Concurrent & Multicore OCaml: A deep dive

KC Sivaramakrishnan[1] & Stephen Dolan[1]

Leo White[2], Jeremy Yallop[1,3], Armaël Guéneau[4], Anil Madhavapeddy[1,3]

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Concurrency ≠ Parallelism

- Concurrency
  - Programming technique
  - **Overlapped** execution of processes
- Parallelism
  - (*Extreme*) Performance hack
  - **Simultaneous** execution of computations

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(***Fibers***) (***Domains***)

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- ***Algebraic Effects and Handlers***

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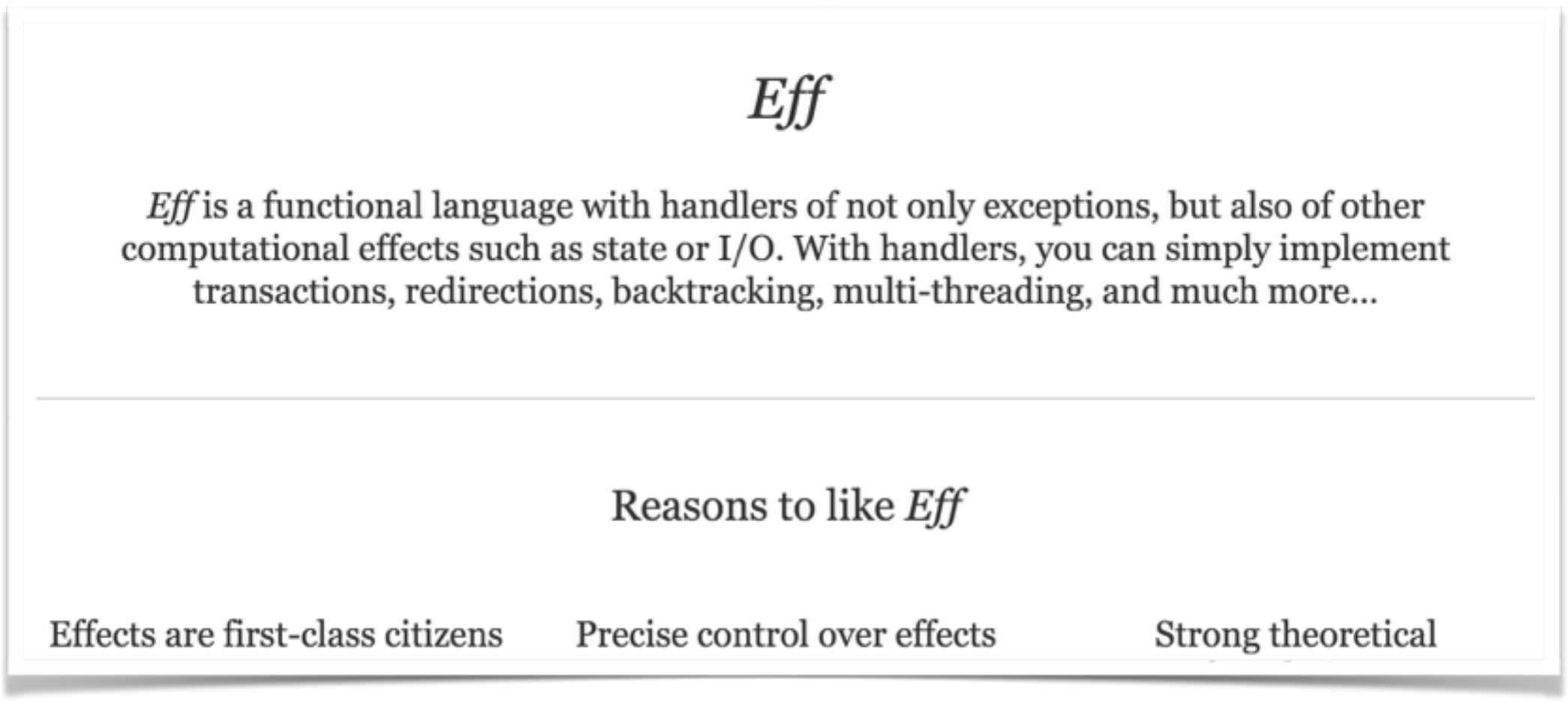
- *Eff* — **http://www.eff-lang.org/**



Eff

Eff is a functional language with handlers of not only exceptions, but also of other computational effects such as state or I/O. With handlers, you can simply implement transactions, redirections, backtracking, multi-threading, and much more...

Reasons to like *Eff*

Effects are first-class citizens

Precise control over effects

Strong theoretical

Algebraic Effects: Example

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exception Foo of int

let f () = 1 + (raise (Foo 3))

let r =
  try
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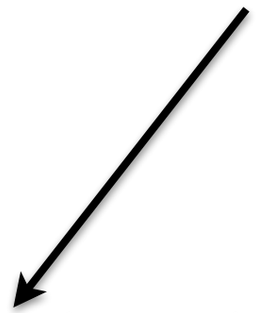

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fiber — lightweight stack

Scheduler Demo[1]

[1] https://github.com/kayceesrk/ocaml15-eff/tree/master/chameneos-redux

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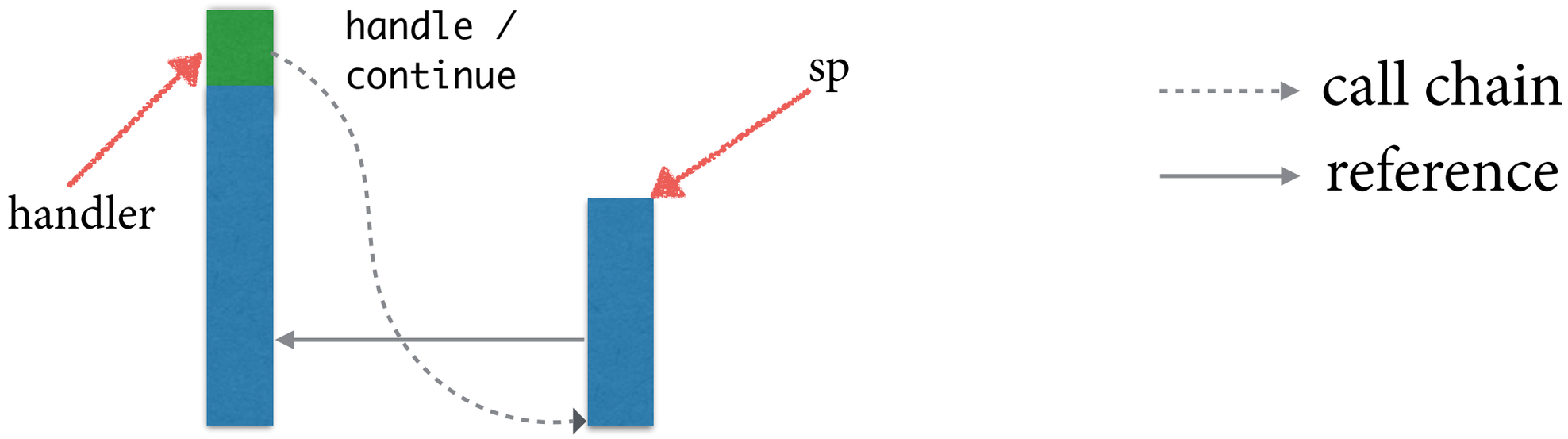

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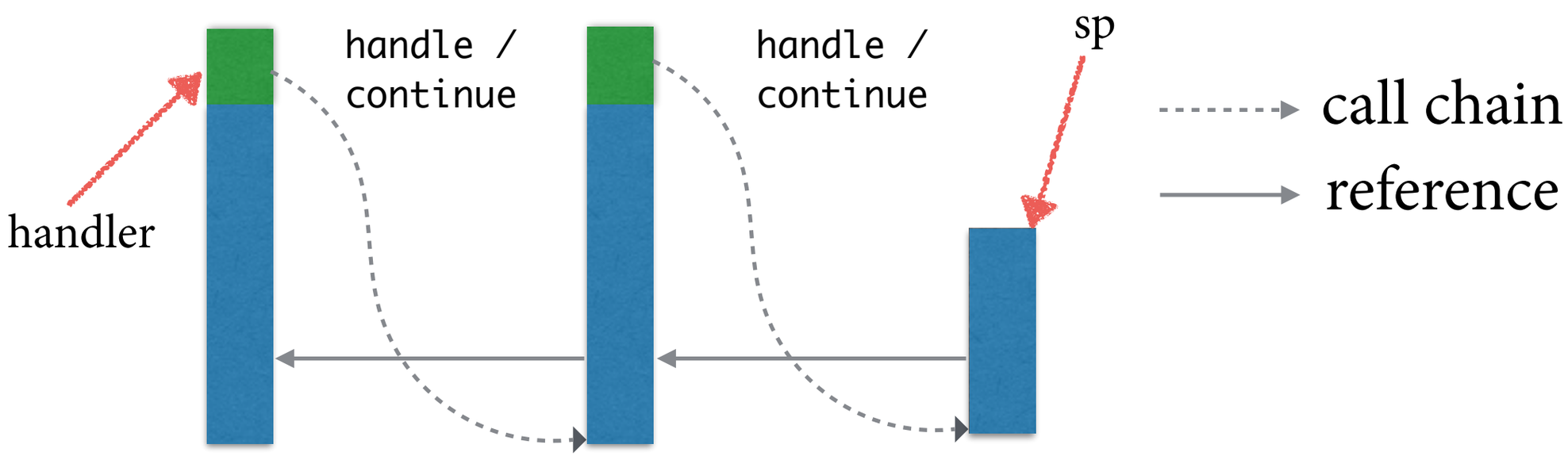

