

**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



Running out of memory

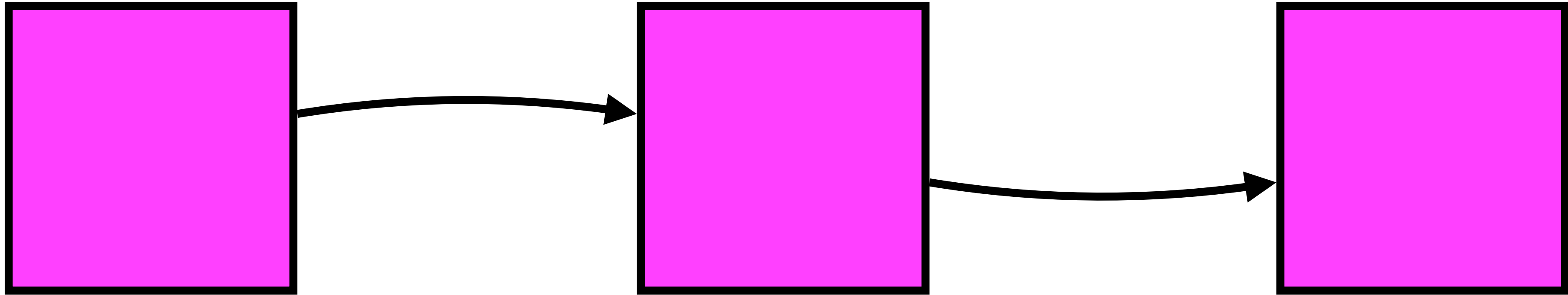


Running out of memory

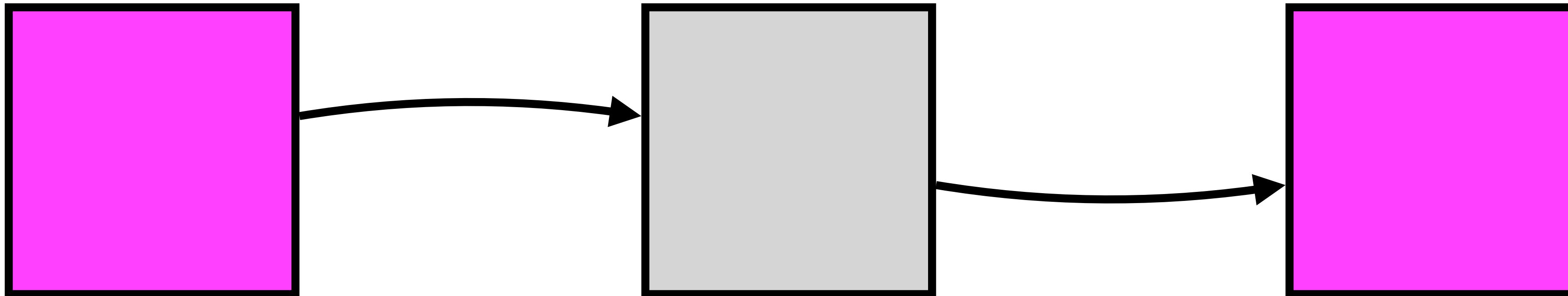


Breaking things

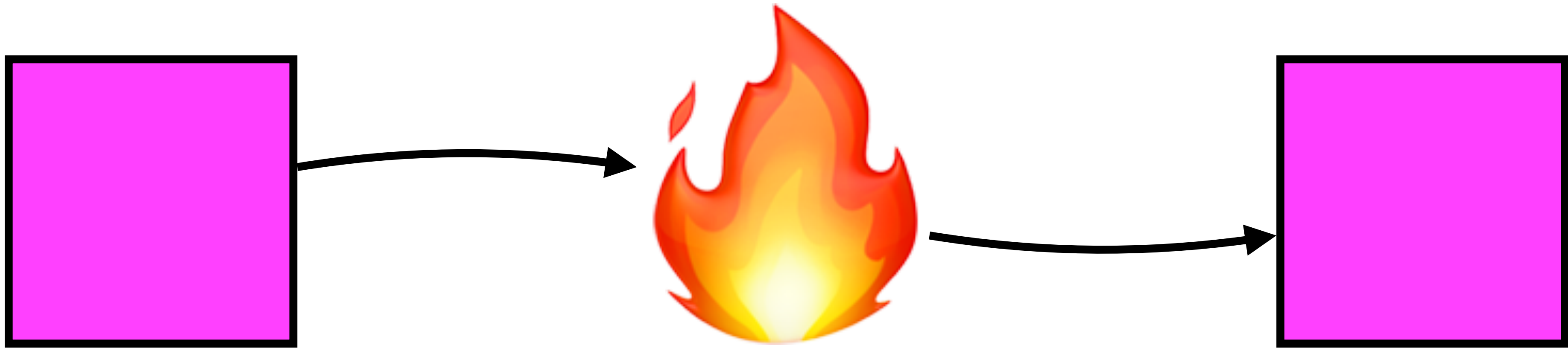
DANGLING POINTERS



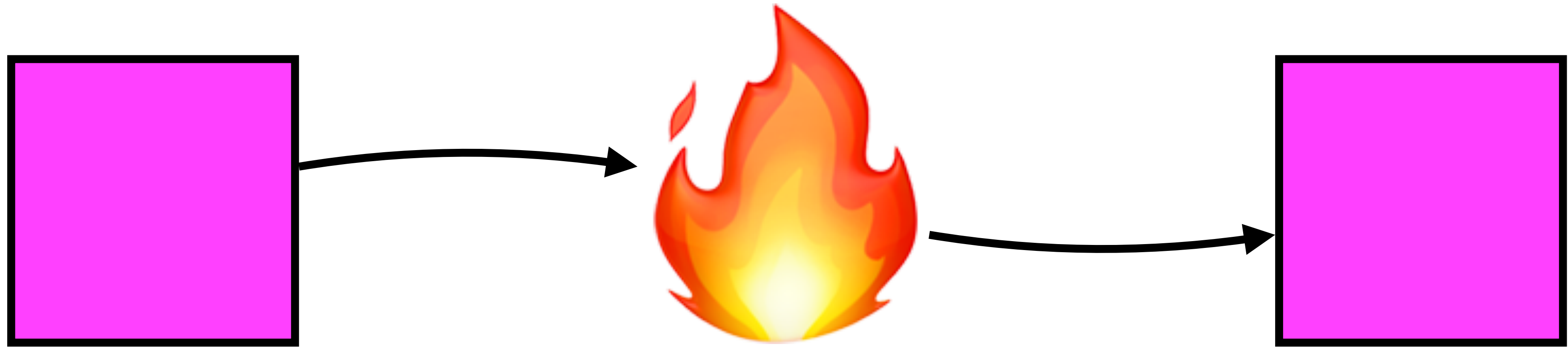
DANGLING POINTERS



DANGLING POINTERS



DANGLING POINTERS



Memory Leak

REFERENCE COUNTING

If nothing points to it, nothing's using it

REFERENCE COUNTING

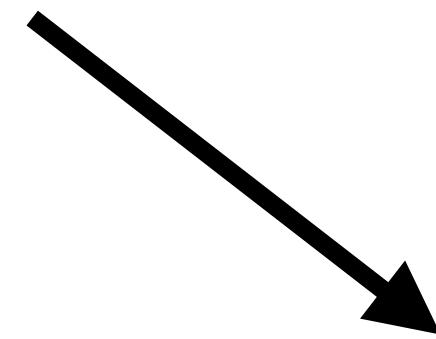
REFERENCE COUNTING

`name = "nodefest"`

REFERENCE COUNTING

name = "nodefest"

name

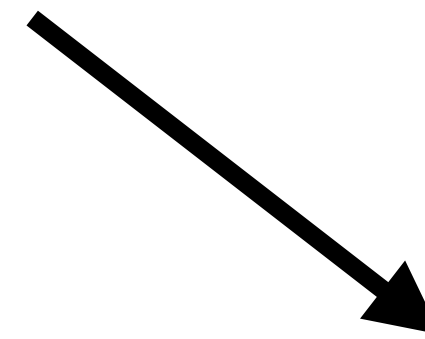


"nodefest"	1
------------	---

REFERENCE COUNTING

```
name = "nodefest"  
other_name = name
```

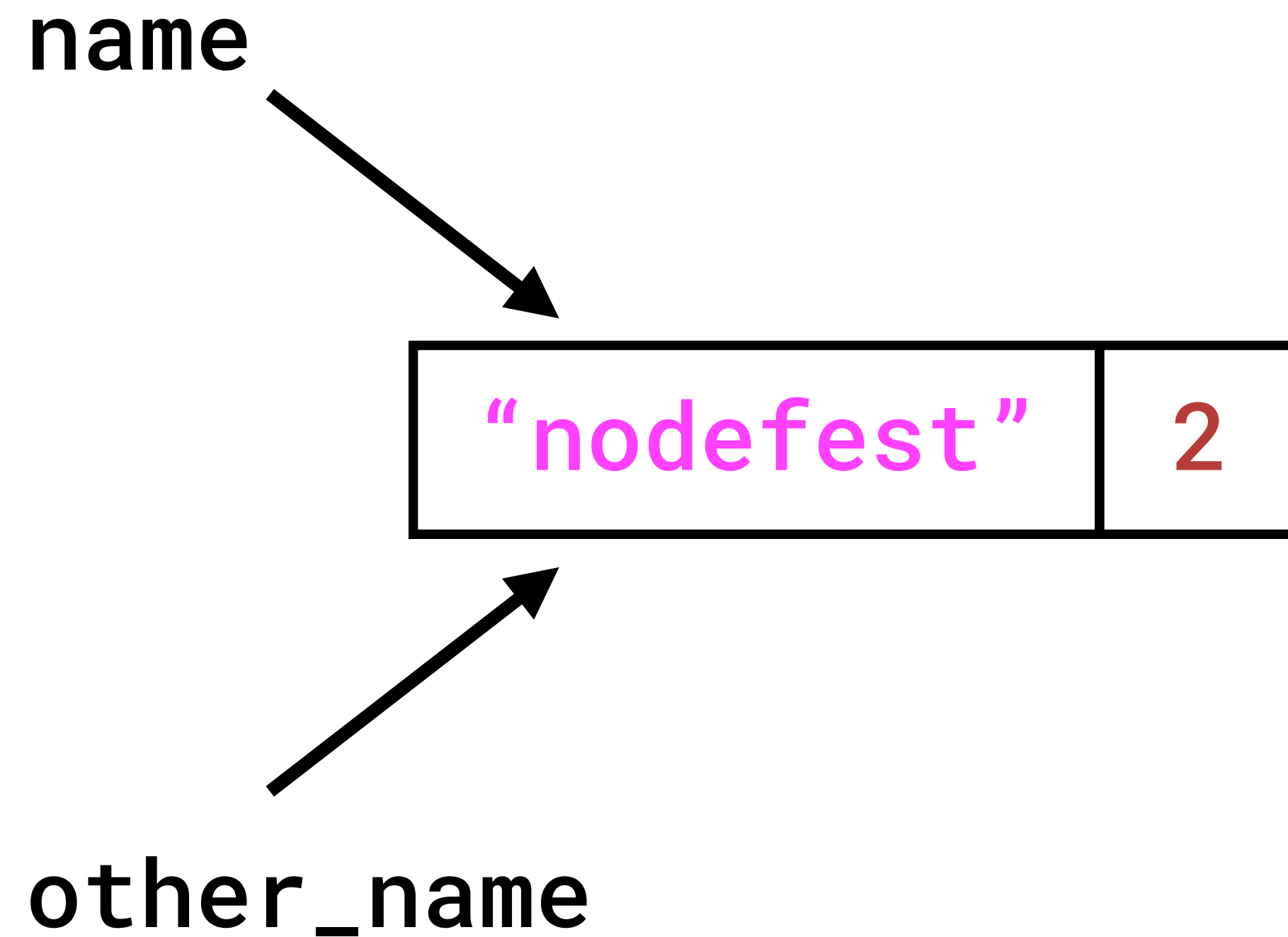
name



"nodefest"	1
------------	---

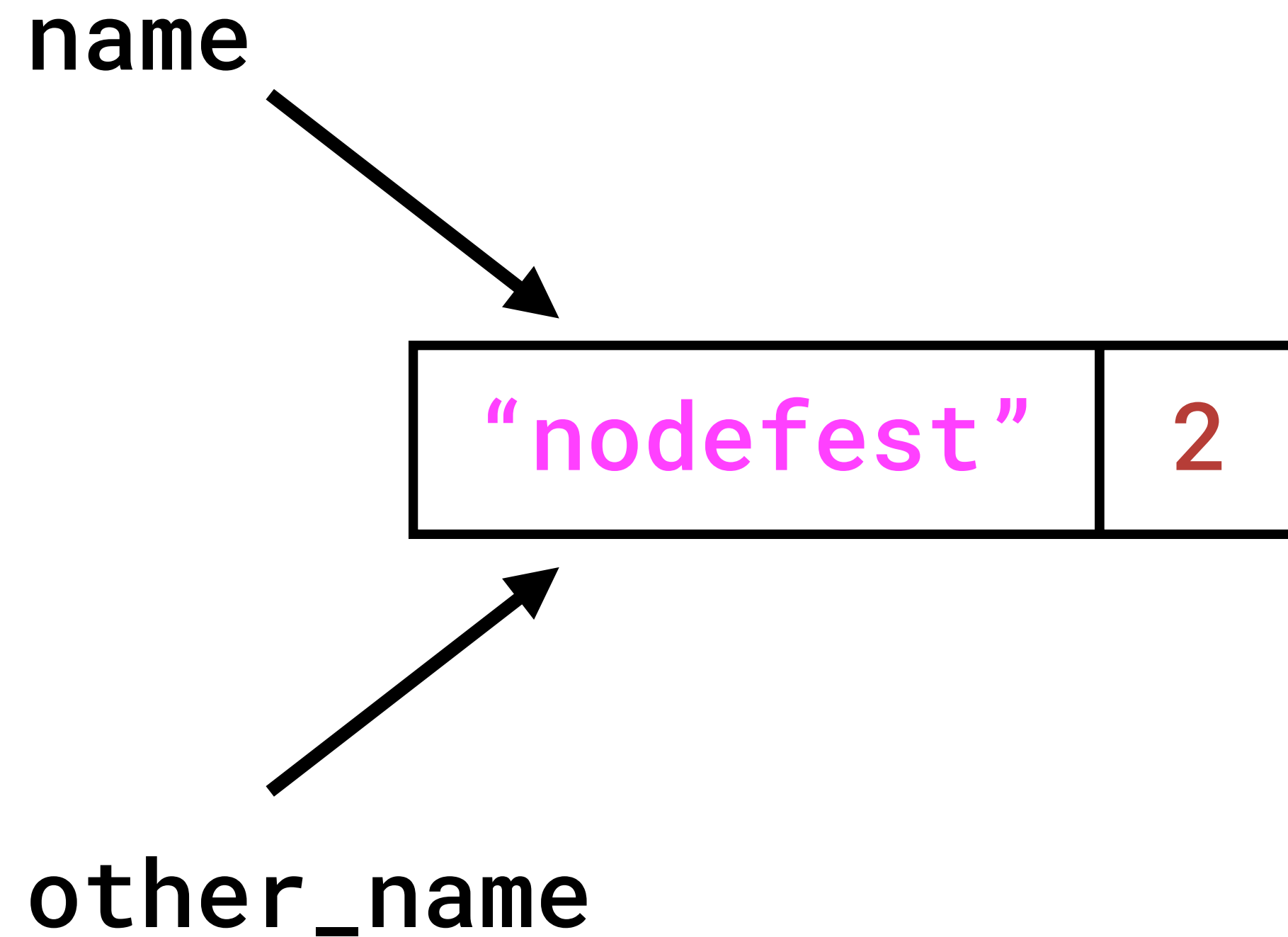
REFERENCE COUNTING

```
name = "nodefest"  
other_name = name
```



REFERENCE COUNTING

```
name = "nodefest"  
other_name = name  
  
name = nil
```



