Effect Handlers in Multicore OCaml

Daniel Hillerström, Daan Leijen, Sam Lindley, Matija Pretnar, Andreas Rossberg, **KC Sivaramakrishnan**

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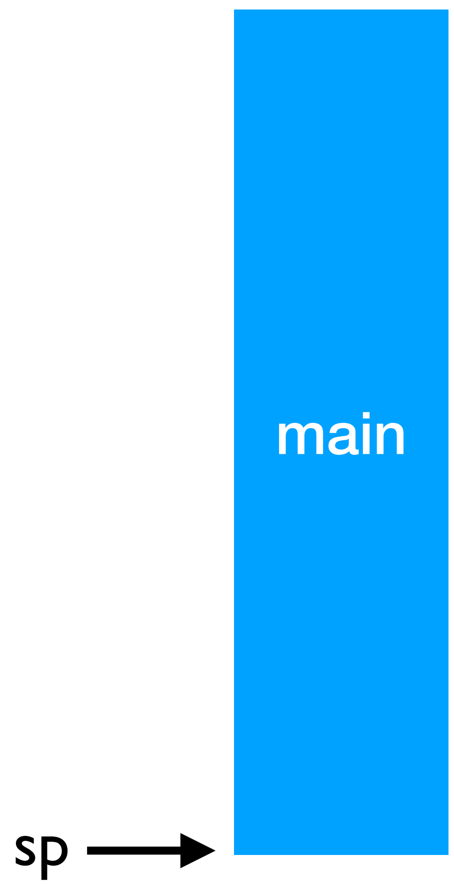
pc



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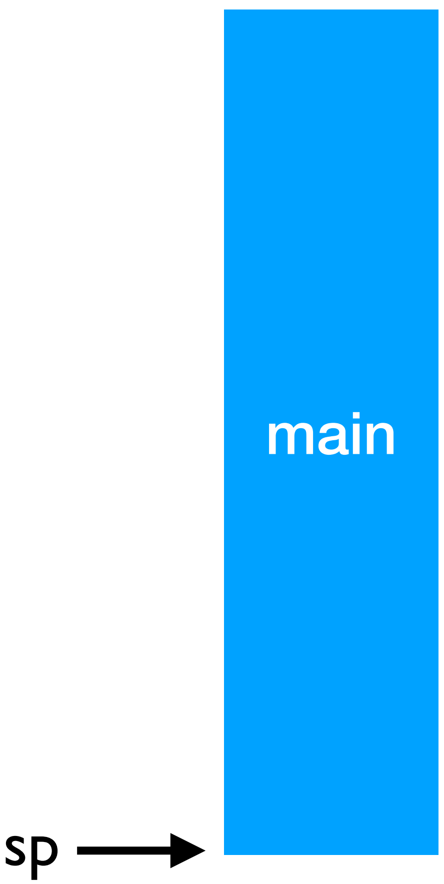

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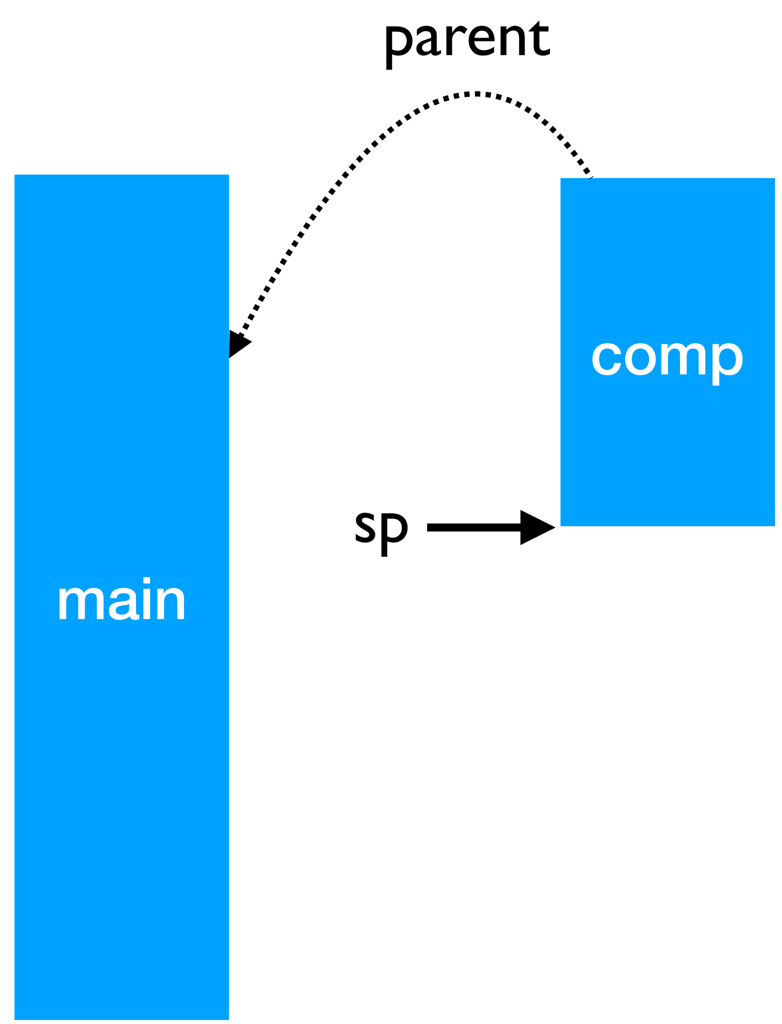

