Welcome to our Presentation

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- University of Salzburg, department of Computer Sciences

- Garbage Collection in V8

What is V8 and what is a Garbage Collector?

A Garbage Collector is a program that produces dangling pointers

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- V8 is developed by Google and the Open Source Community
- A Garbage Collector is a program that provides automatic memory management.

Modern Garbage Collectors

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- Multithreading

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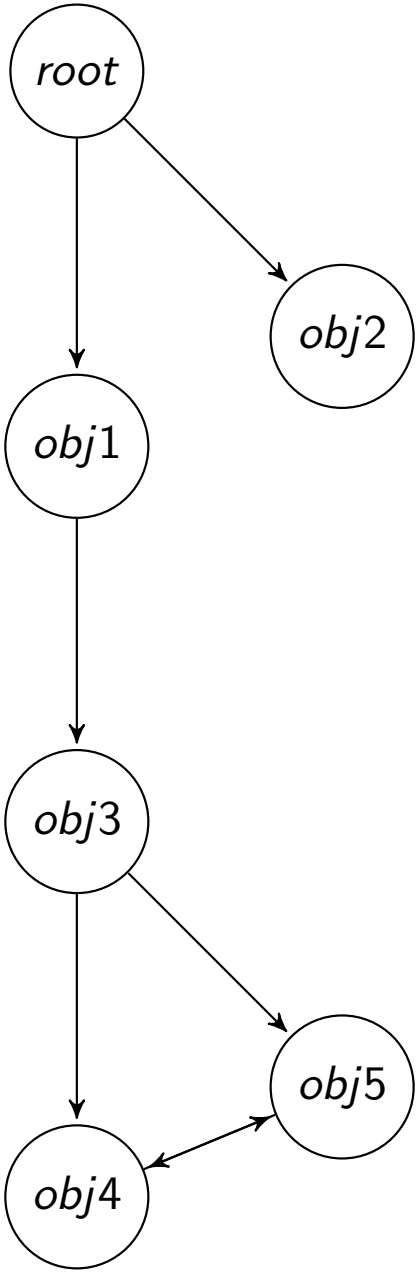
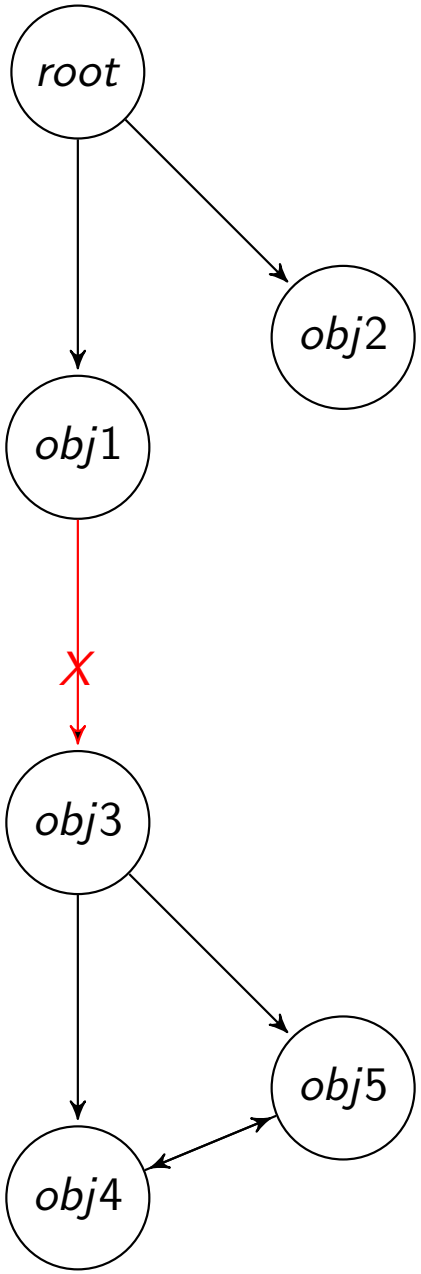
- Cost of execution time circa 5%
- Multithreading
- Mixed Strategies

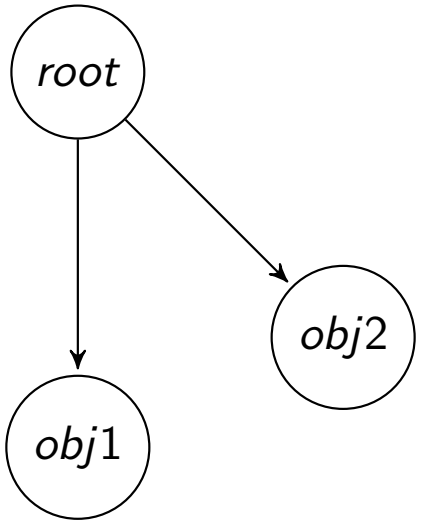
How does a Object Graph look like?

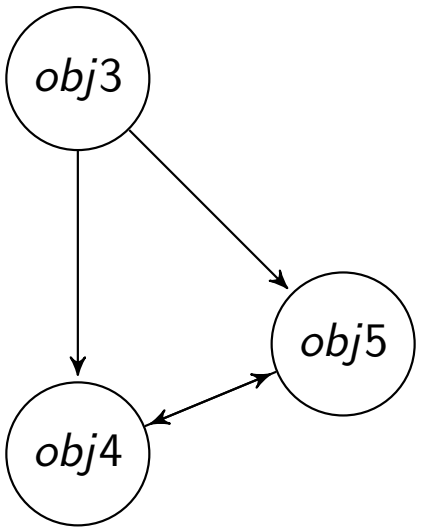


Now a dereference takes place



The Objects can not be reached from the root node





How does a Simple Garbage Collector work?

```
1     var new = function(ref){
2         ref = allocate();
3
4         if(ref === null){
5             mark();
6             sweep();
7             ref = allocate();
8         }
9
10        if(ref === null)
11            throw new outOfMemoryException();
12    }
```

Mark

```
1     var mark = function(){
2         var ref;
3         for(var obj : heap){
4             ref = obj.address;
5
6             if(ref && ref.Unmarked){
7                 ref.mark();
8                 recursiveMark(ref);
9             }
10        }
11    }
```

Sweep

```
1     var sweep = function(){
2         foreach(var obj : heap){
3             if(obj.isMarked)
4                 obj.UnMark();
5             else
6                 free(obj);
7         }
8     }
```

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  1. Mark and Sweep
  2. Generational Garbage Collection

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- Reference counting

Which techniques are used in modern languages?

- Tracing Garbage Collection (JavaScript, Python, Ruby, Rust, C#)
  1. Mark and Sweep
  2. Generational Garbage Collection
- Reference counting (C++, PHP, Perl, Vala)

State of the art Generational Garbage Collection

Generational Garbage Collection

What is the difference?