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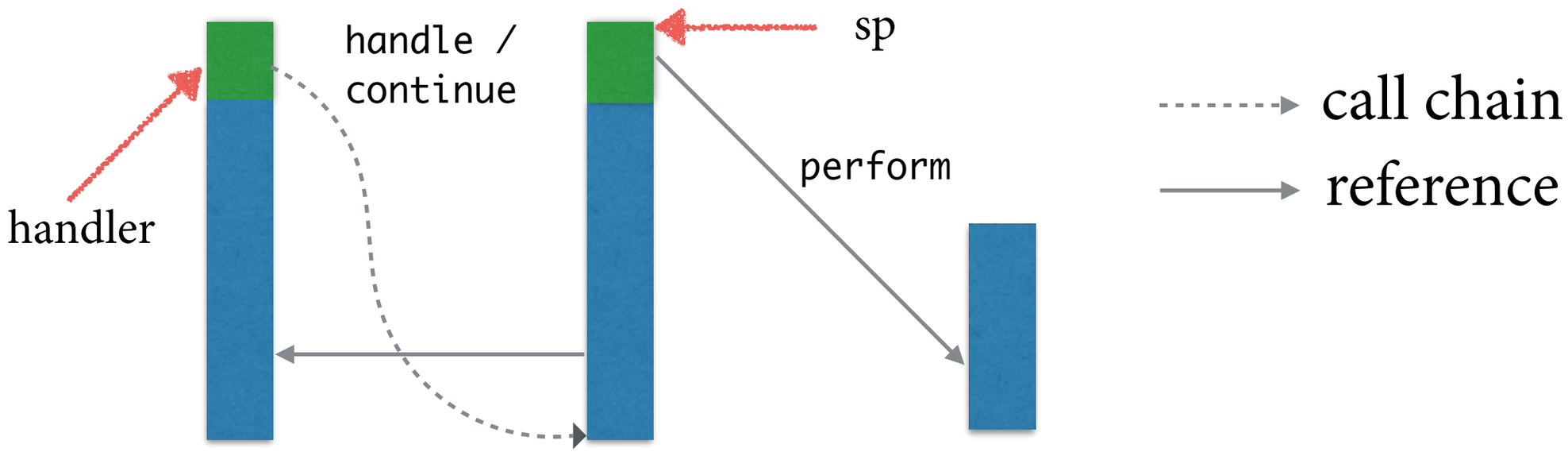

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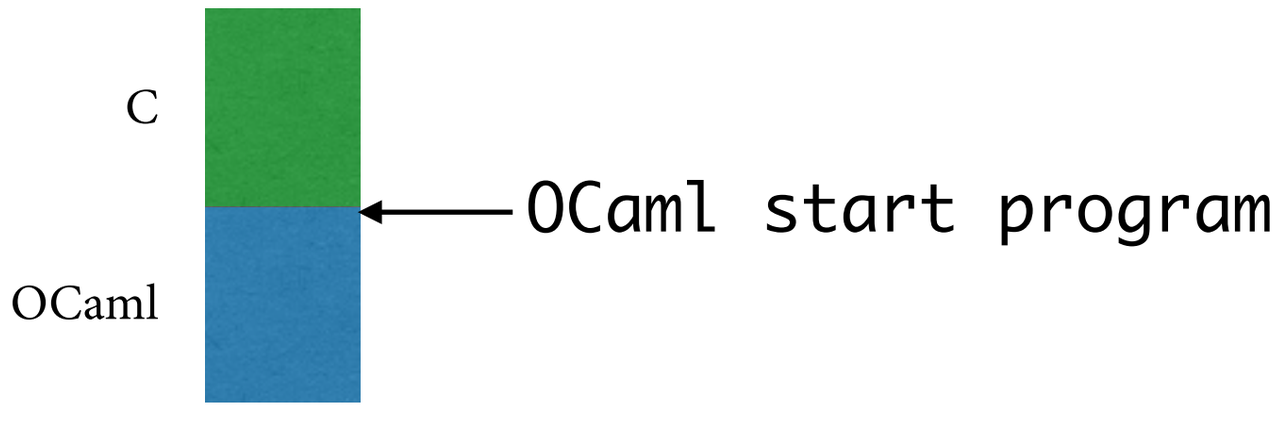

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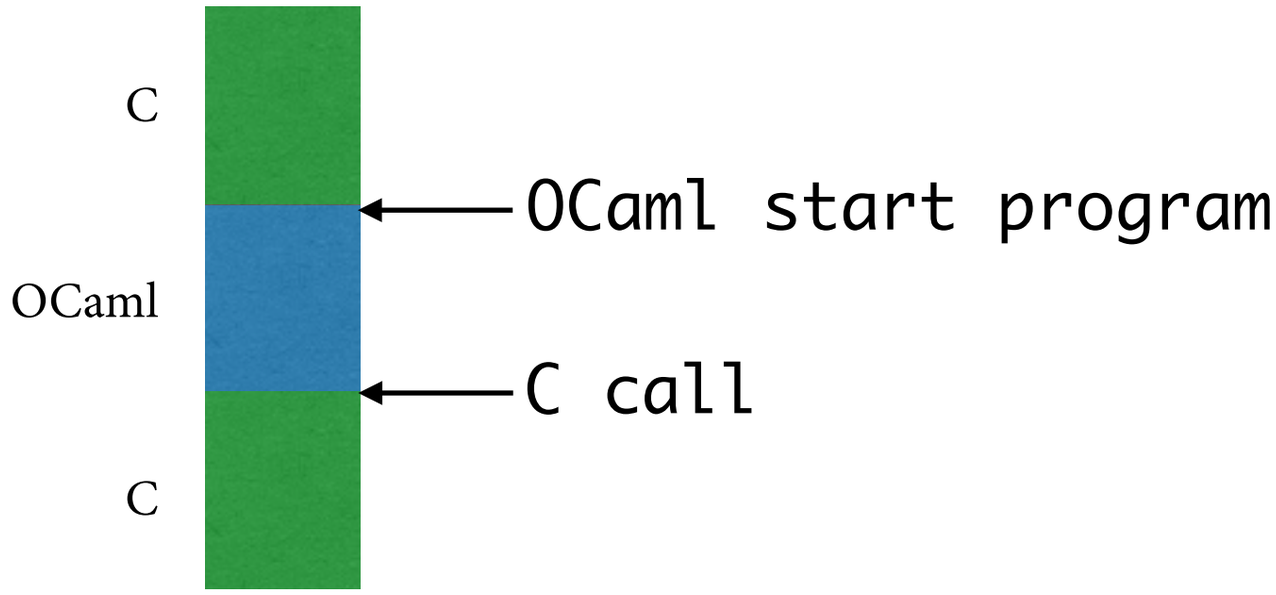

