

**WHO TAKES OUT  
YOUR TRASH?**

**@sannekalkman**









**Magic is just (computer) science you don't understand yet**





Allocate memory



Allocate memory



Find the garbage





Allocate memory



Find the garbage



Free up memory

# **REFERENCE COUNTING**

**If nothing points to it, nothing's using it**

# REFERENCE COUNTING

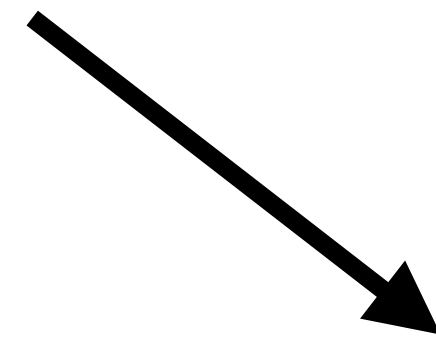
# REFERENCE COUNTING

```
name = "webcamp"
```

# REFERENCE COUNTING

name = "webcamp"

name

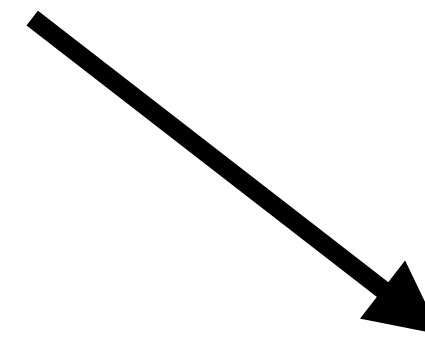


"webcamp"	1
-----------	---

# REFERENCE COUNTING

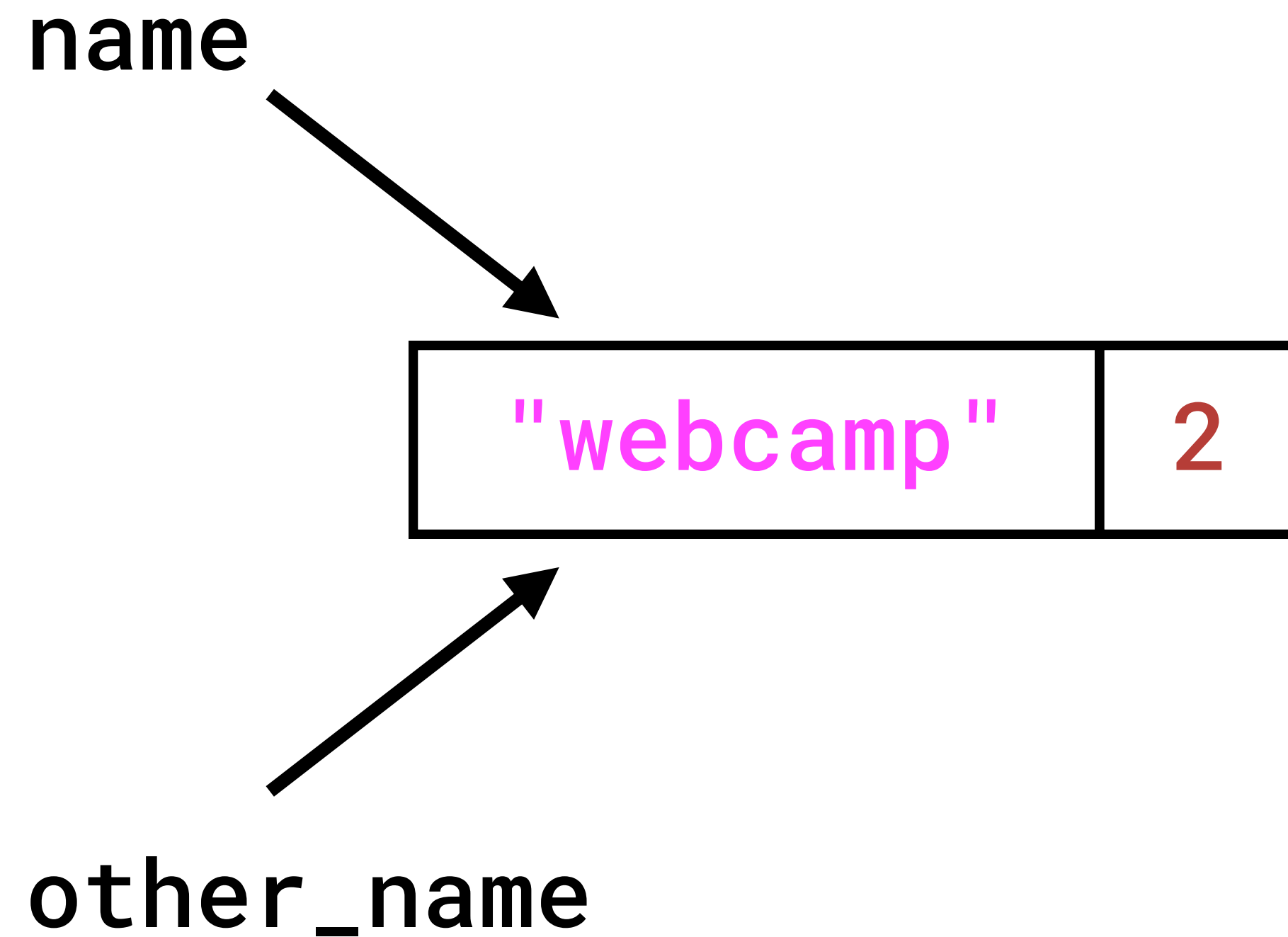
```
name = "webcamp"  
other_name = name
```

name



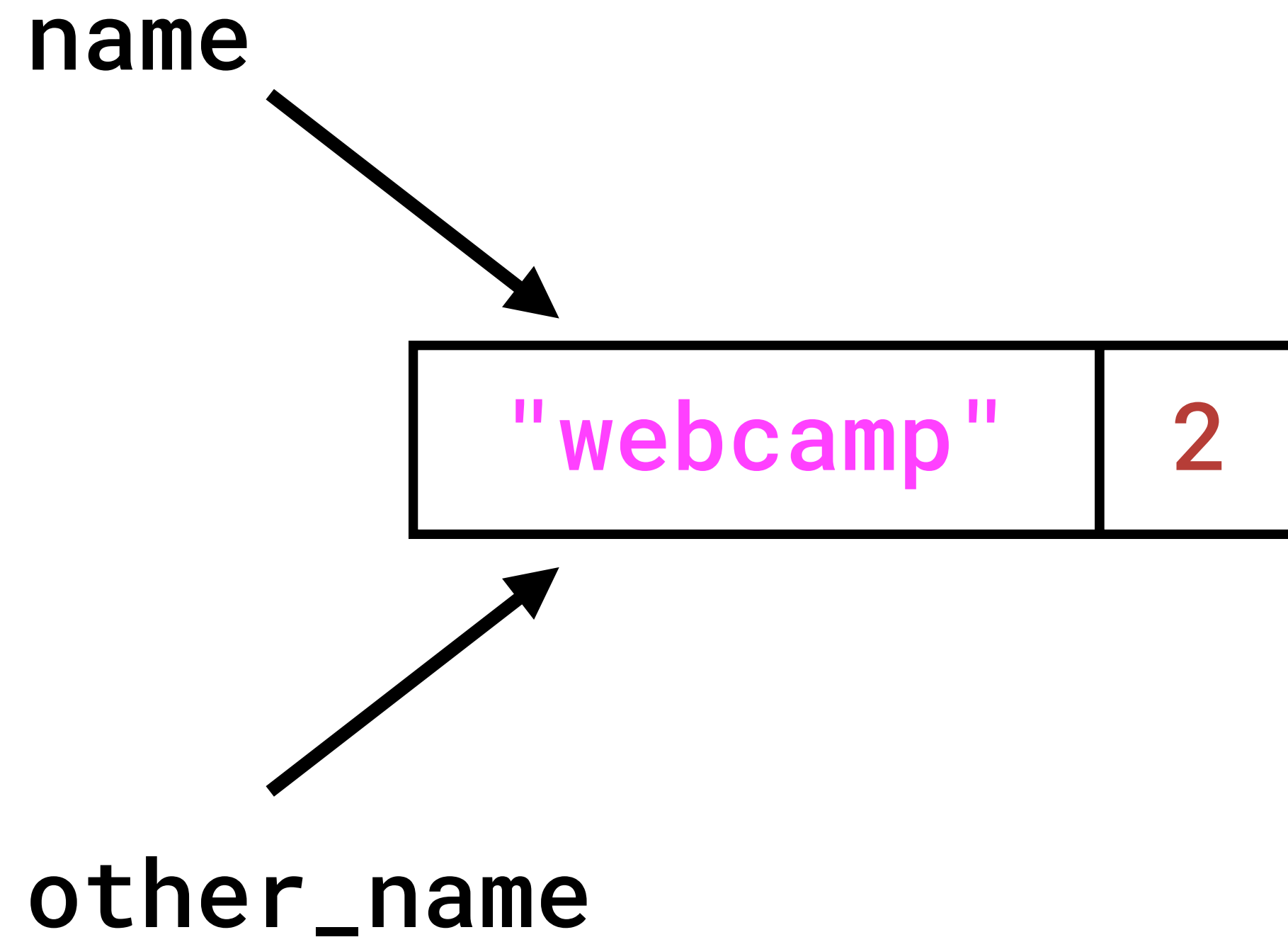
# REFERENCE COUNTING

```
name = "webcamp"  
other_name = name
```



# REFERENCE COUNTING

```
name = "webcamp"  
other_name = name  
  
name = nil
```





# REFERENCE COUNTING

```
name = "webcamp"  
other_name = name  
  
name = nil
```

name



other\_name

# REFERENCE COUNTING

```
name = "webcamp"  
other_name = name
```

```
name = nil  
other_name = nil
```

name



other\_name

# REFERENCE COUNTING

name

```
name = "webcamp"  
other_name = name
```

```
name = nil  
other_name = nil
```



other\_name

# REFERENCE COUNTING

name

```
name = "webcamp"  
other_name = name
```

```
name = nil  
other_name = nil
```