- Divides the heap into more heaps (V8 uses two generations)

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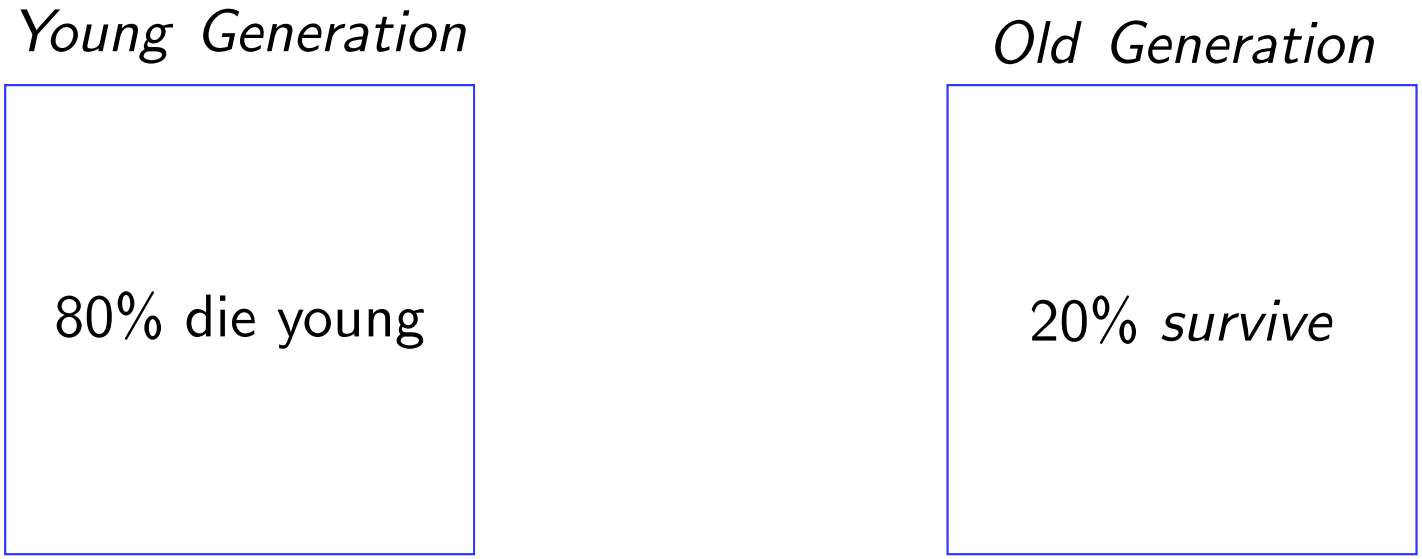
- Mark and Compact

More generations less Stop-the-World interrupts



What are the differences between the Old- and Young-generation?

Young Generation

- Fast collection

What are the differences between the Old- and Young-generation?

Young Generation

- Fast collection
- Frequent collection

What are the differences between the Old- and Young-generation?

Young Generation

- Fast collection
- Frequent collection
- Needs more space

Why is the collection of the Young Generation faster?

Keyword, Mark and Copy

To Space

From Space

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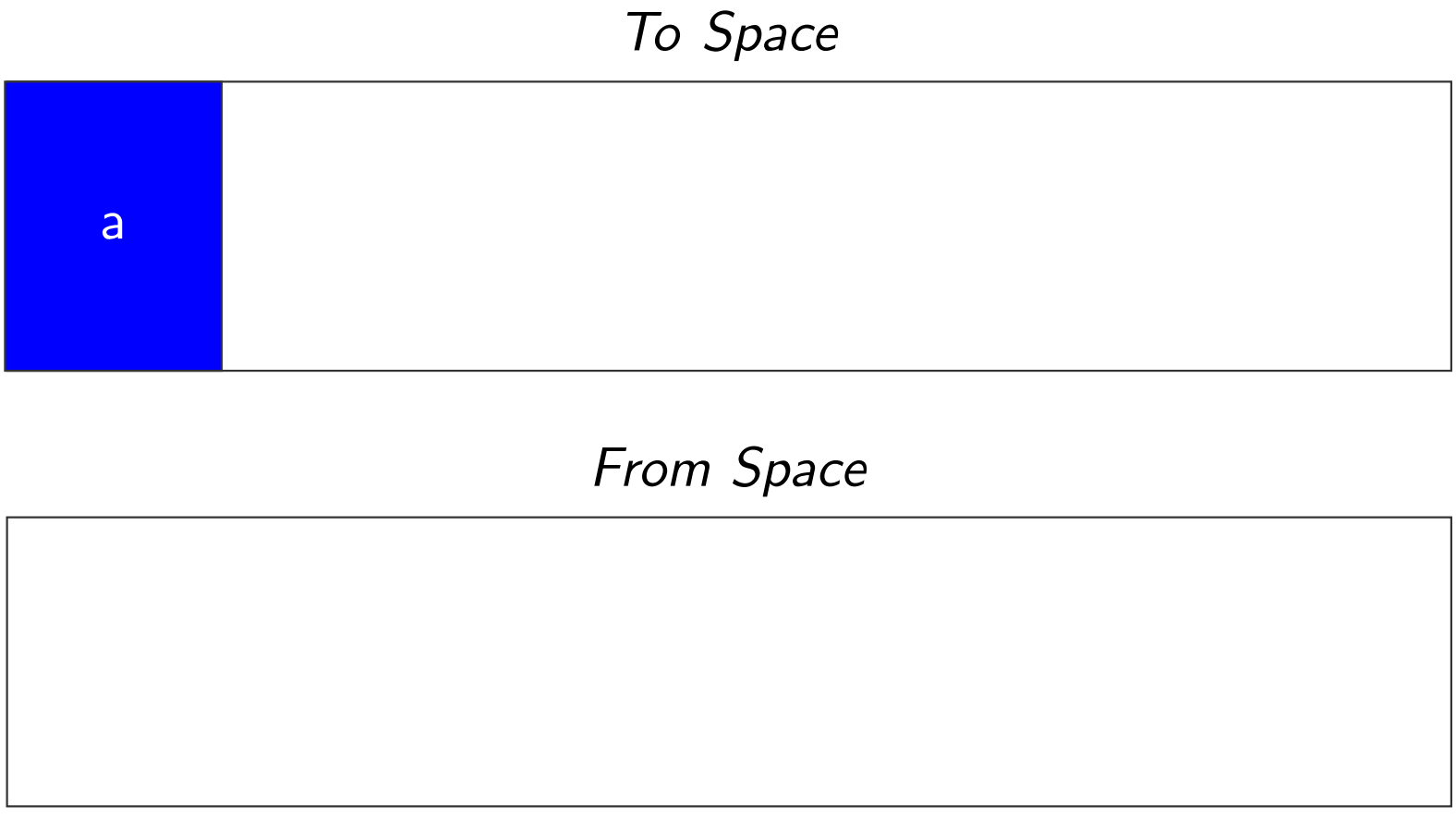

