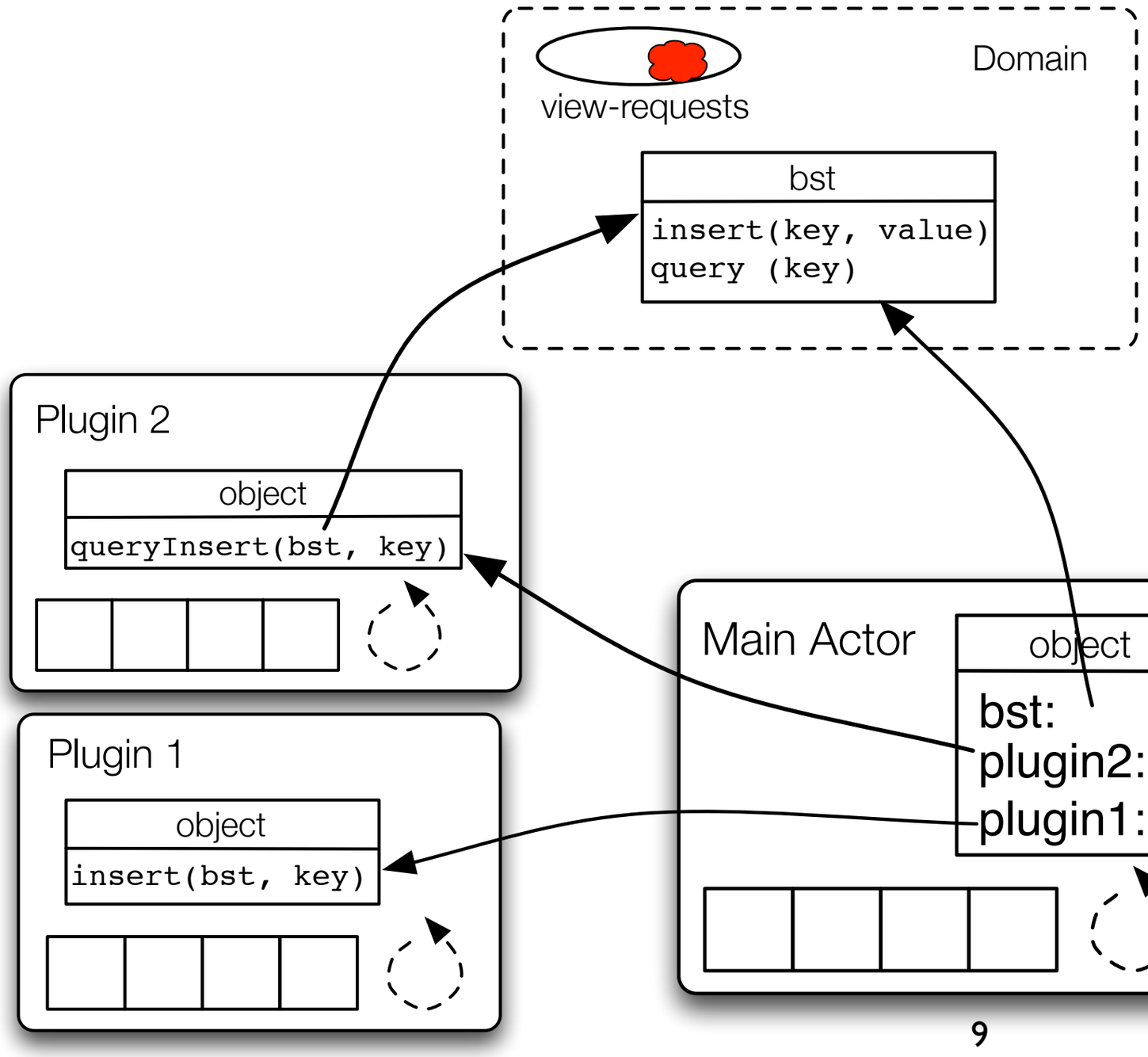


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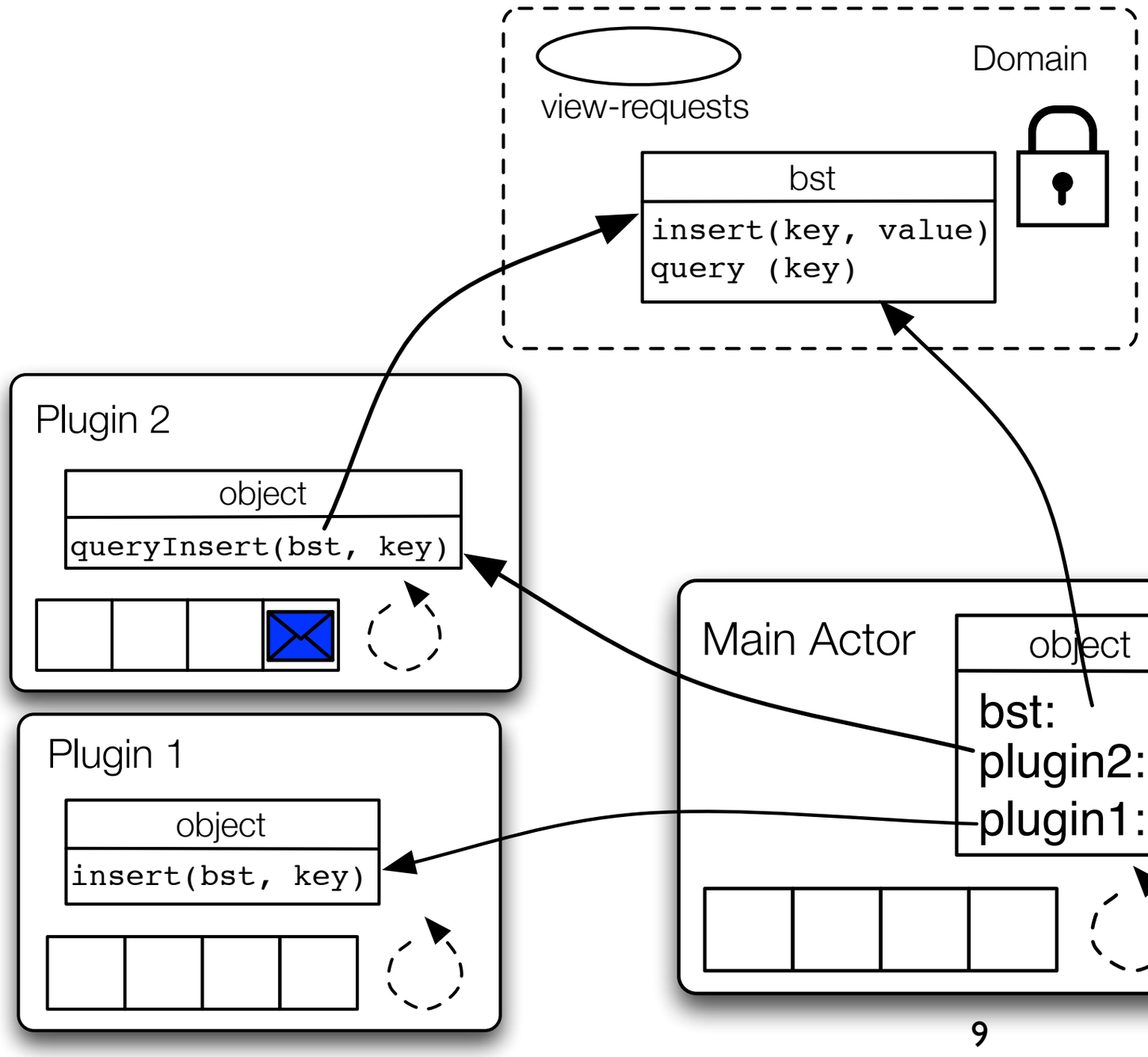


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    