other\_name

**CYCLES**

# CYCLES

```
one = {  
  other: nil  
}
```

# CYCLES

```
one = {  
  other: nil  
}
```



# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```





# CYCLES

```
one = {  
  other: nil  
}
```

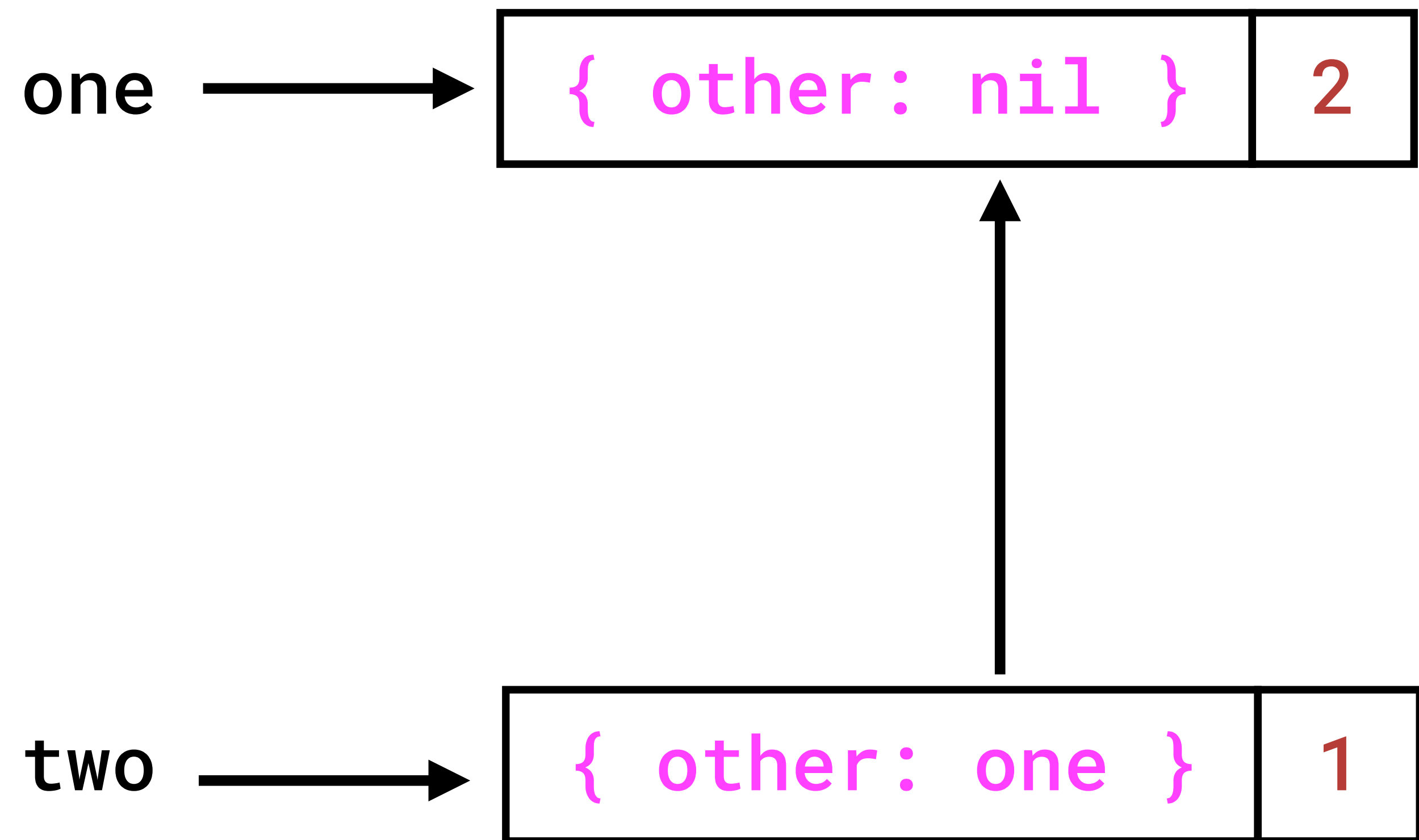
```
two = {  
  other: one  
}
```



# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

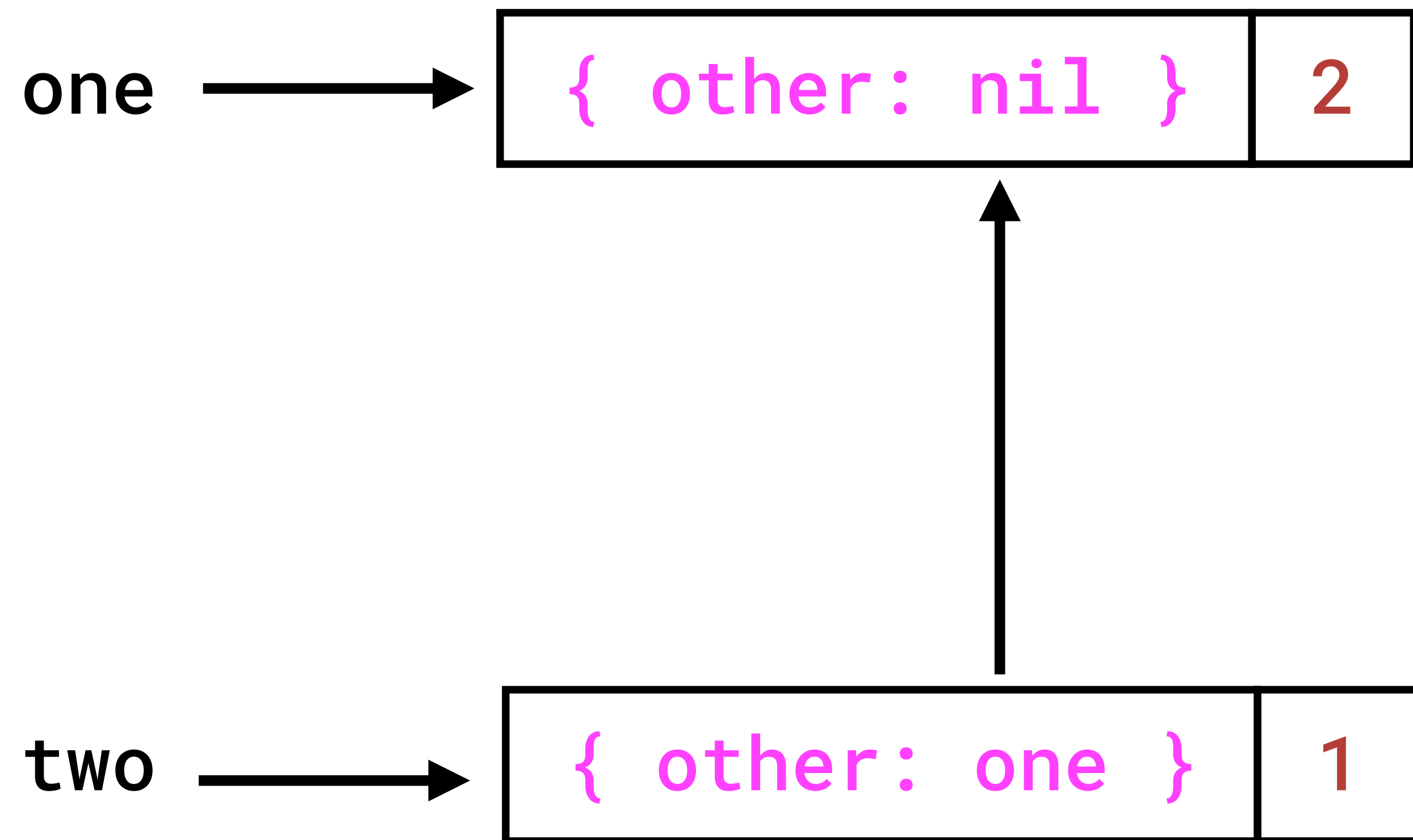


# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

```
one[:other] = two
```

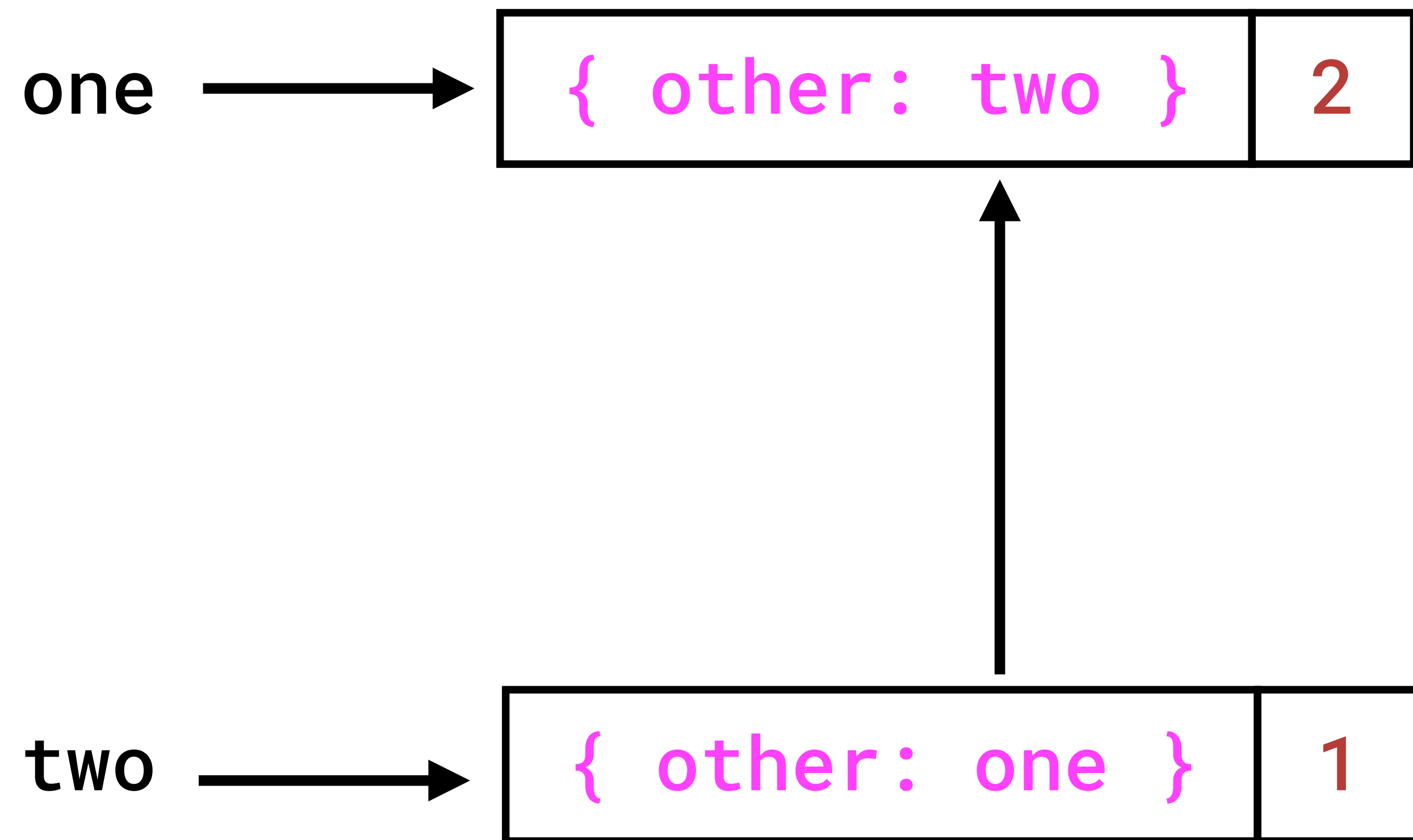


# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

```
one[:other] = two
```

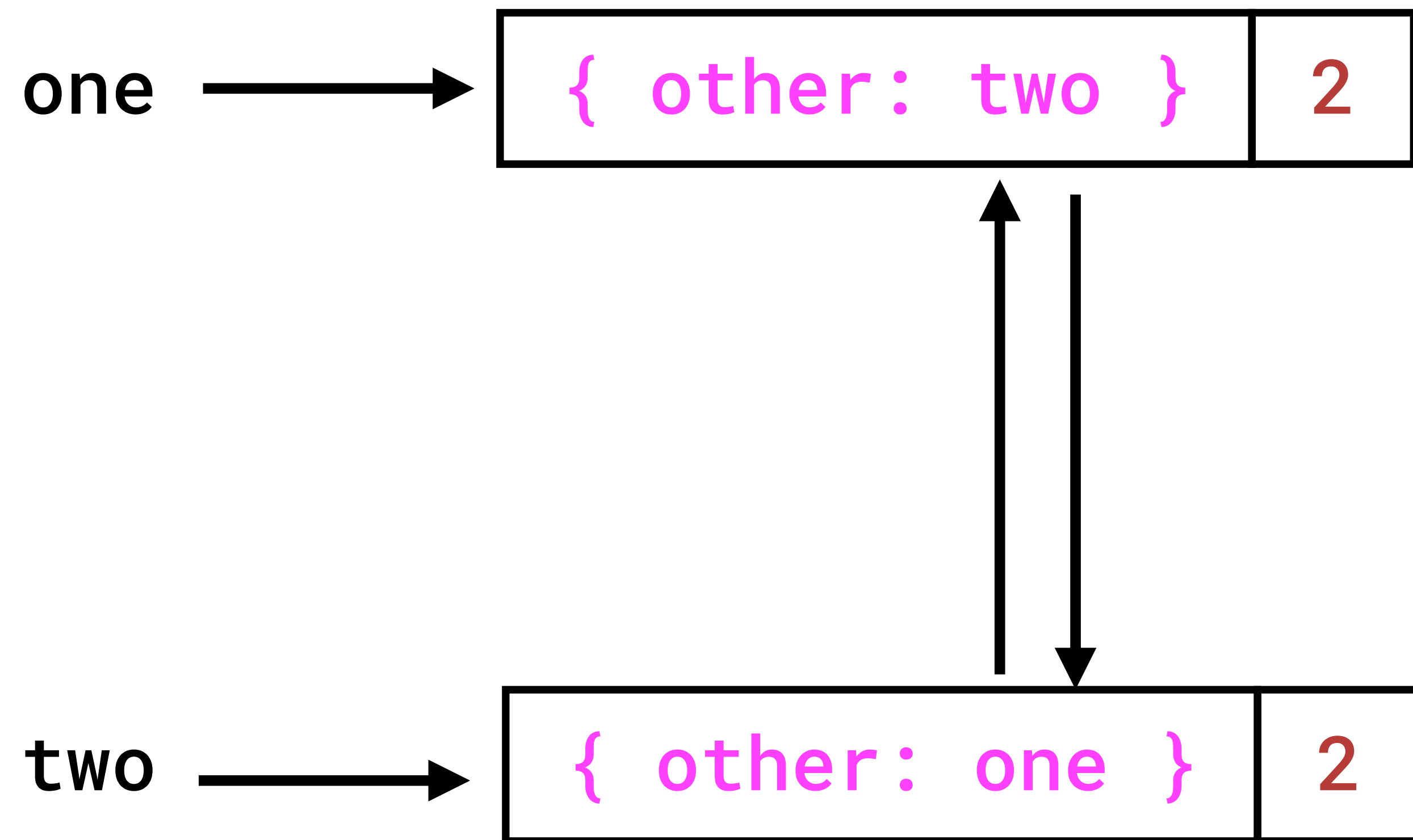


# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

```
one[:other] = two
```