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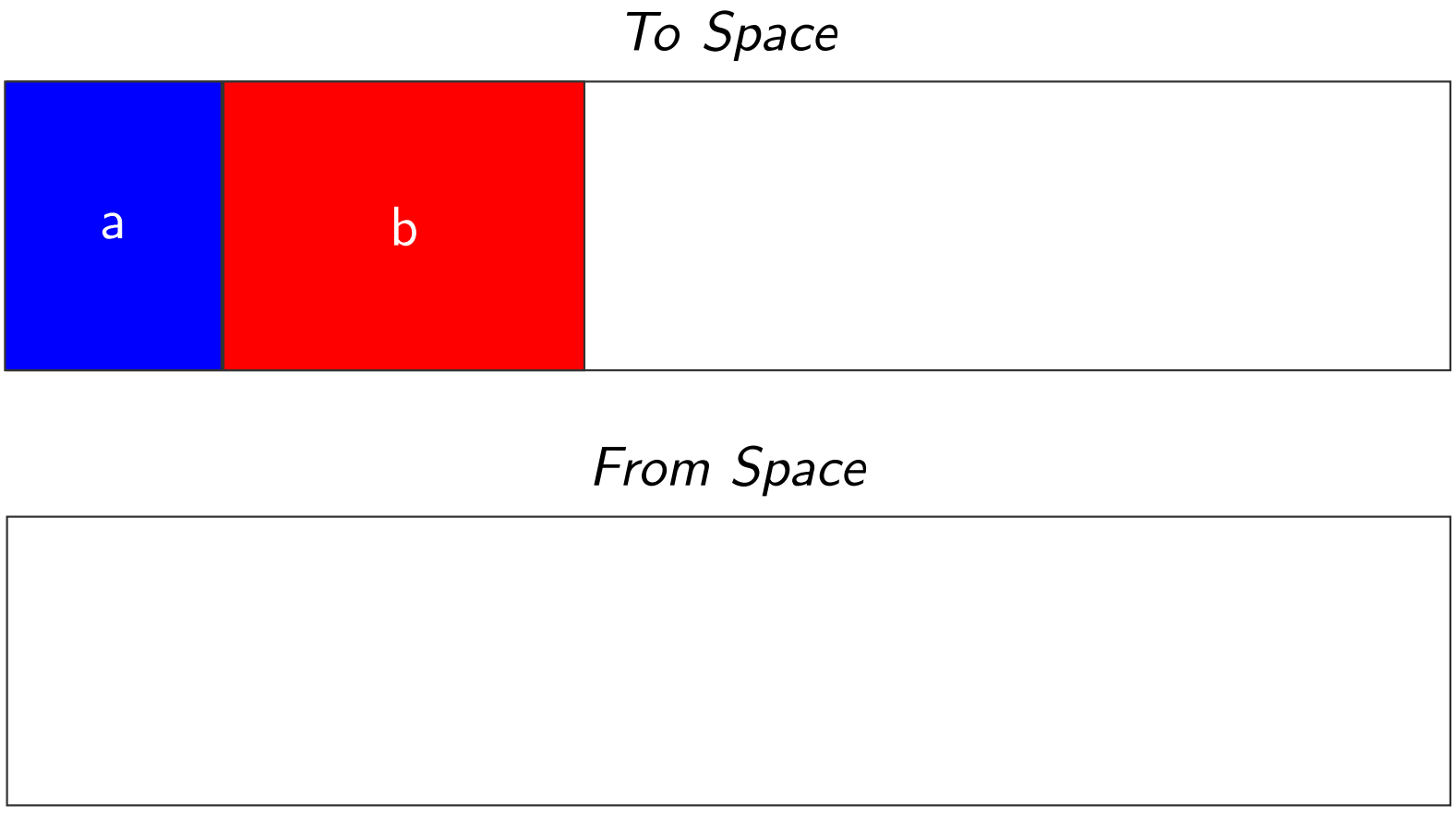

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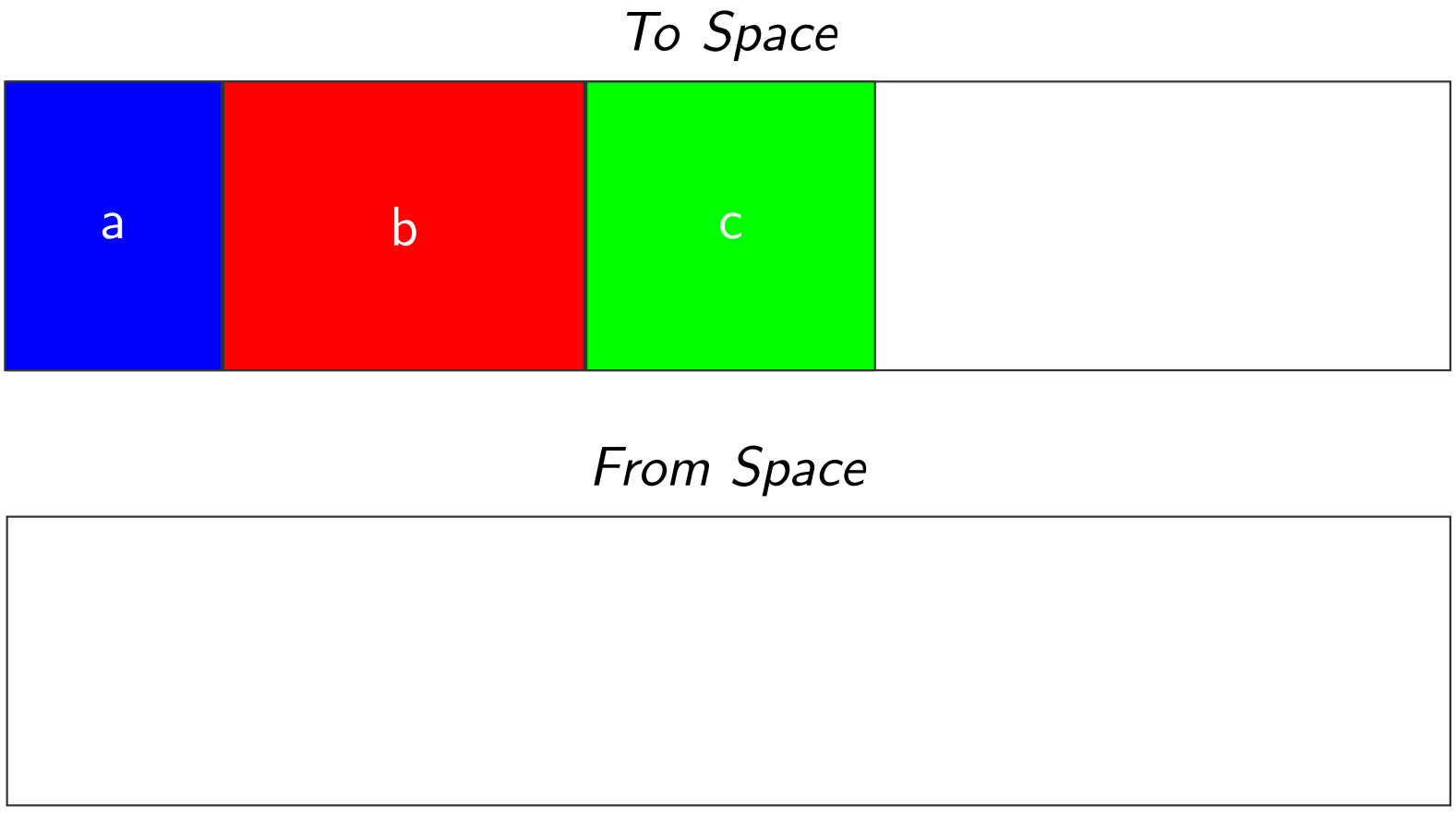