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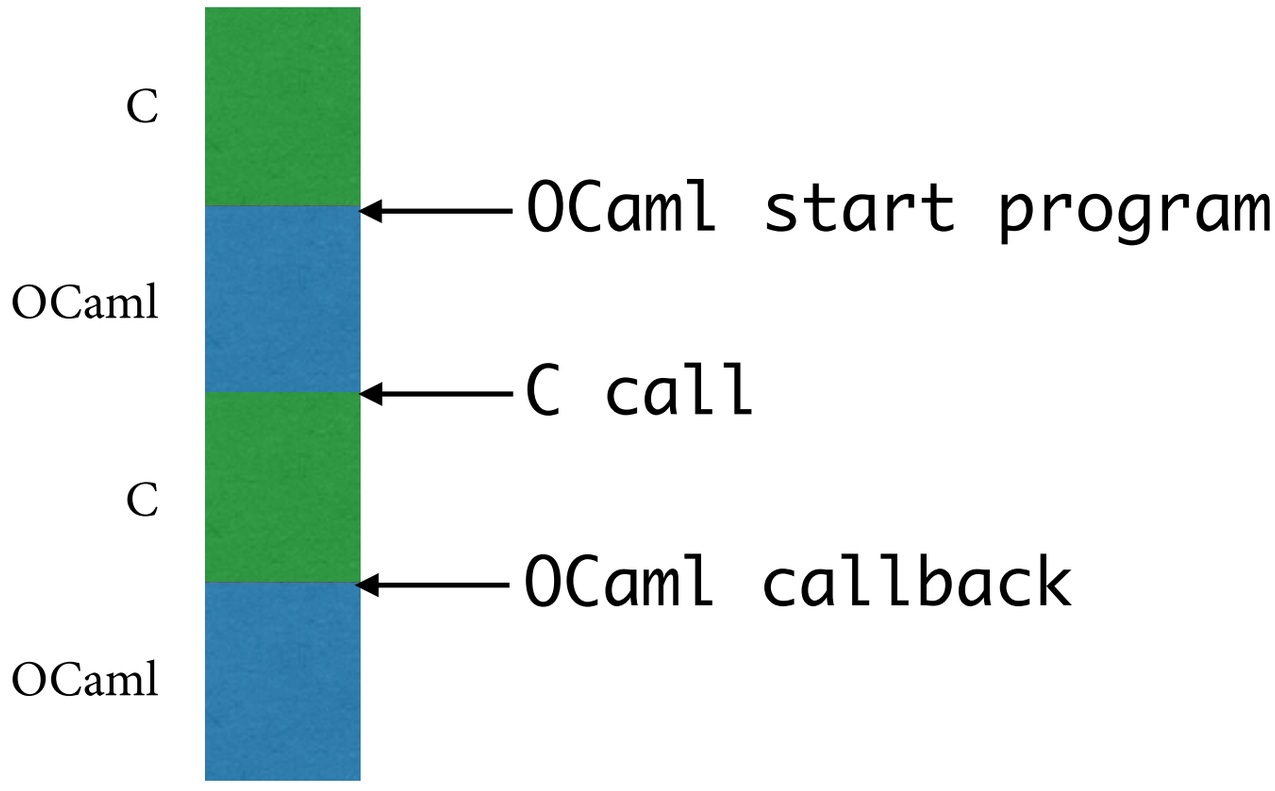

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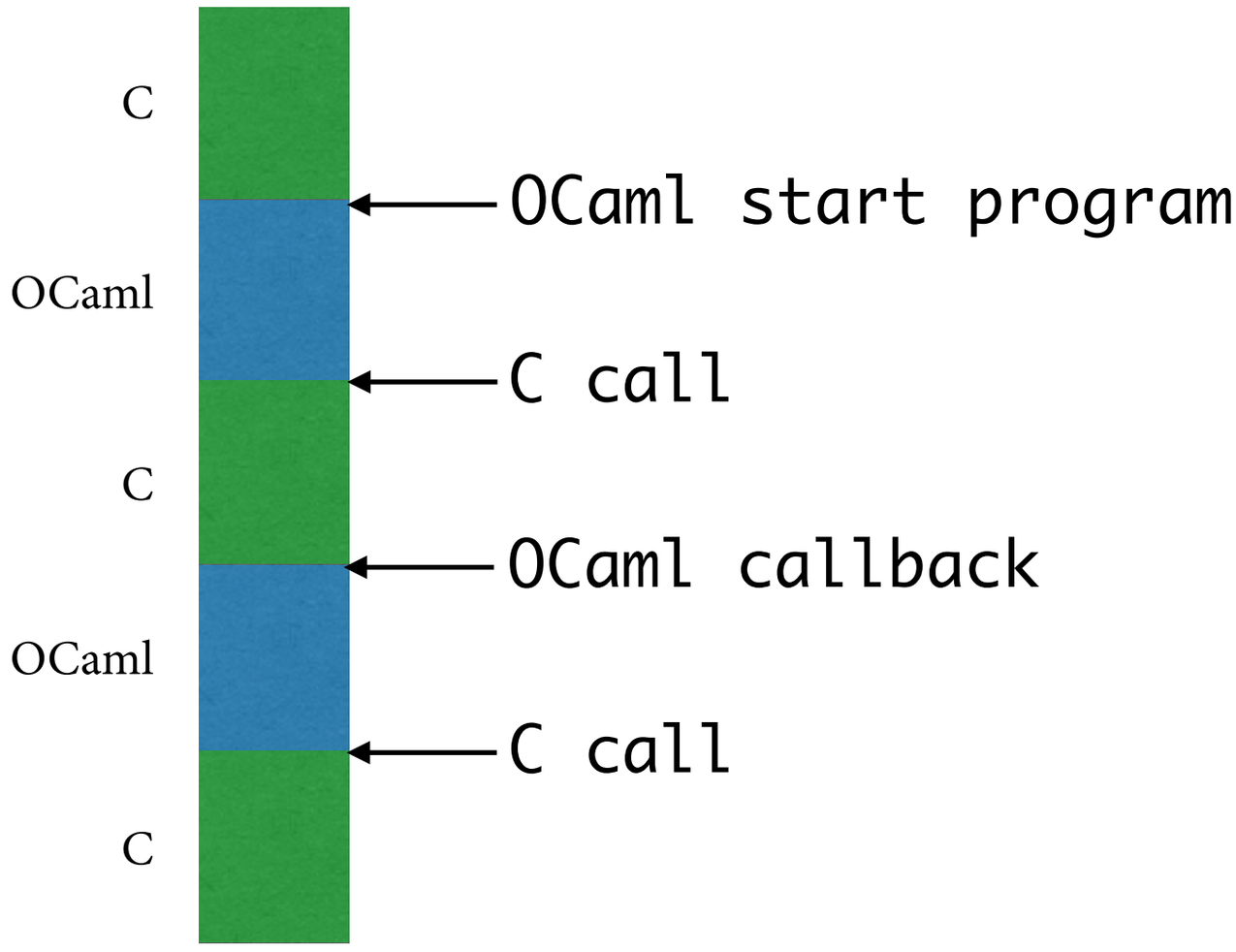

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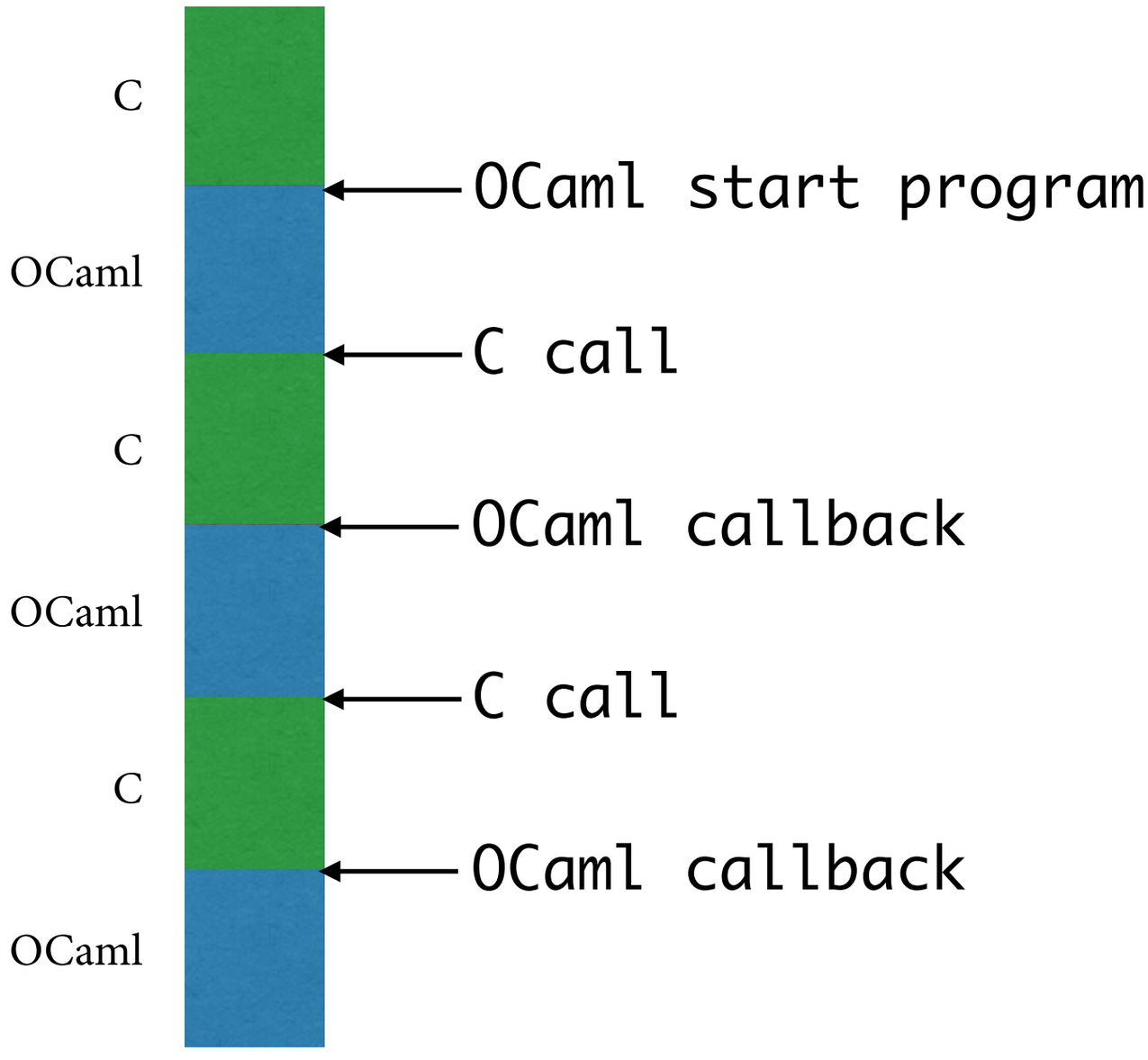

