Capabilities, Session Types and Active Objects

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Outline

Overview

- global heap

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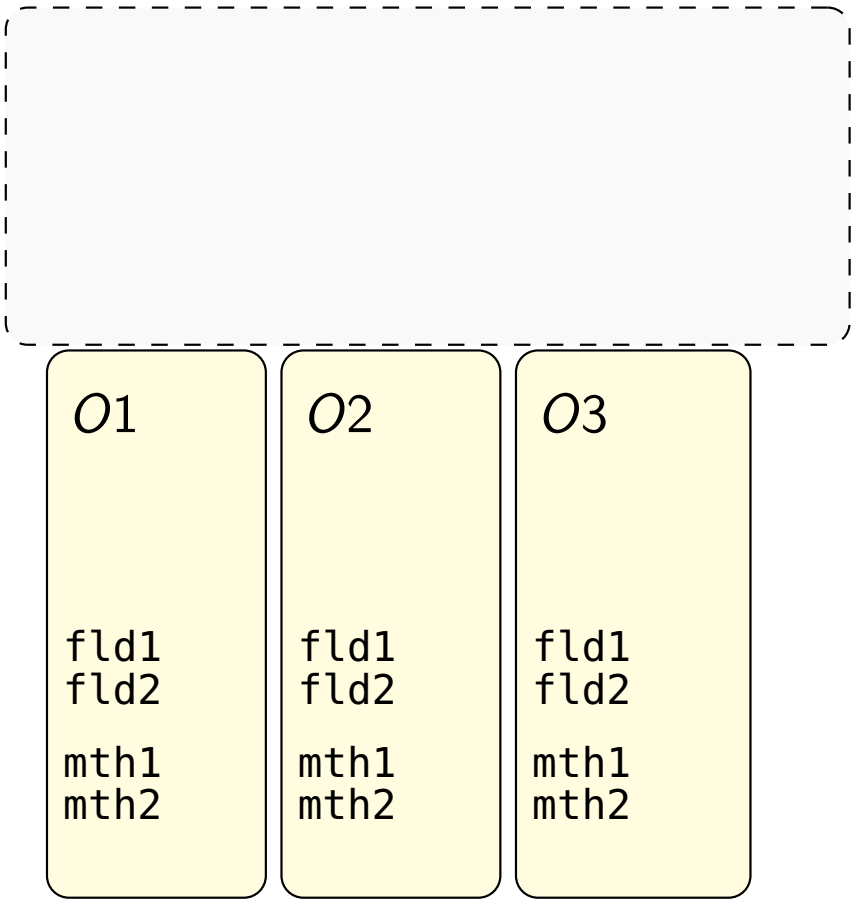

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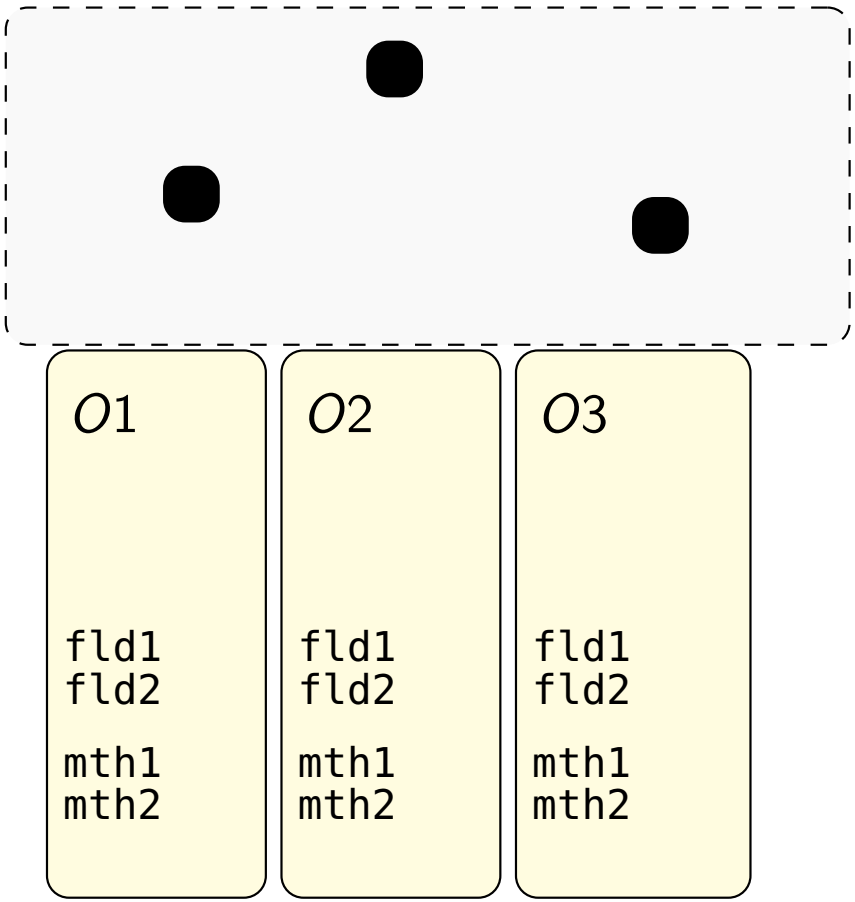