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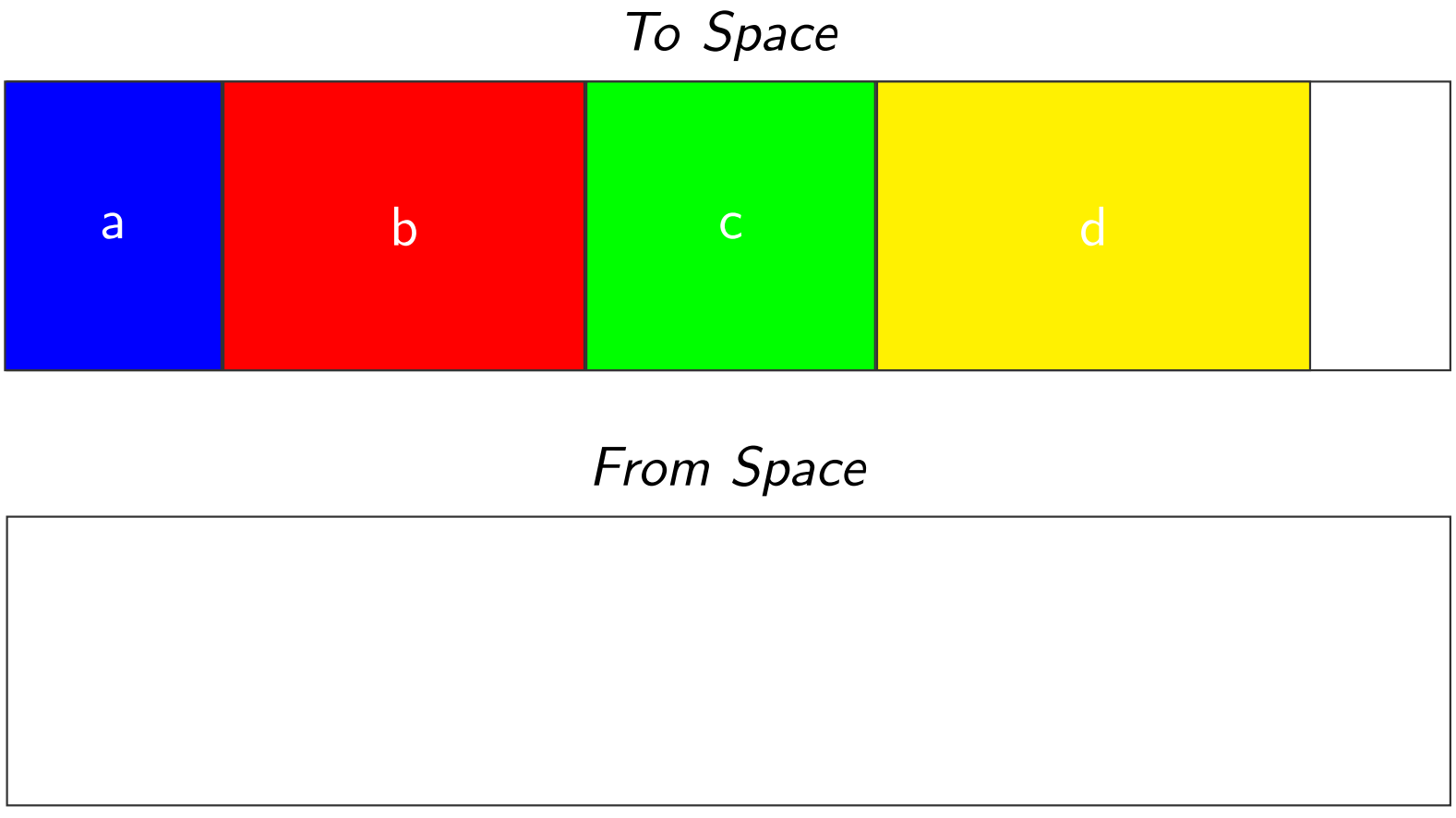

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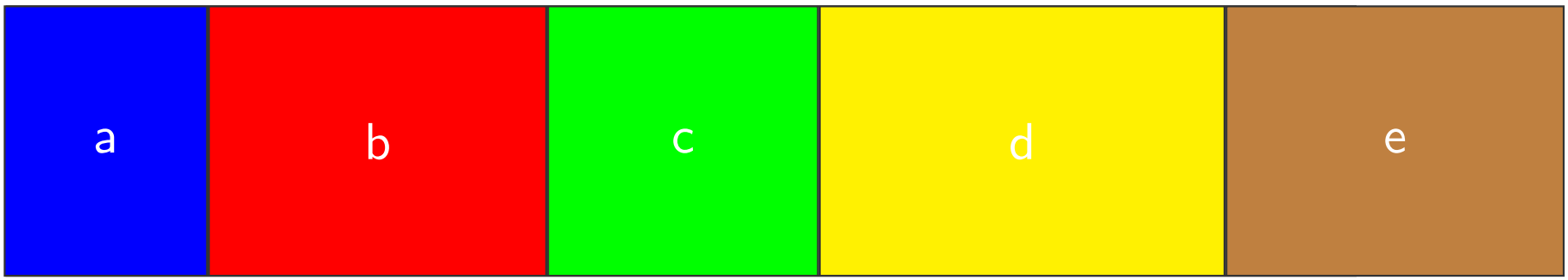

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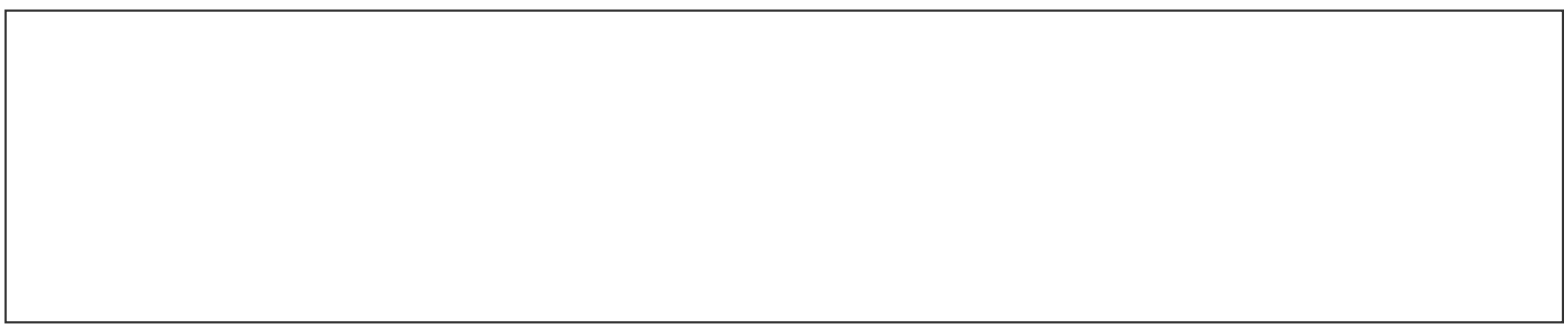

Now the mark phase starts

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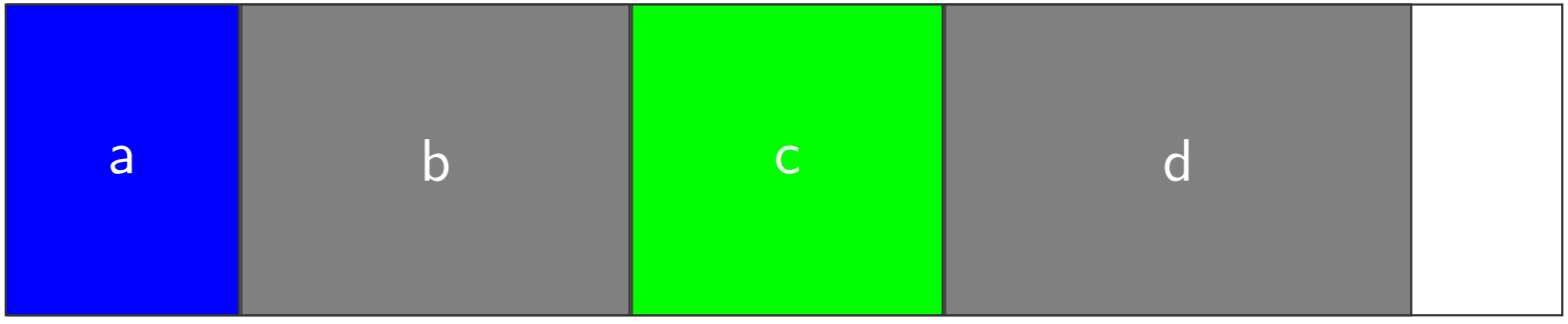