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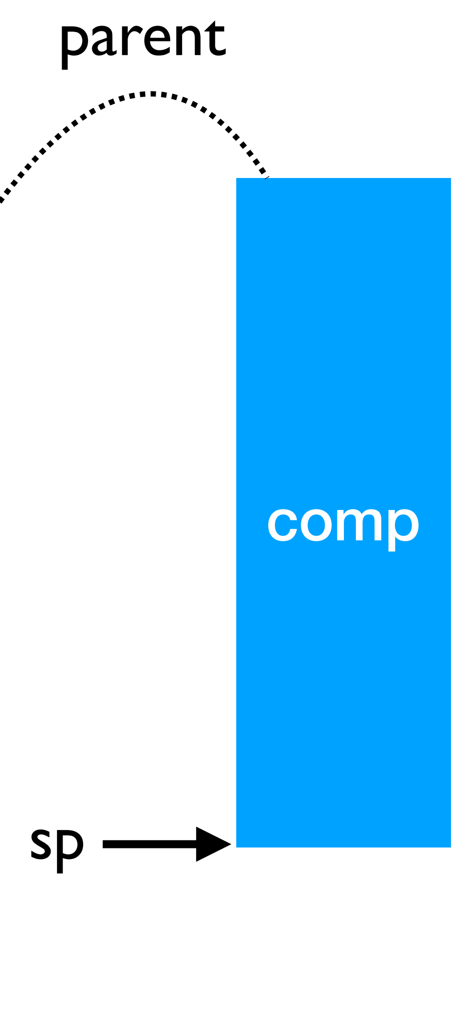

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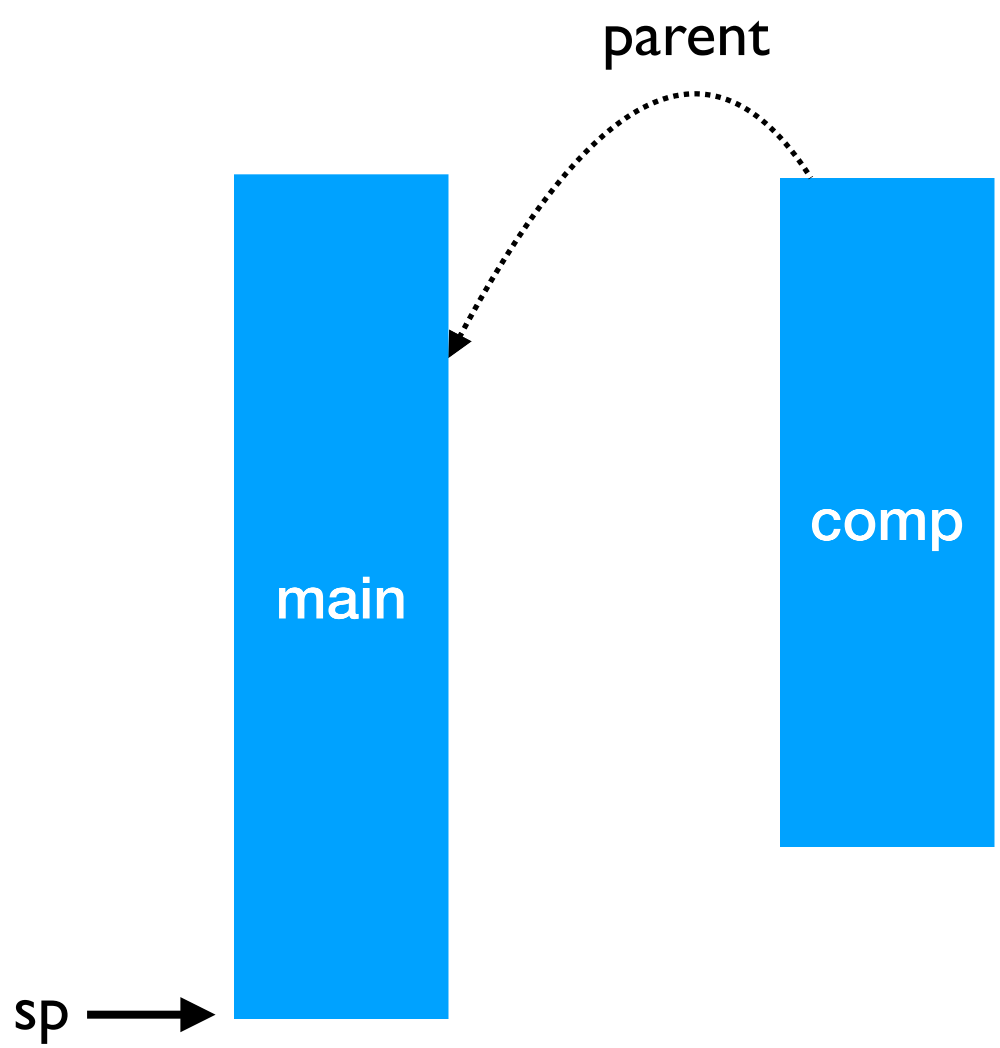

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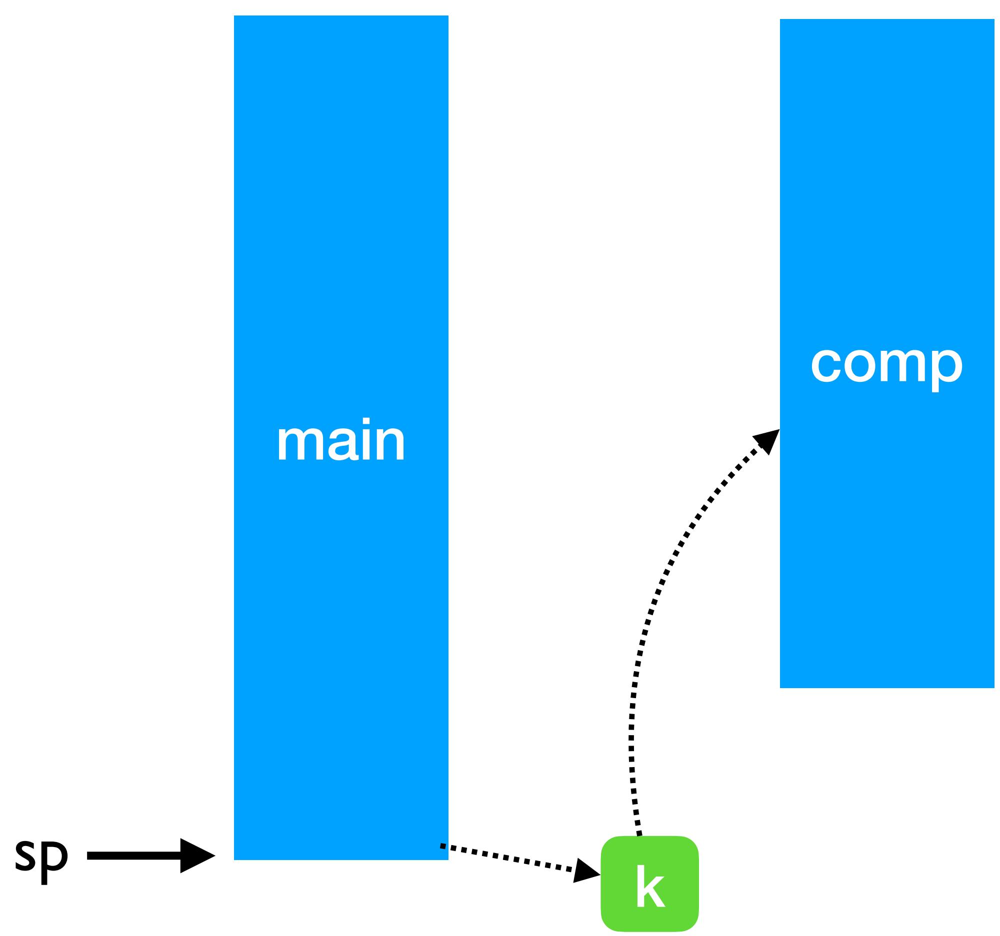