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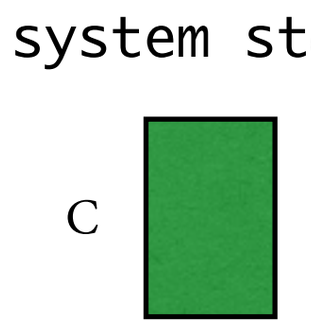

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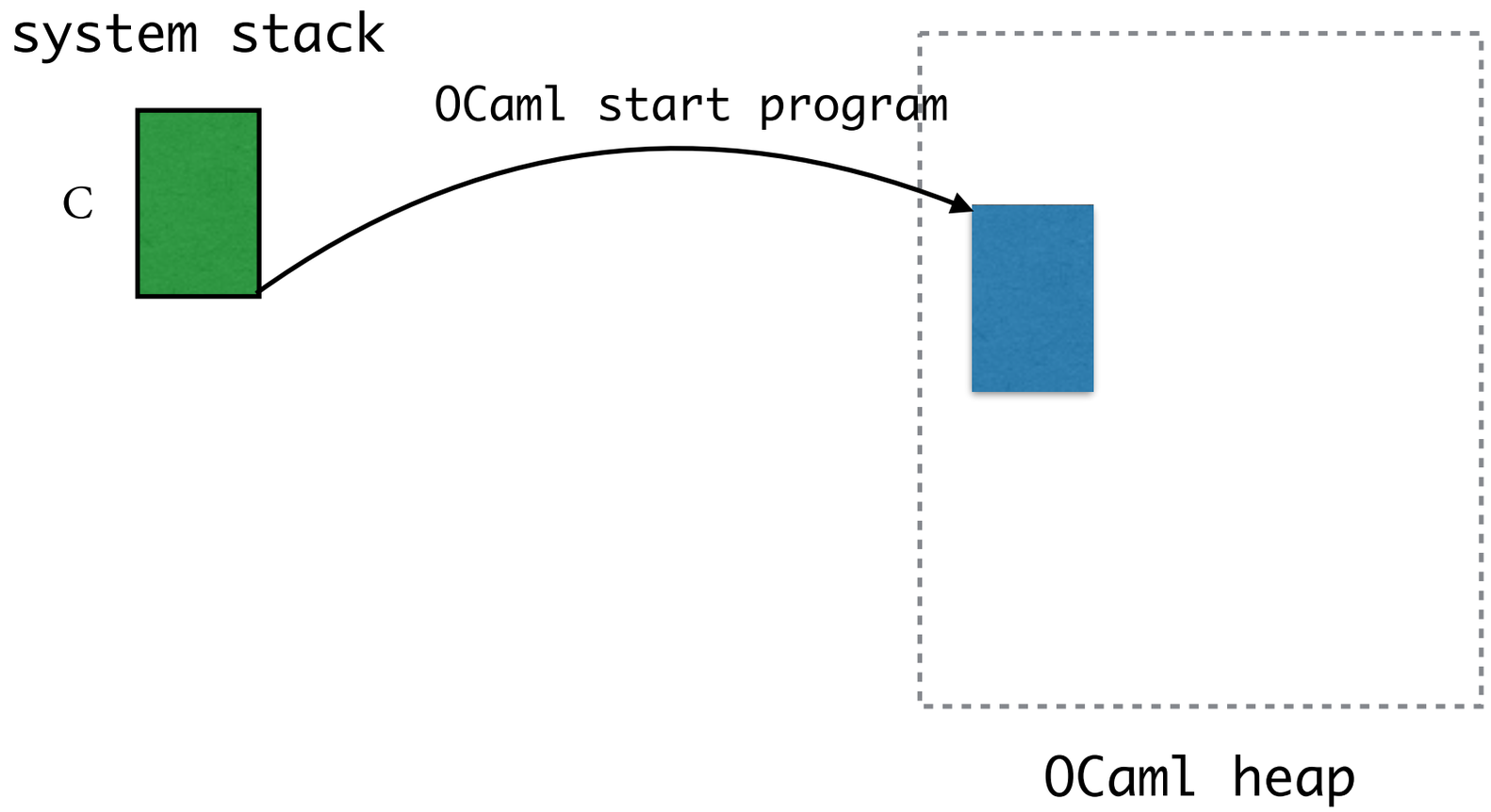

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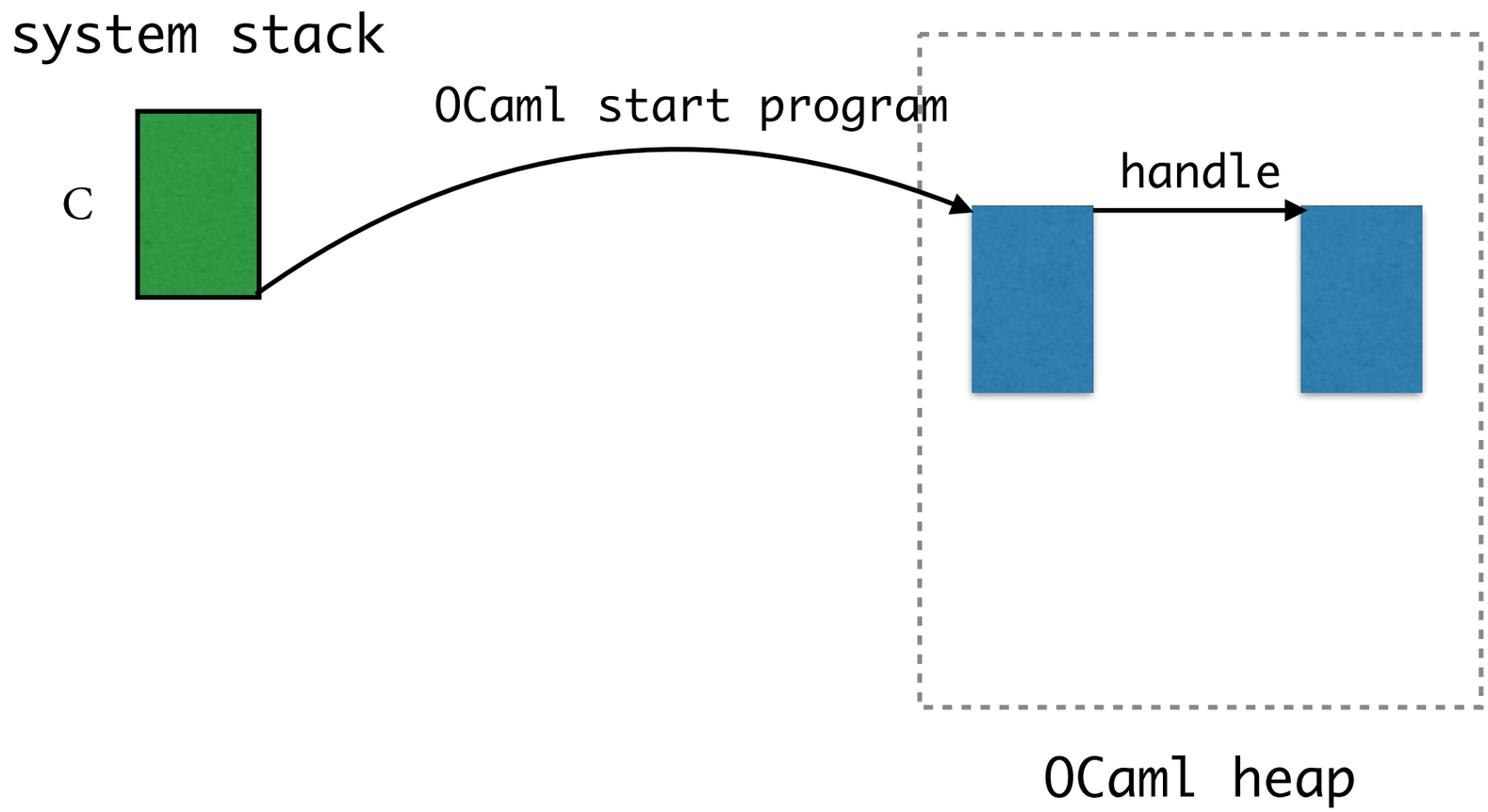