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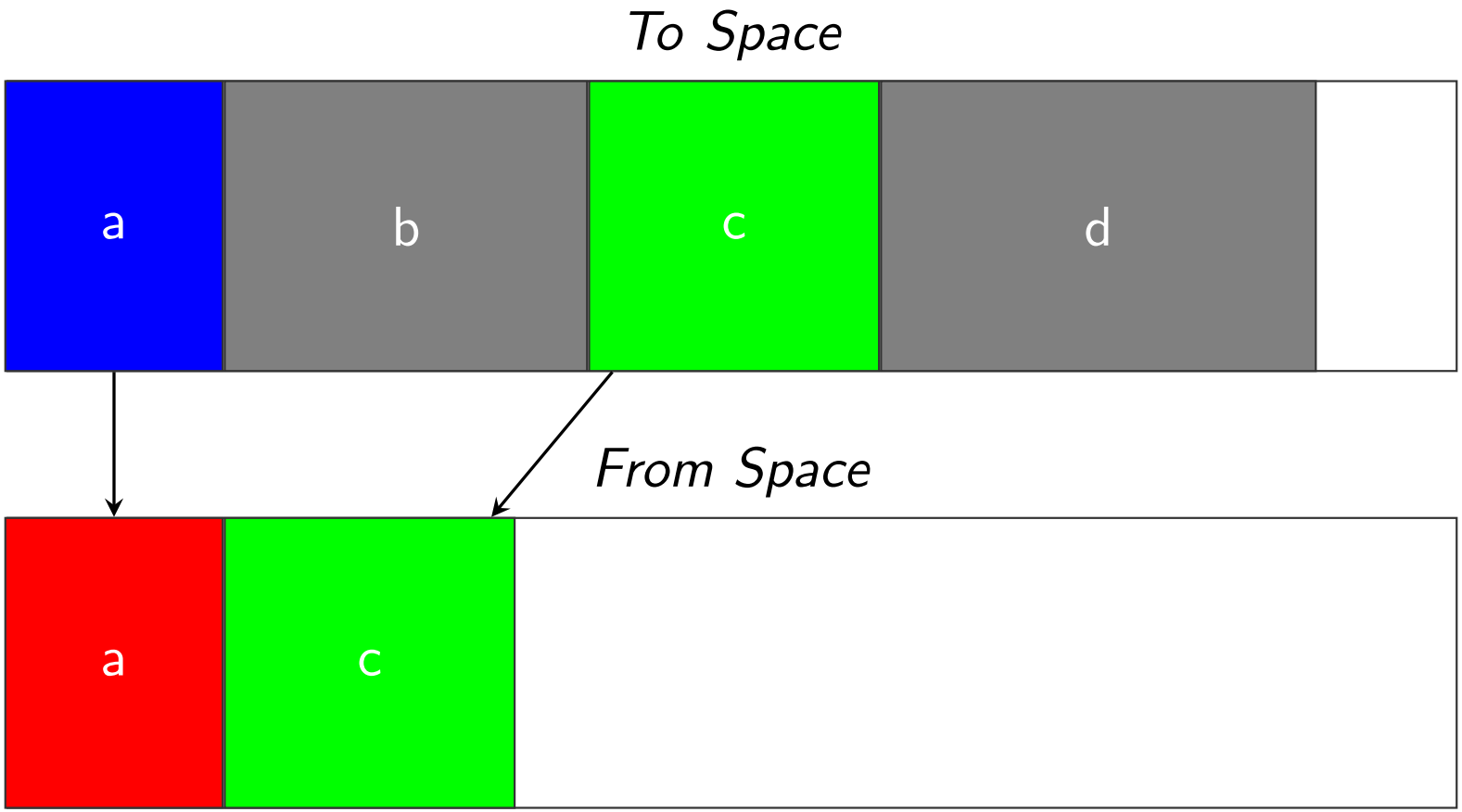

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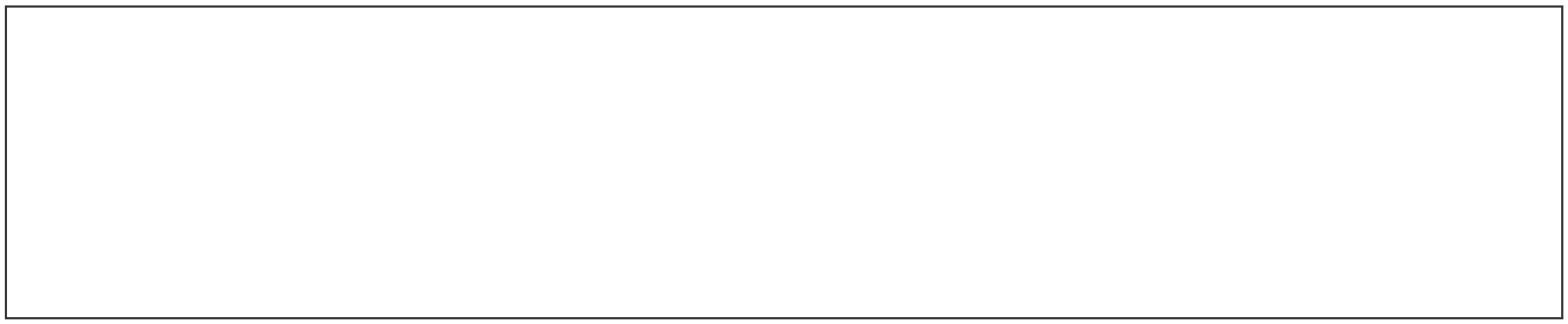

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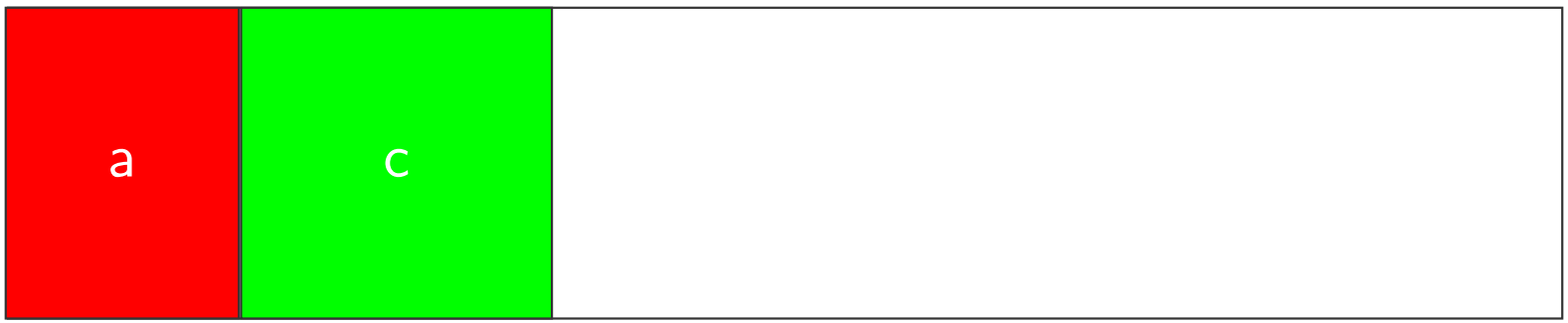