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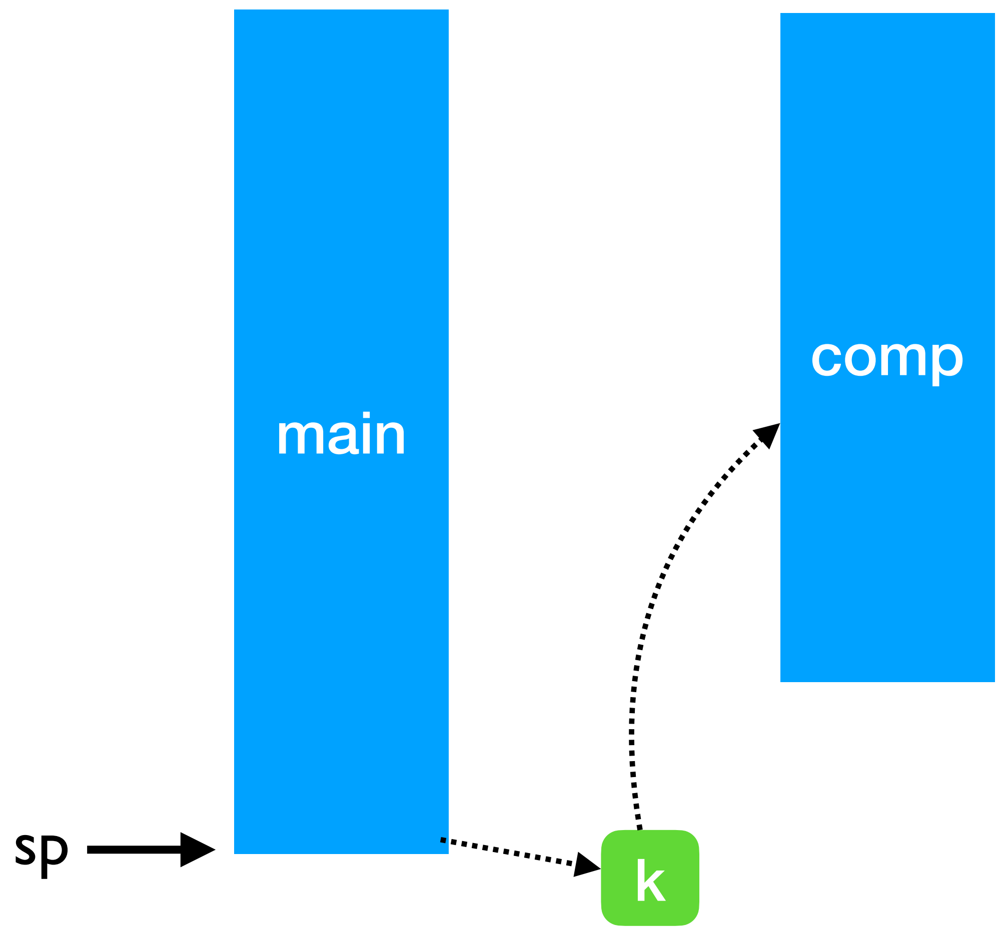

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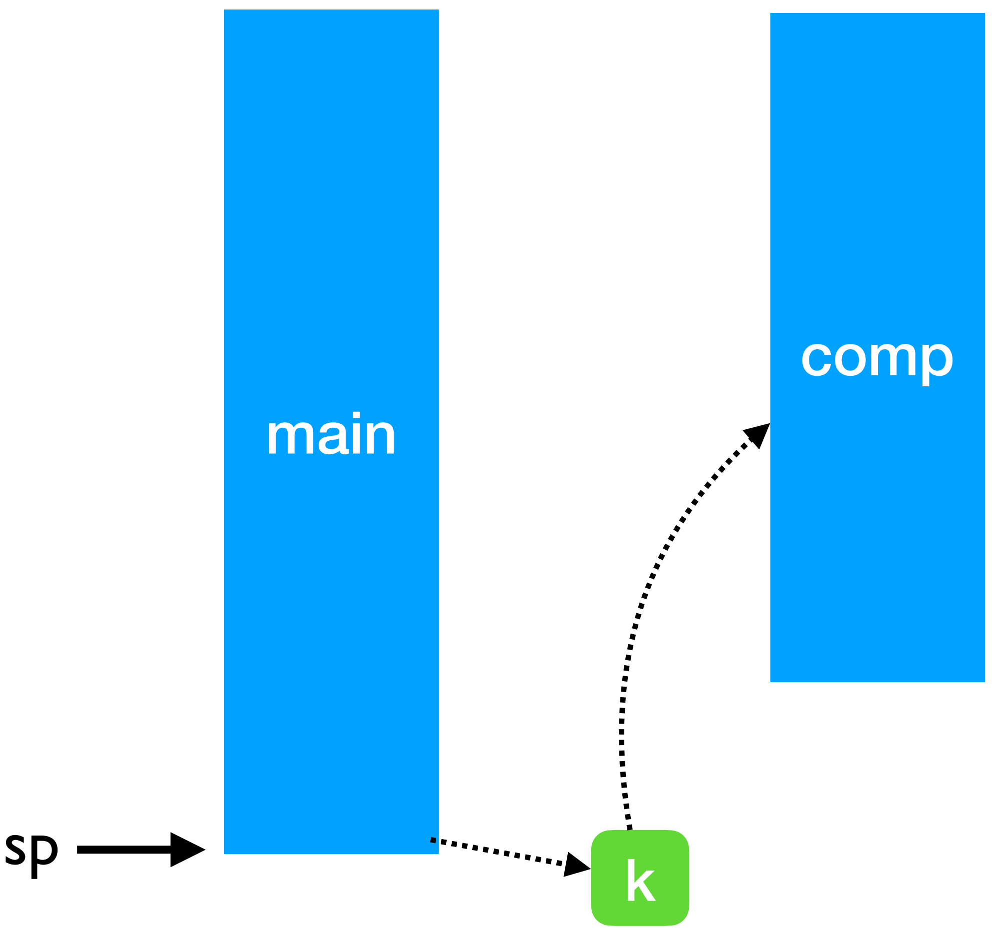