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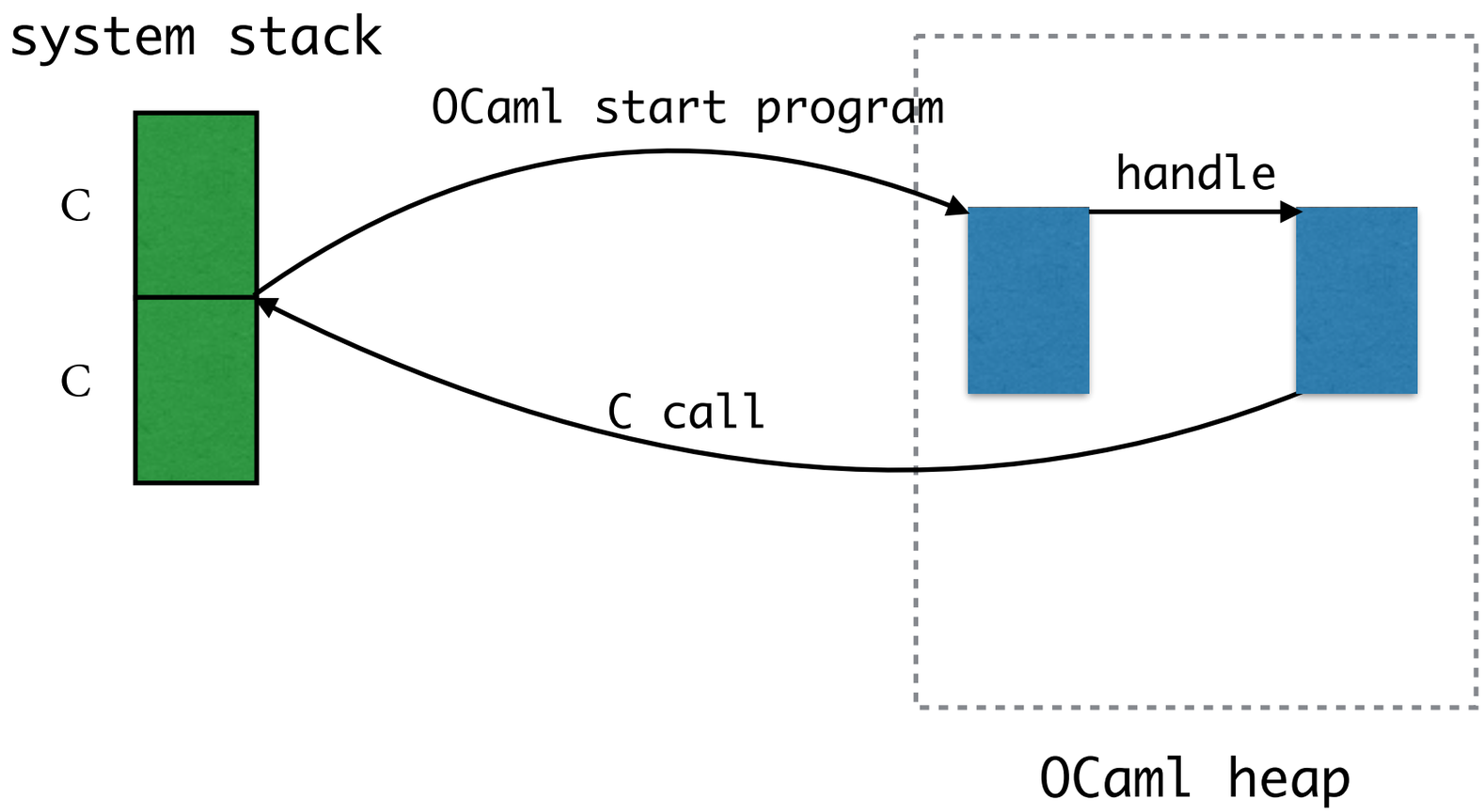

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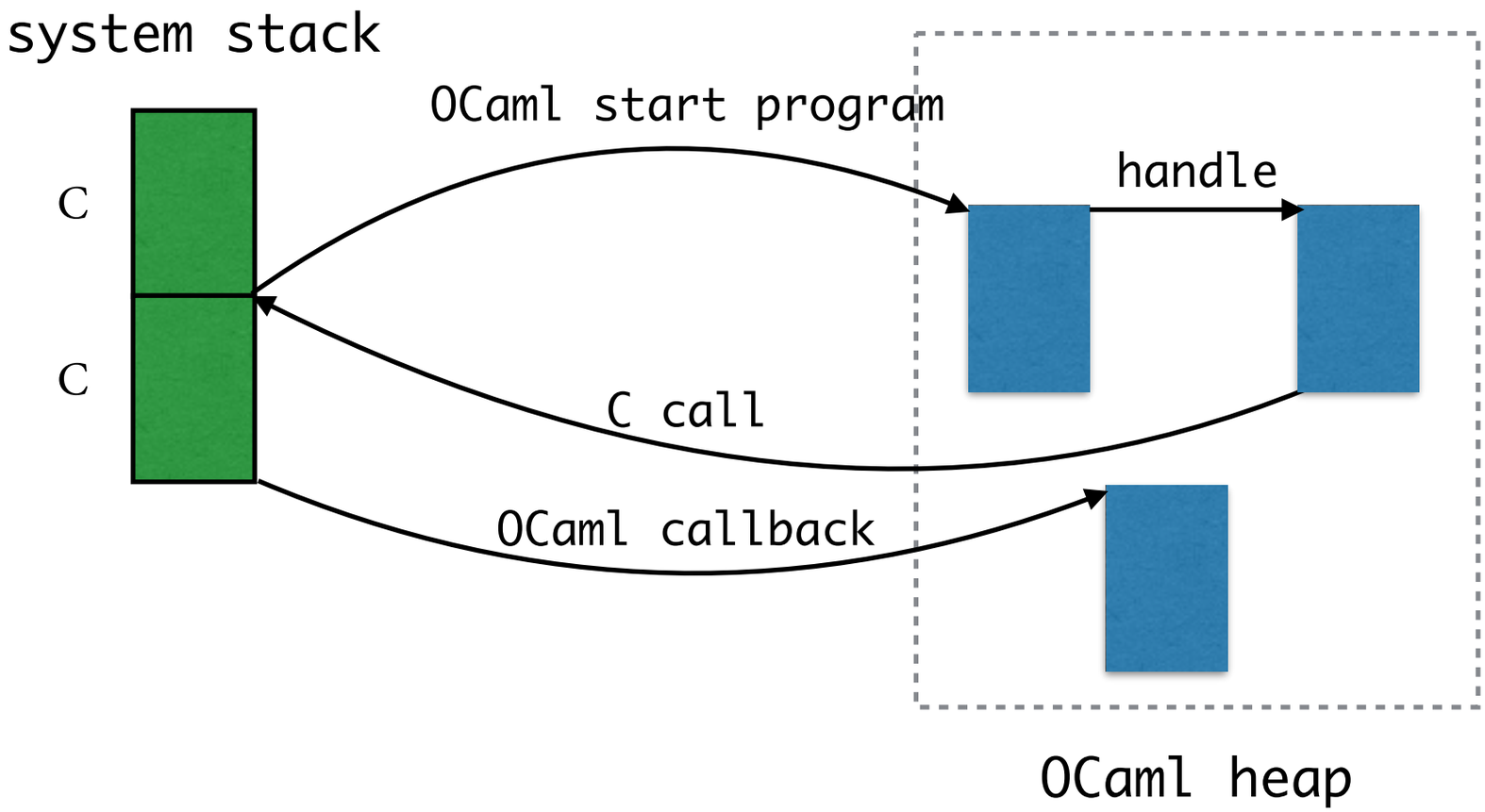