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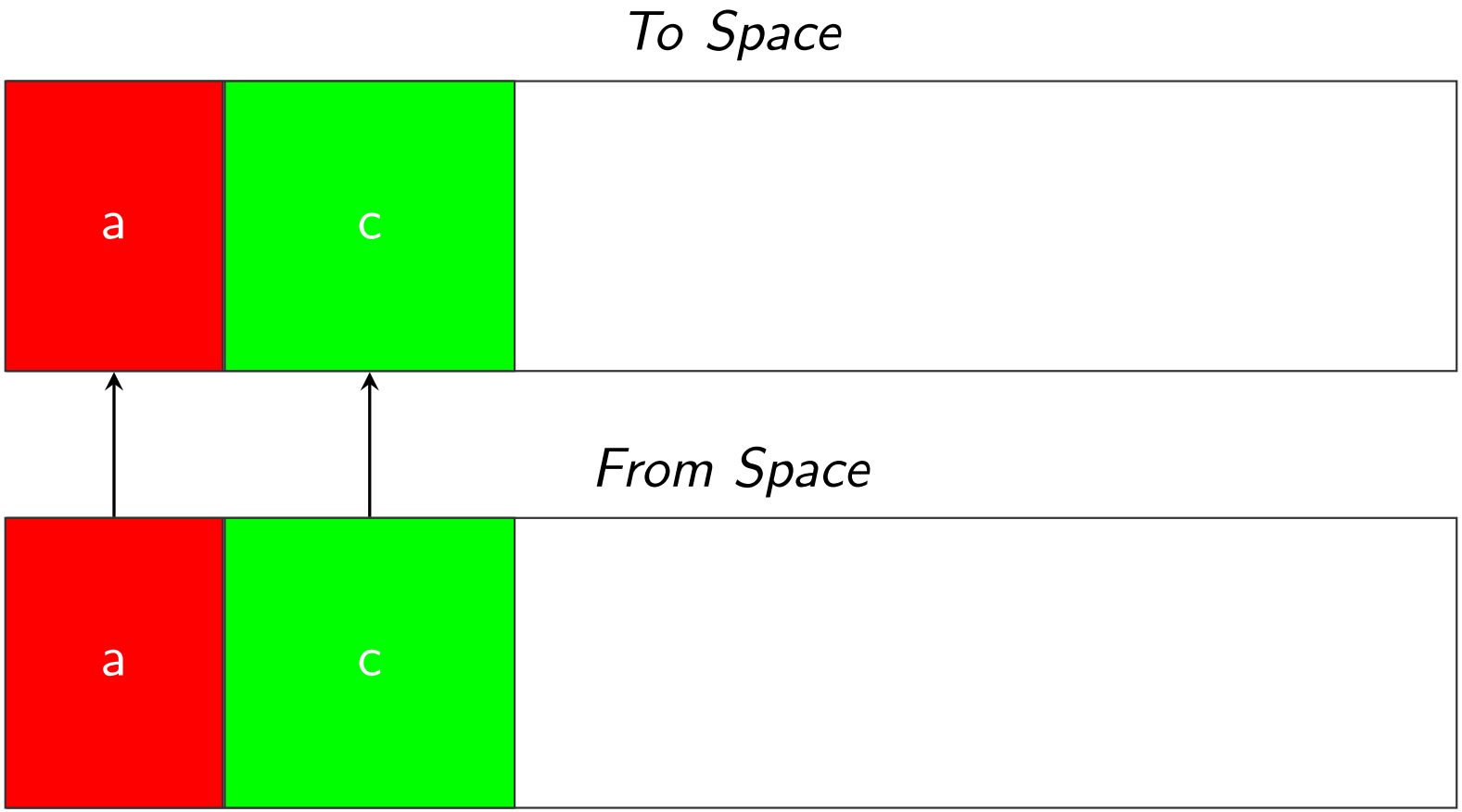

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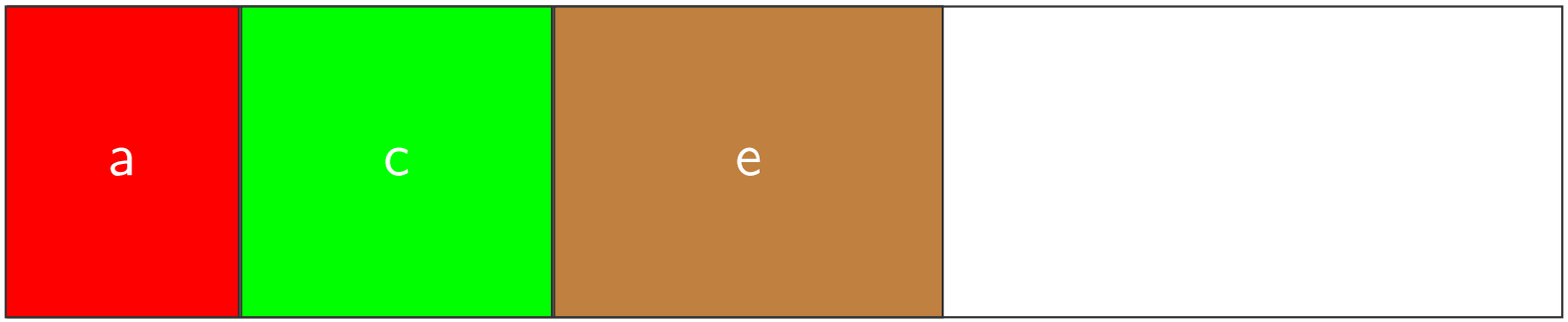

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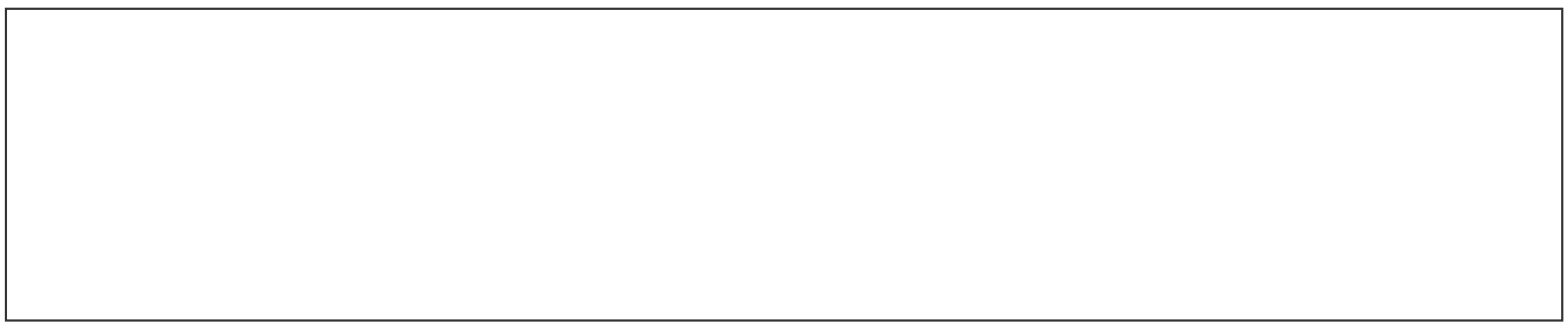

What are the differences between the Old- and Young-generation?

Old Generation

- Slower collection

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What are the differences between the Old- and Young-generation?

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- Slower collection
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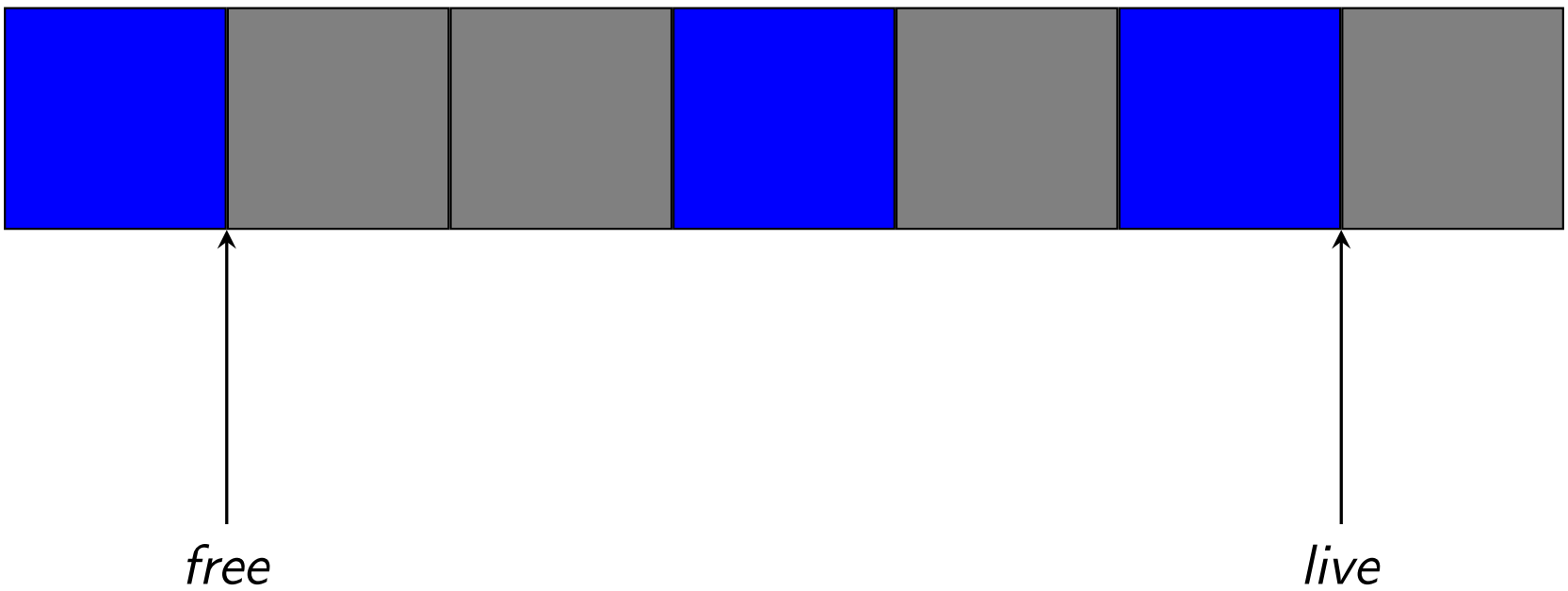
Keyword Mark and Compact