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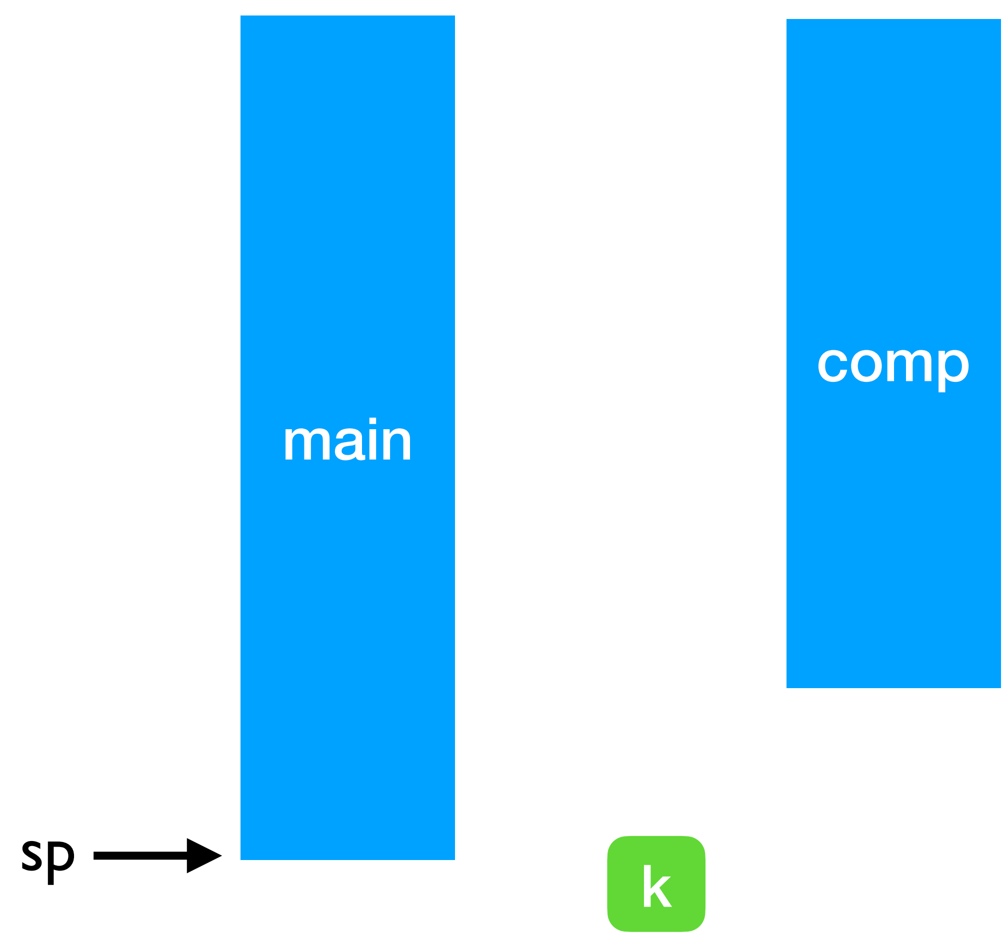