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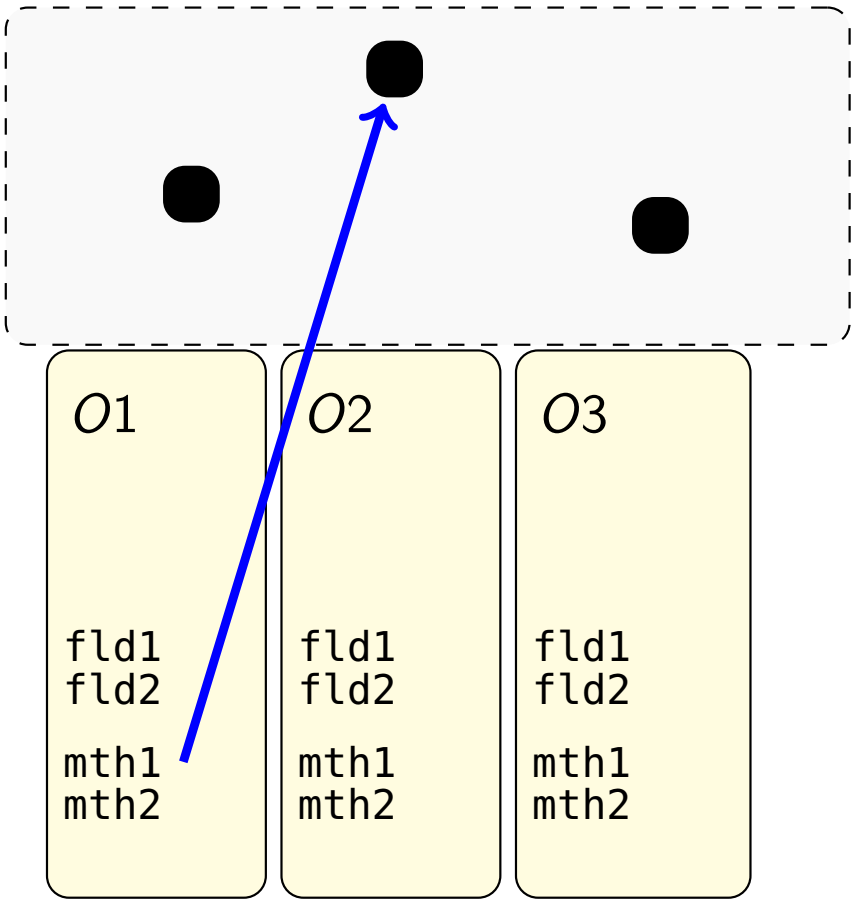

