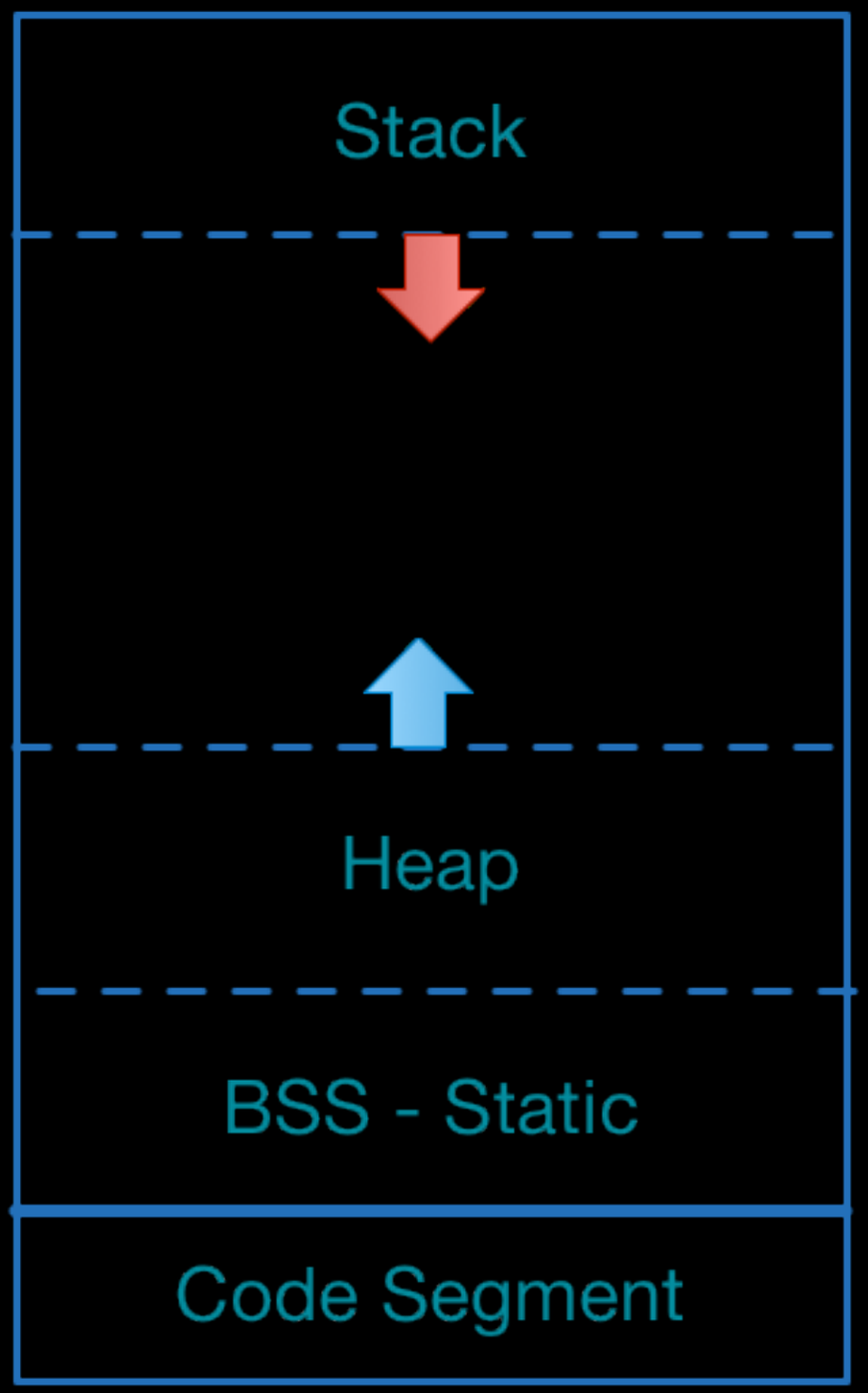
InProcess Memory Structure

Structure

Data Segment
- BSS
- Heap
- Stack

Data Segment is dynamic

Code Segment is readonly



BSS

- Global variables
- Constant values
- Static variables

Stack

Behaves like `Regular Stack` (LIFO)

Push when

- Enter scope (function or loop)
- Declare primitive variables

Pop when

- Exit scope (function or loop)

StackOverflow

- Overflow when calling many functions nestly
- Common issue of non-tail recursive functions

```
class Overflow {
  static int count = 0;
  static void repeat(){
    count += 1;
    repeat();
  }

  public static void main(String[] args){
    try{
      repeat();
    }catch(Throwable e){
      System.err.println("Completed times: " + count);
      System.err.println("Reason: " + e);
    }
  }
}
```

Completed times: 22127

Reason: java.lang.StackOverflowError

Manage Stack Segment

- No, it is handled automatically by process
- Avoid "very long recursive calls"

Heap

- Dynamic allocation memory
- Allocated memory when creating objects
- Deallocated memory when release objects

Manual Heap

- C: malloc/free
- C++: new/delete

Garbage Collection(GC)

- Java
- C#
- Go
- Javascript

Mixed (Reference Counting)

- Swift
- Objective-C
- Rust
- C++ (Smart Pointer)

OutOffMemory

```
class OutOfMemory {
  public static void main(String[] args){
    int GB = 1024 * 1024 * 1024;
    Object[]os = new Object[10 * GB];
  }
}
```

```
Exception in thread "main"
java.lang.NegativeArraySizeException
 at OutOfMemory.main(OutOfMemory.java:4)
```

Cyclic Reference

- `Object A` has **STRONG** reference to `B`
- `Object B` also has **STRONG** reference to `A`
- GC or ARC can not break **CYCLIC REFERENCE**

- GC languages still have `Memory Leaks` issues