CMSC 131
Object-Oriented Programming I

Memory Maps, Parameter Passing

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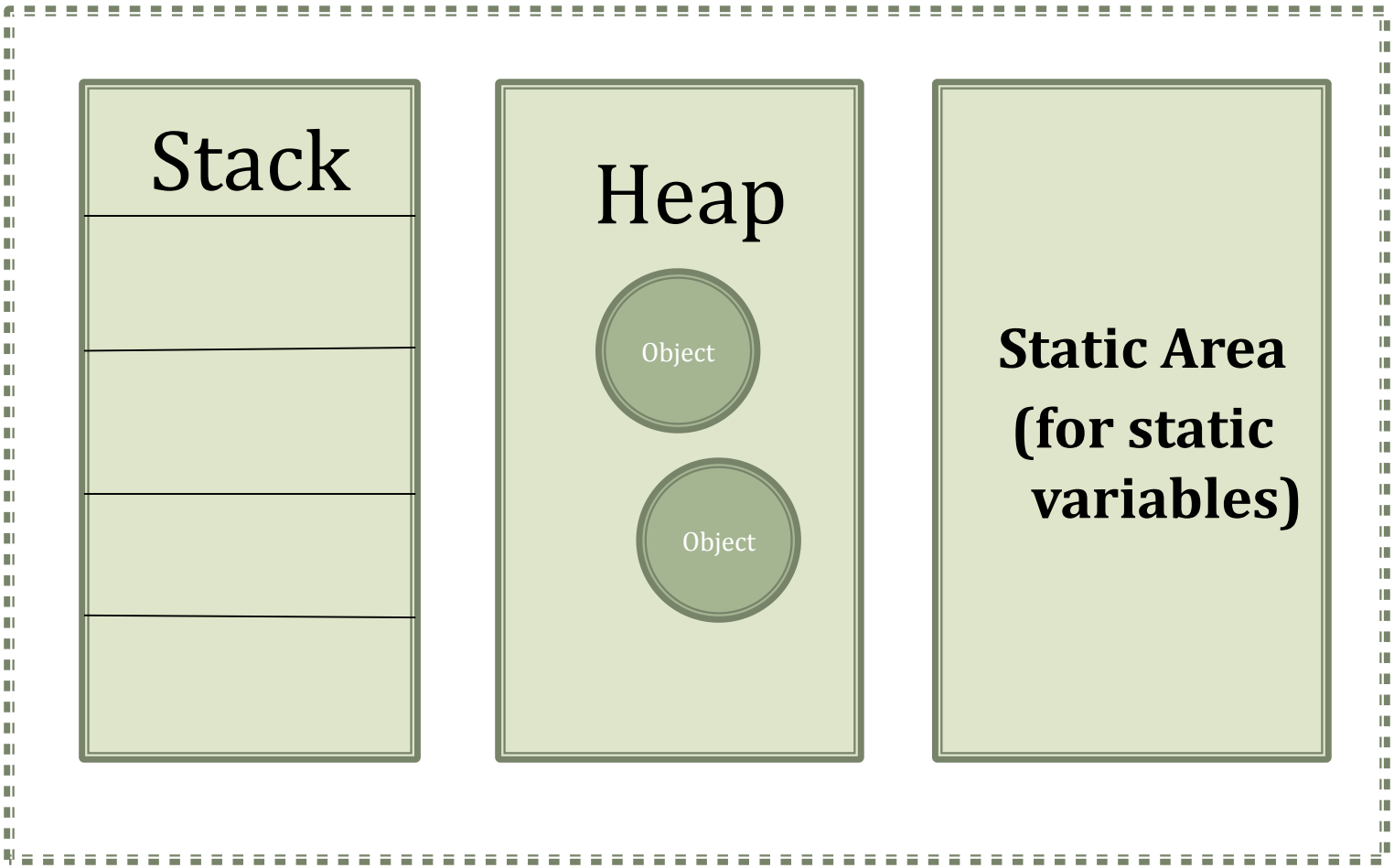
This material is based on material provided by Ben Bederson, Bonnie Dorr, Fawzi Emad, David Mount, Jan Plane