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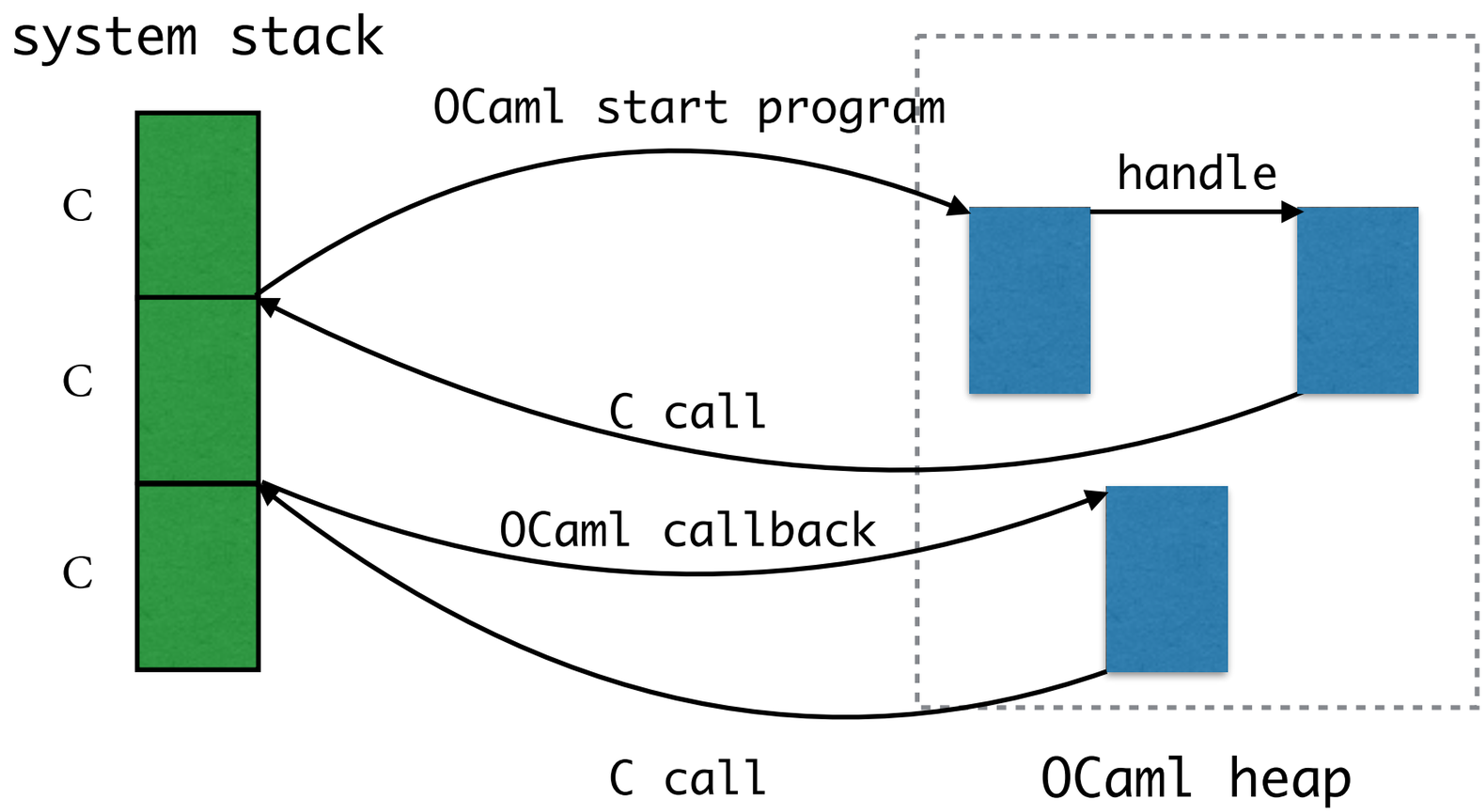

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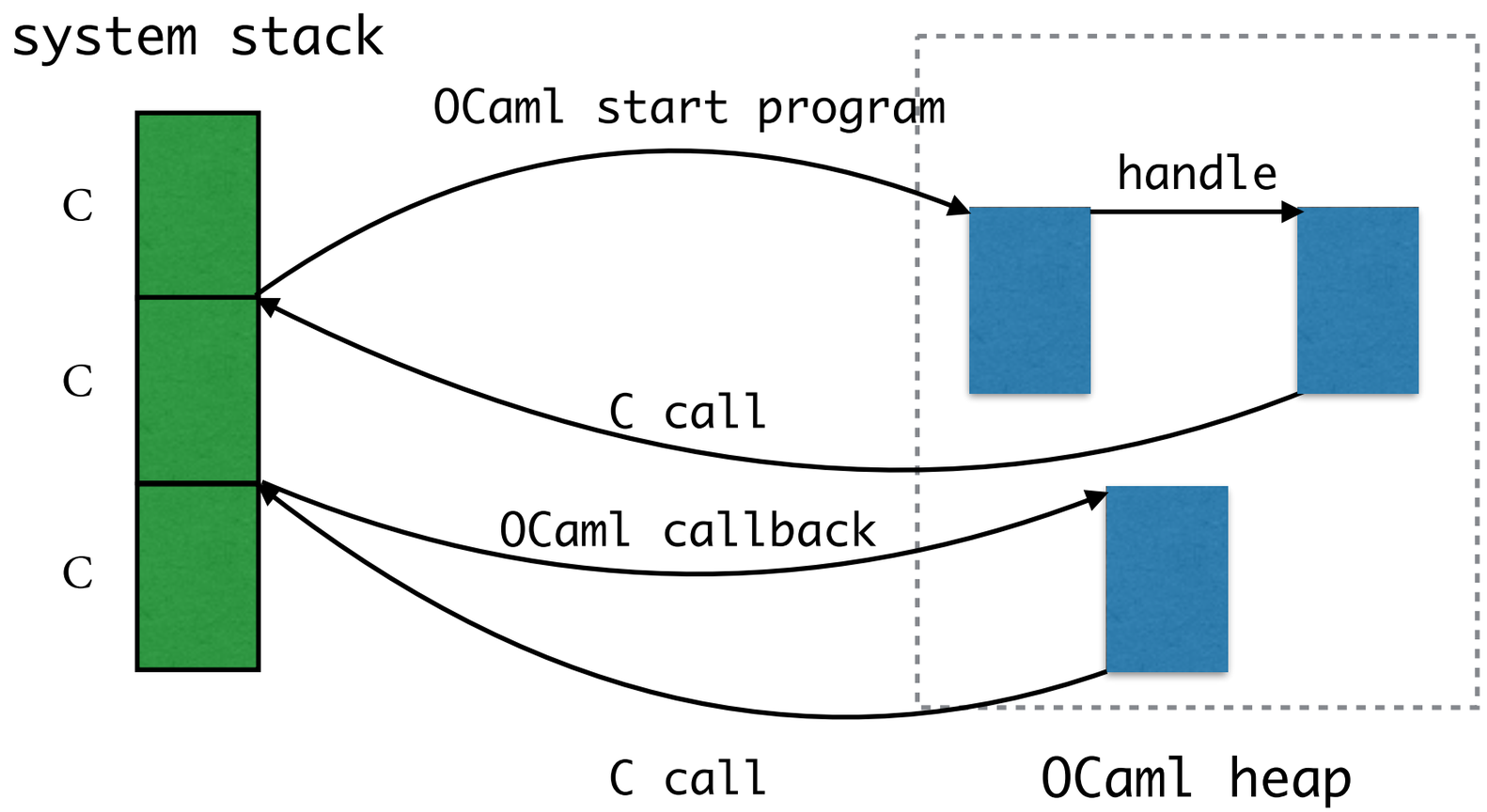

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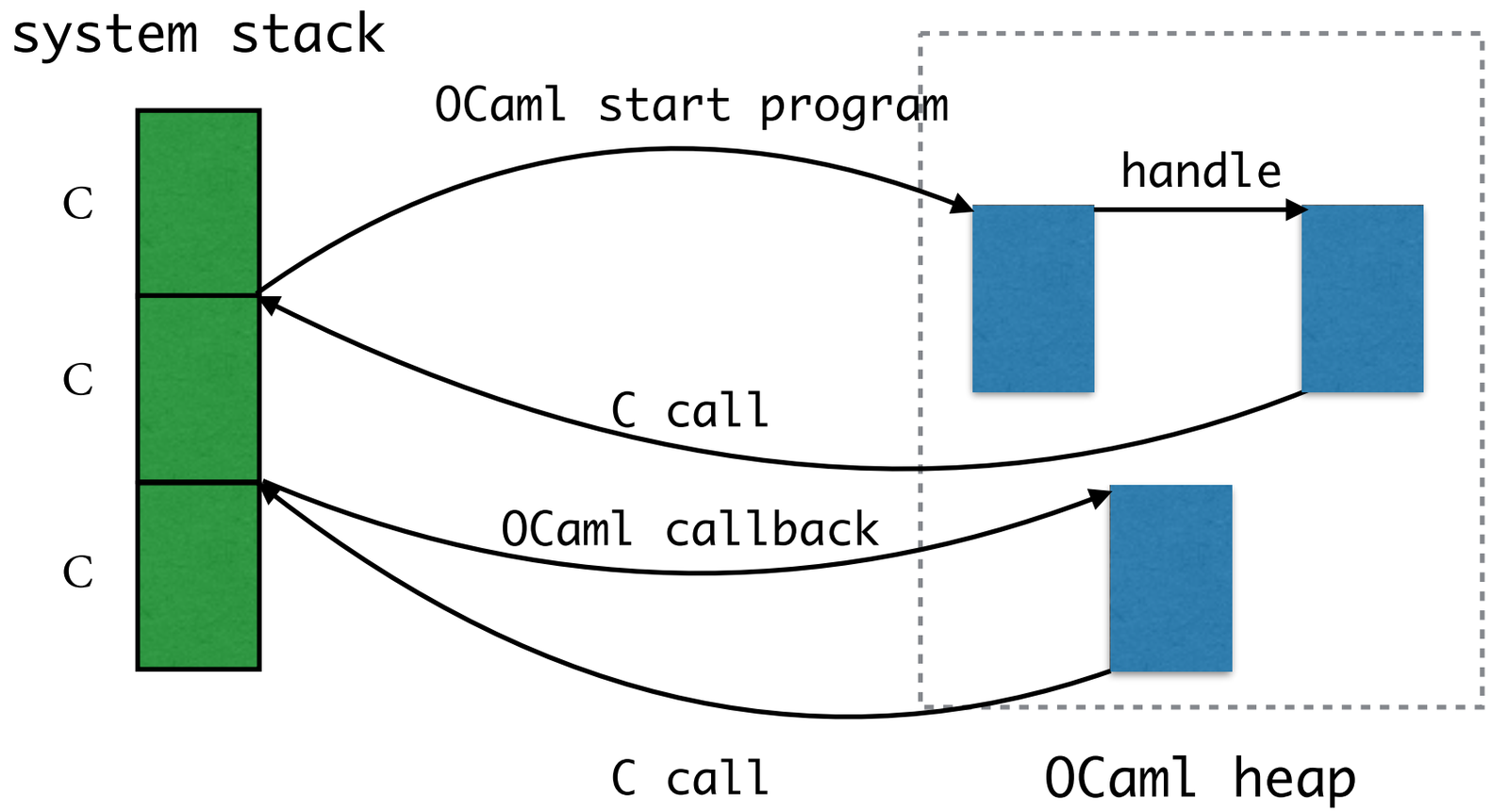