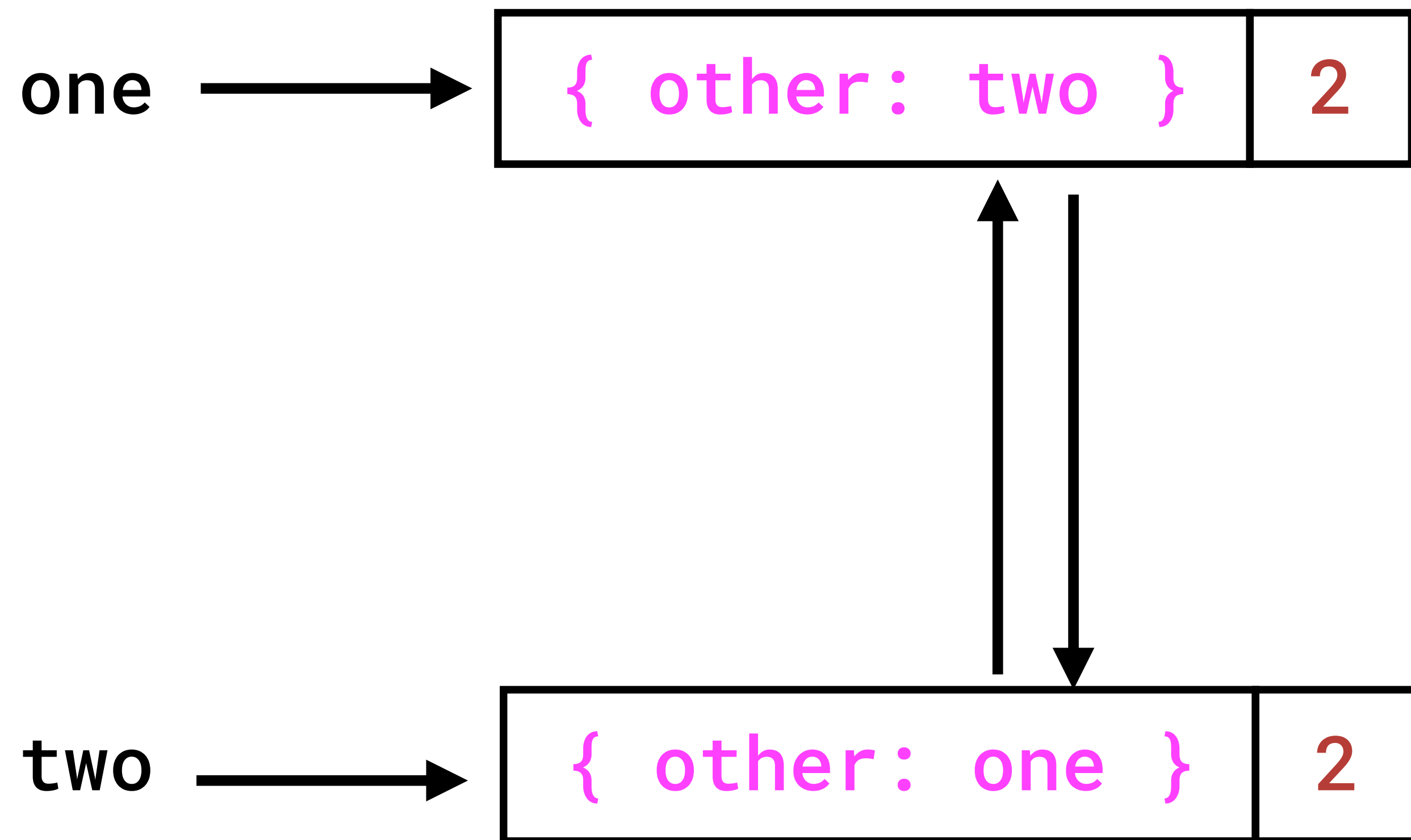
# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

```
one[:other] = two
```

```
one = nil  
two = nil
```



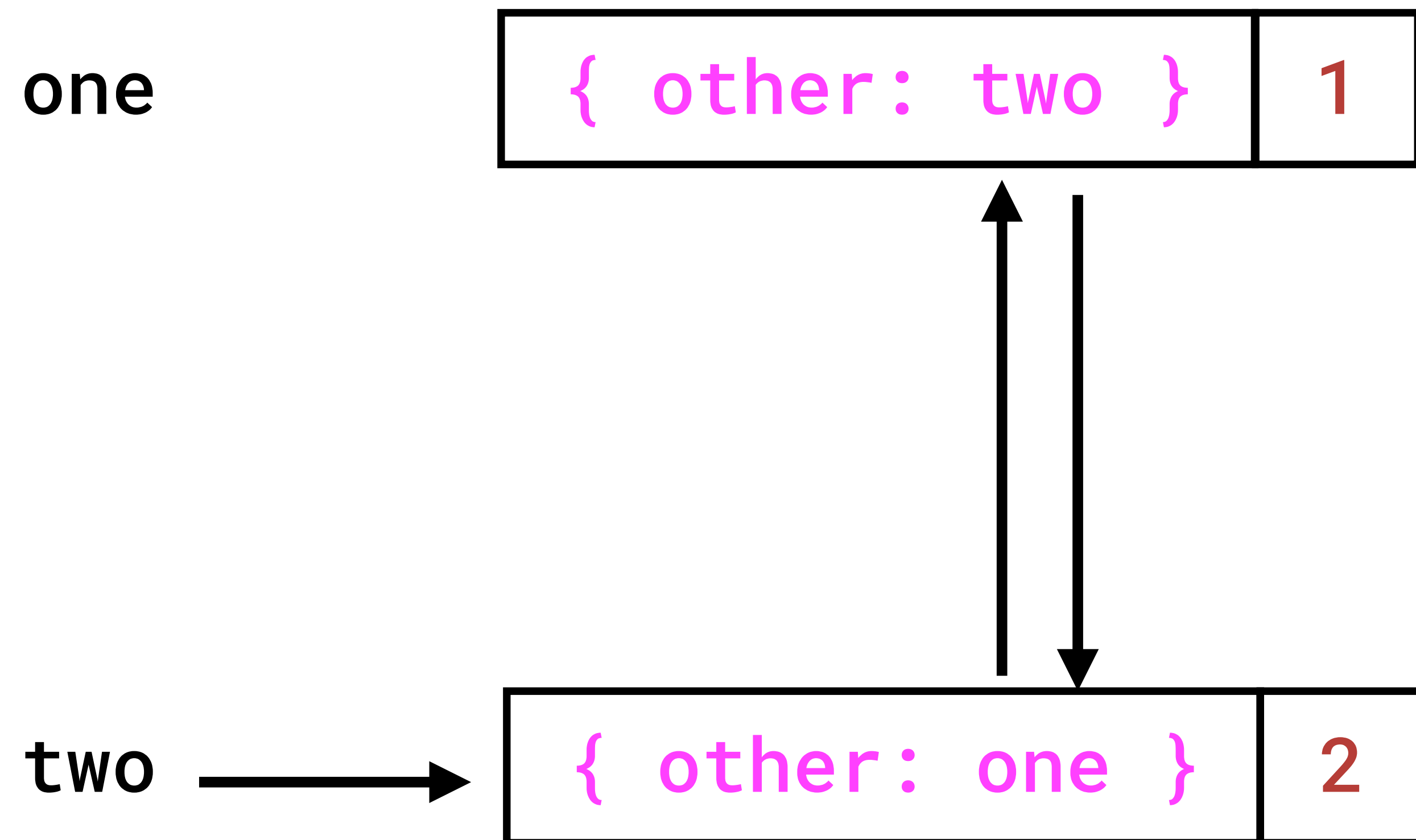
# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

```
one[:other] = two
```

```
one = nil  
two = nil
```



# CYCLES

```
one = {  
  other: nil  
}
```

```
two = {  
  other: one  
}
```

```
one[:other] = two
```

```
one = nil  
two = nil
```