REFERENCE COUNTING

```
name = "nodefest"  
other_name = name  
  
name = nil
```

name



other_name

REFERENCE COUNTING

```
name = "nodefest"  
other_name = name
```

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

name



other_name

REFERENCE COUNTING

name

```
name = "nodefest"  
other_name = name
```

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



other_name

REFERENCE COUNTING

name

```
name = "nodefest"  
other_name = name
```

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



other_name

CYCLES

CYCLES

```
a = {  
  other: nil  
}
```

CYCLES

```
a = {  
  other: nil  
}
```



CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```



CYCLES

```
a = {  
  other: nil  
}
```

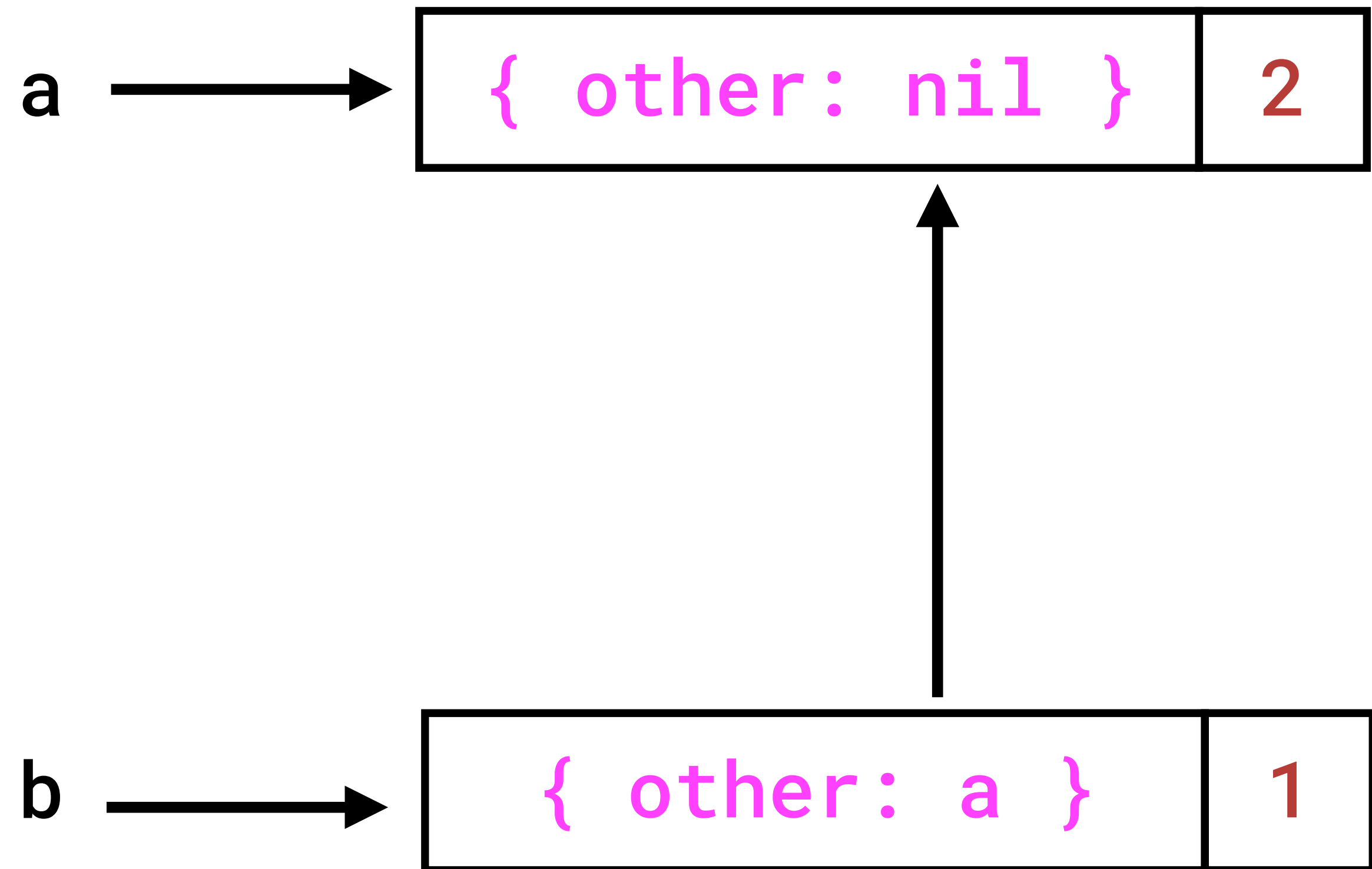
```
b = {  
  other: a  
}
```



CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

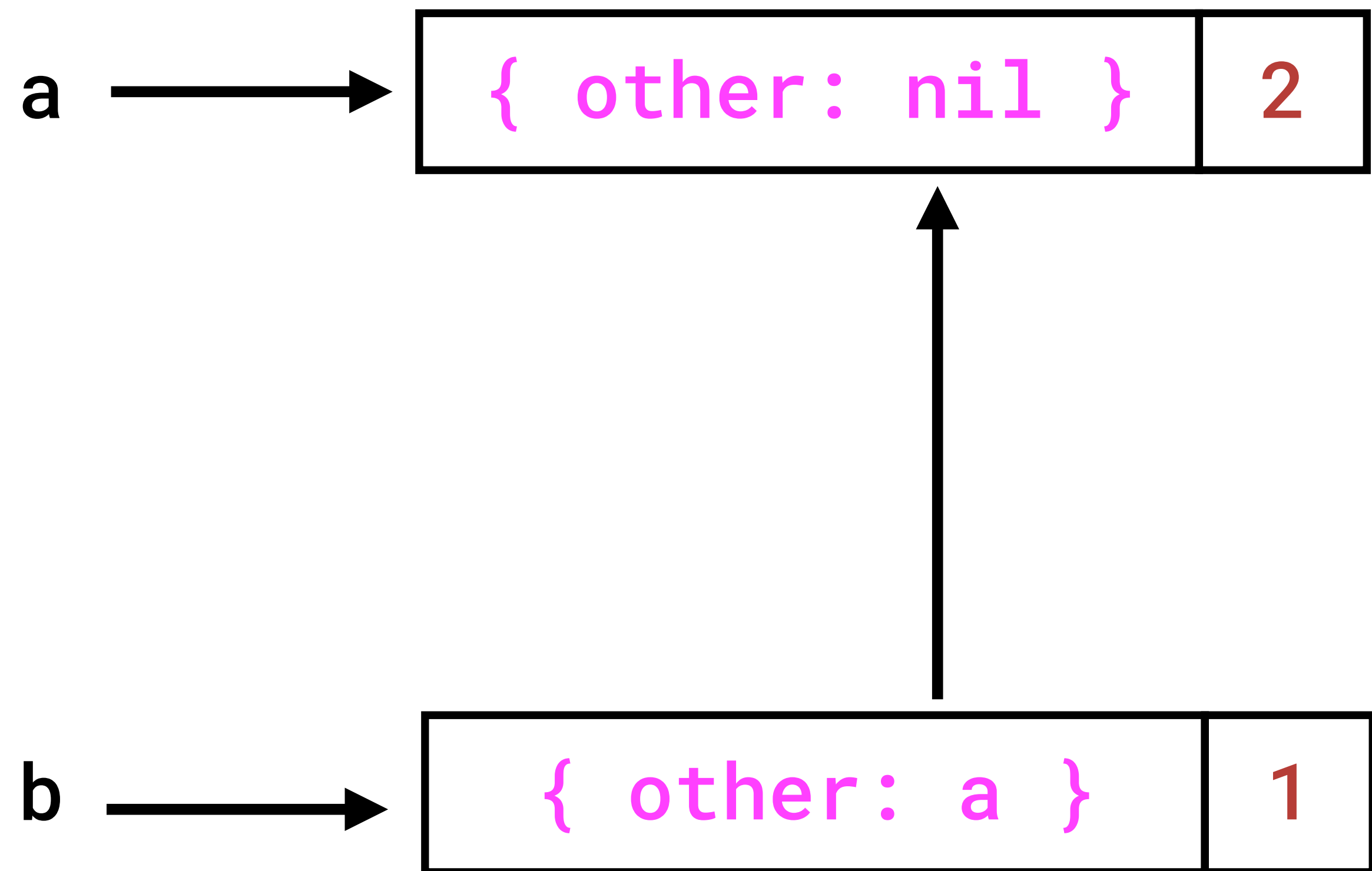


CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

```
a[:other] = b
```

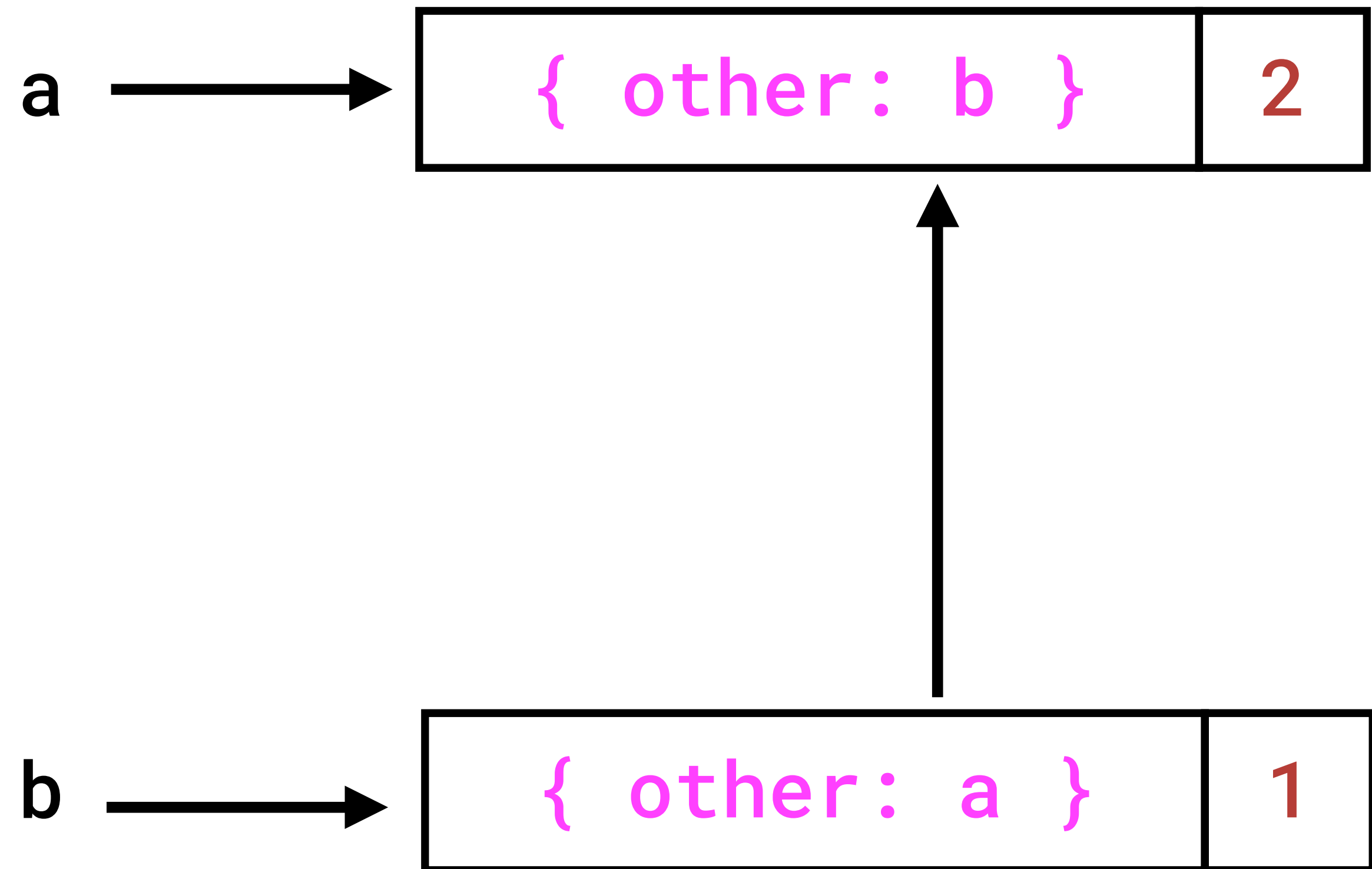


CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

```
a[:other] = b
```

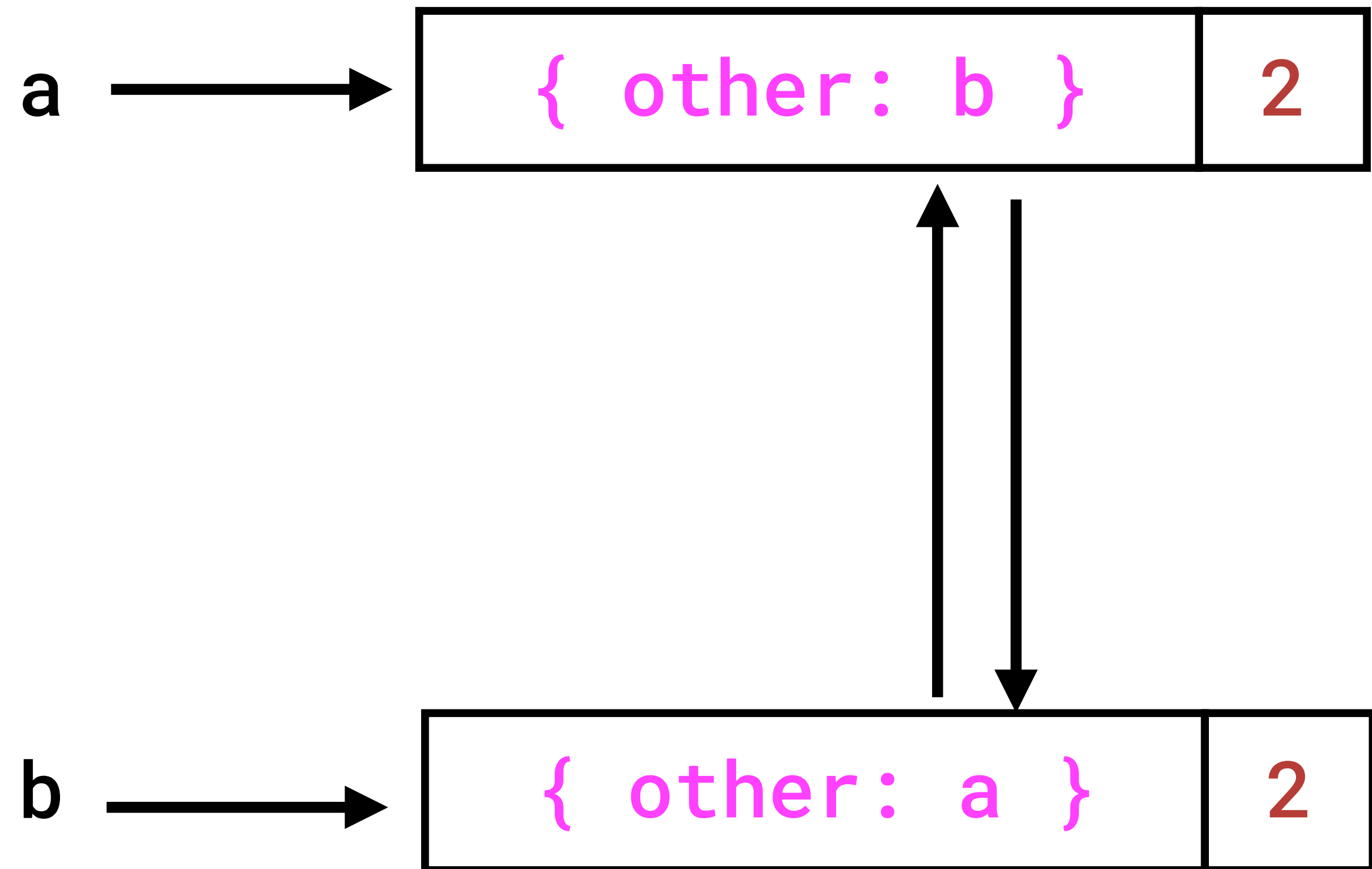


CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

```
a[:other] = b
```



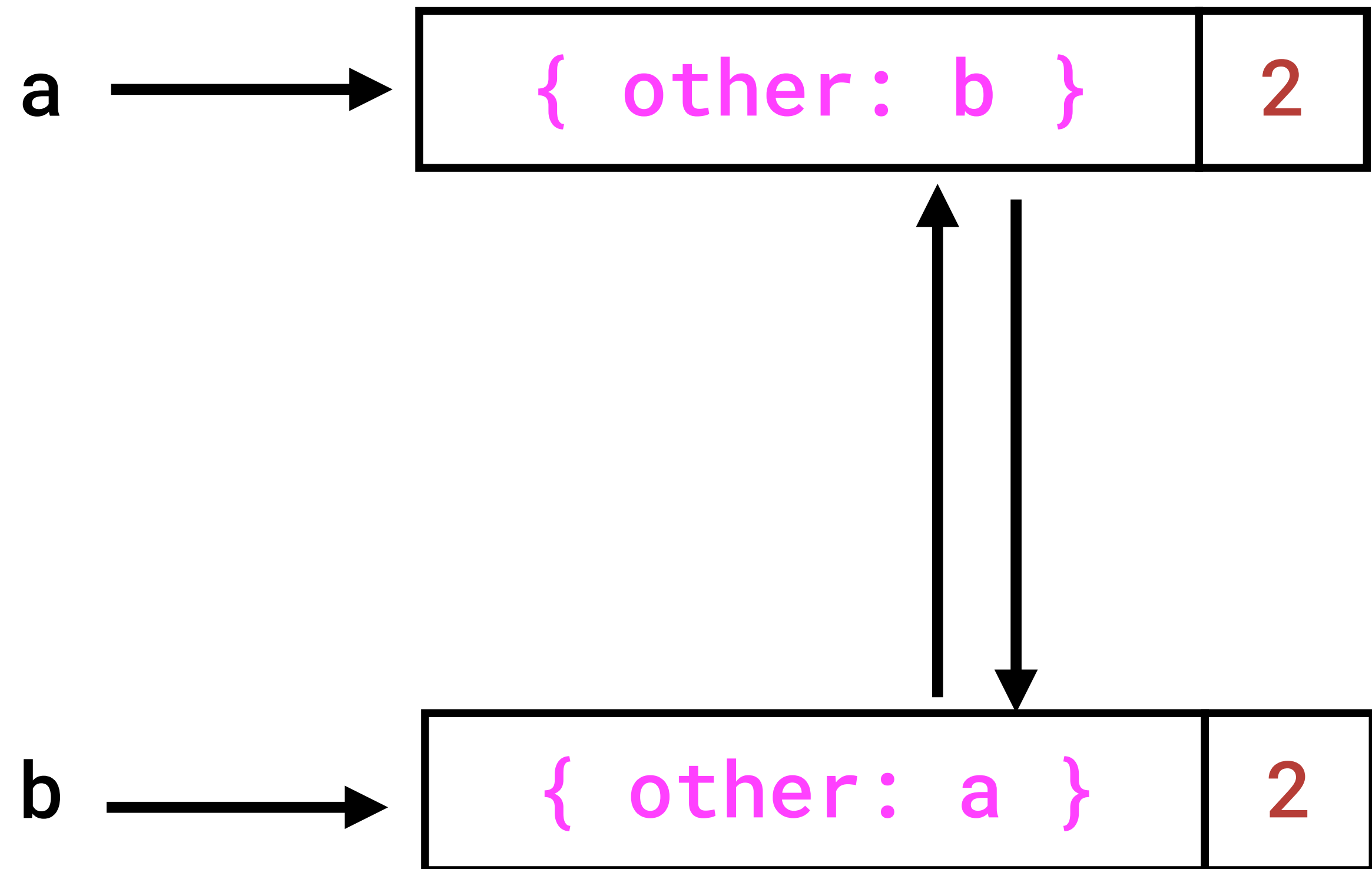
CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

```
a[:other] = b
```

```
a = nil  
b = nil
```



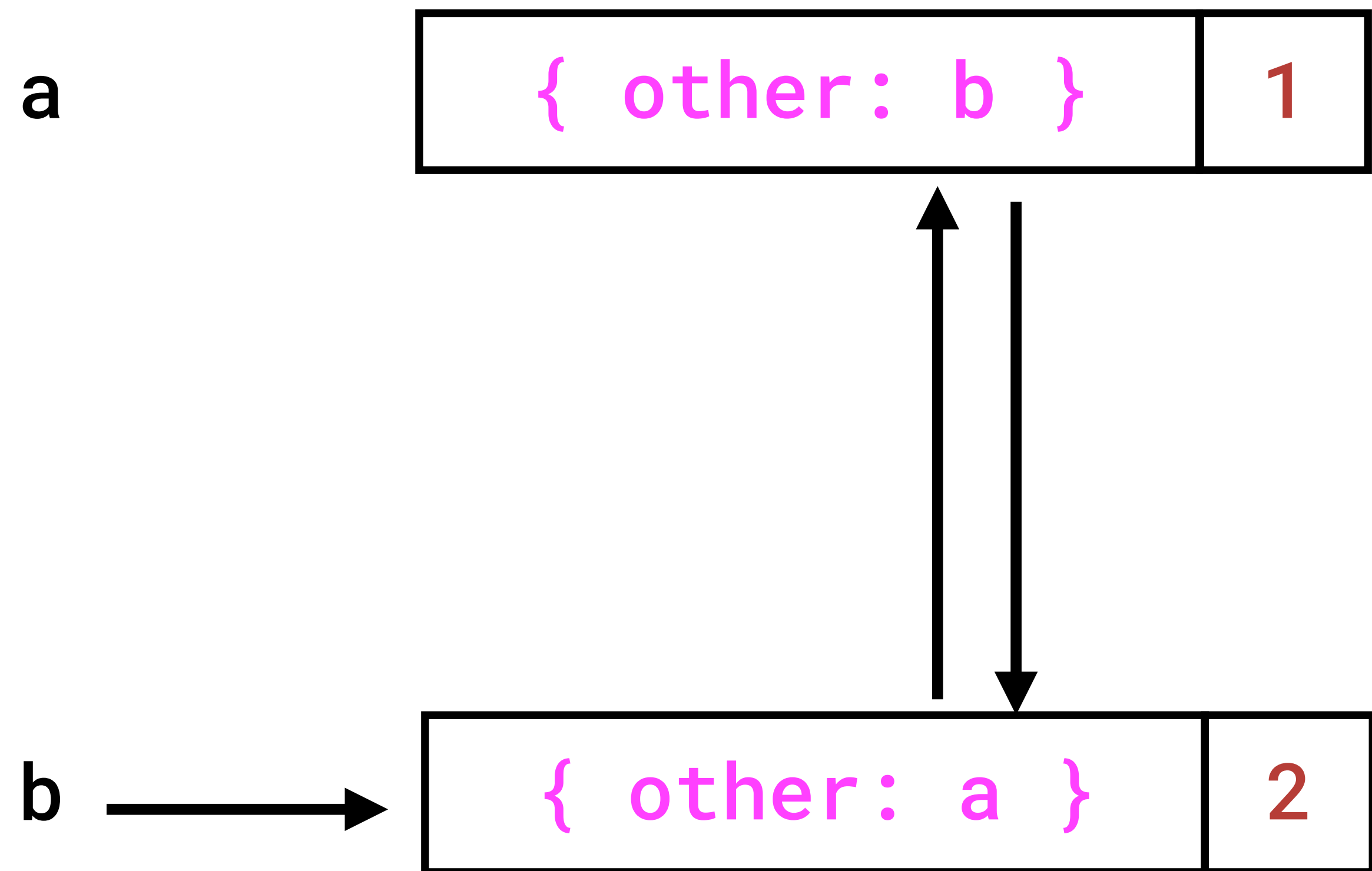
CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

```
a[:other] = b
```

```
a = nil  
b = nil
```



CYCLES

```
a = {  
  other: nil  
}
```

```
b = {  
  other: a  
}
```

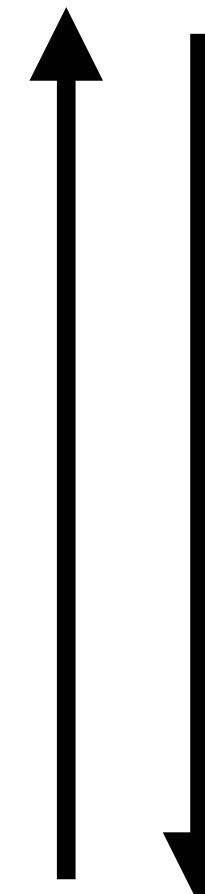
```
a[:other] = b
```

```
a = nil  
b = nil
```

a



b



MARK & SWEEP

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



NY - NI

NO - NPA

NOA - NONG

TUR - UZ

YOHU - Z

N - NUC

PRE - Q

SONN - STA

[Empty label]

[Empty label]

NUC - NI

R - RUC

STR - SU

WAN - WED

[Empty label]

U - UUC

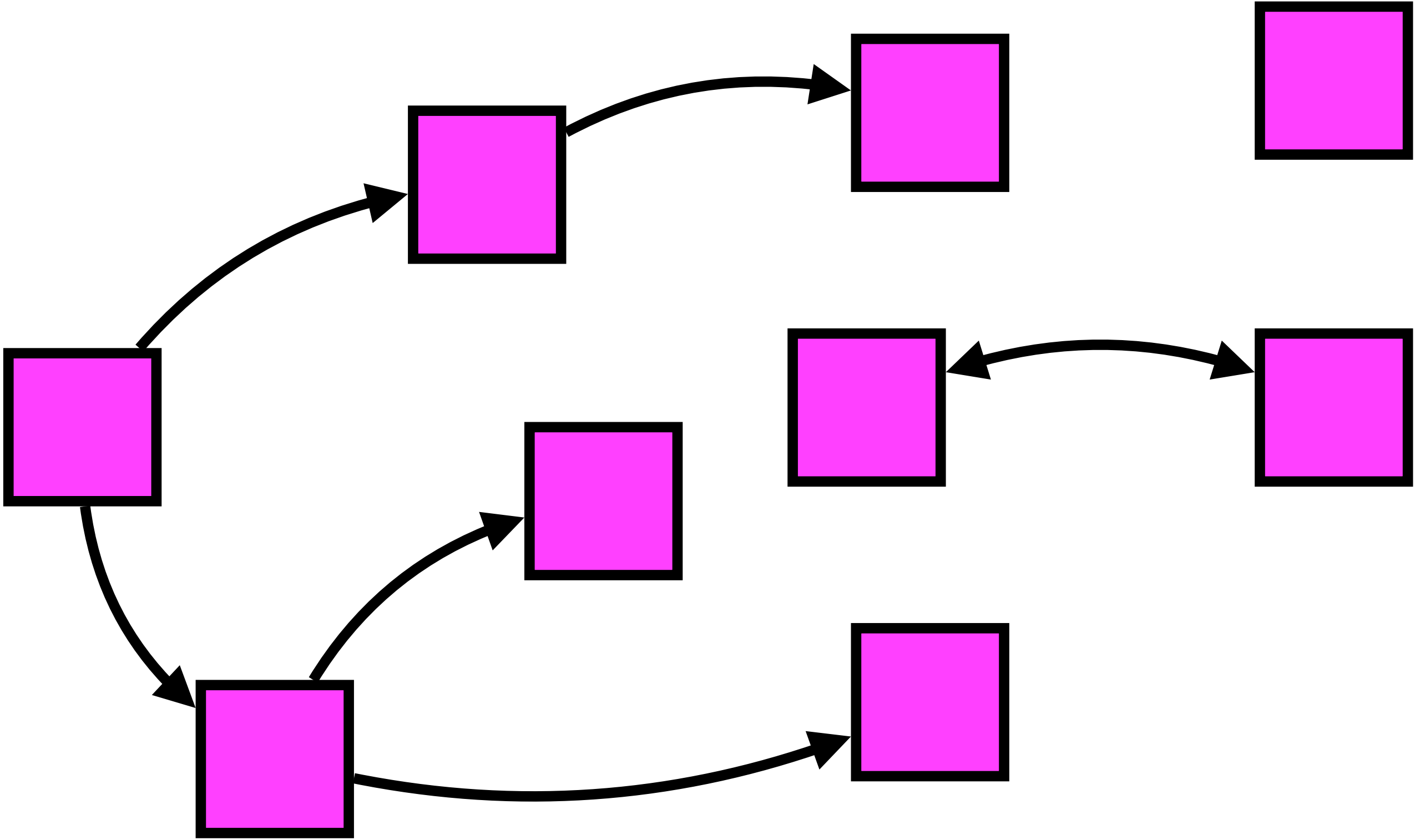
EST - ROR

SW - SZ

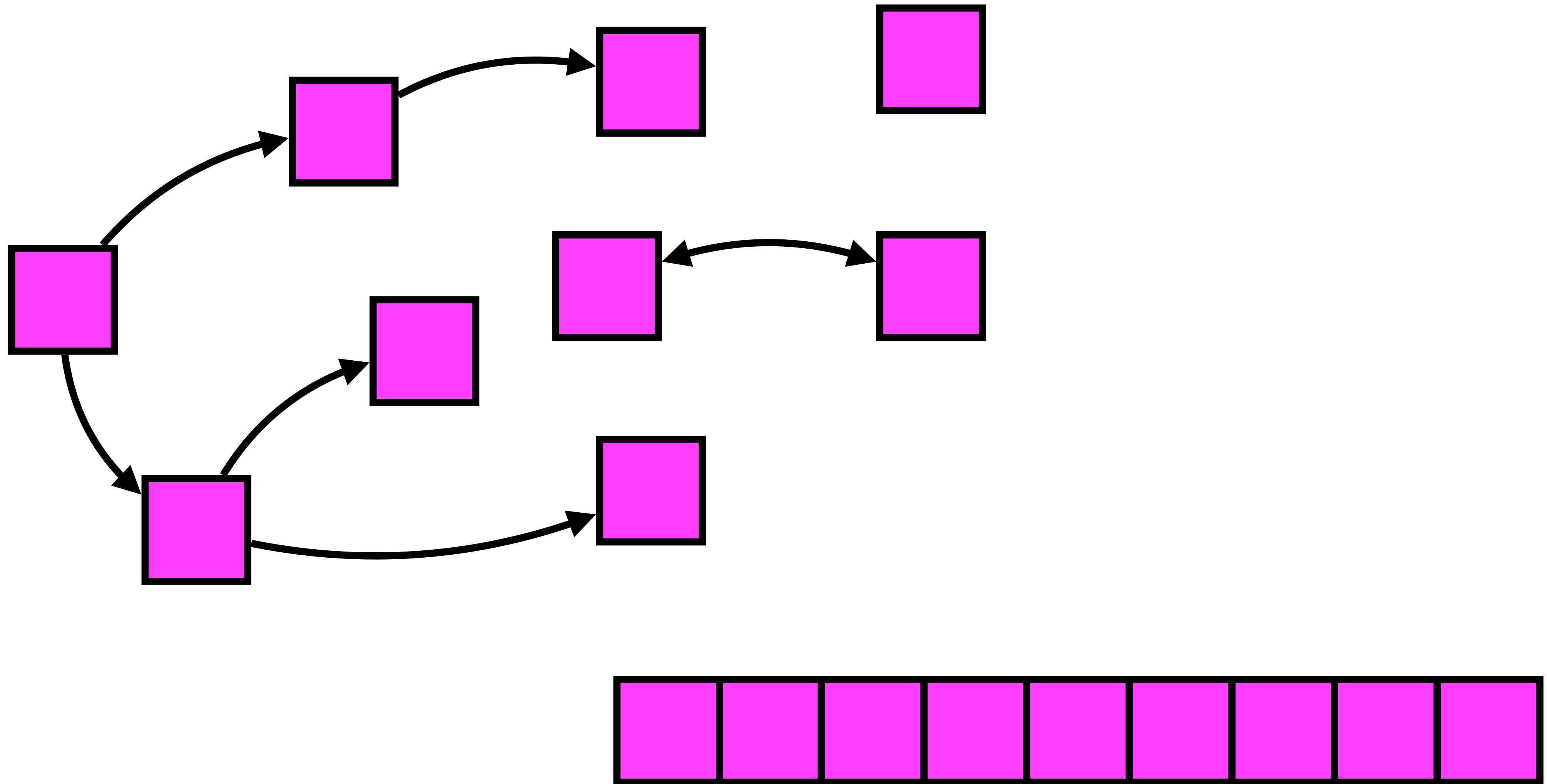
WEE - WIA

[Empty label]