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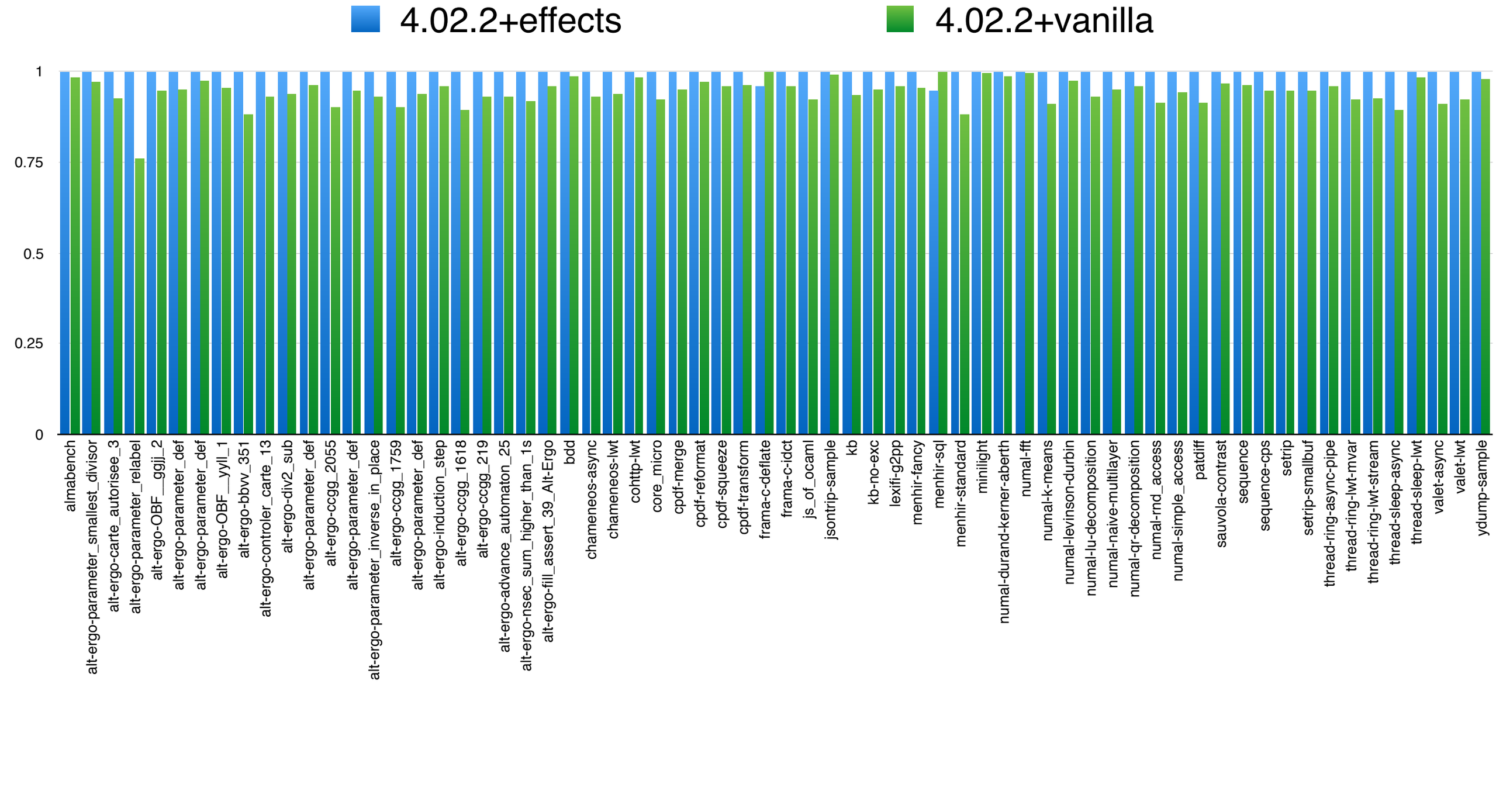
   - Simple static analysis eliminates many checks
2. FFI calls are more expensive due to stack switching
   - Specialise for calls which {allocate / pass arguments on stack / do neither}

Performance : Vanilla OCaml

Normalised time (lower is better)