one



two

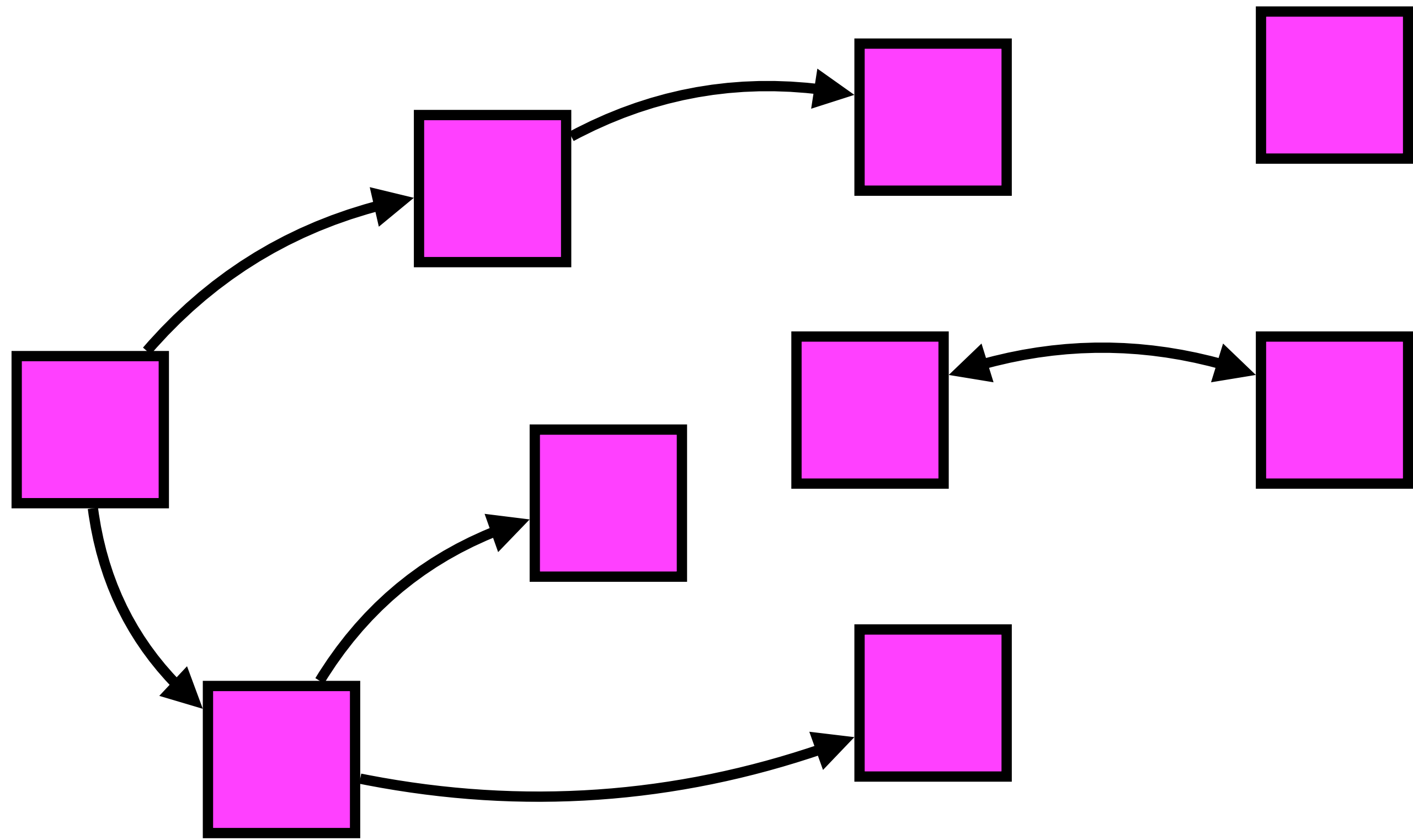




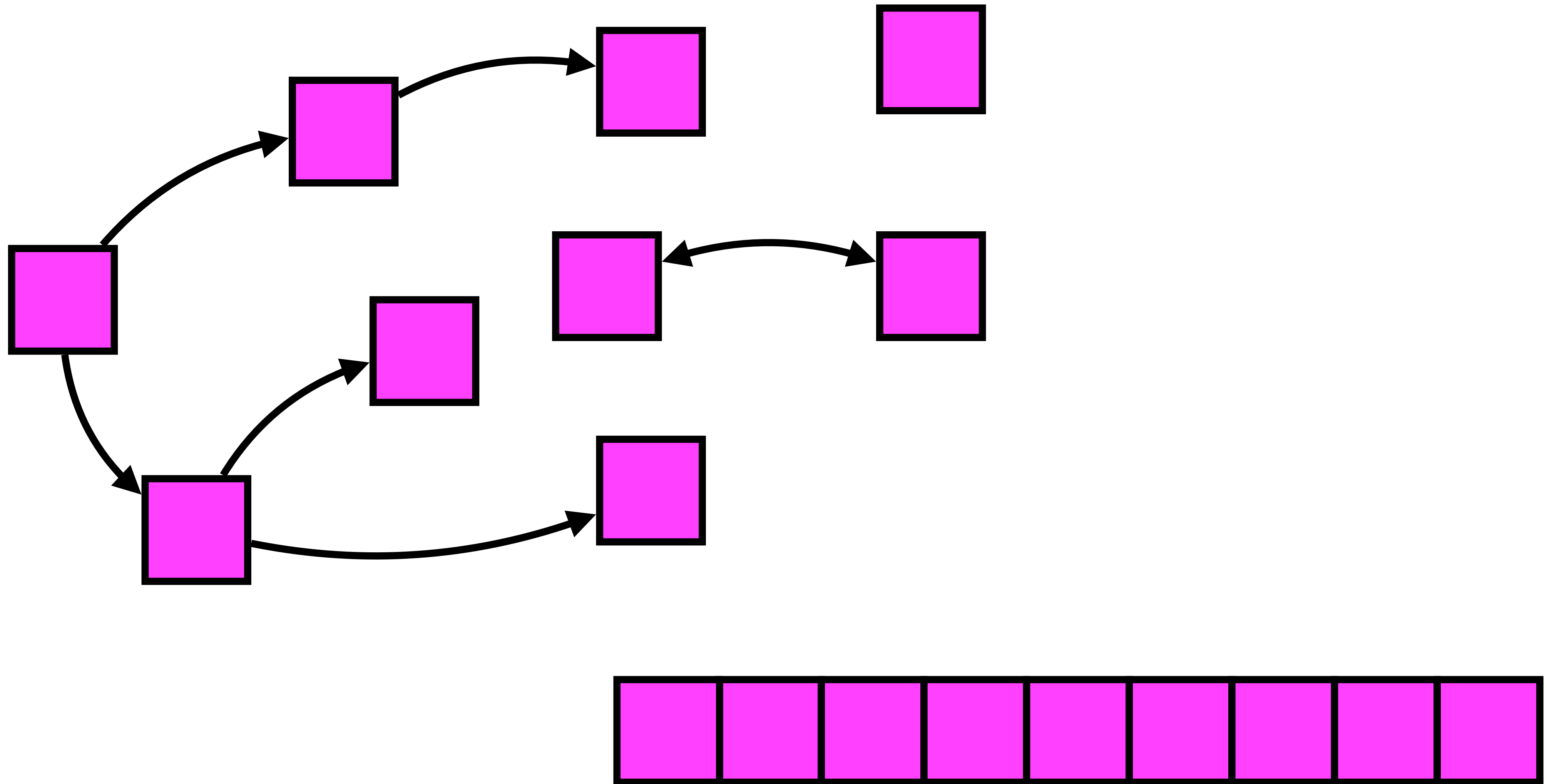
# **MARK & SWEEP**

**If you can't get to it, you can't be using it**

# MARK & SWEEP

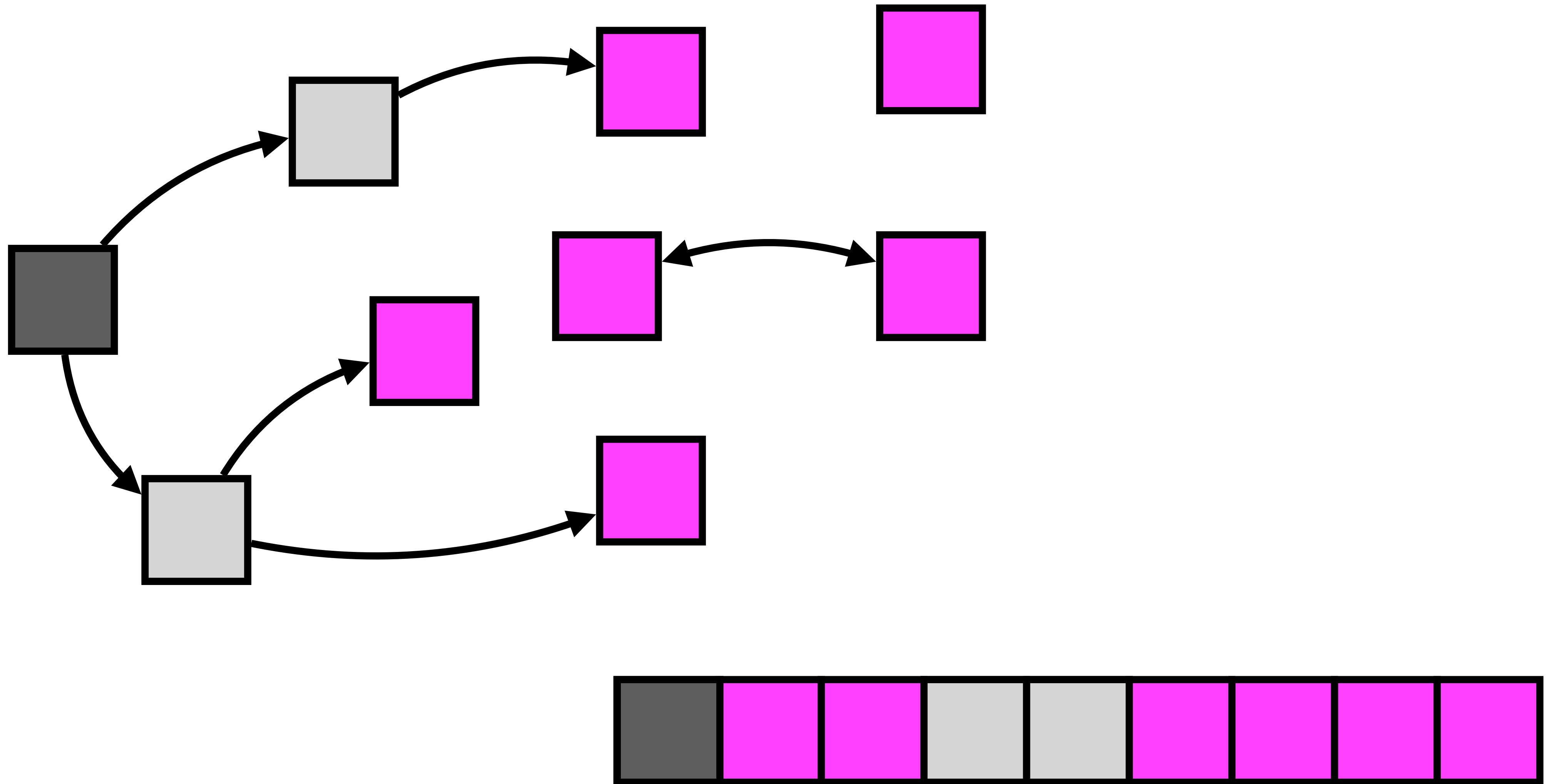


# MARK & SWEEP

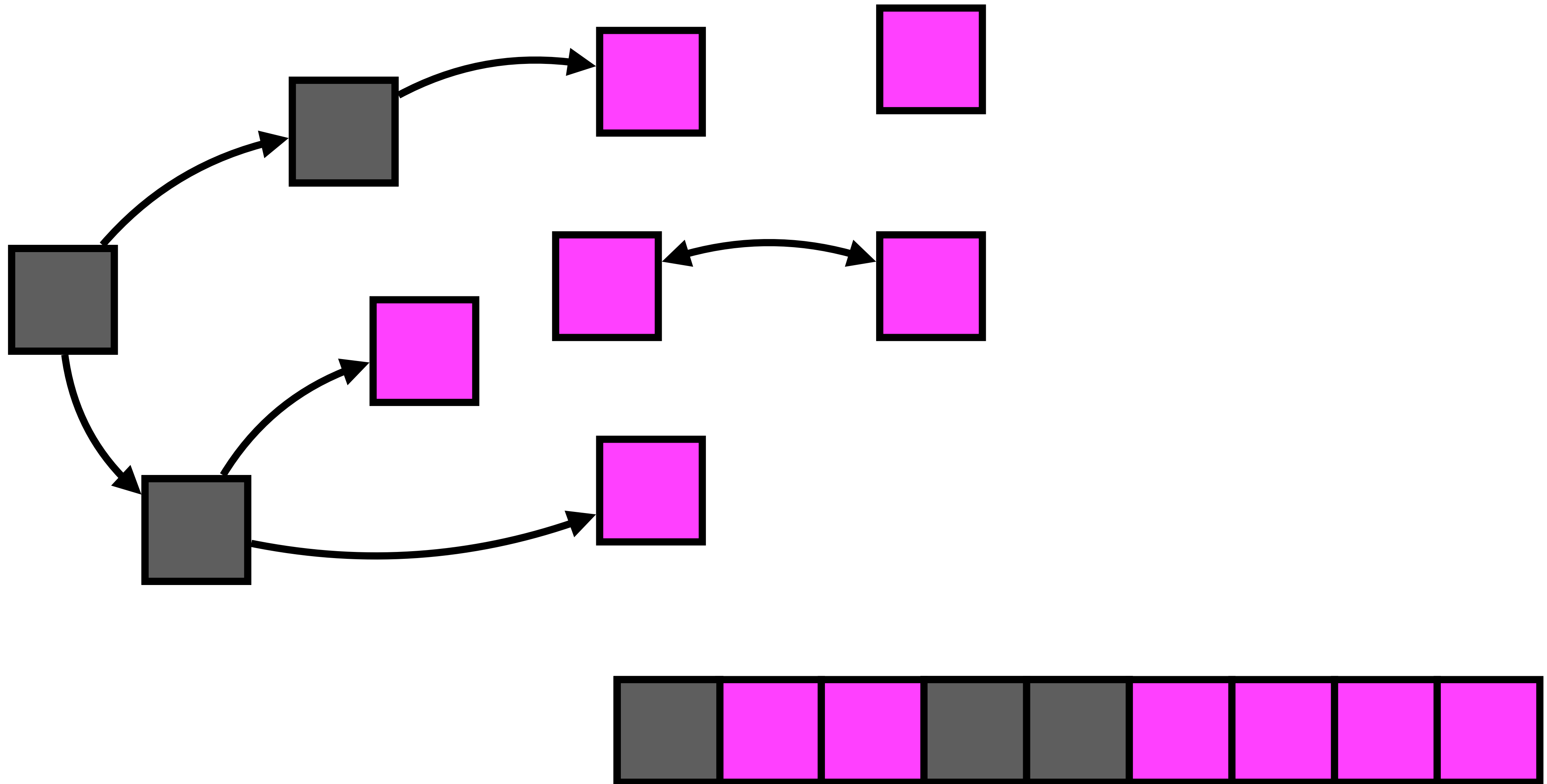




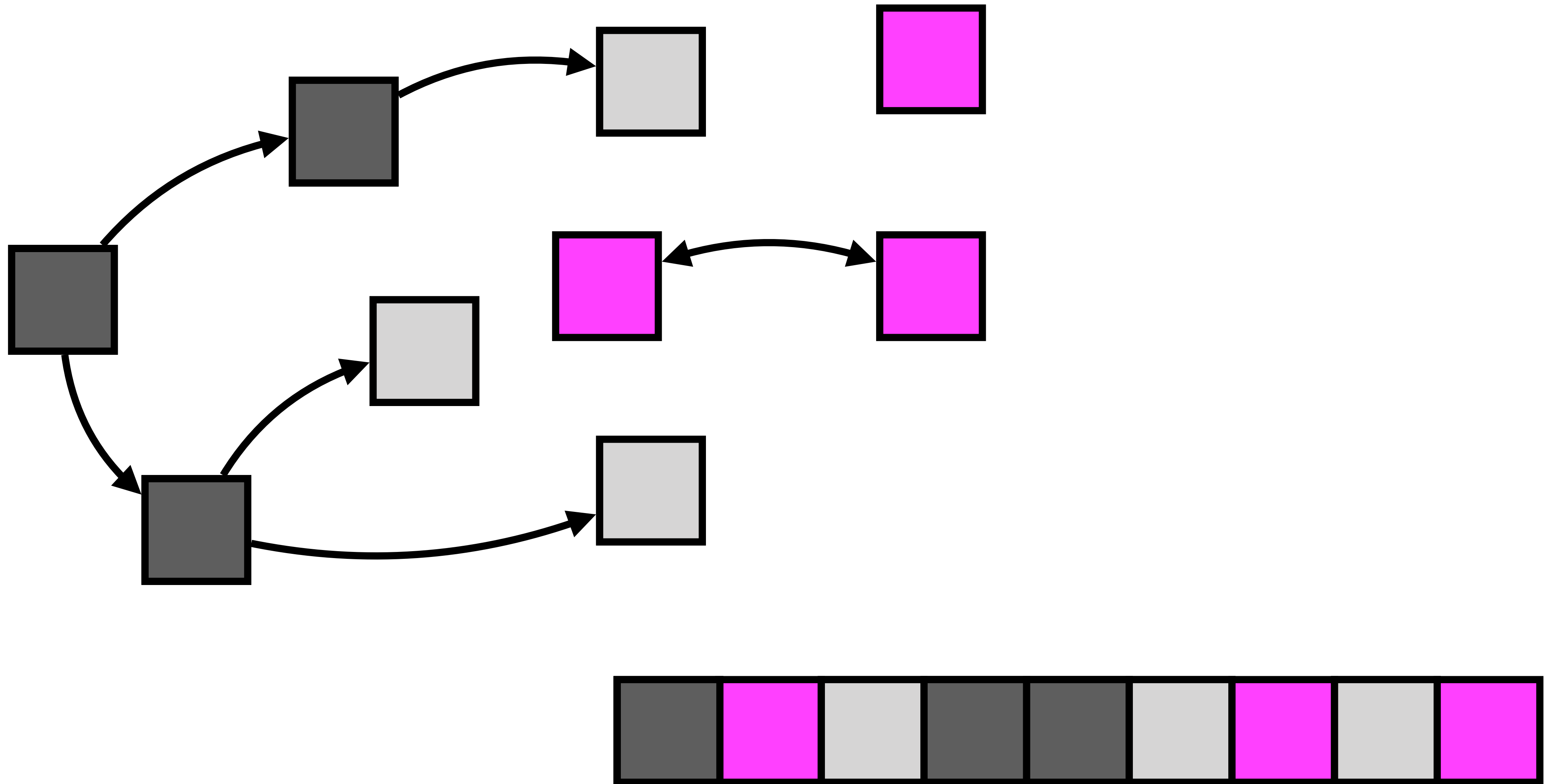
# MARK & SWEEP



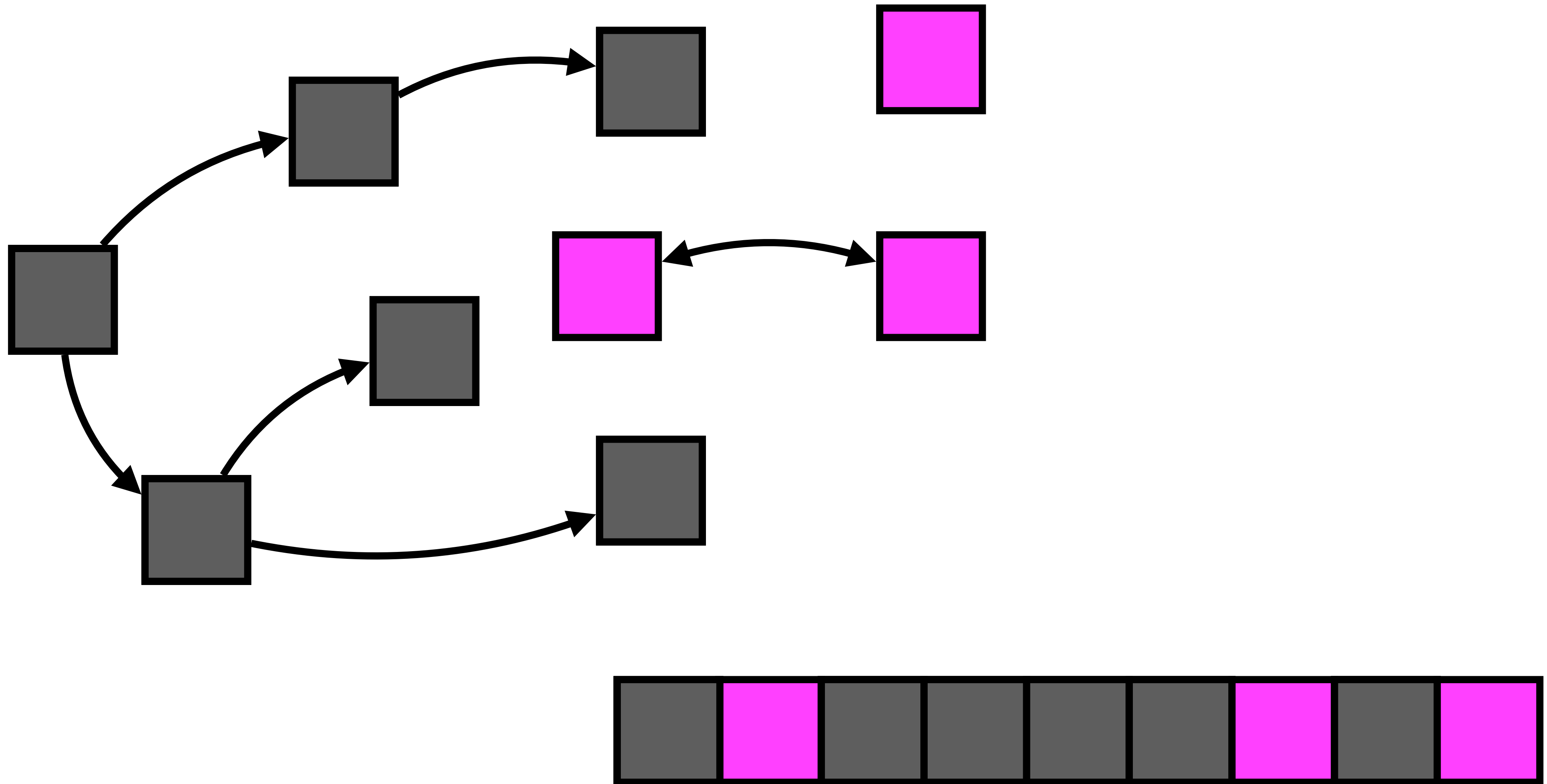
# MARK & SWEEP



# MARK & SWEEP

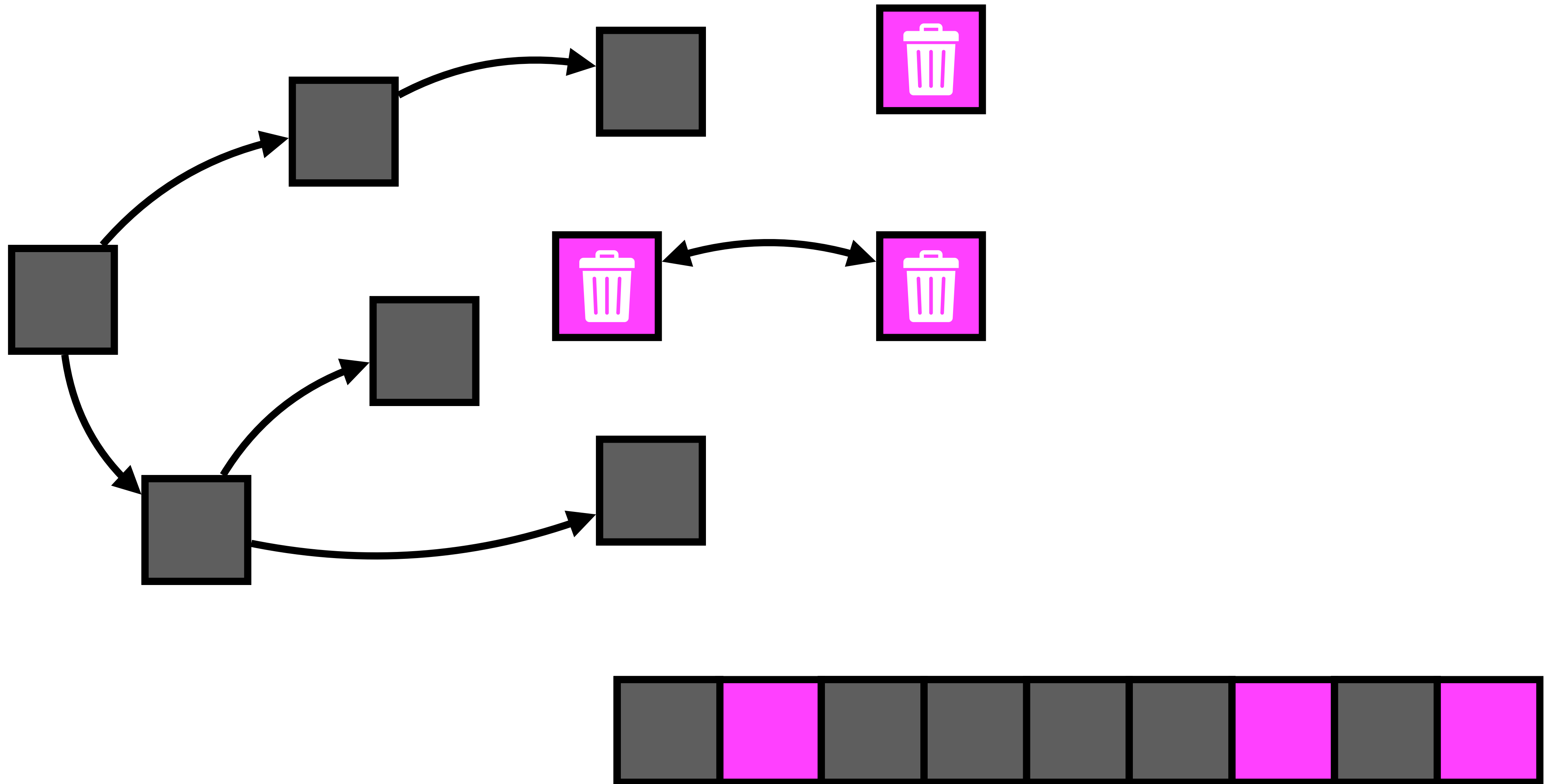