whenExclusive(bst) {
      value := bst.query(key);
      if(value > 0) {
        bst.insert(key, value - 1)
      }
    }
  }
}

plugin2<-queryInsert(bst, 42)
```
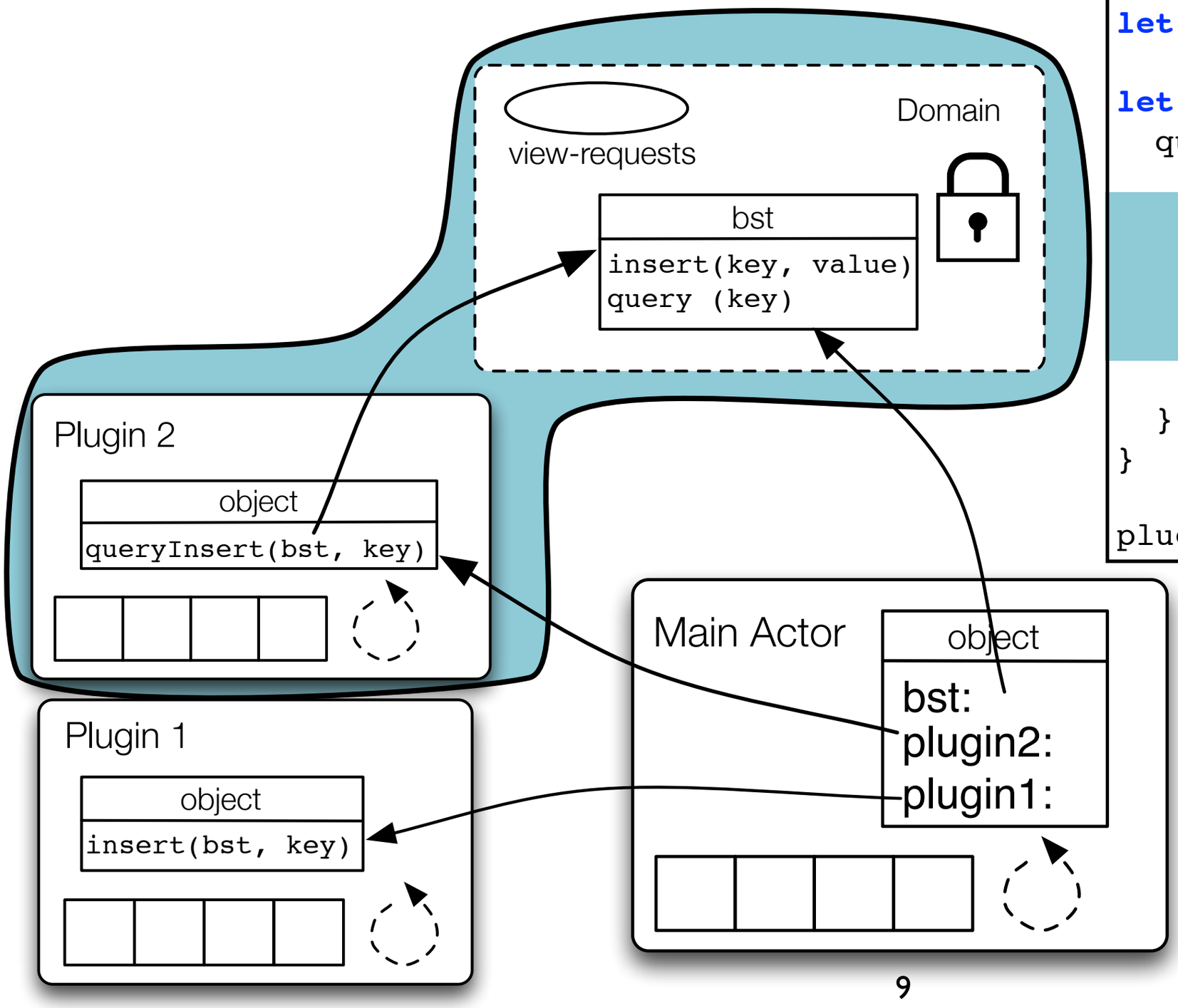

Motivating example

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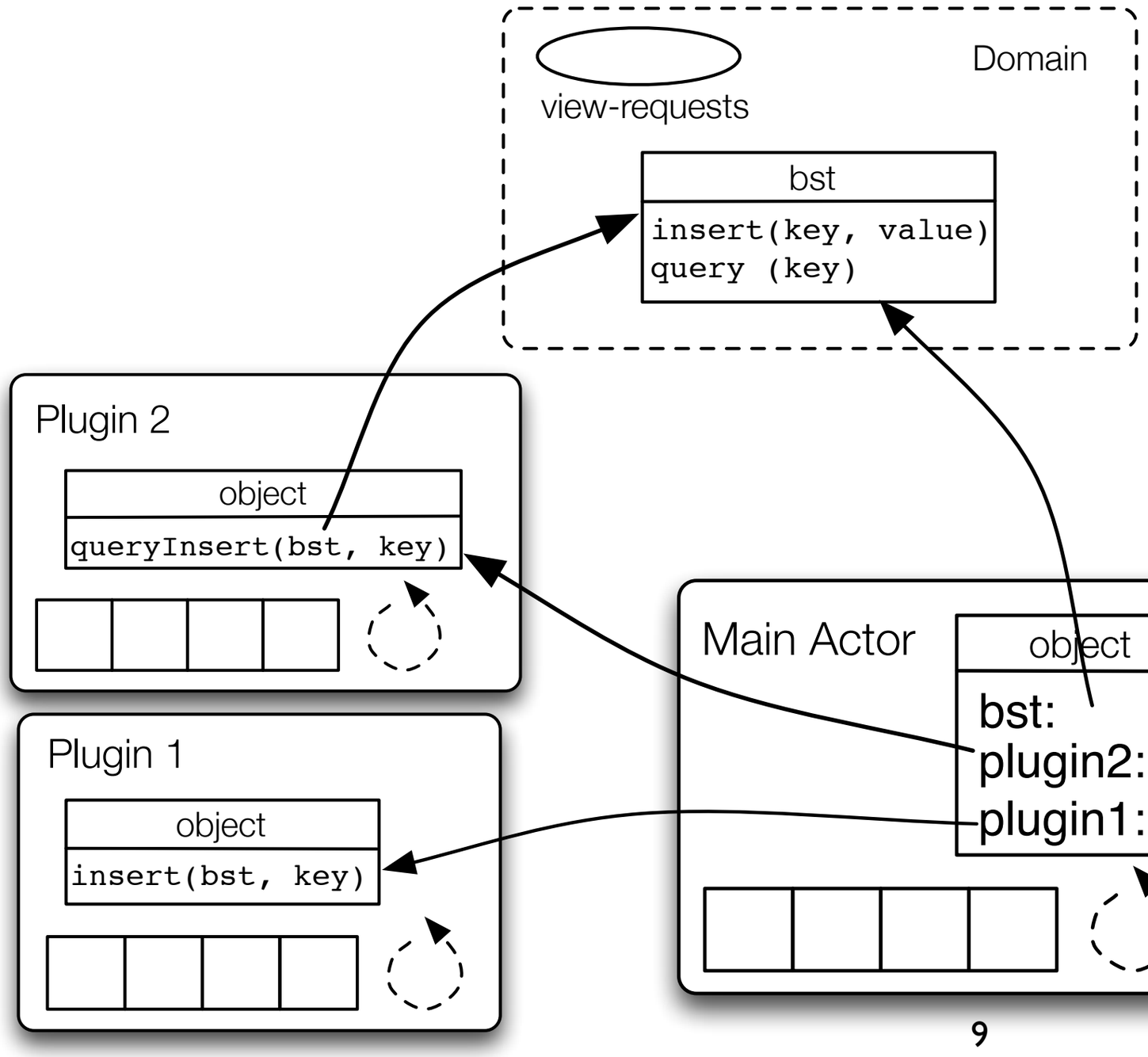


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