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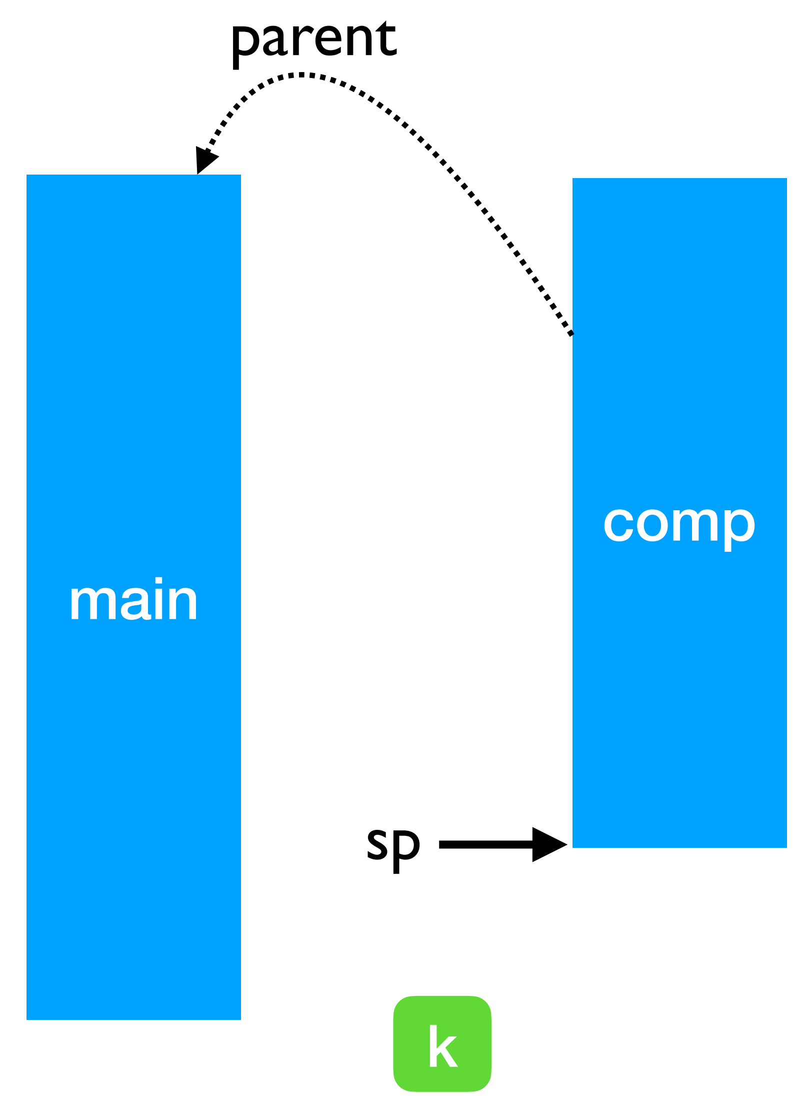

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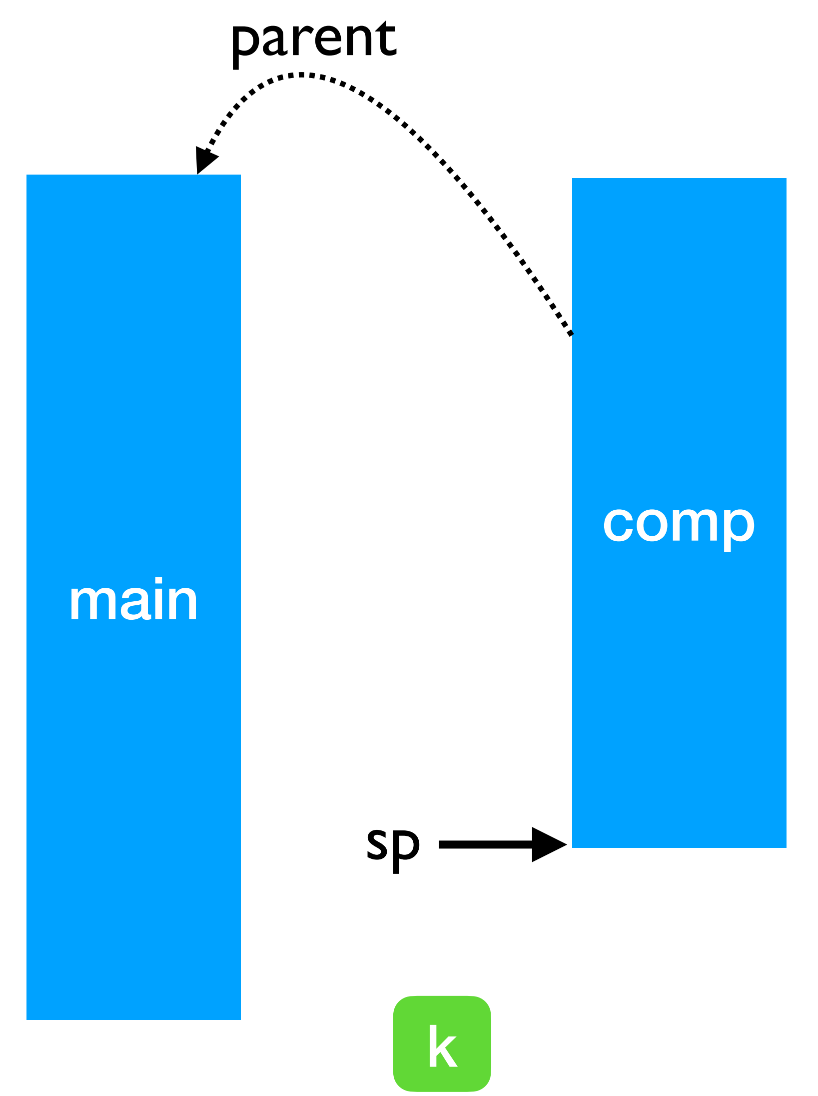