Overview

- Memory Maps
- Parameter Passing

Java Program Memory



Static Area

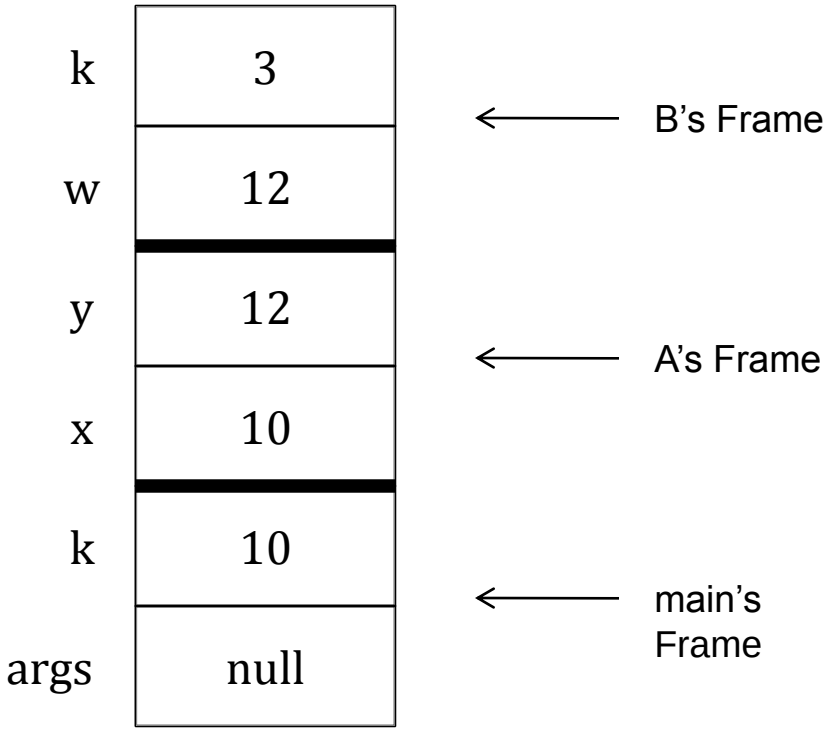
- A static field is shared among all instances of the class
- **Example:** Banana.java
- Let's draw a diagram for the above code
- Notice that count is shared and each increase method call modifies the same count variable

Call Stack

- Stack → Abstract data type that allows insertions/removals only from one end
  - Example: stack of clean plates in a dinner
  - Operations:
    - Push → add an element to the stack
    - Pop → remove an element from the stack
    - Follows a LIFO (Last-In-First-Out) policy
- Java call stack
  - Each time a method is called an entry in this stack is added
  - The entry is called a frame
  - The frame has local variables, parameters and other data
  - Also referred to as the Activation Record Stack