# MARK & SWEEP

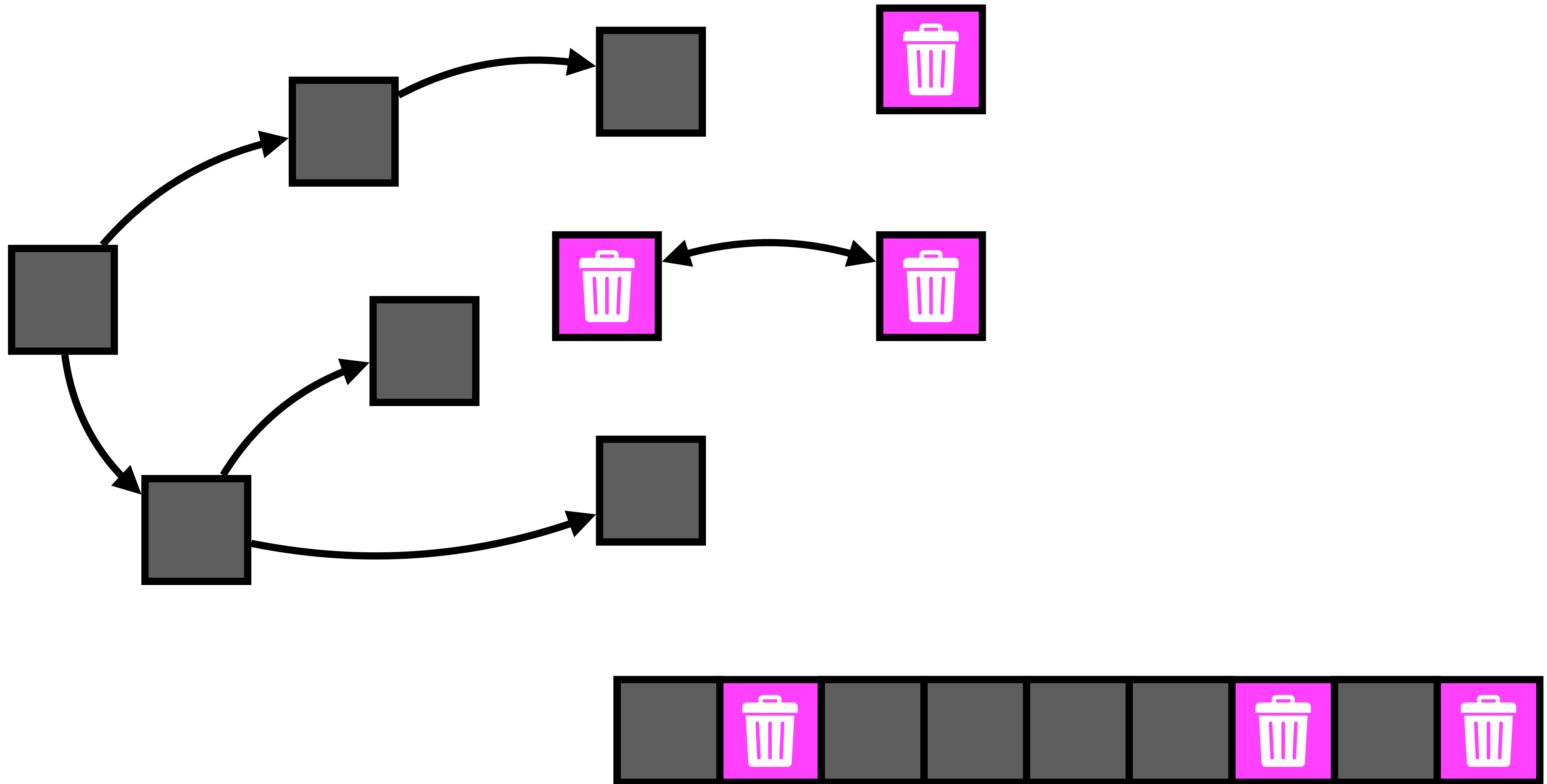




# MARK & SWEEP



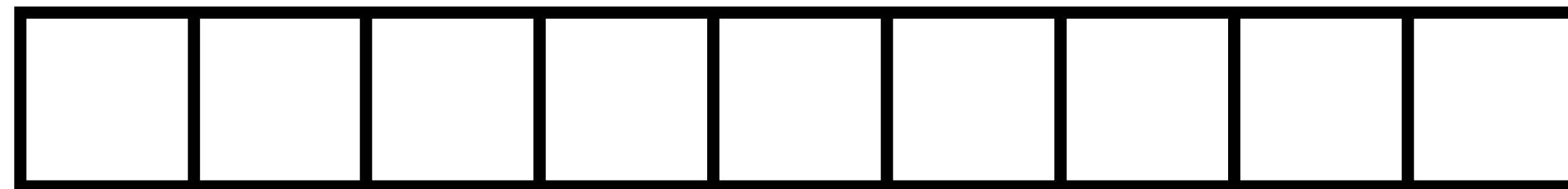
# MARK & SWEEP



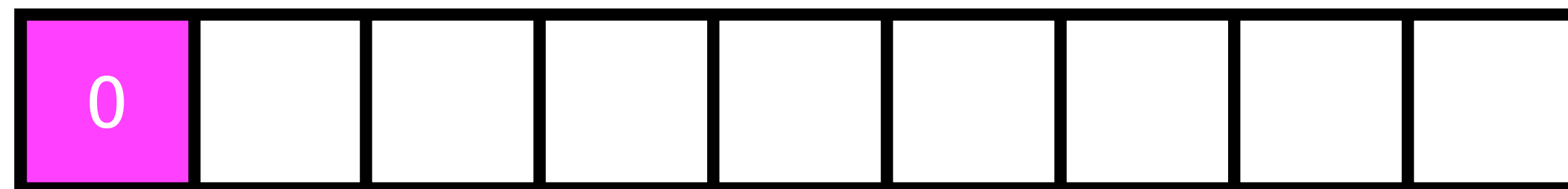
# **COPYING COLLECTION**

**Keep your stuff together**

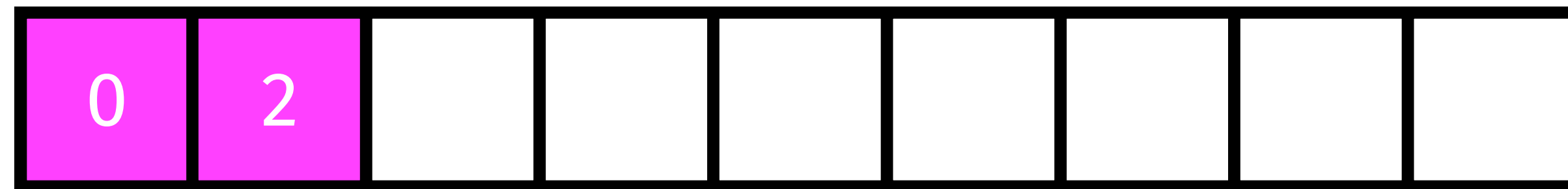
# COPYING COLLECTION



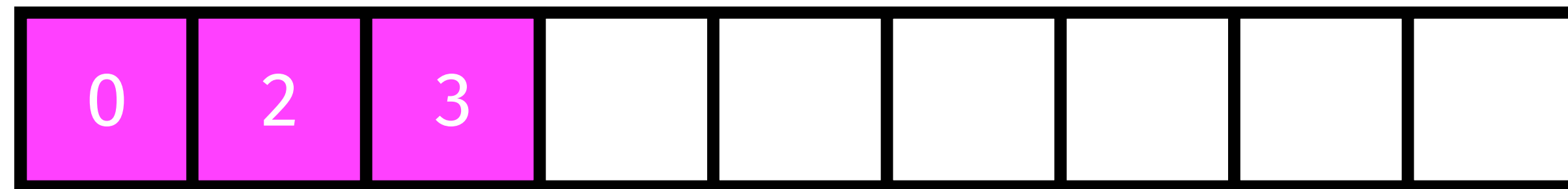
# COPYING COLLECTION



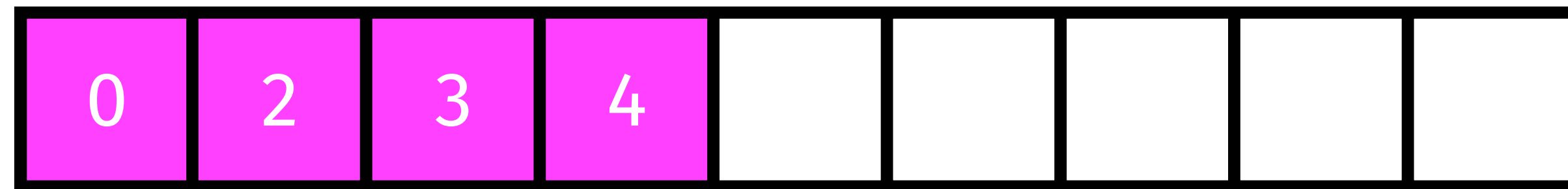