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Handlers can be nested

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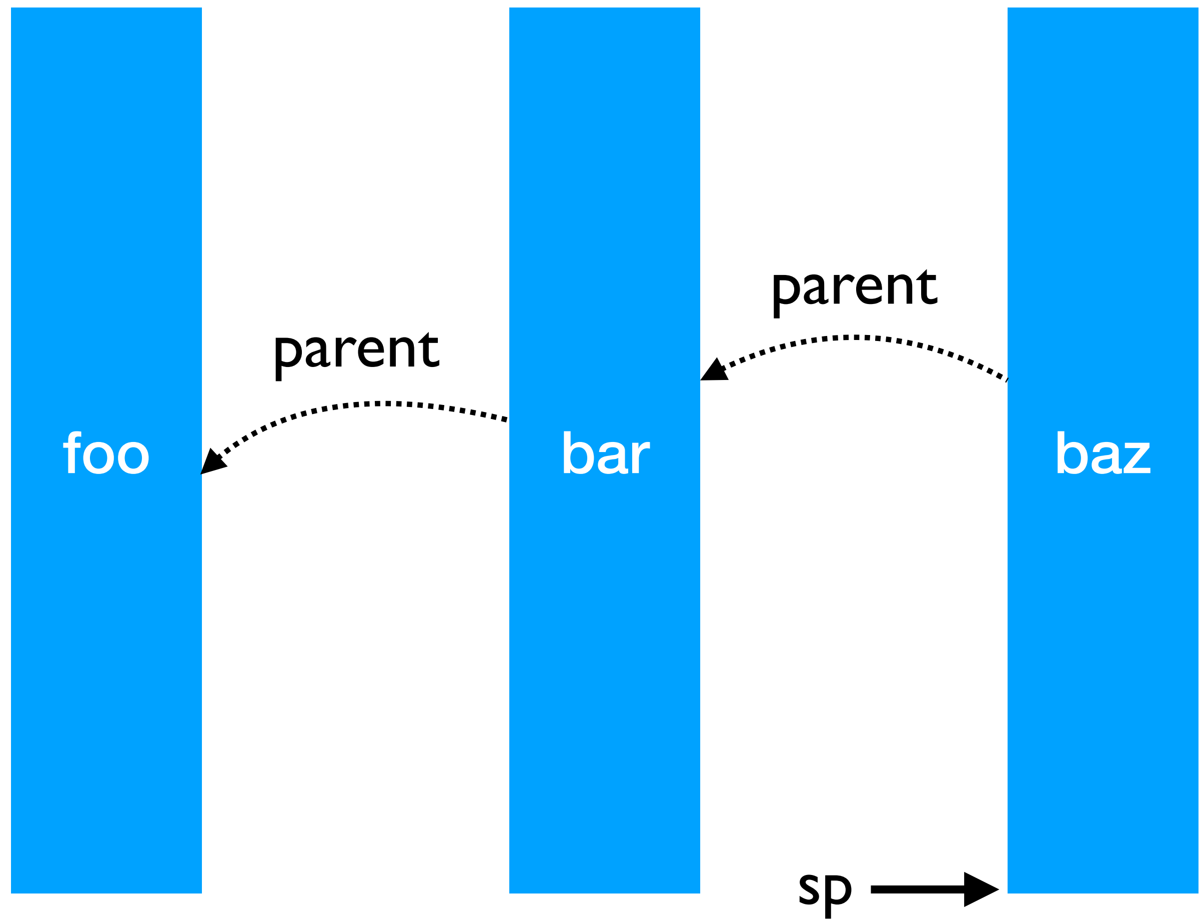

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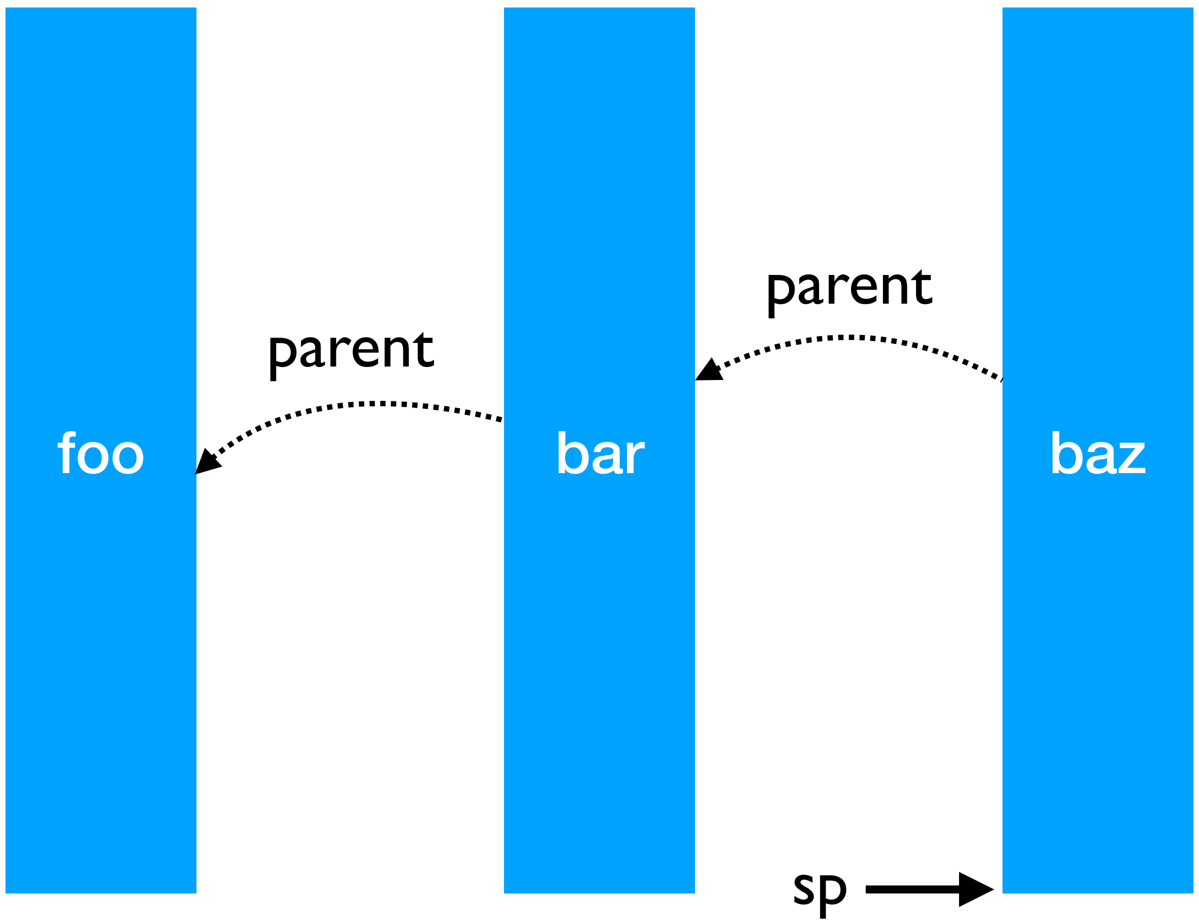