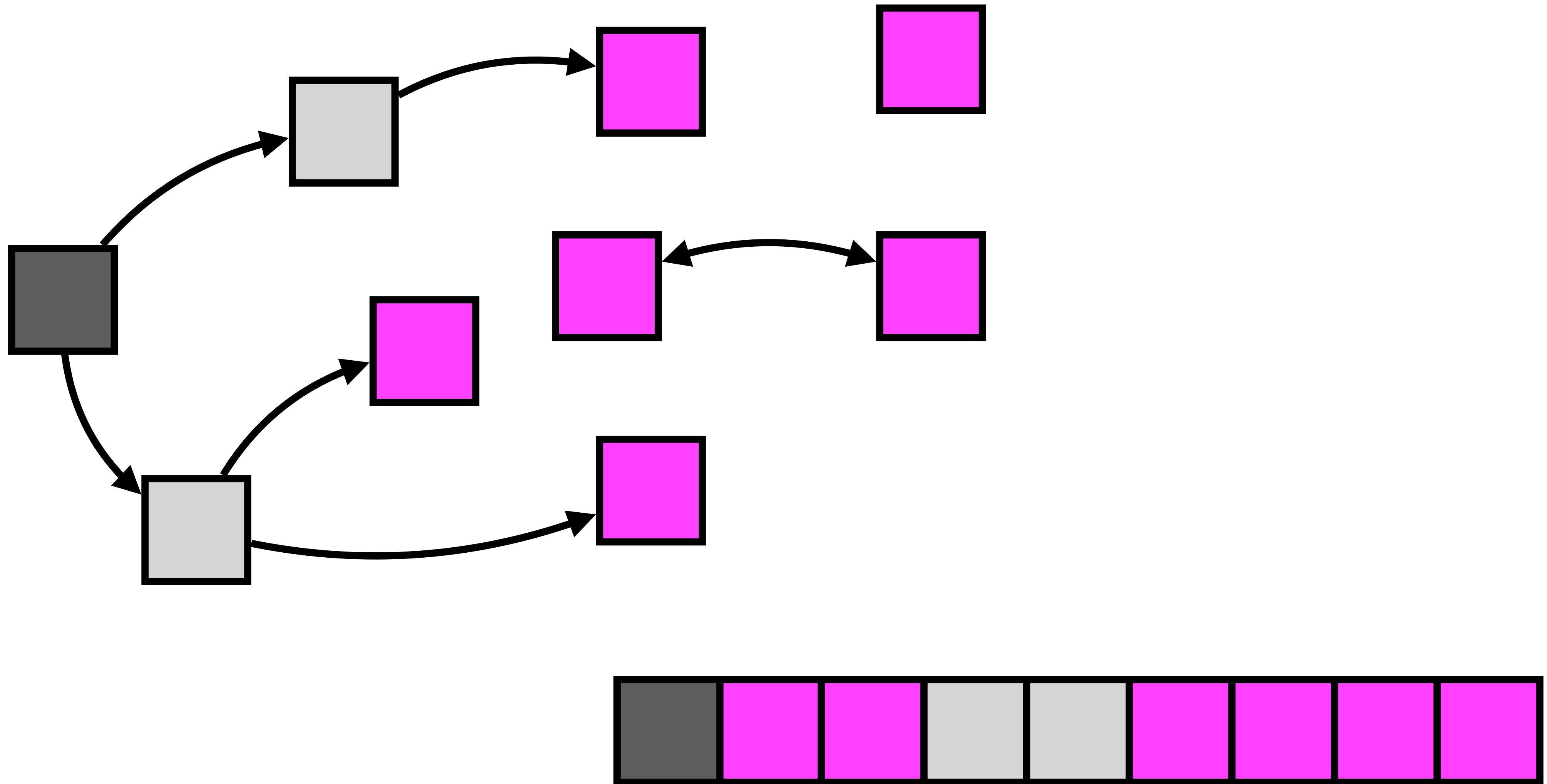
MARK & SWEEP



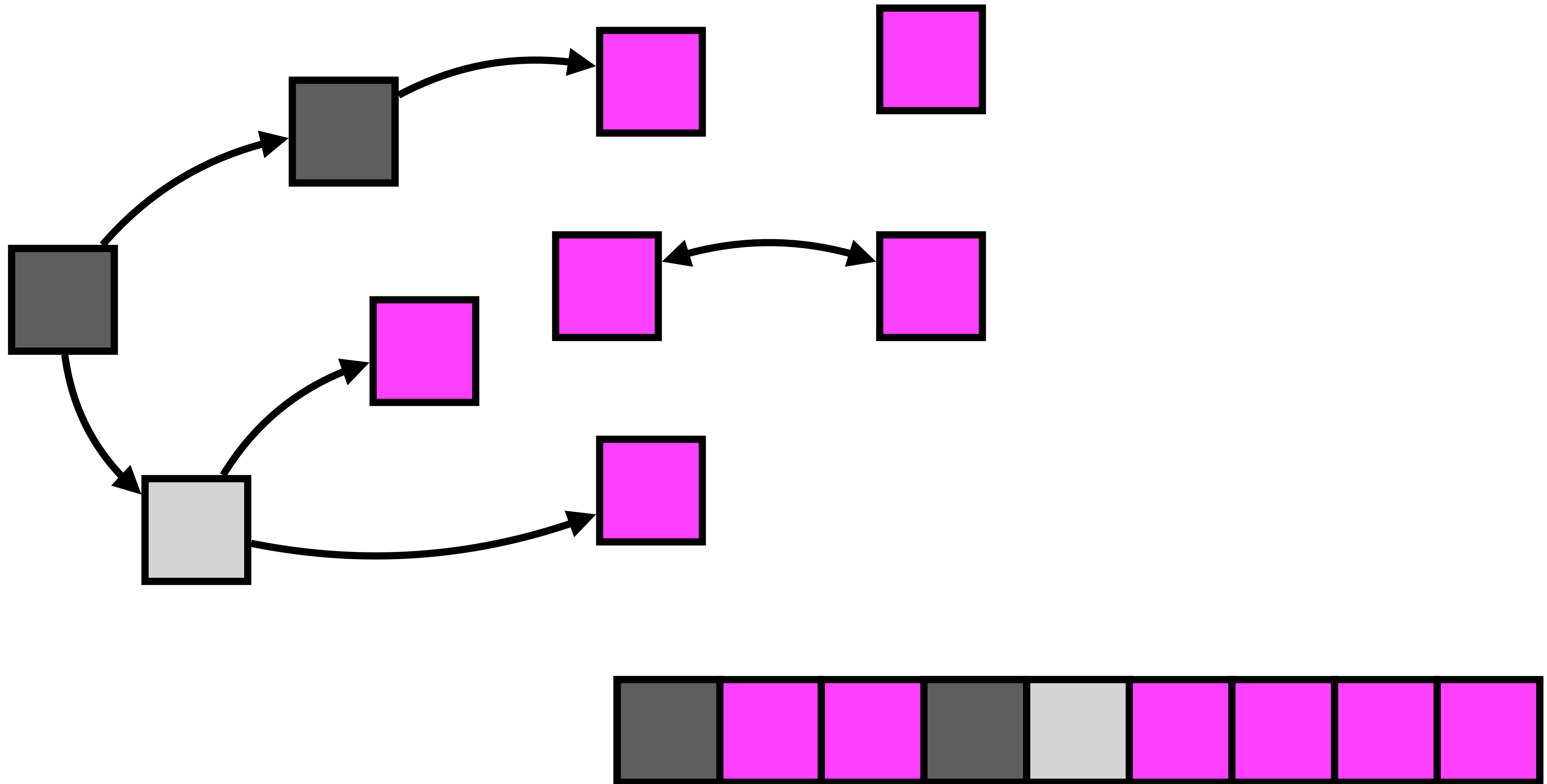
MARK & SWEEP



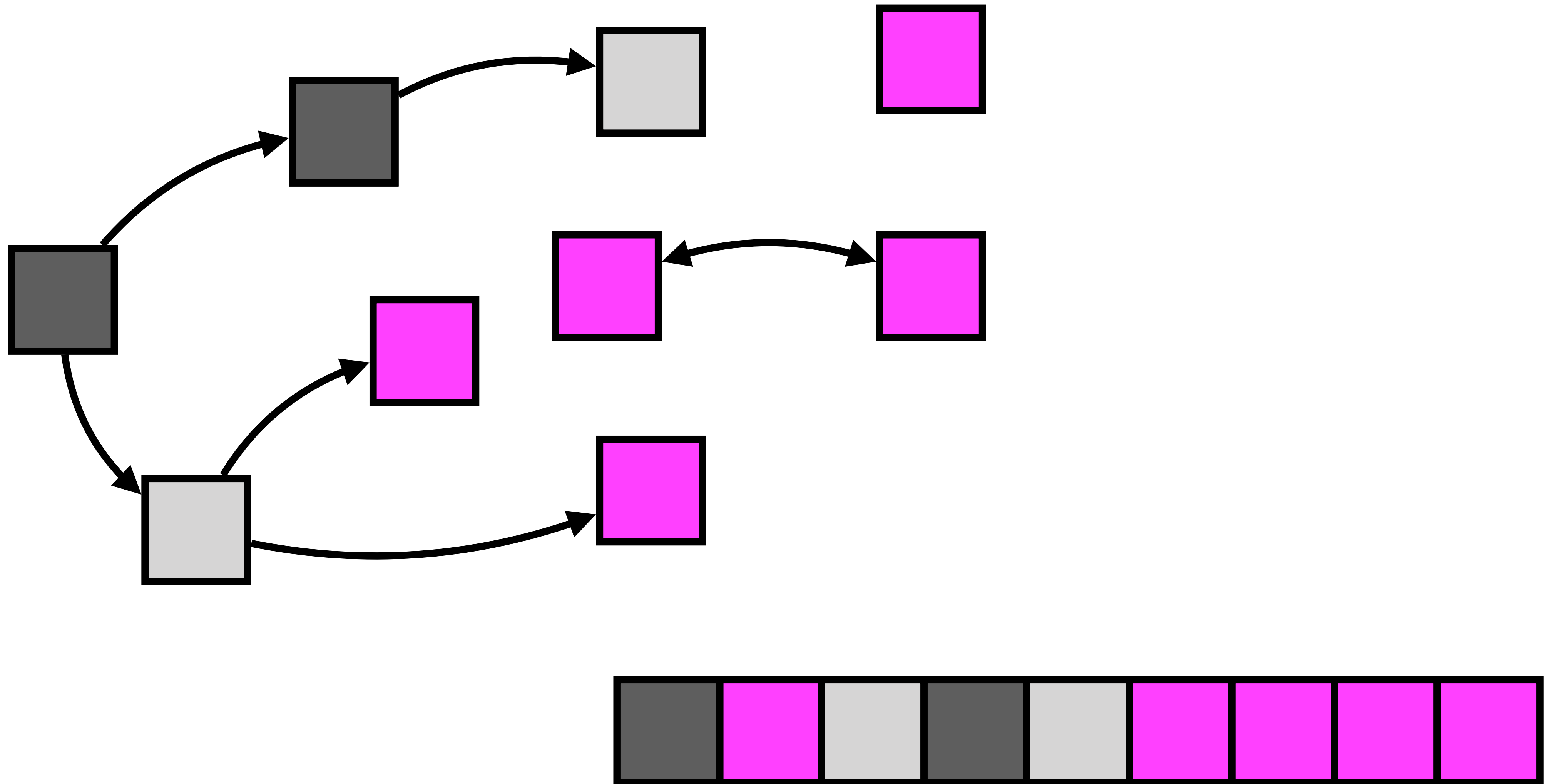
MARK & SWEEP



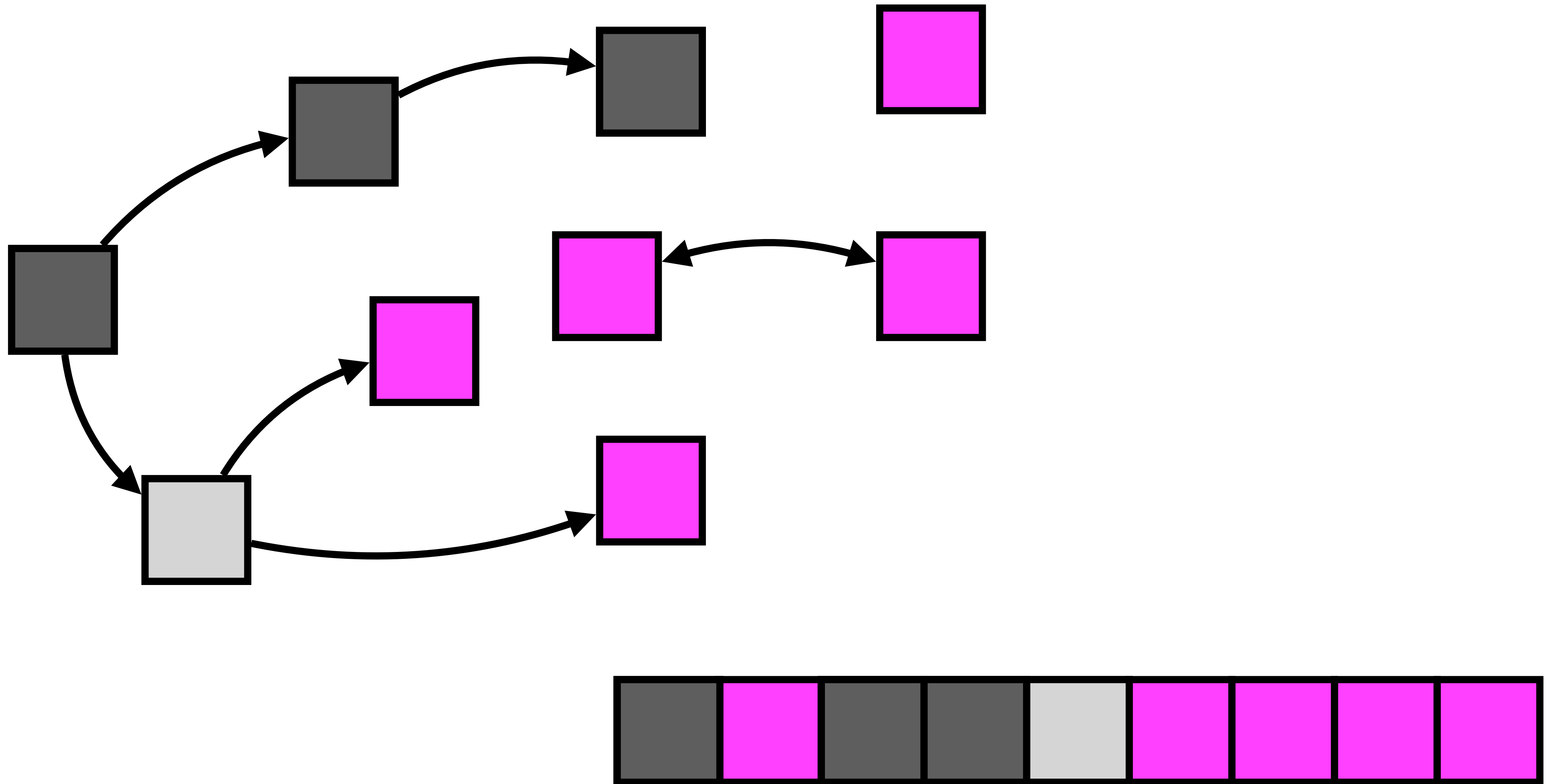
MARK & SWEEP



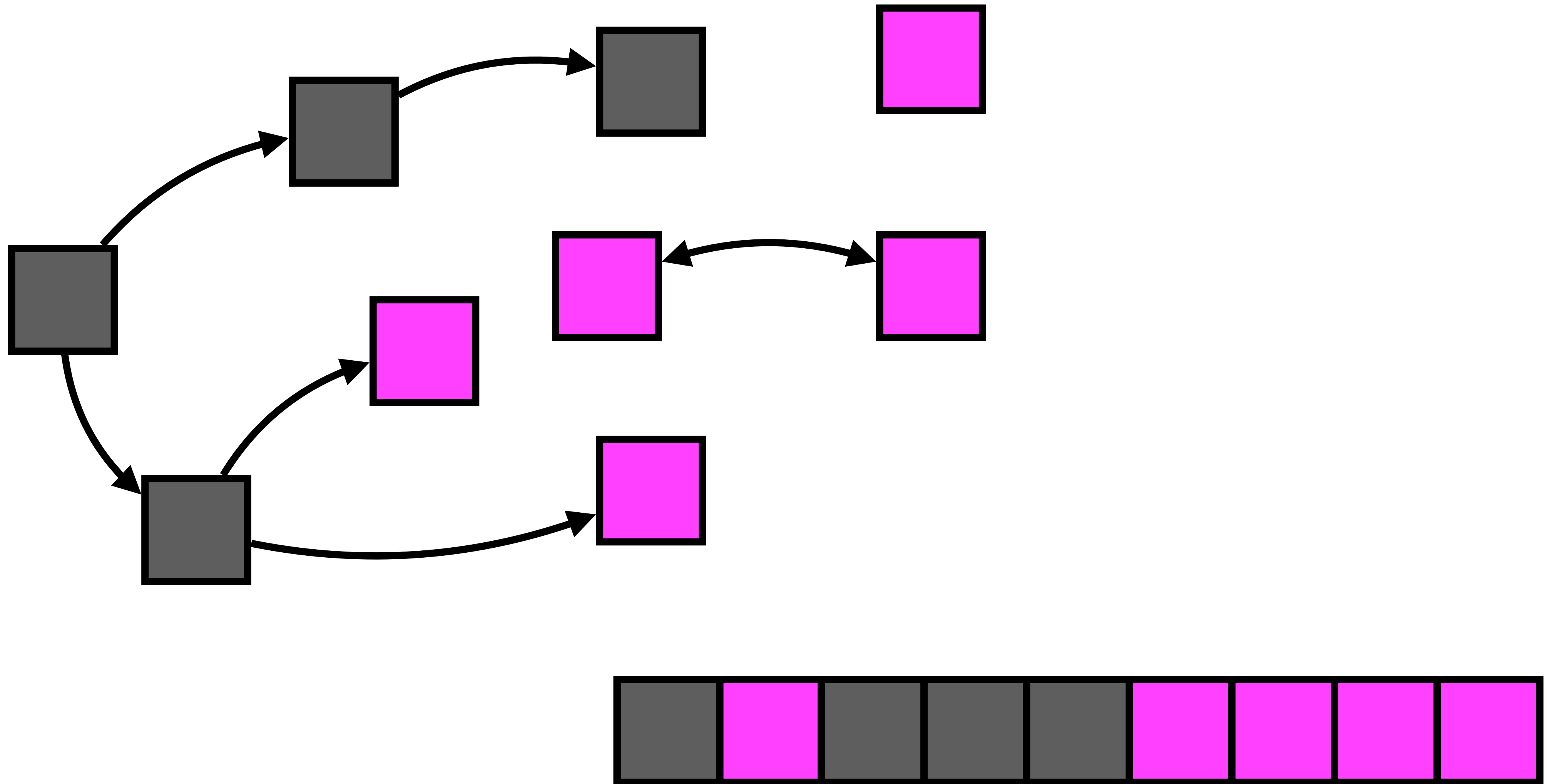
MARK & SWEEP



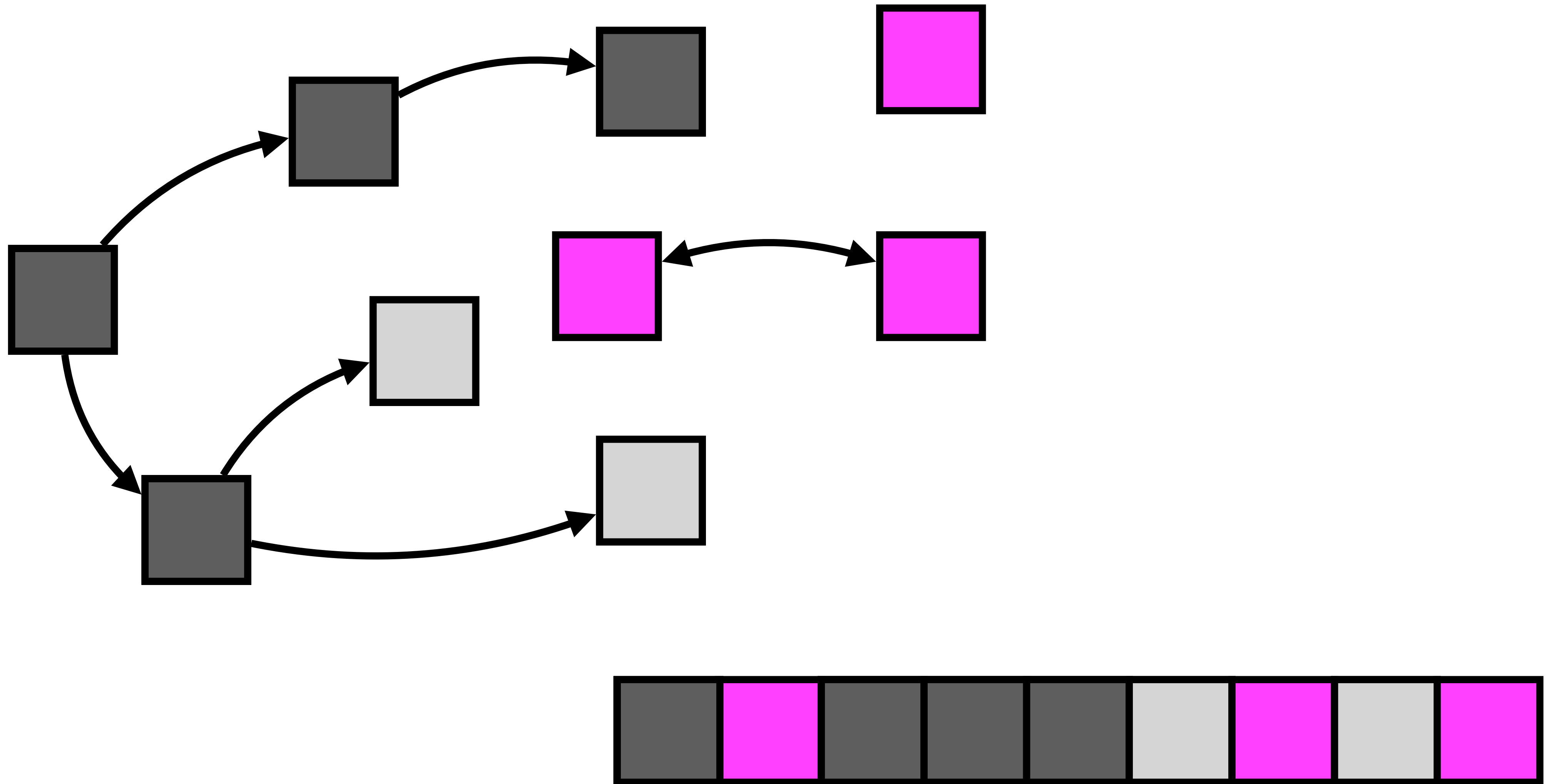
MARK & SWEEP



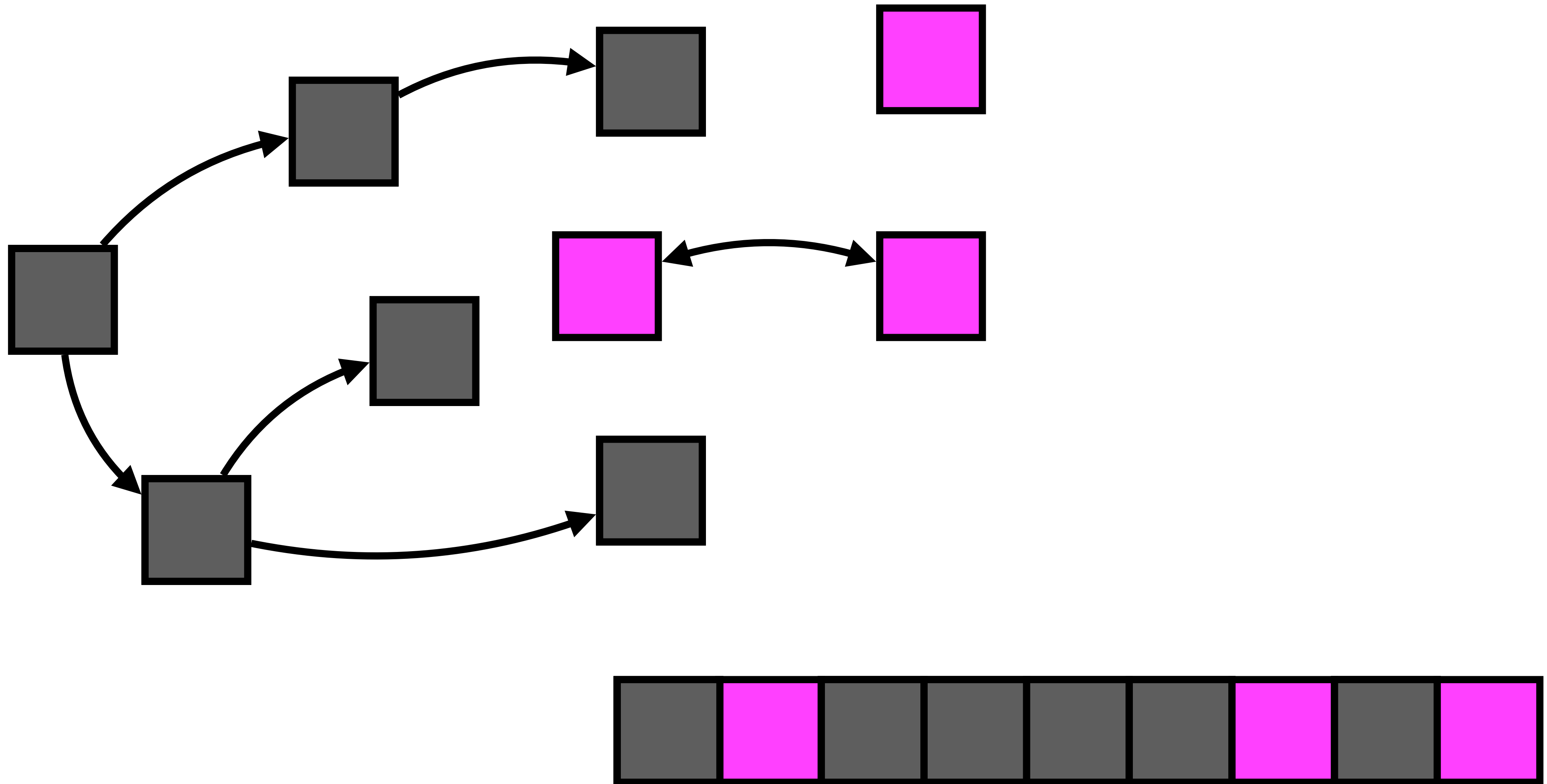
MARK & SWEEP