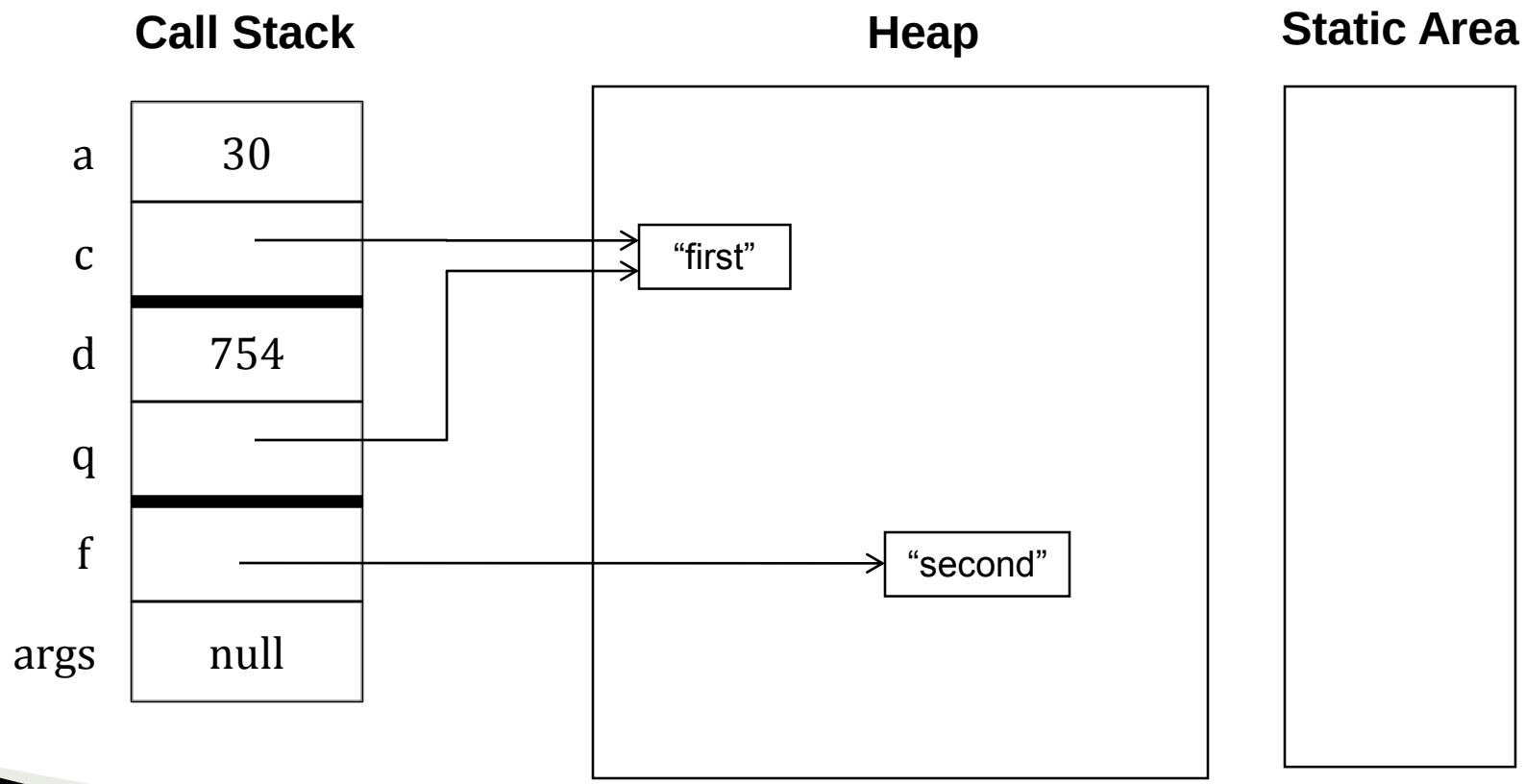
Call Stack/Example

```
public static void A(int x) {
    int y = x + 2;
    B(y);
}
public static void B(int w) {
    int k = 3;
    System.out.println(k + w);
}
public static void main(String[] args) {
    int k = 10;
    A(k);
}
```



Memory Maps

- Memory maps will be used to represent the state of the call stack and the heap
- You need to know how to draw memory maps ☺



Call Stack

- The call stack makes it possible for:
  - Local variables to be created/destroyed
    - Variables are created when frame is created and placed in the stack
    - Variables are destroyed when frame is removed from the stack
  - The order in which methods are called is respected
    - If A calls B, and B calls C, then C's frame must be removed before B's, and B's before A's
  - Us to use the same name for local variables in different methods
    - Each frame "hides" the variable
- In our examples, the frame will include local variables and parameters

Passing Parameters

- In many languages there are different ways to pass parameters
  - By value
  - By reference
- In Java ALL parameters are passed by value
  - A copy of the argument is used to initialized the parameter
  - If you change the value assigned to a parameter that will not change the value of the argument
- IMPORTANT: It is the nature of what you pass what makes a difference
  - If you pass a primitive type value, nothing can change the argument
  - If you pass a reference then we may change the object associated with the reference in the method that has been called.
    - Remember that a reference variable does not store the object
      - It stores an address

Passing Parameters

- **Primitive Types**
  - Let's see passing parameters when dealing with primitive types
  - Let's draw a memory map for the code in Swapping.java
- **Reference Types**
  - Let's see passing parameters when dealing with reference types
  - Let's draw a memory map for the code in Increasing.java
  - You MUST DOCUMENT if you method is going to change a value passed via a parameter
    - Some call it a destructive method
    - How would we prevent a parameter from being modified?
      - Copy constructor