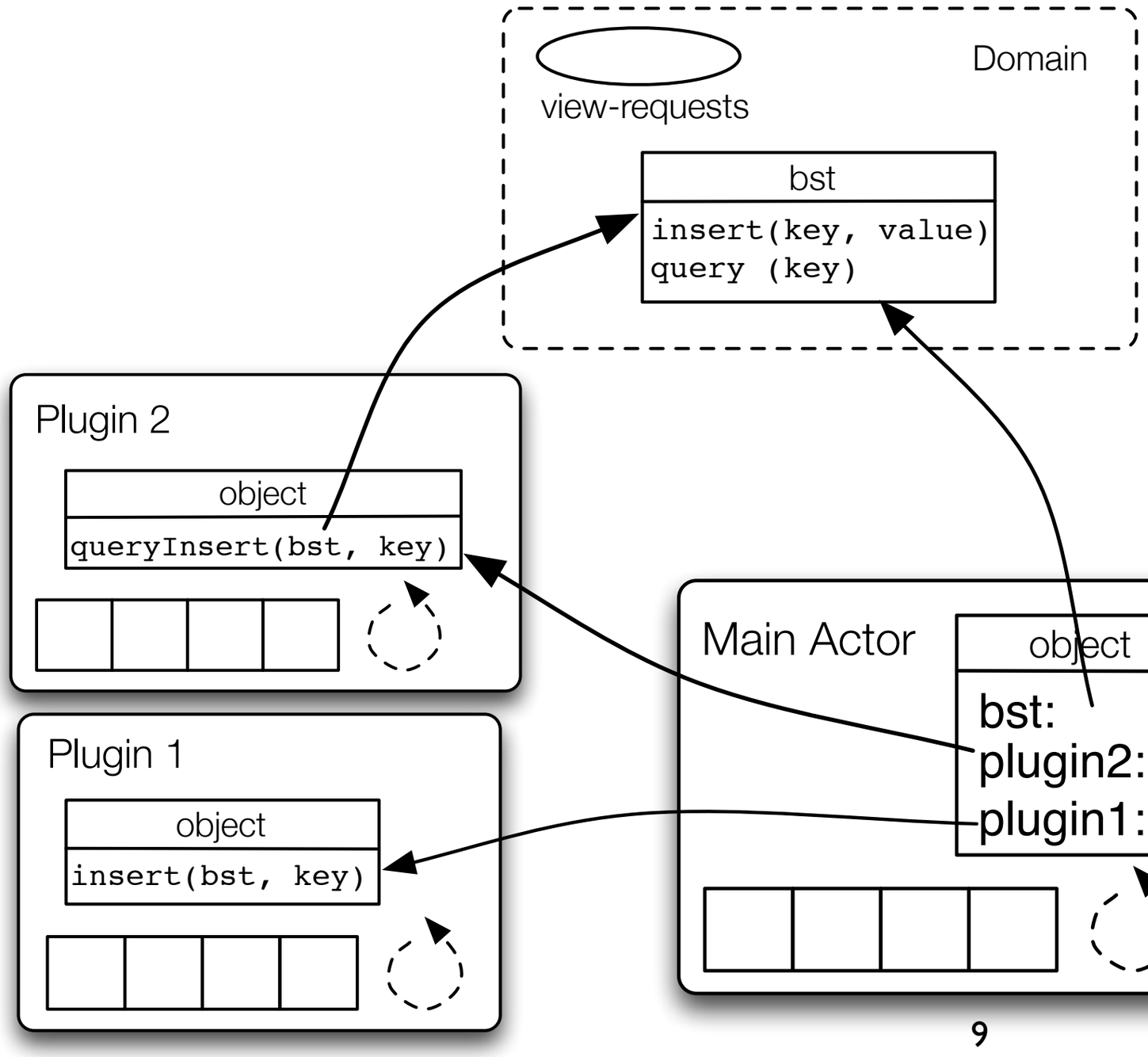


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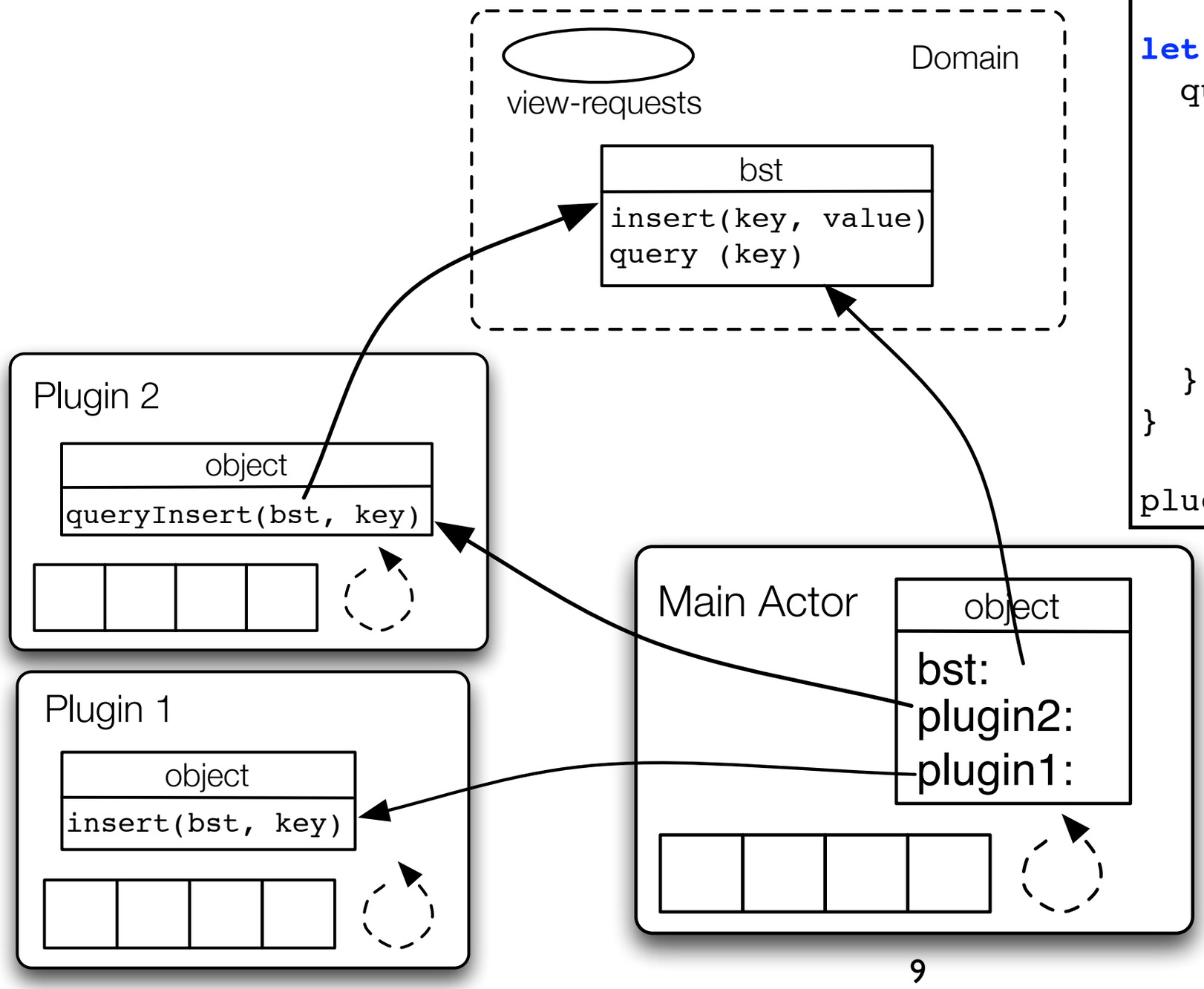
1. No CPS code

Motivating example