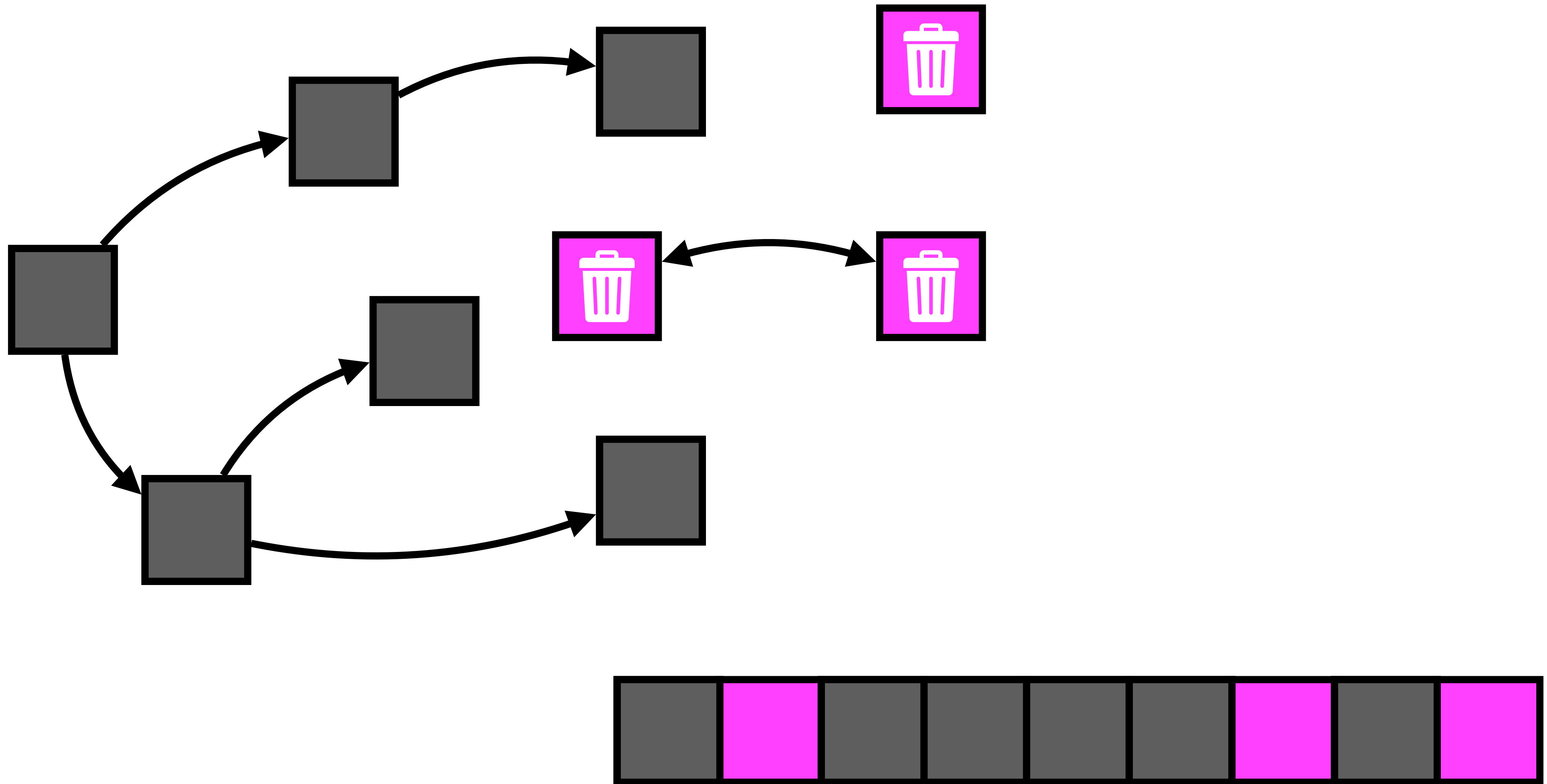
MARK & SWEEP



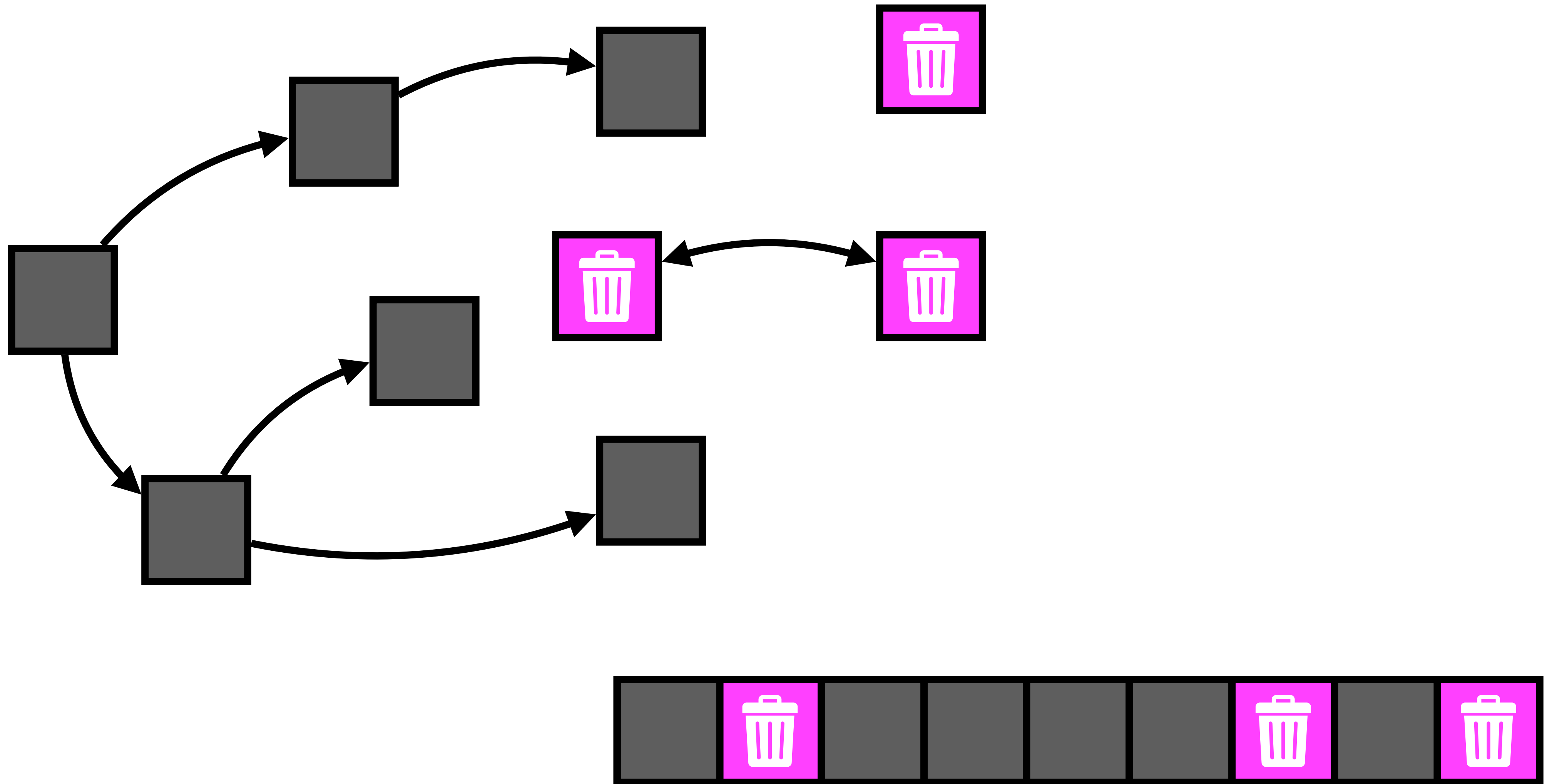
MARK & SWEEP



MARK & SWEEP



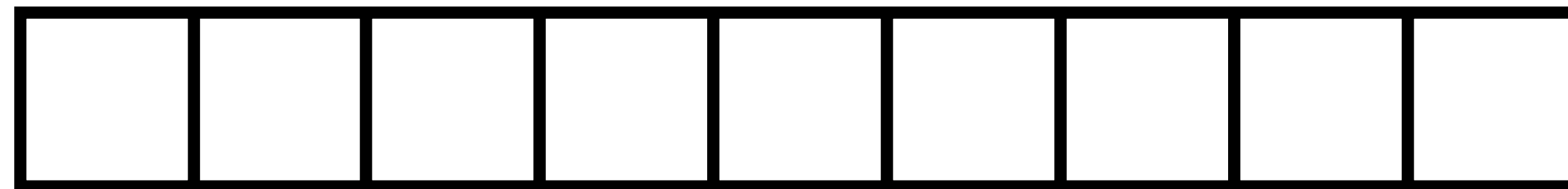
MARK & SWEEP



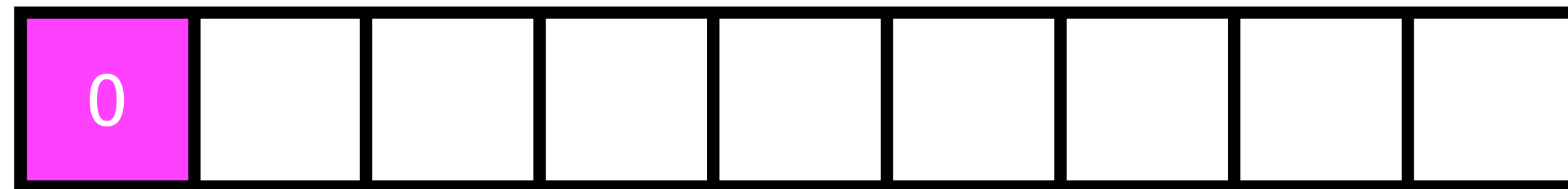
COPYING COLLECTION

Keep your stuff together

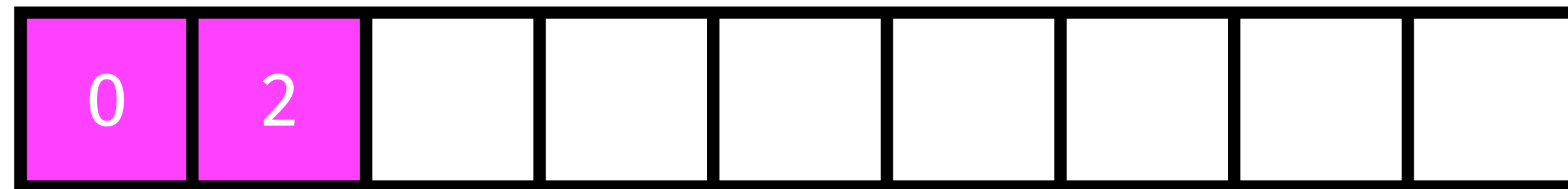
COPYING COLLECTION



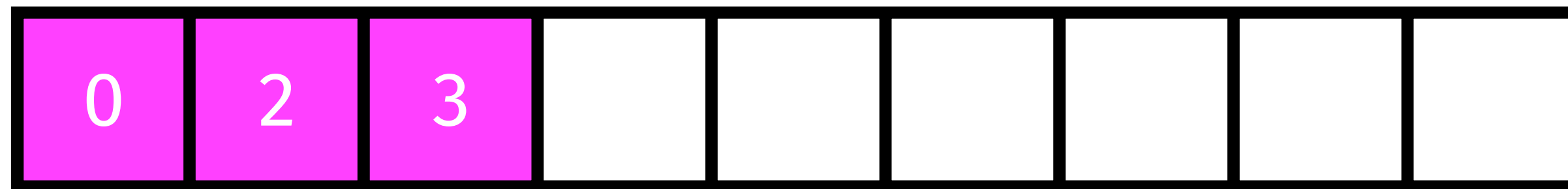
COPYING COLLECTION