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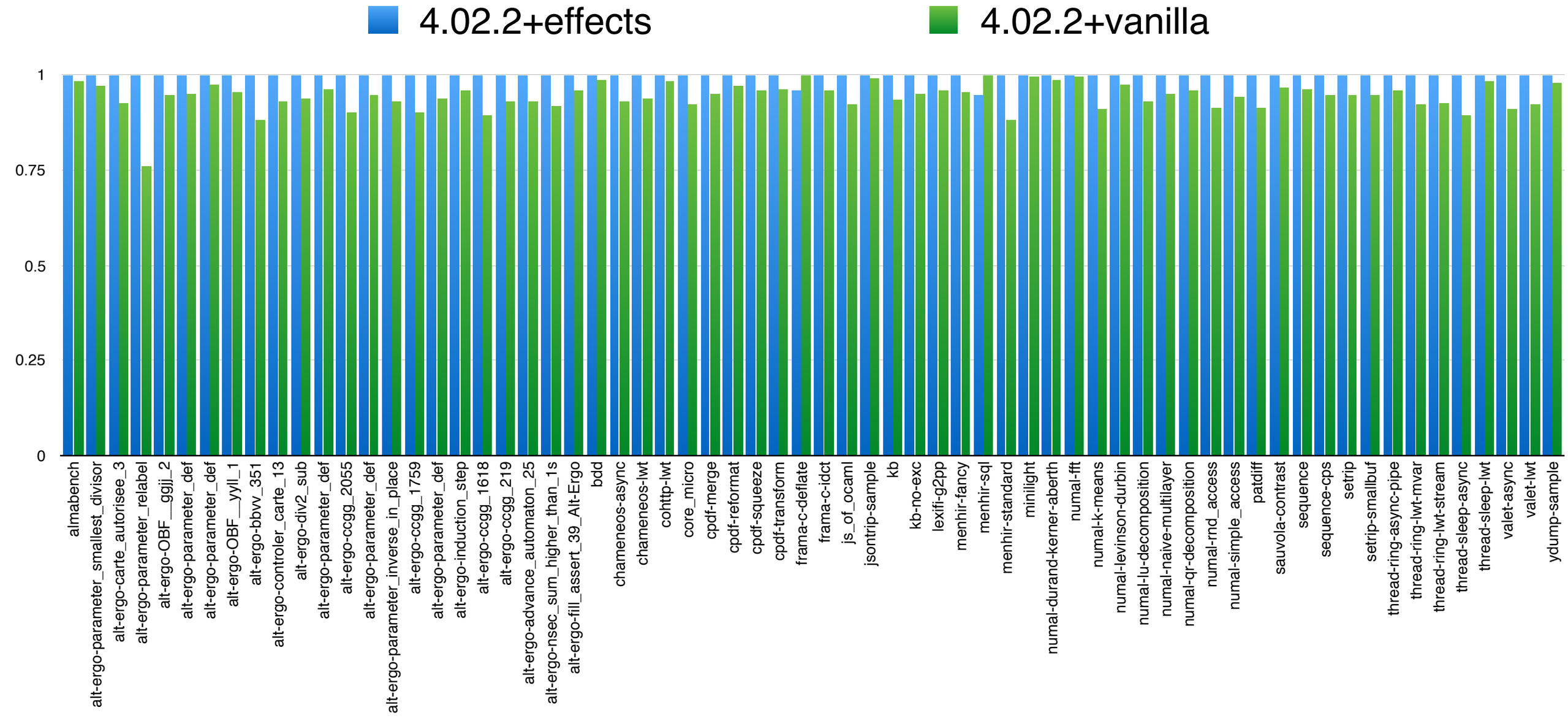
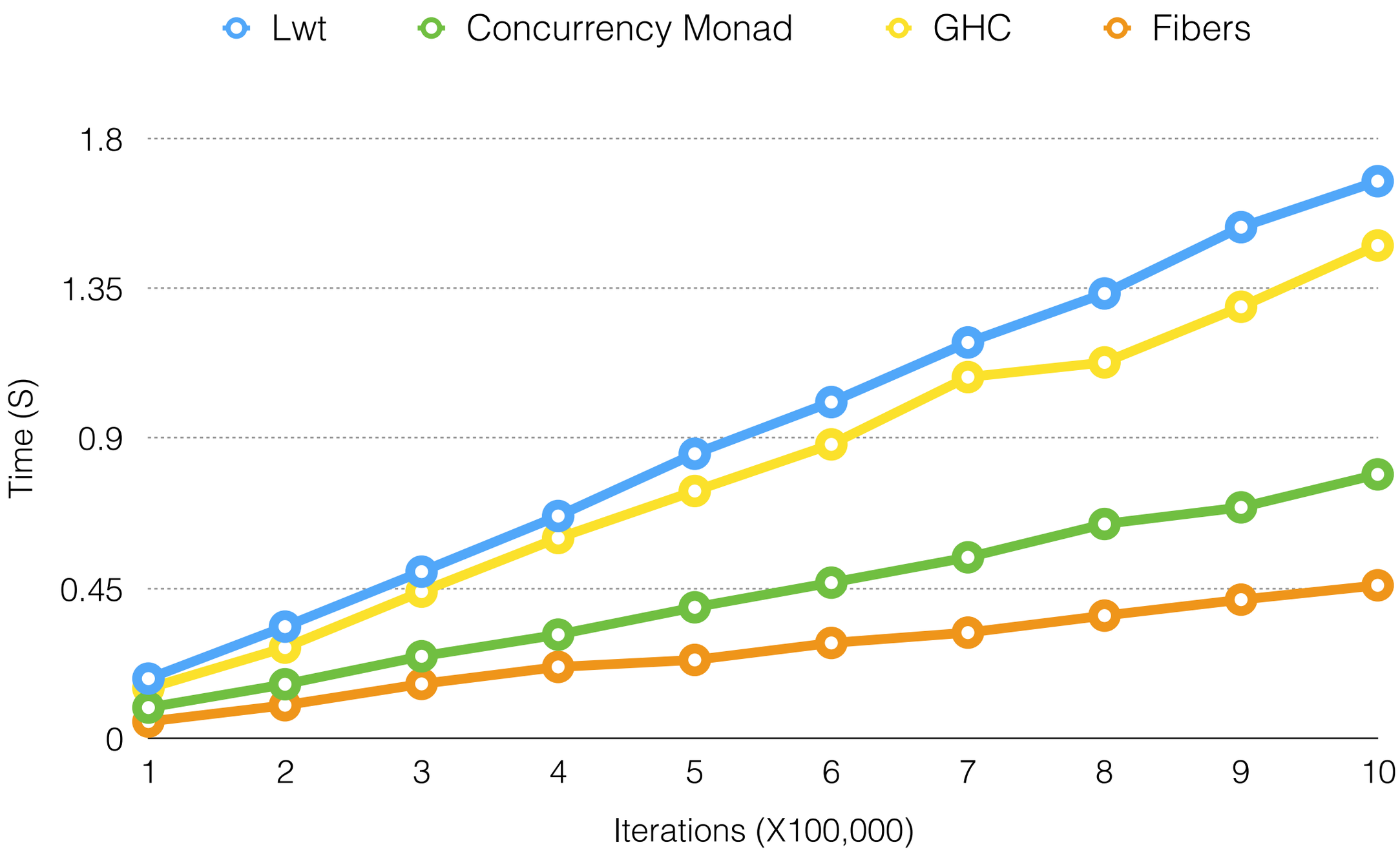


4.02.2+effects ~**5.4%** slower

Performance : Chameneos-Redux



Generator from Iterator[1]

```
type 'a t =
| Leaf
| Node of 'a t * 'a * 'a t

let rec iter f = function
  | Leaf -> ()
  | Node (l, x, r) -> iter f l; f x; iter f r
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(* val to_gen : 'a t -> (unit -> 'a option) *)
let to_gen (type a) (t : a t) =
  let module M = struct effect Next : a -> unit end in
  let open M in
  let step = ref (fun () -> assert false) in
  let first_step () =
    try
      iter (fun x -> perform (Next x)) t; None
    with effect (Next v) k ->
      step := continue k; Some v
  in
    step := first_step;
    fun () -> !step ()
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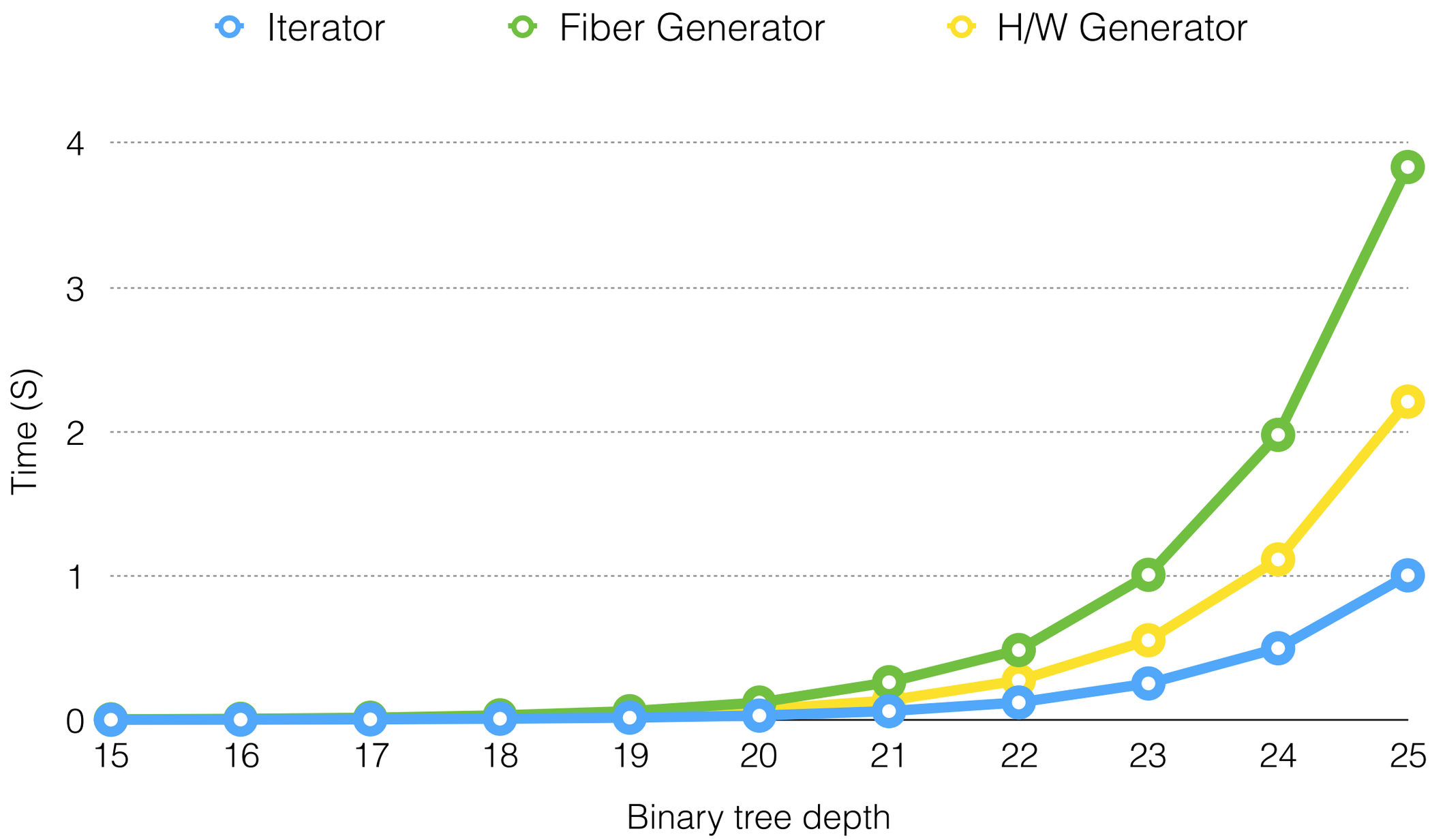

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- Work-in-progress!
  - *Runs "hello-effects-world"!*

fin.

https://github.com/kayceesrk/ocaml-eff-example