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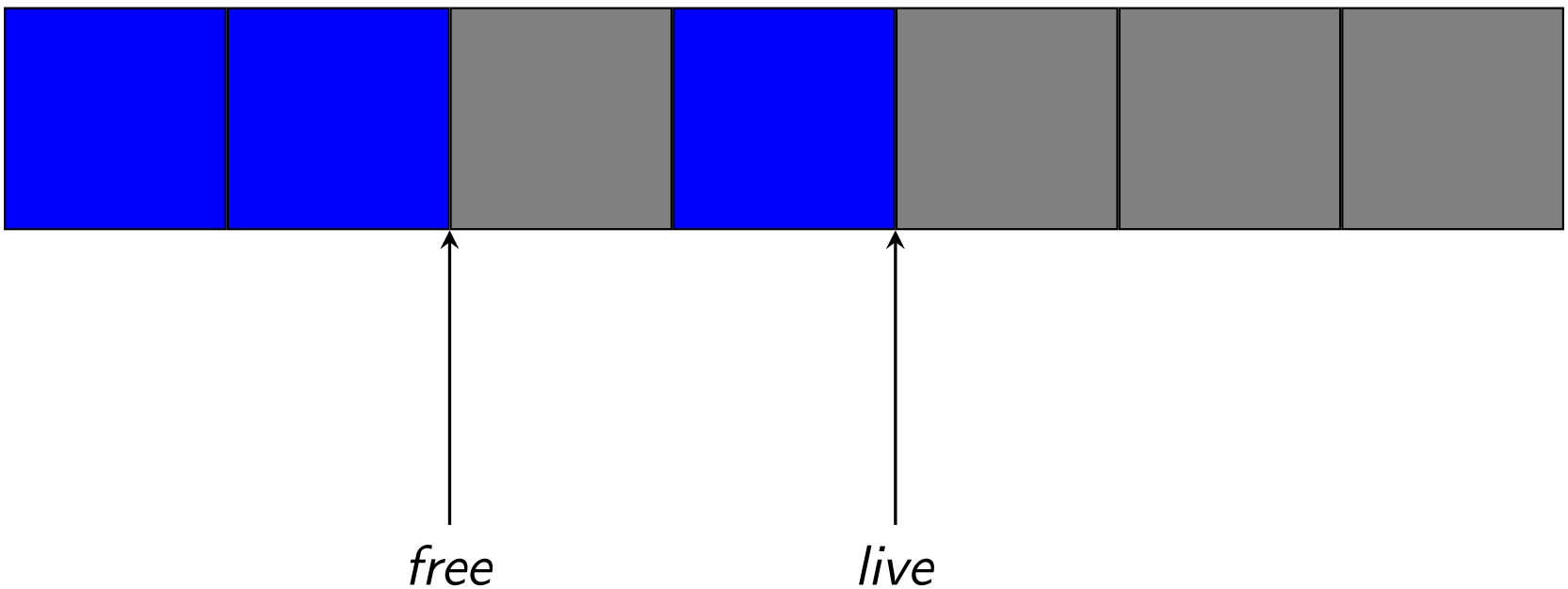

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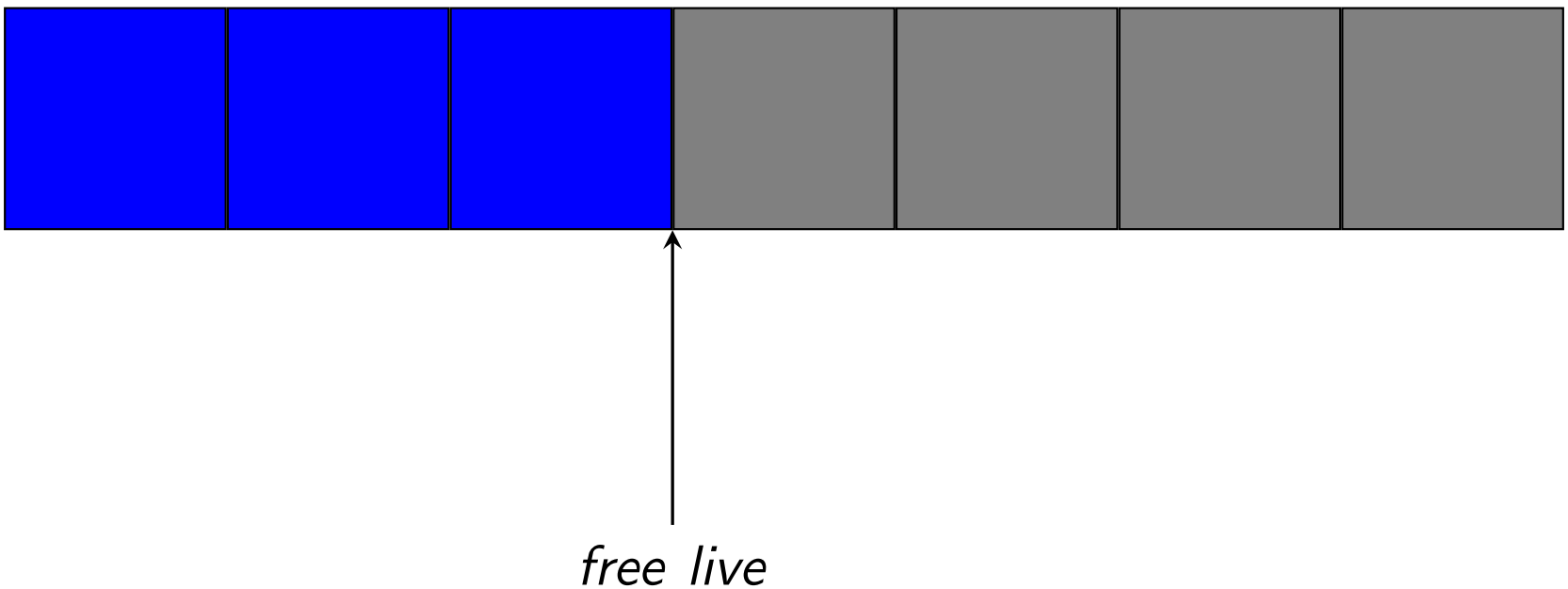
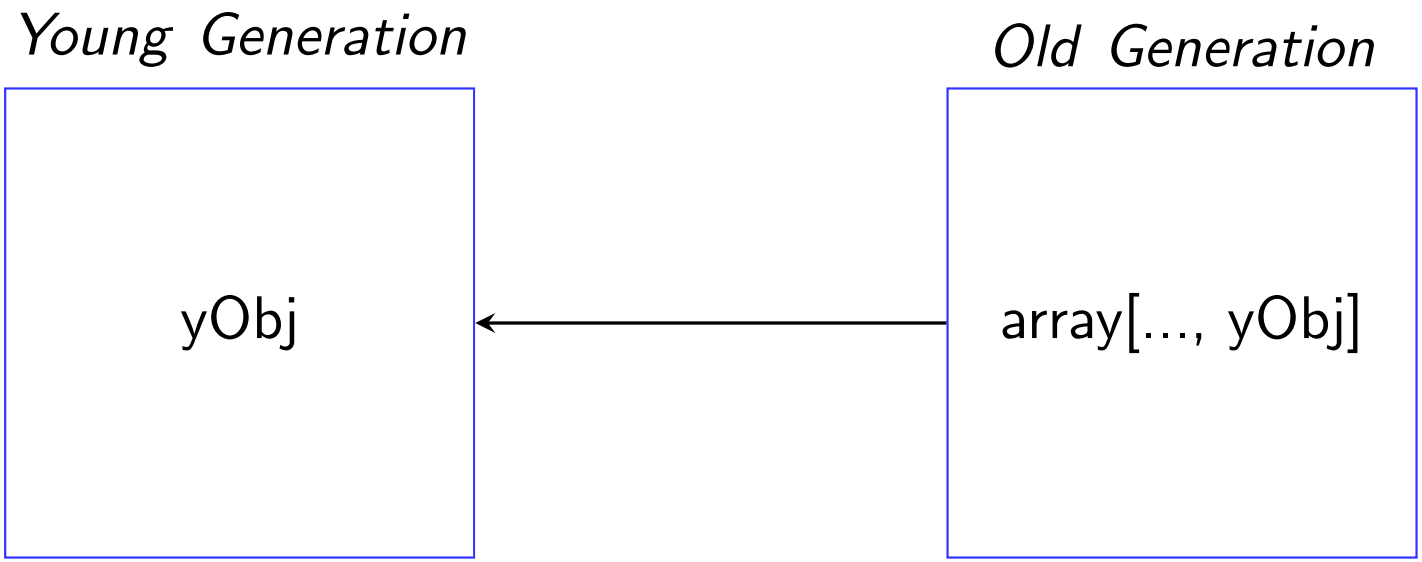