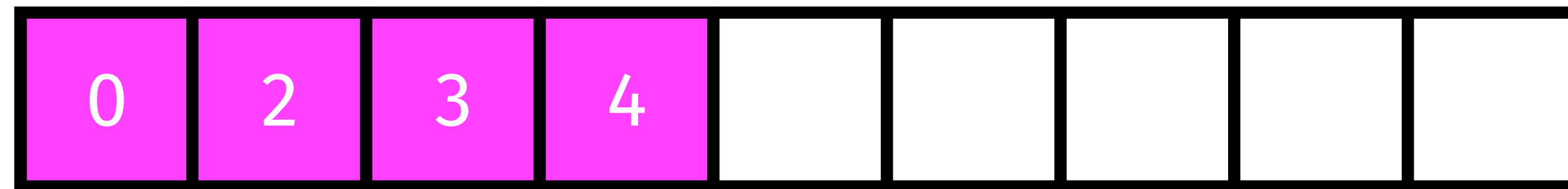
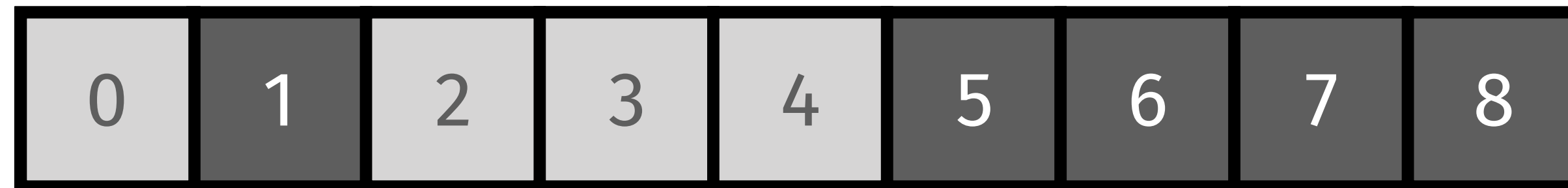
COPYING COLLECTION



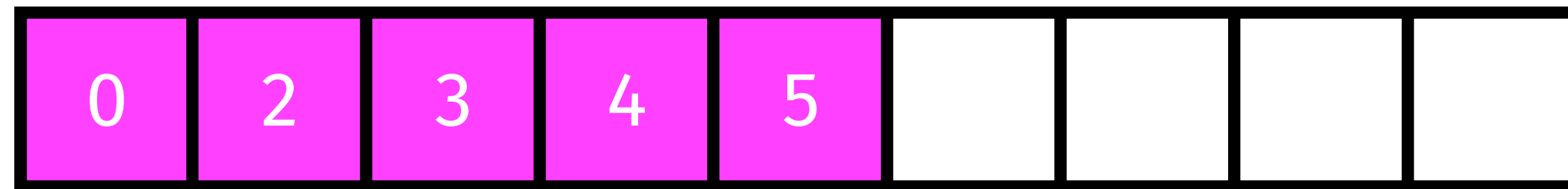
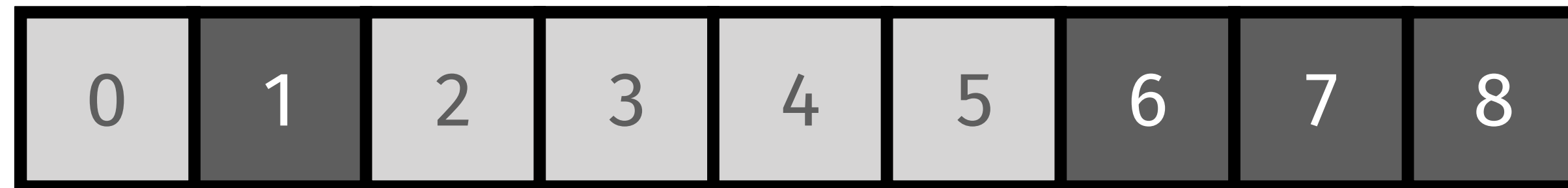
COPYING COLLECTION



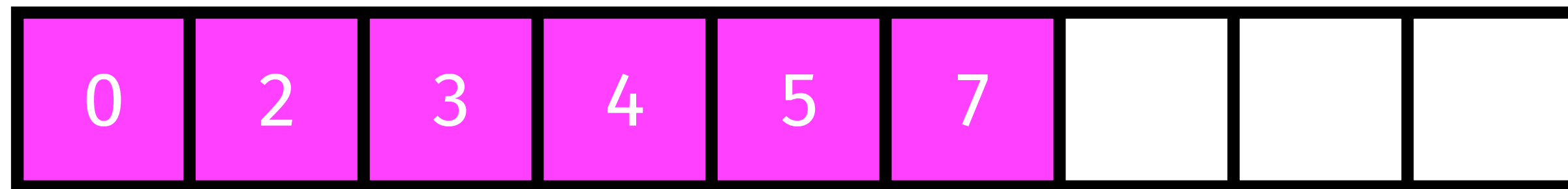
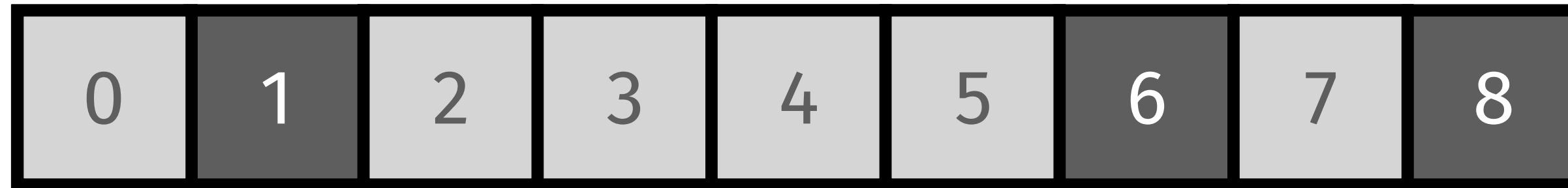
COPYING COLLECTION



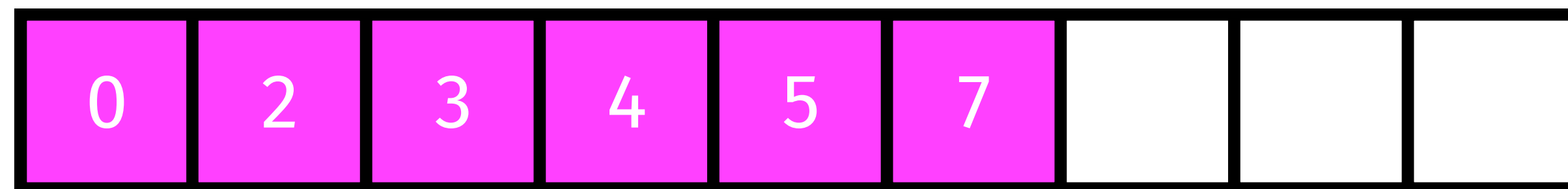
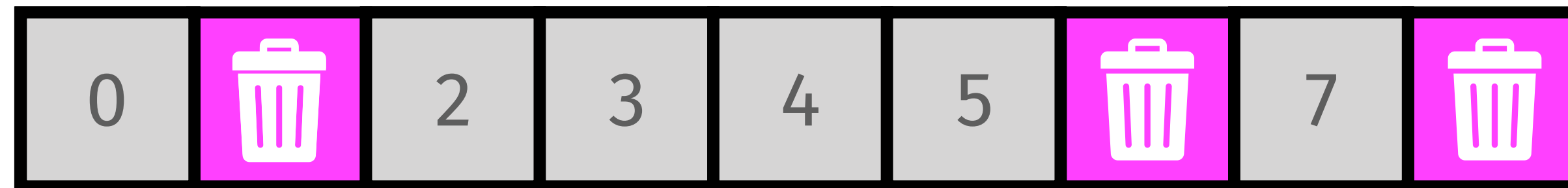
COPYING COLLECTION