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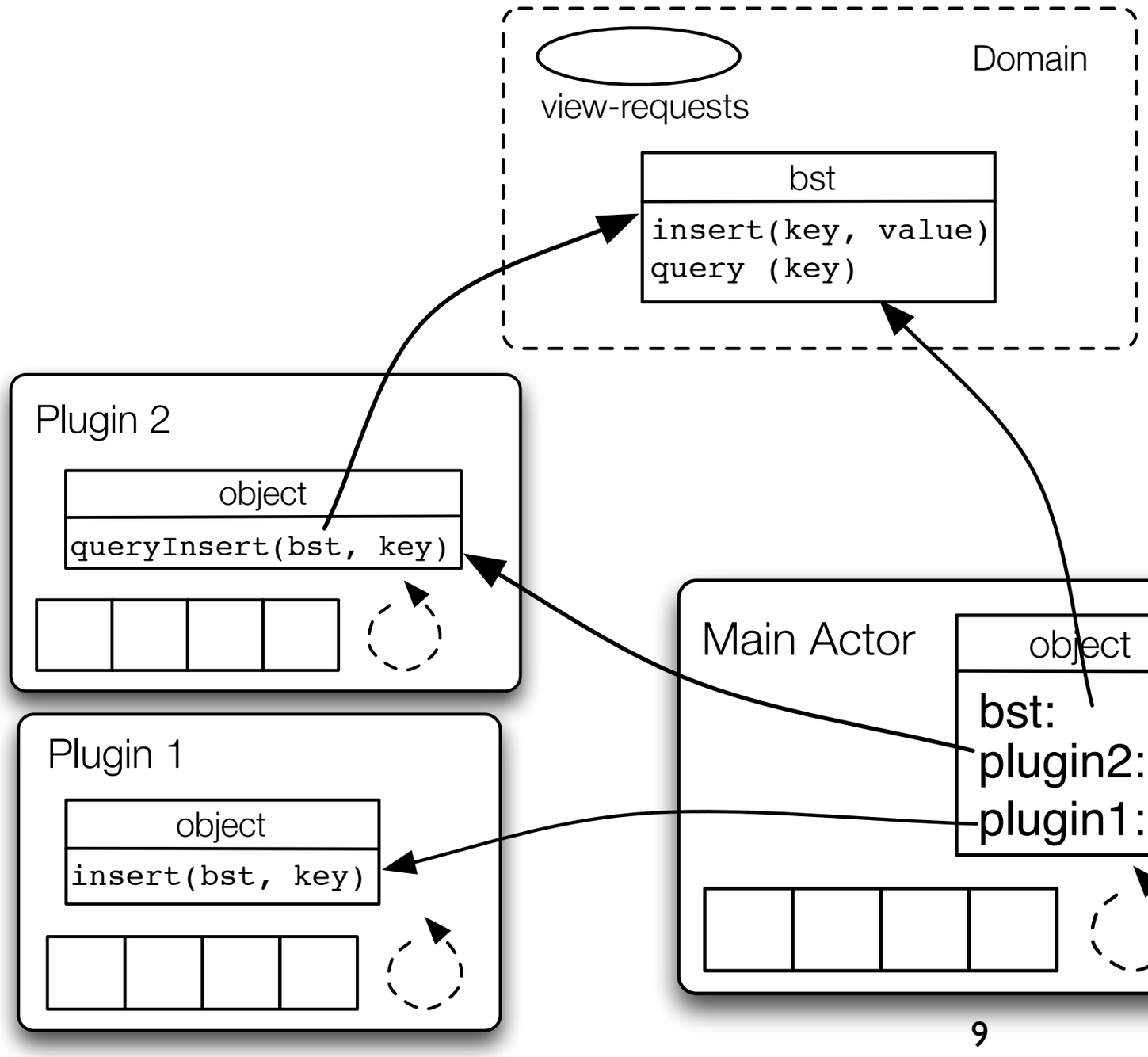
1. No CPS code
2. Synchronization

Motivating example

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1. No CPS code
2. Synchronization
3. Parallel reads

Conclusion

- **Safe**
  - Isolation properties still valid
  - Deadlock and race-condition free
- **Expressive**
  - Able to express the concept “shared state”
  - No inversion of control
- **Efficient**
  - Synchronous access to shared state
  - Parallel reads through the use of shared views