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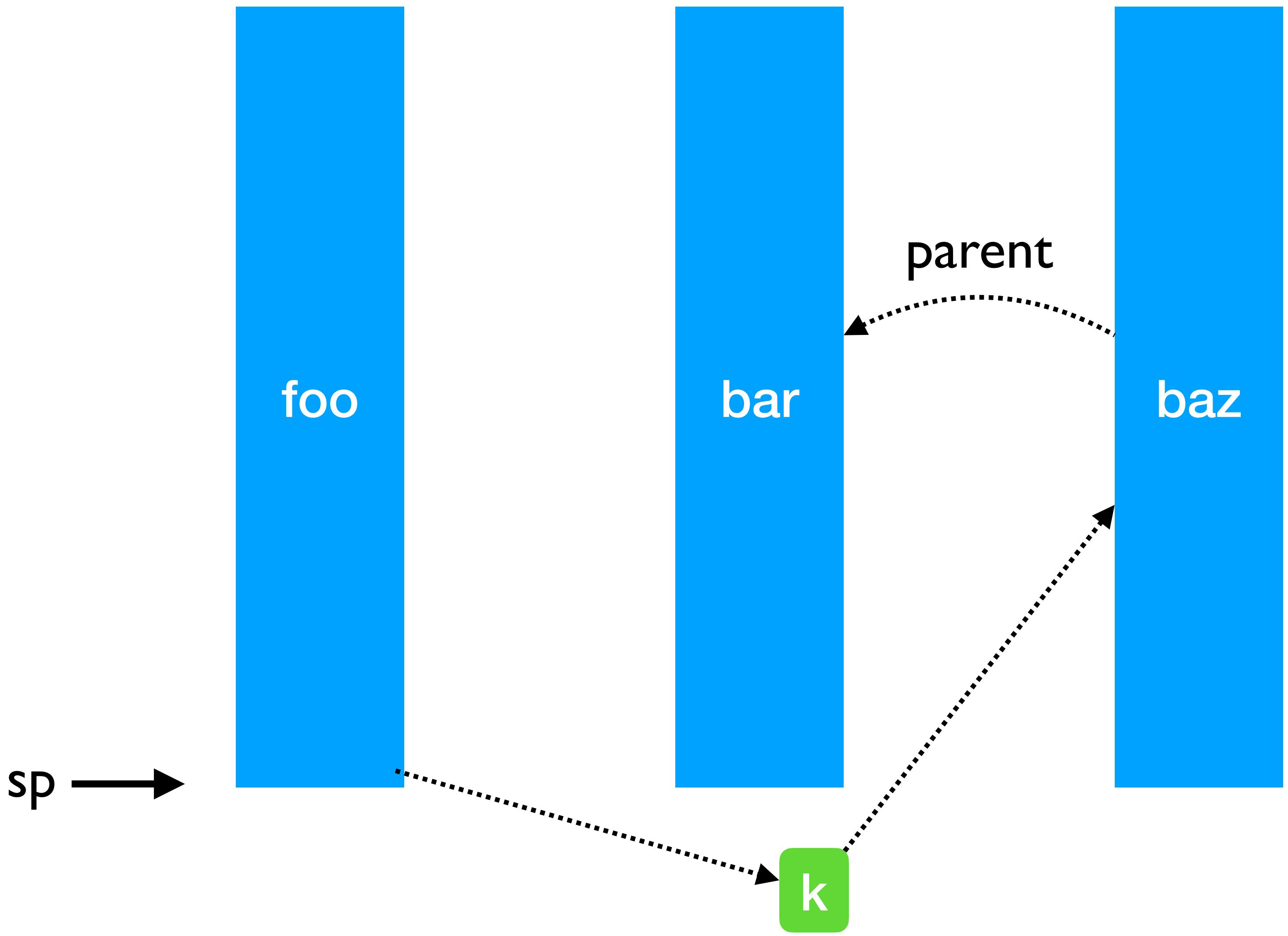

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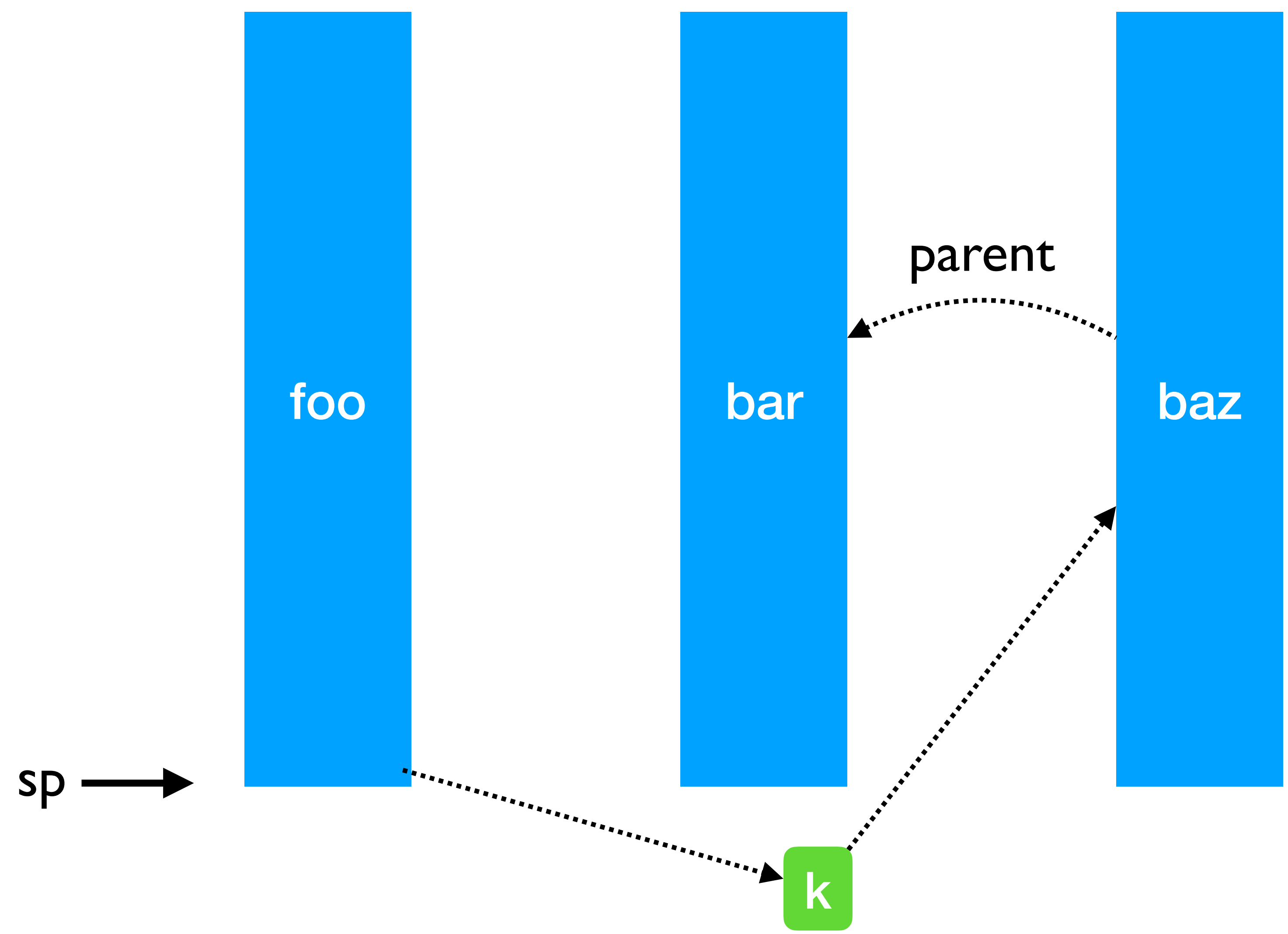