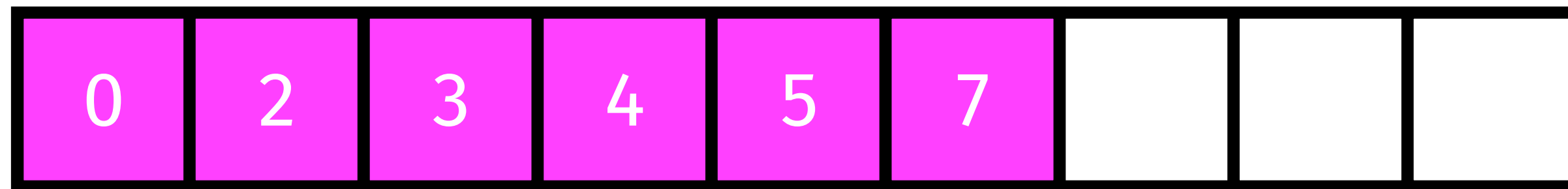
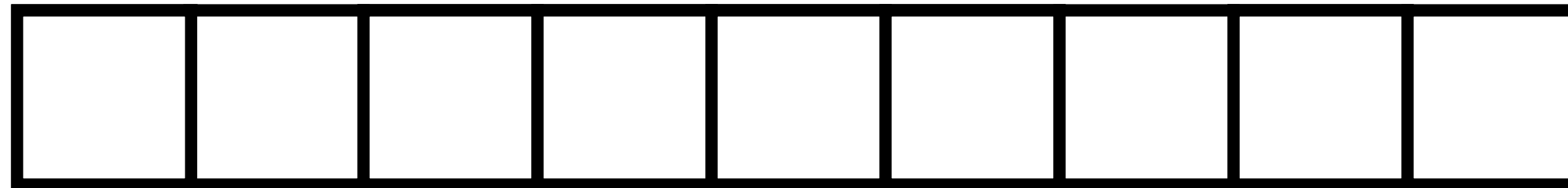
COPYING COLLECTION



COPYING COLLECTION



COPYING COLLECTION

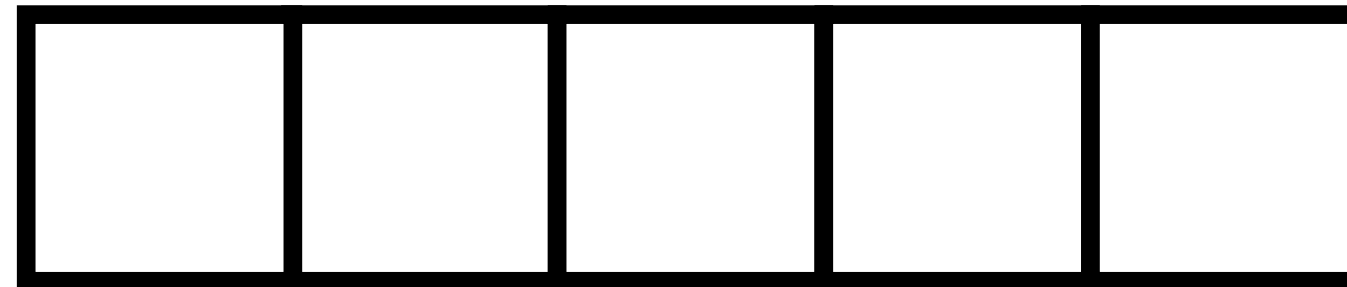


GENERATIONAL COLLECTION

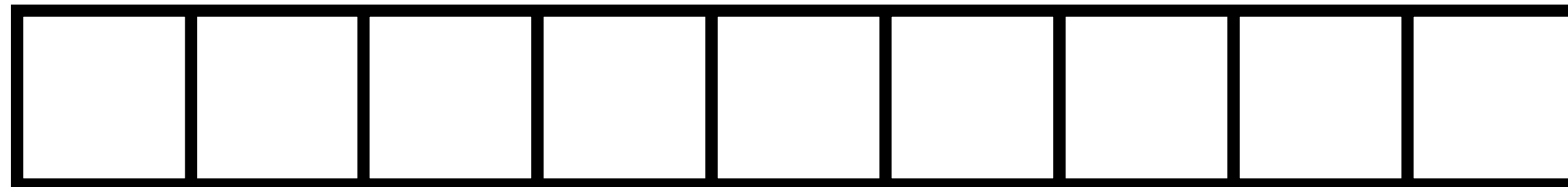
If you've been using it for a while, it's probably important