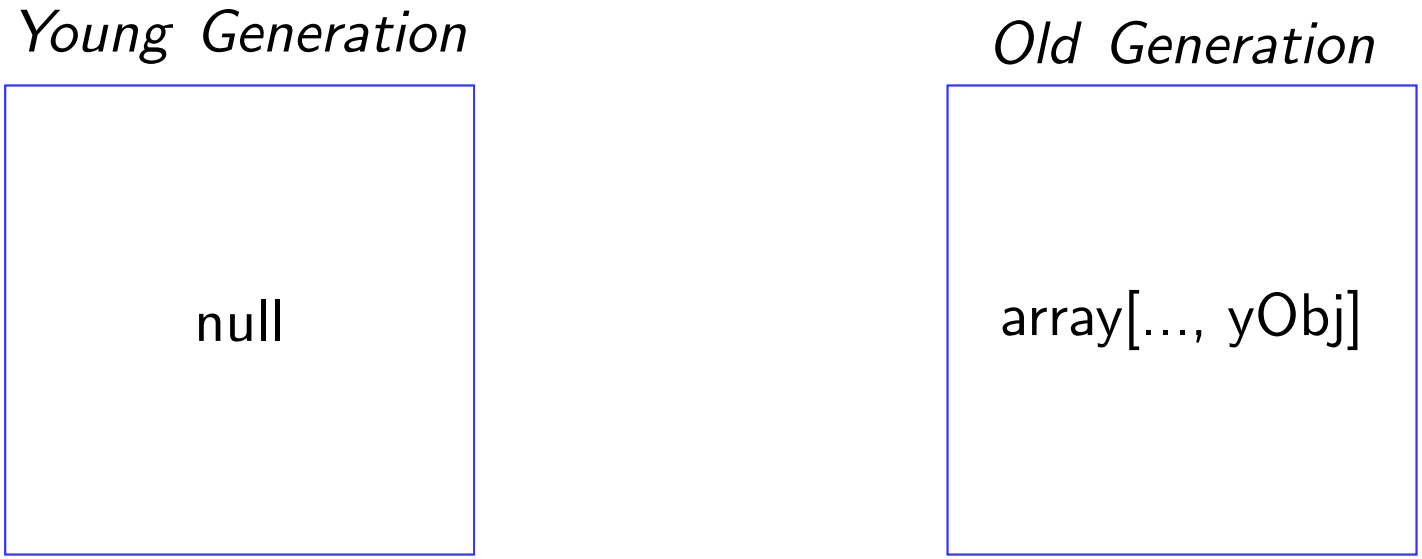
There is one big flaw with Generations

Intergenerational References



Now the Young Generation gets collected

We have a null reference in the Old Generation



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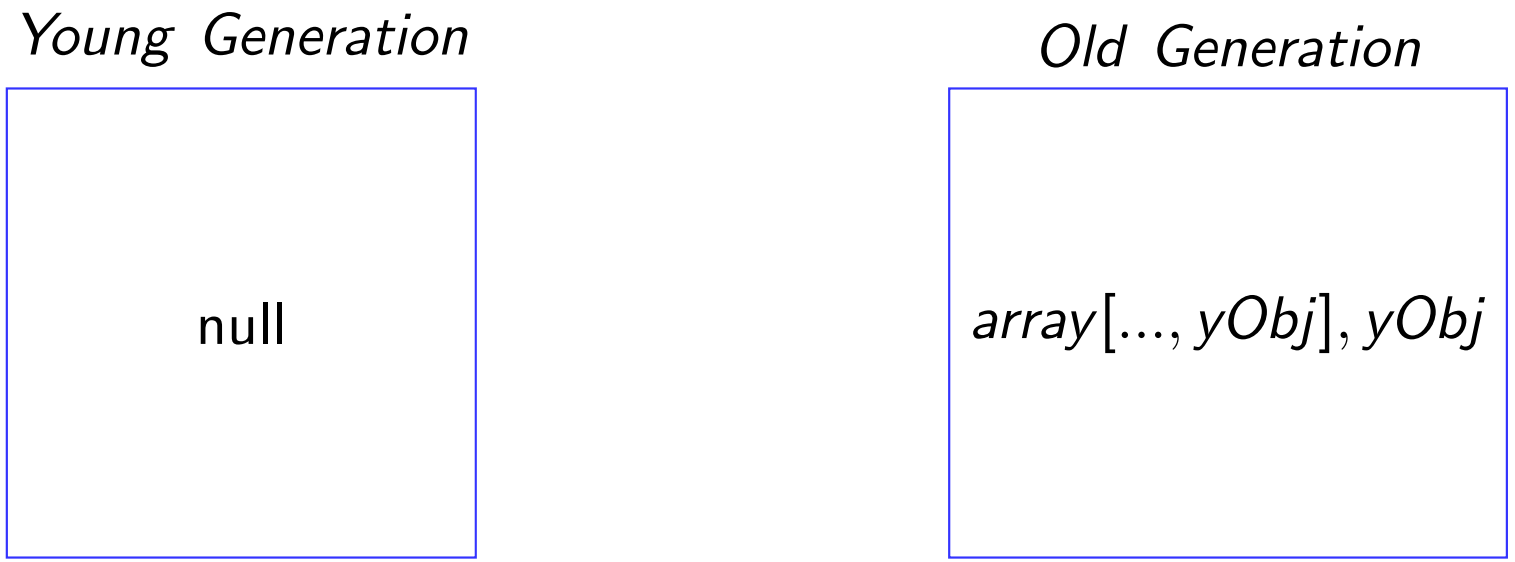

Thank you for your attention

Any further questions?