# COPYING COLLECTION



# COPYING COLLECTION

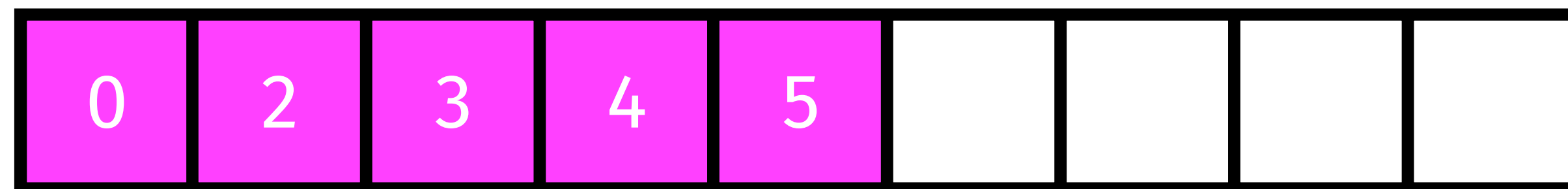


# COPYING COLLECTION

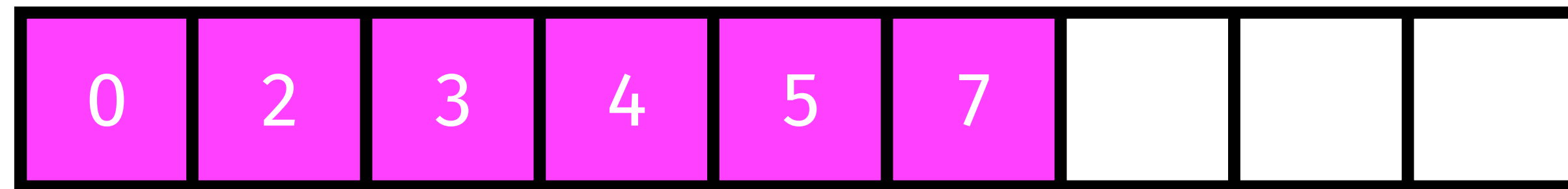




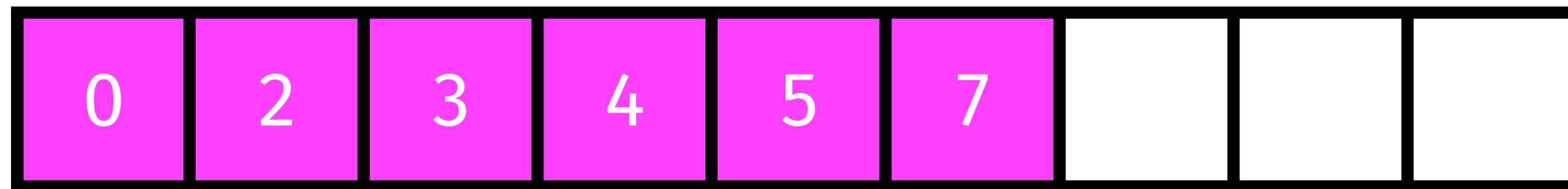
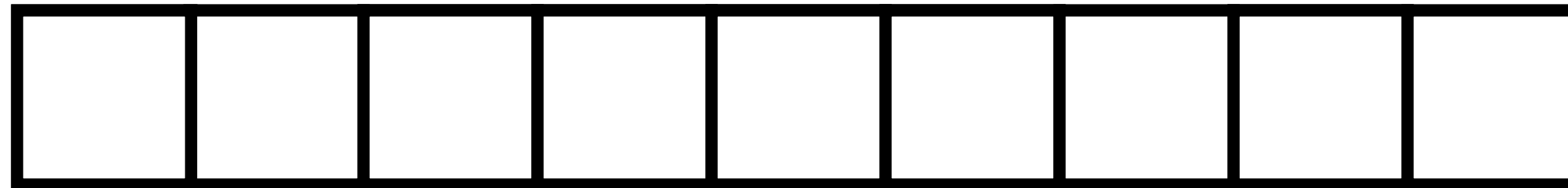
# COPYING COLLECTION



# COPYING COLLECTION



# COPYING COLLECTION

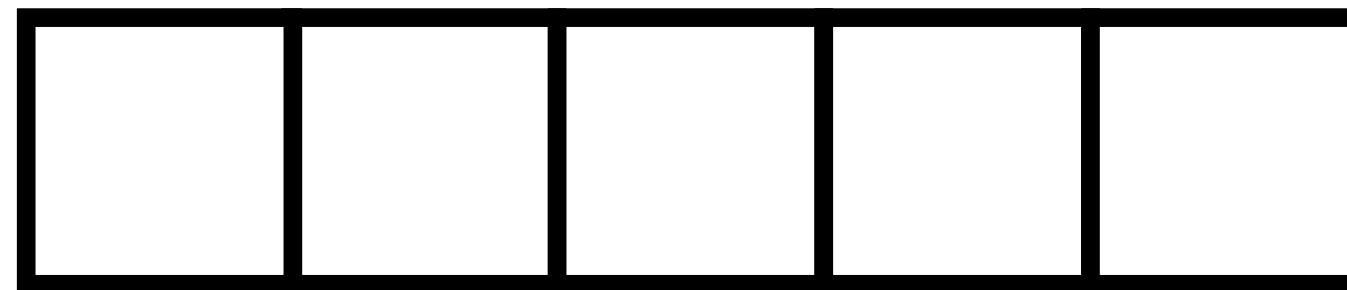


# **GENERATIONAL COLLECTION**

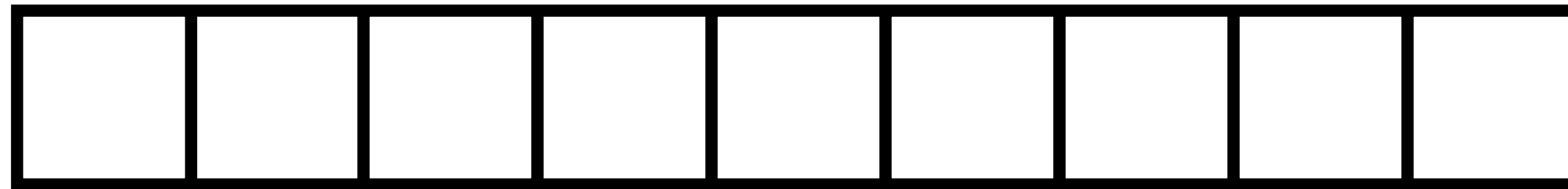
**If you've been using it for a while, it's probably important**