GENERATIONAL COLLECTION

New objects

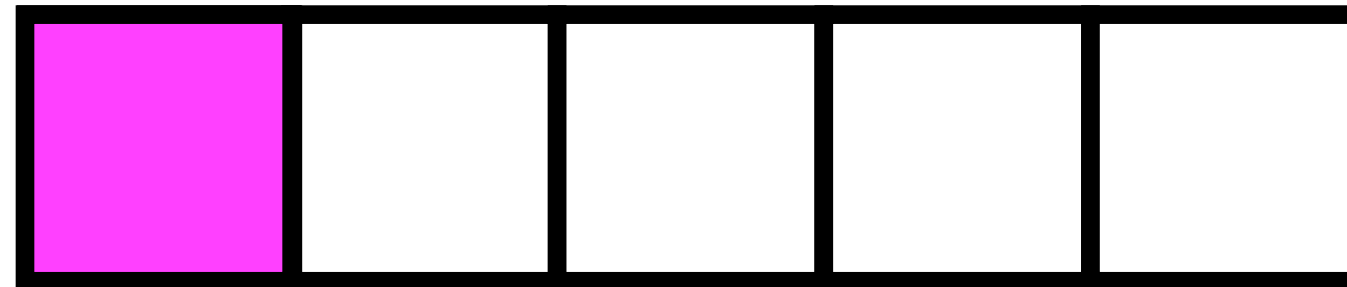


Old objects

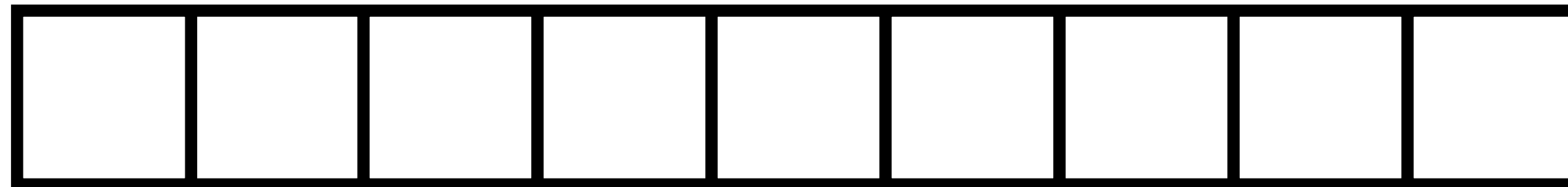


GENERATIONAL COLLECTION

New objects

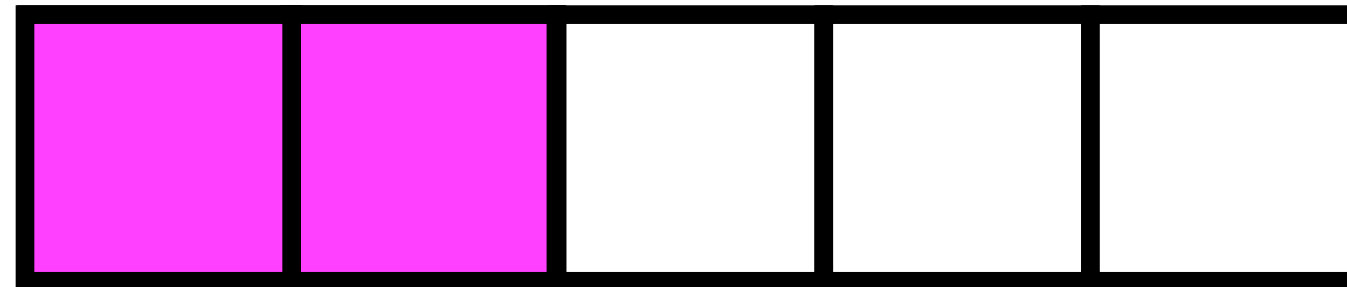


Old objects

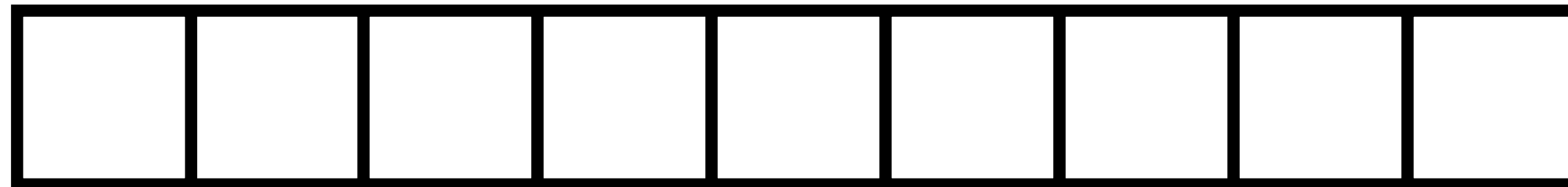


GENERATIONAL COLLECTION

New objects

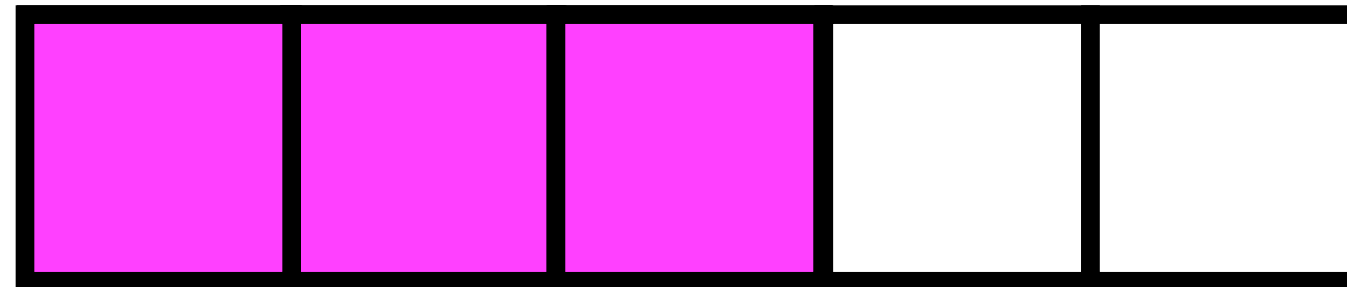


Old objects

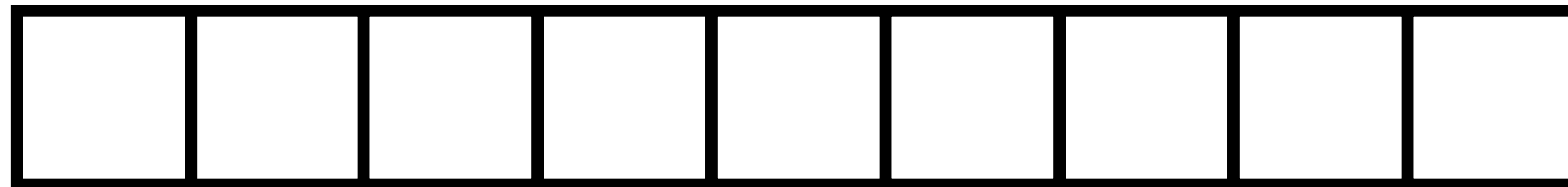


GENERATIONAL COLLECTION

New objects

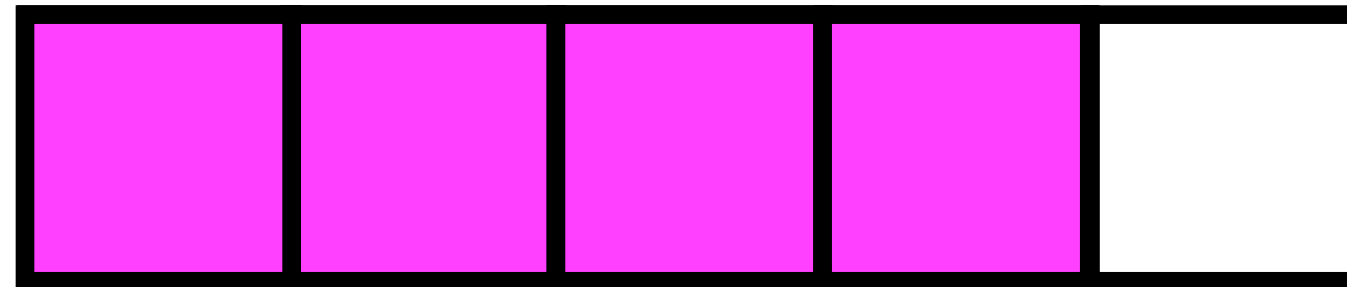


Old objects

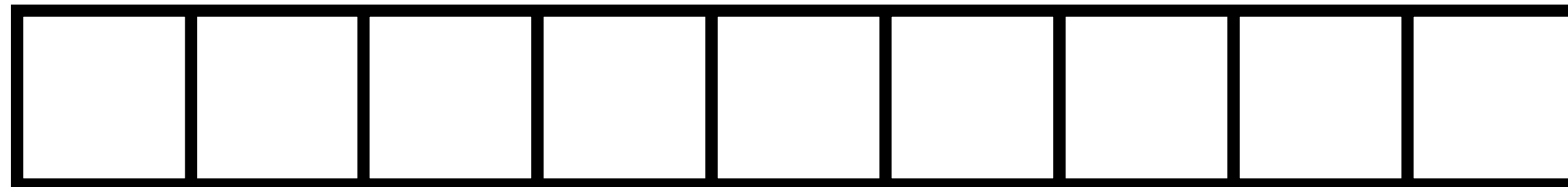


GENERATIONAL COLLECTION

New objects

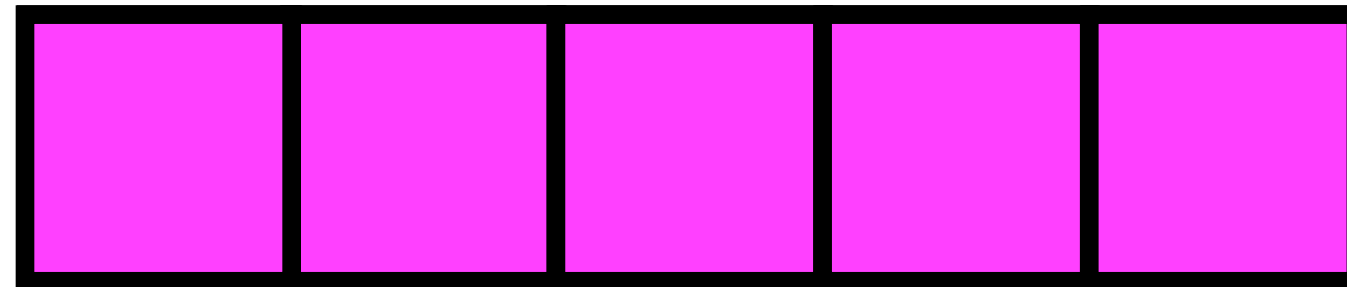


Old objects

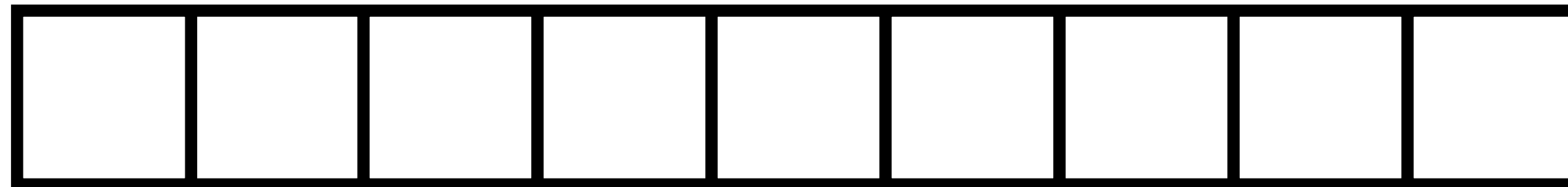


GENERATIONAL COLLECTION

New objects

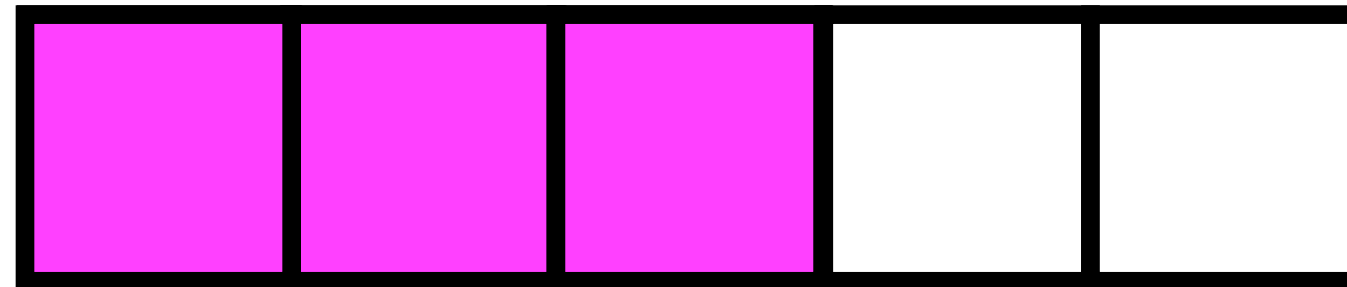


Old objects

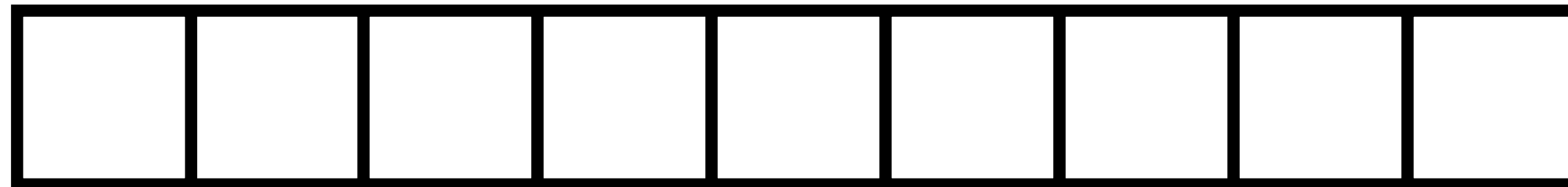


GENERATIONAL COLLECTION

New objects

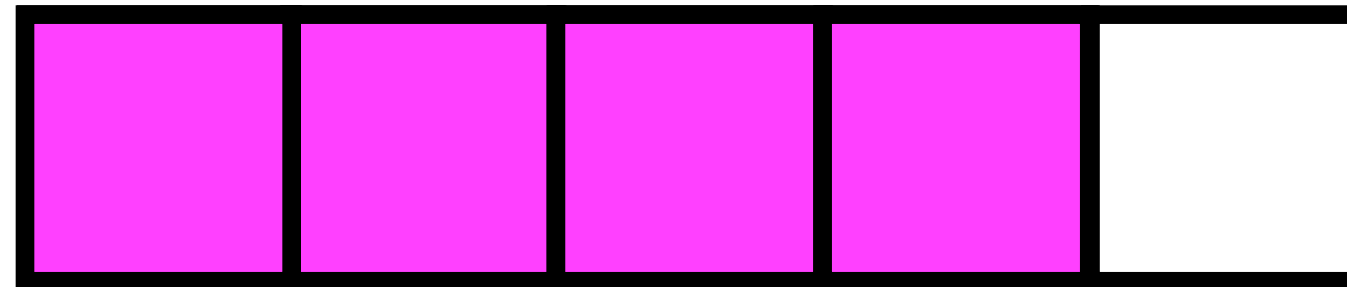


Old objects

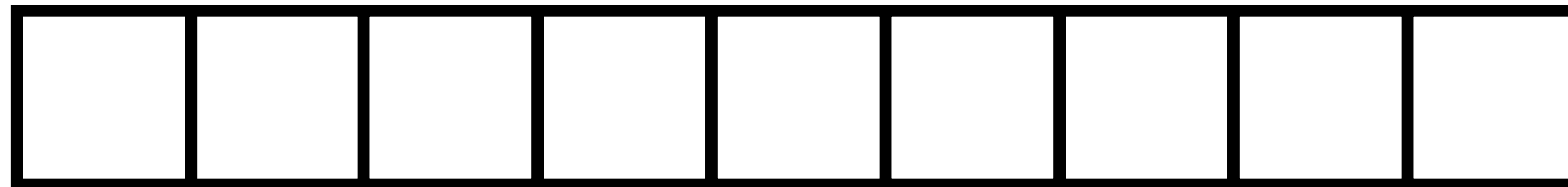


GENERATIONAL COLLECTION

New objects

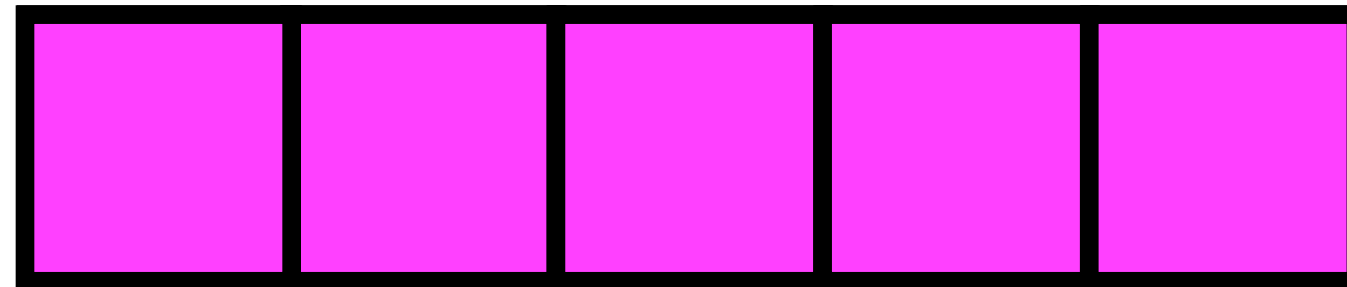


Old objects

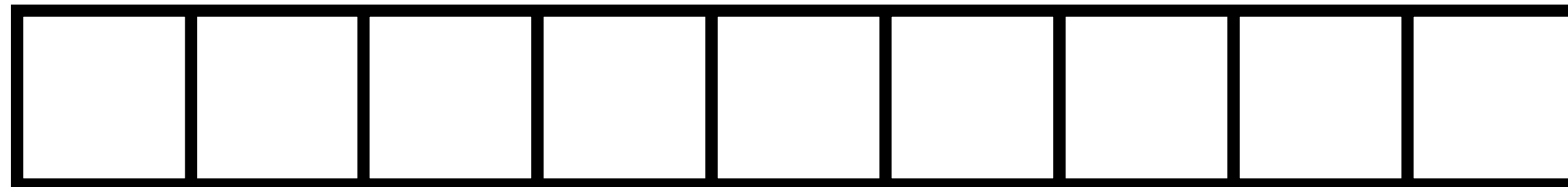


GENERATIONAL COLLECTION

New objects

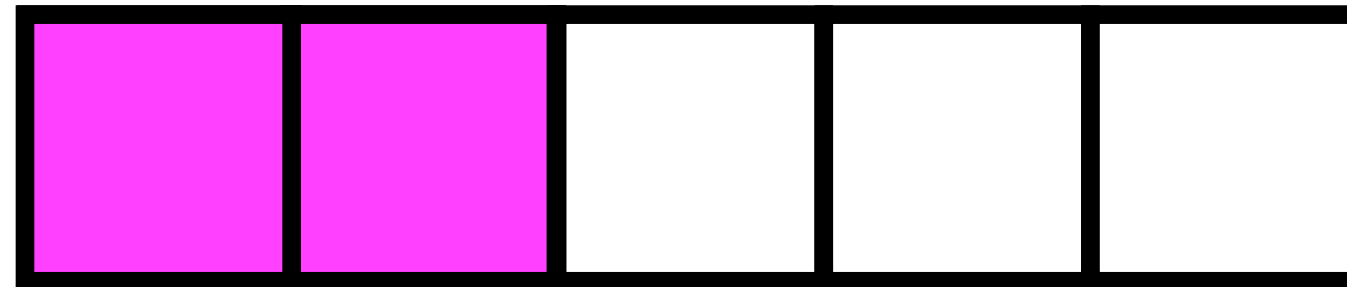


Old objects

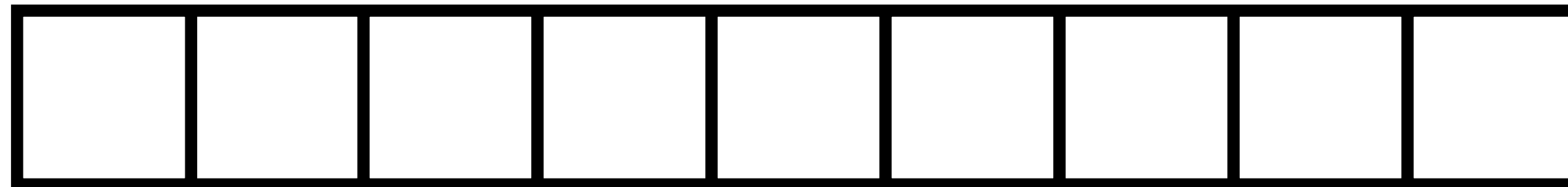


GENERATIONAL COLLECTION

New objects

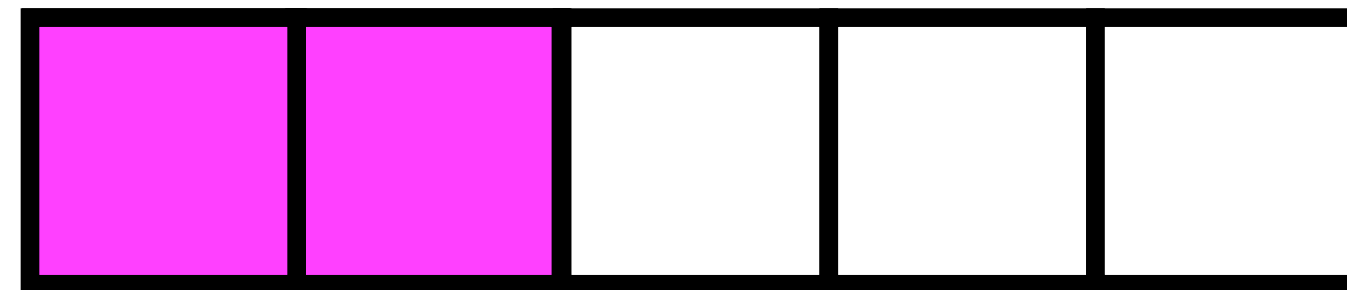


Old objects

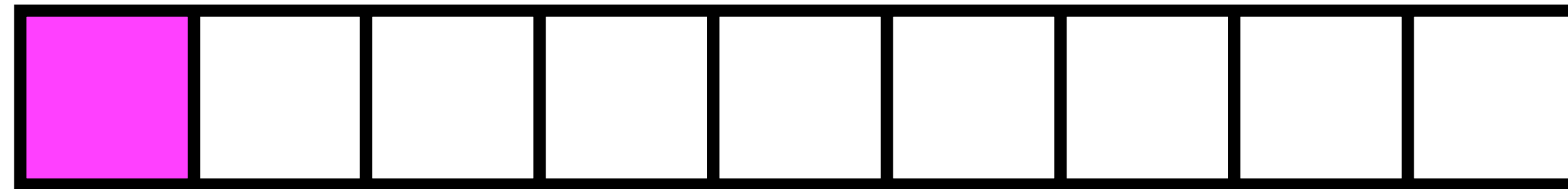


GENERATIONAL COLLECTION

New objects

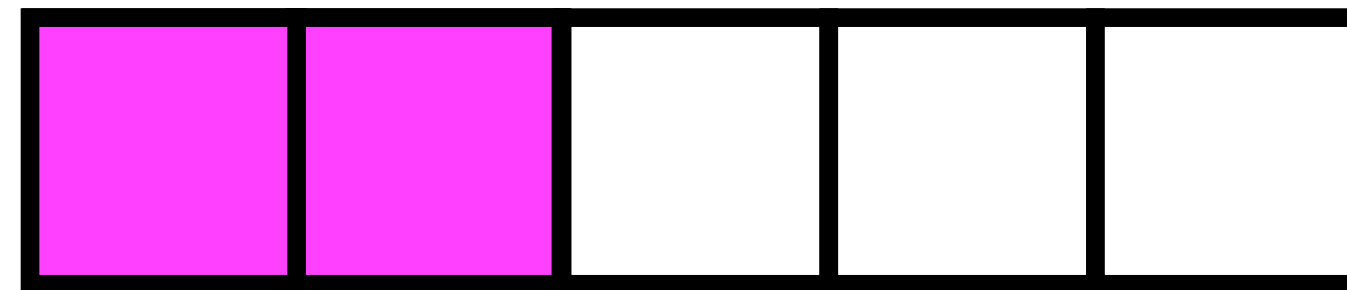


Old objects

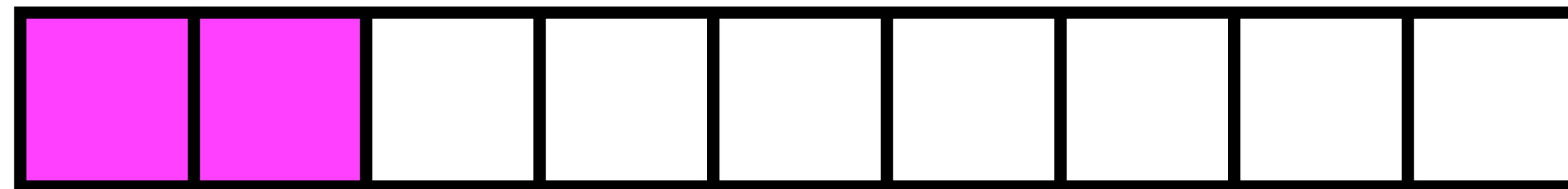


GENERATIONAL COLLECTION

New objects

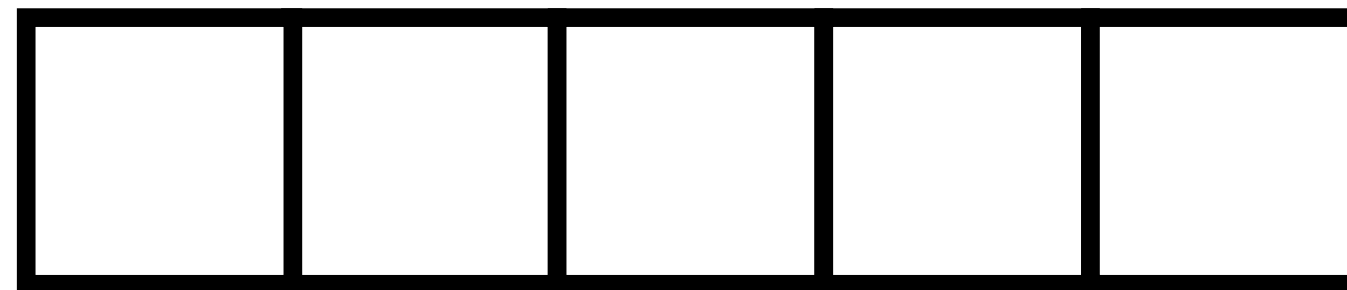


Old objects

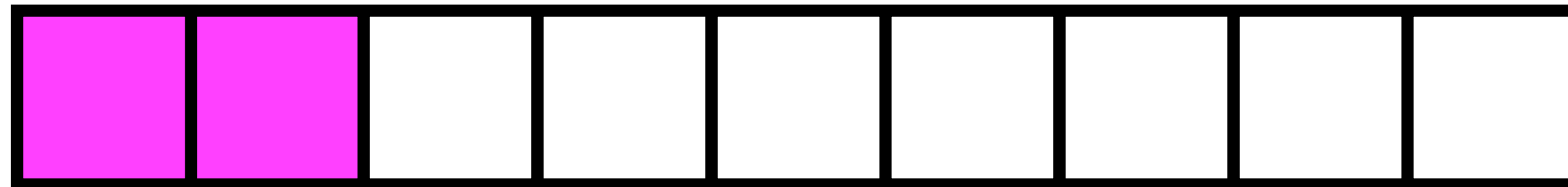


GENERATIONAL COLLECTION

New objects



Old objects





Garbage collection is no longer magic!

LET ME KNOW WHAT YOU THINK!

Tweet me @sannekalkman

Find me in person later!

The Garbage Collection Handbook - Jones, Hoskin & Moss