- Linear search through handlers
  - *Handler stacks shallow in practice*

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https://github.com/ocaml-multicore/ocaml-multicore/blob/parallel_minor_gc/runtime/amd64.S#L865

Performance

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Instruction Sequence	Significance
a to b	Create a new stack & run the computation
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Instruction Sequence	Significance	Time (ns)
a to b	Create a new stack & run the computation	2479
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Multicore OCaml

Variant	Time (milliseconds)
Iterator (baseline)	202
hw-generator	761 (**3.76x**)
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nodejs 14.07

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Iterator (baseline)	492
generator	43842 (**89.1x**)

Performance: WebServer

- Effect handlers for asynchronous I/O
- Variants
  - **Go** + net/http
  - OCaml + http/af + **Async** (explicit callbacks)
  - OCaml + http/af + **Effect** handlers
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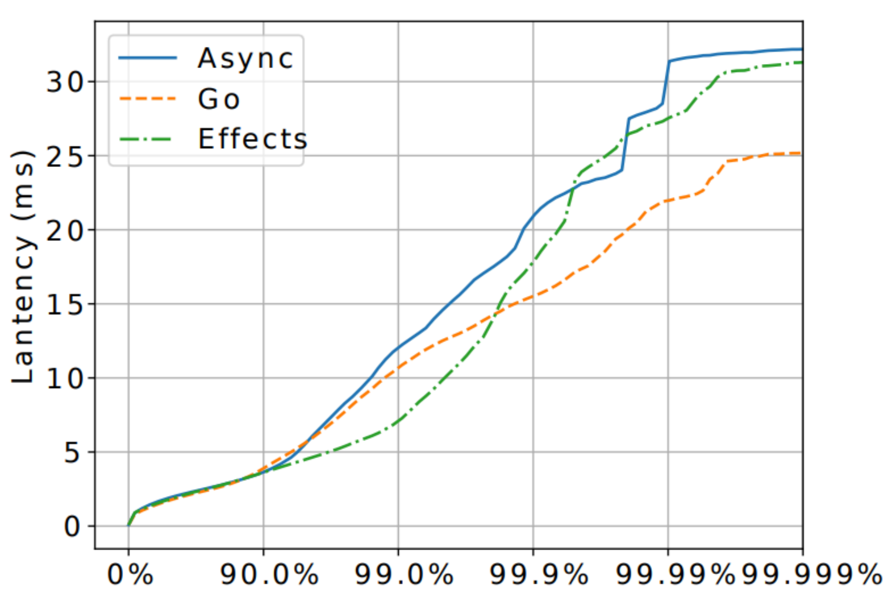
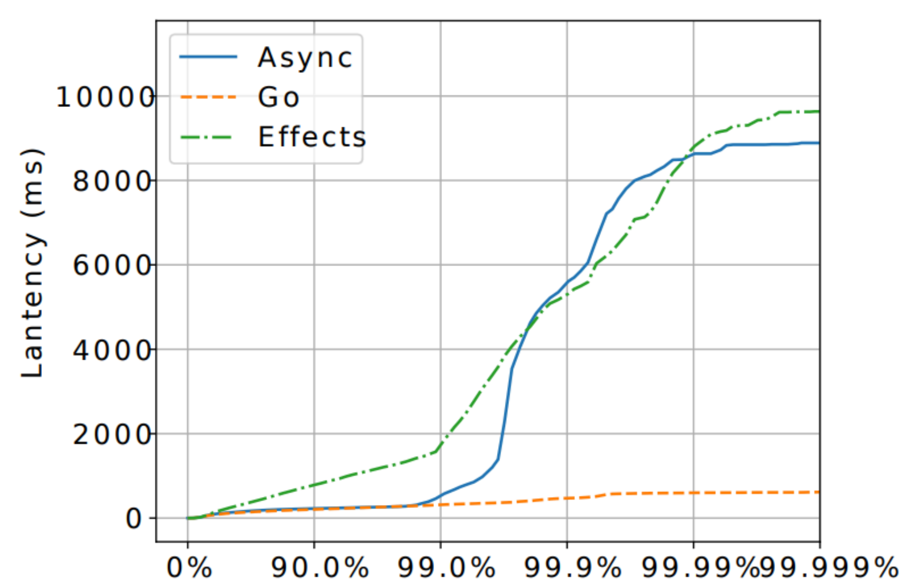


(a) Medium contention: 1k connections, 10k requests/sec



(b) High contention: 10k connections, 30k requests/sec

Thank you!

- Multicore OCaml
  - https://github.com/ocaml-multicore/ocaml-multicore
- A collection of effect handlers examples
  - https://github.com/ocaml-multicore/effects-examples
- JS generator example
  - https://github.com/kayceesrk/wasmfx/tree/master/cg_4_aug_20