# GENERATIONAL COLLECTION

New objects

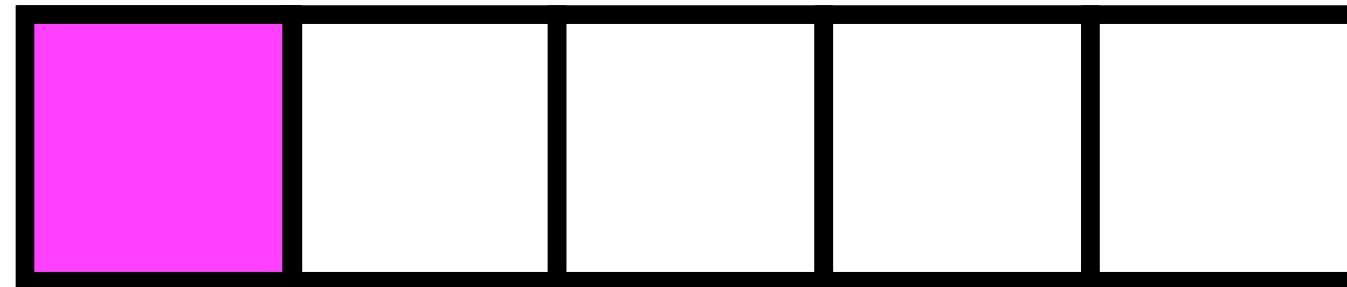


Old objects

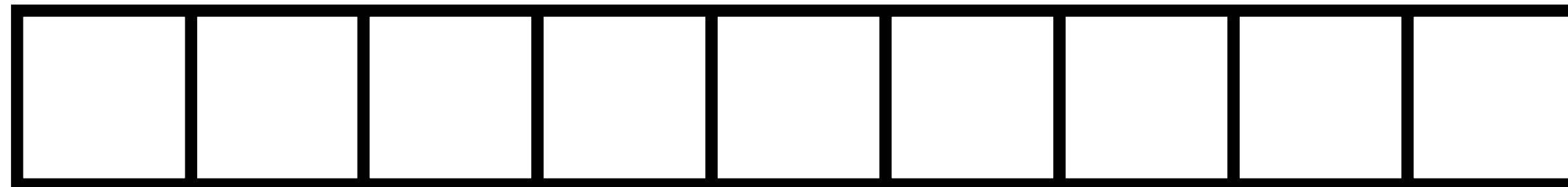


# GENERATIONAL COLLECTION

New objects

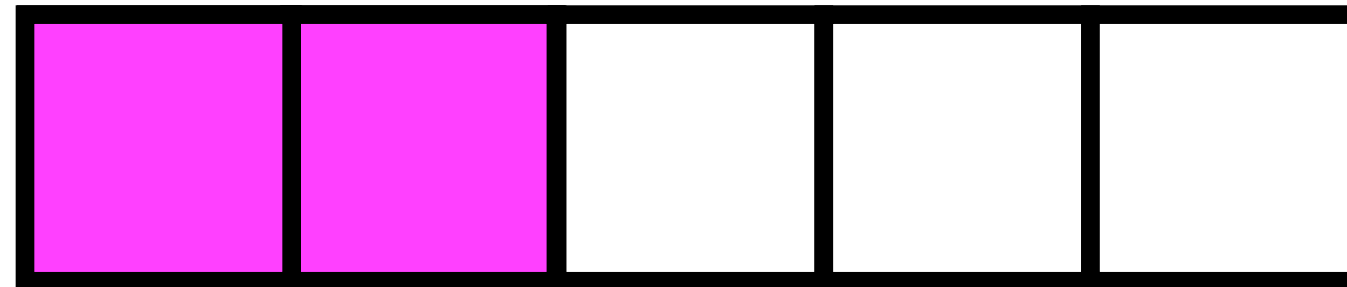


Old objects



# GENERATIONAL COLLECTION

New objects

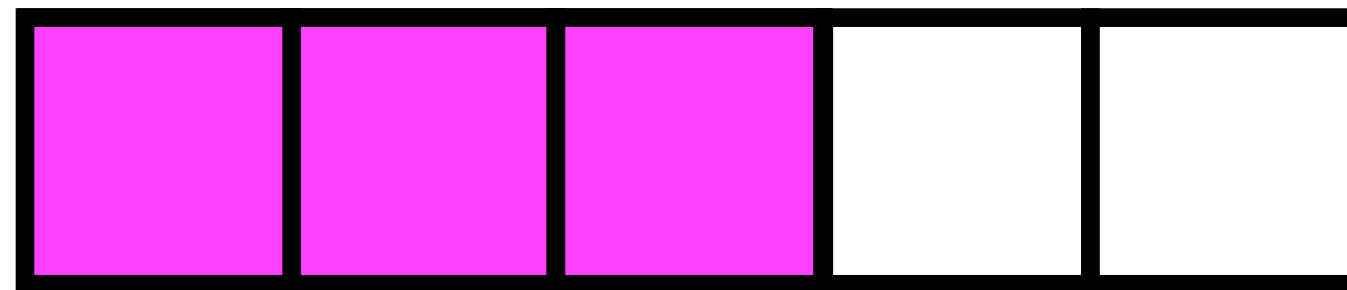


Old objects

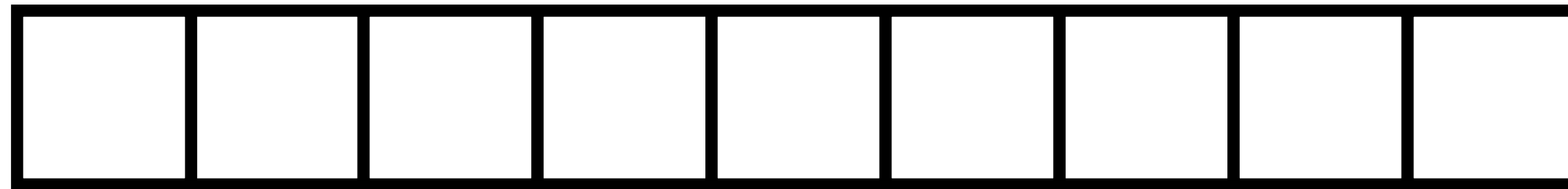


# GENERATIONAL COLLECTION

New objects



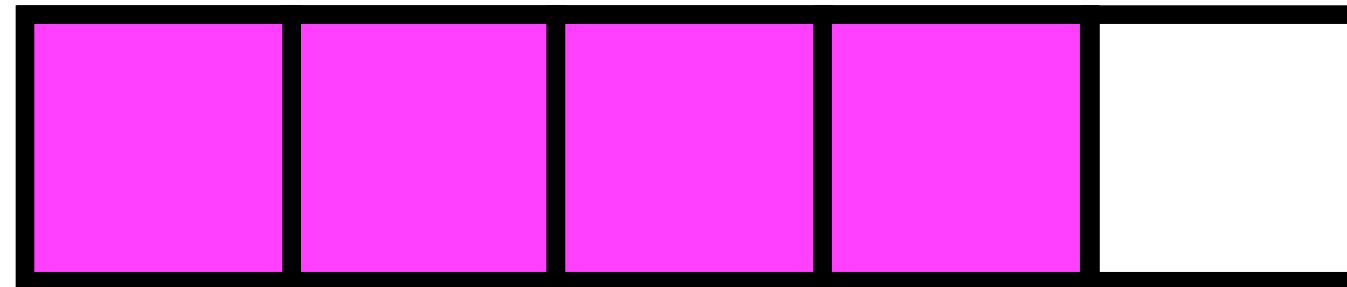
Old objects



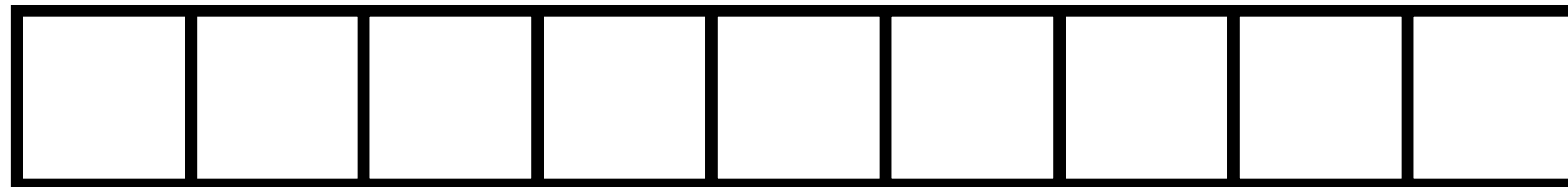


# GENERATIONAL COLLECTION

New objects

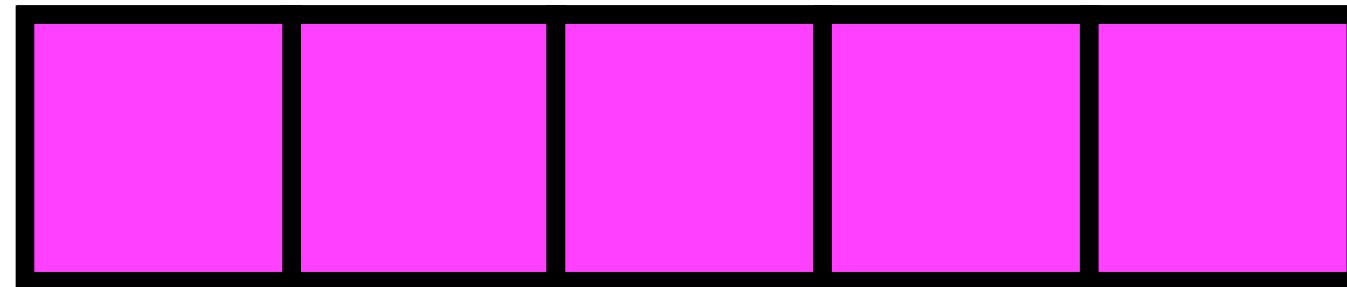


Old objects

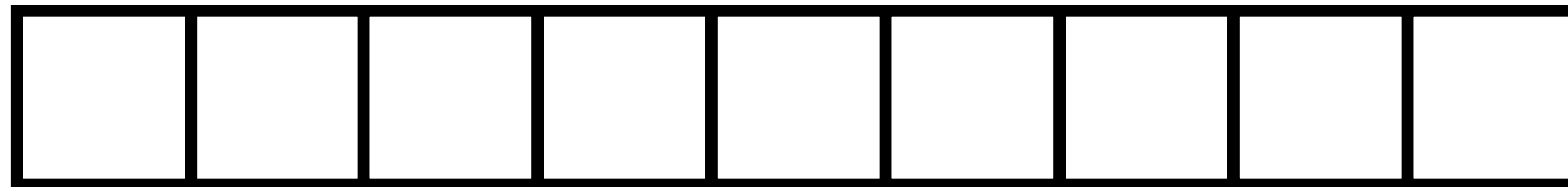


# GENERATIONAL COLLECTION

New objects

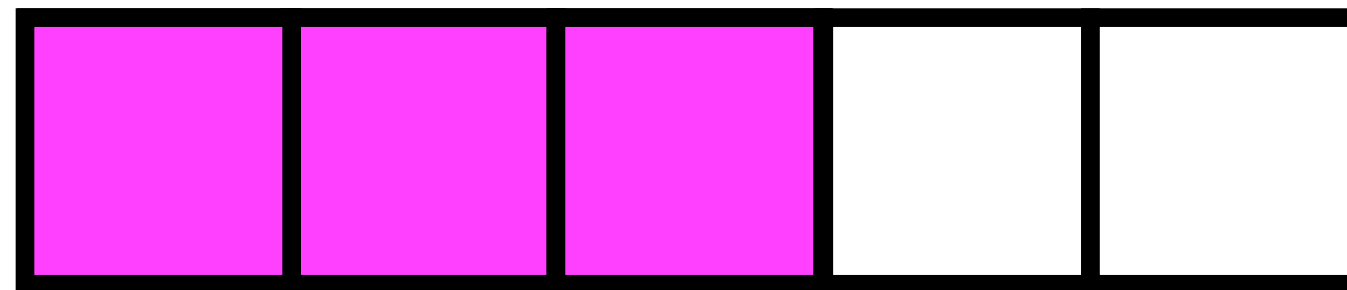


Old objects

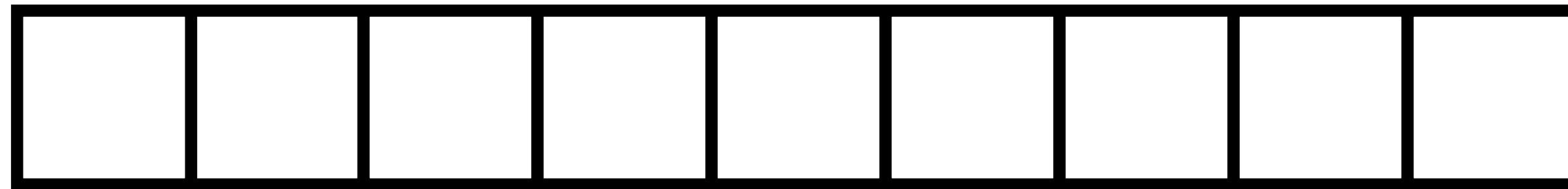


# GENERATIONAL COLLECTION

New objects

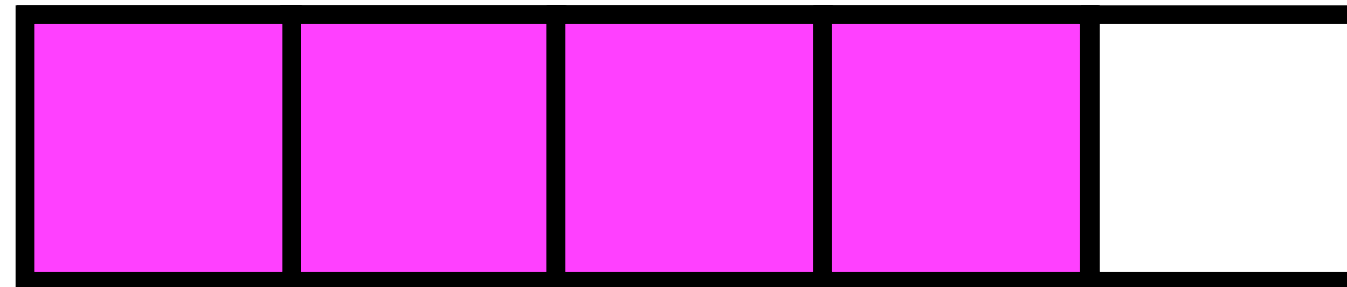


Old objects

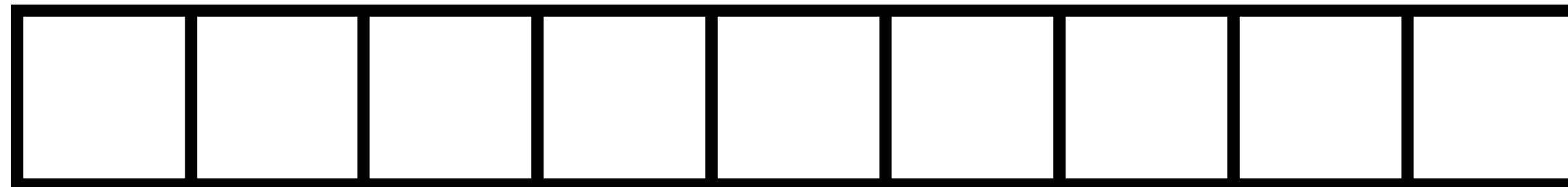


# GENERATIONAL COLLECTION

New objects

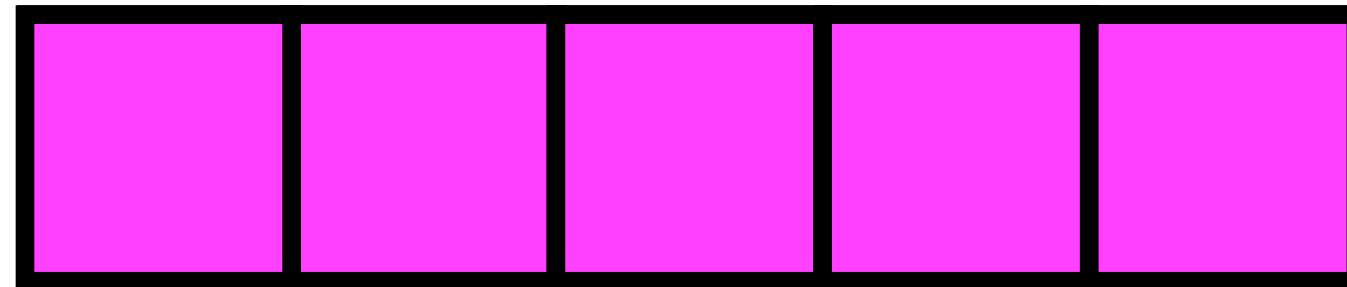


Old objects

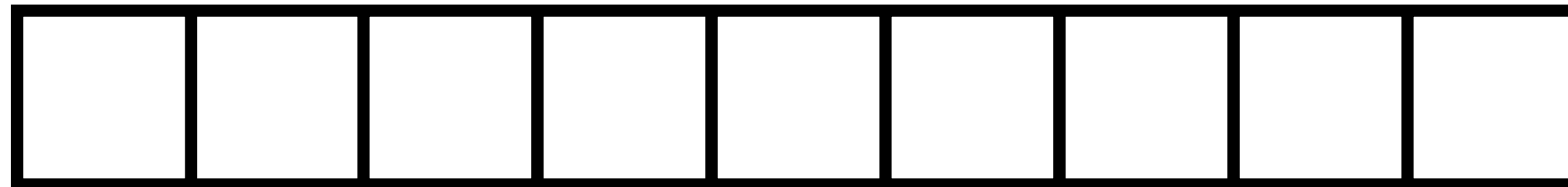


# GENERATIONAL COLLECTION

New objects

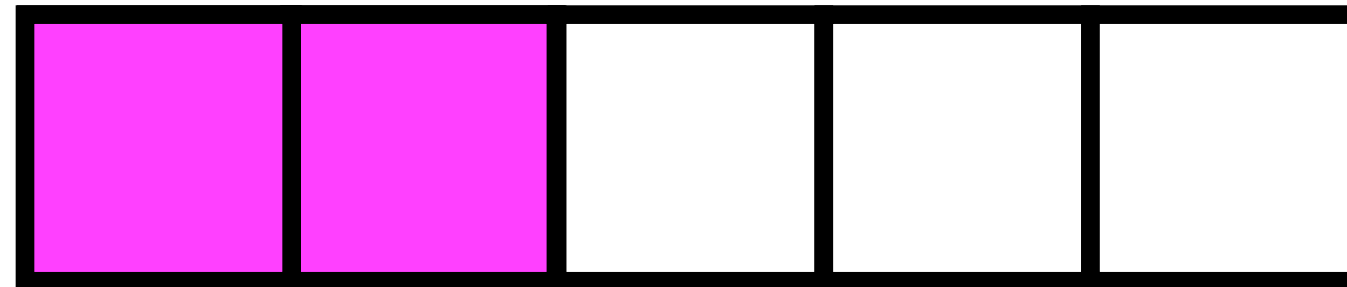


Old objects

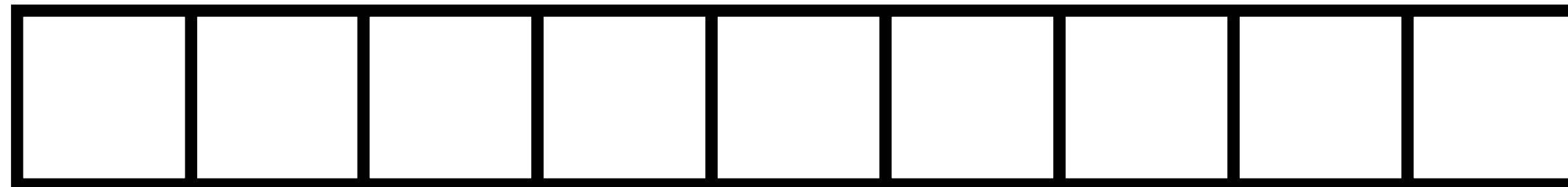


# GENERATIONAL COLLECTION

New objects

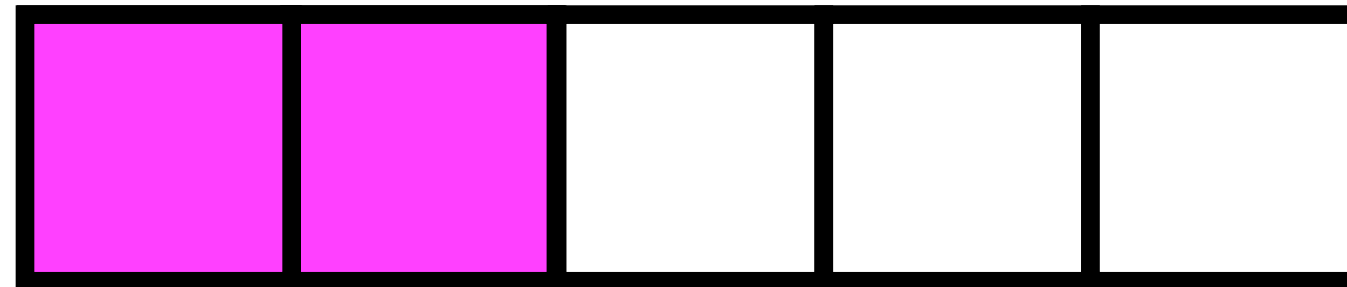


Old objects

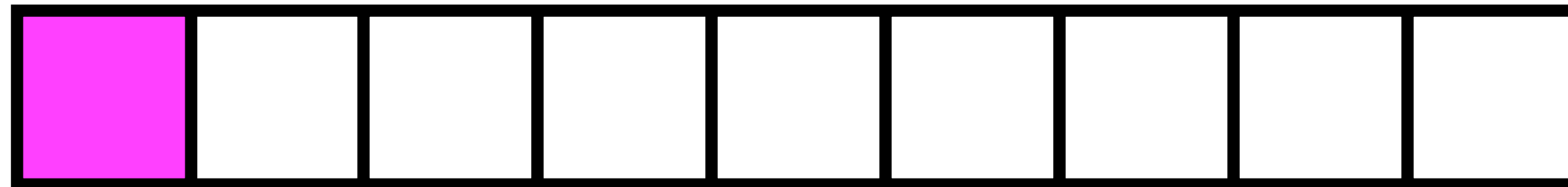


# GENERATIONAL COLLECTION

New objects

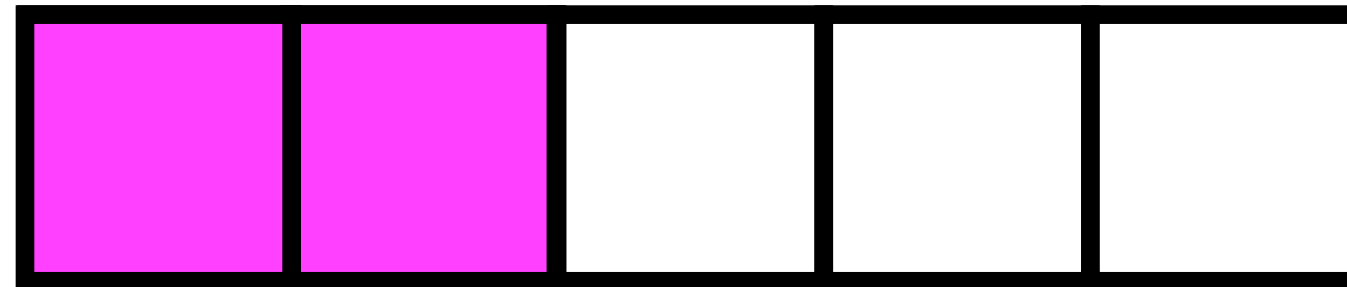


Old objects

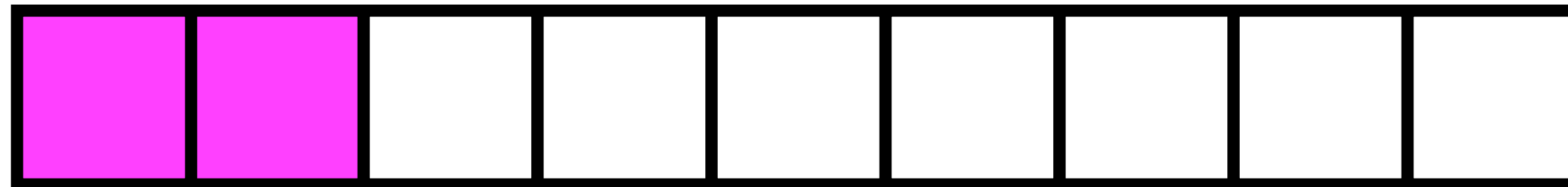


# GENERATIONAL COLLECTION

New objects



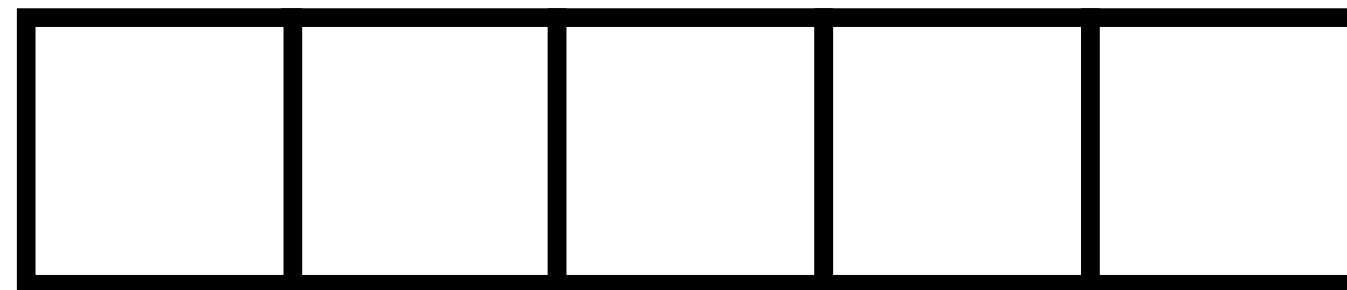
Old objects



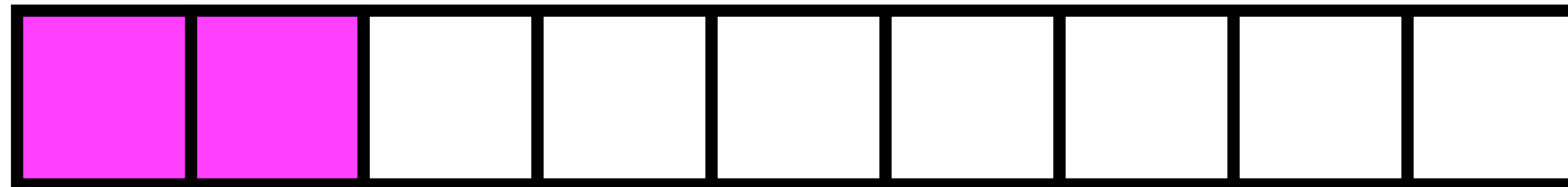


# GENERATIONAL COLLECTION

New objects



Old objects





**Garbage collection is no longer magic!**

# LET ME KNOW WHAT YOU THINK!



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Find me in person later!