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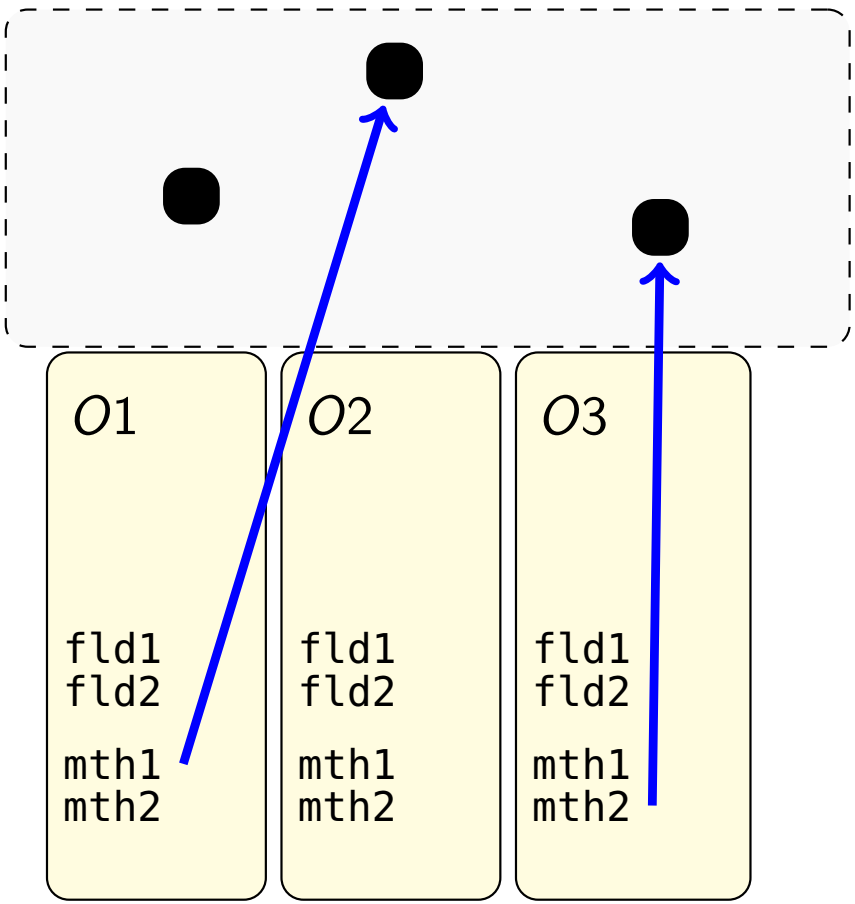

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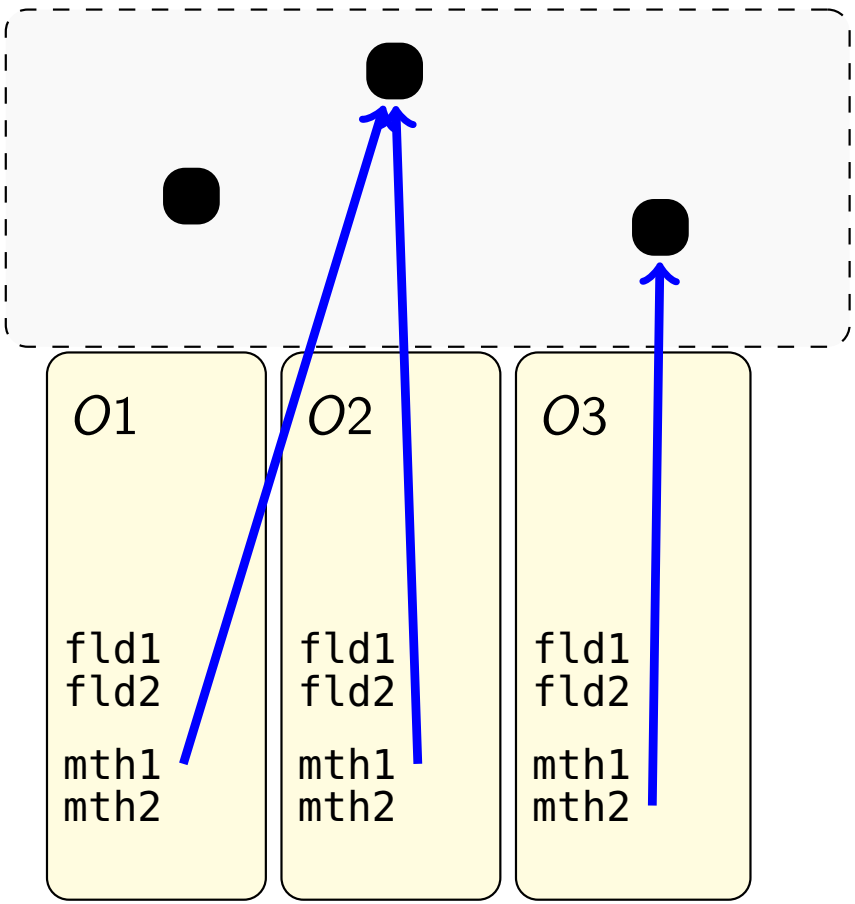

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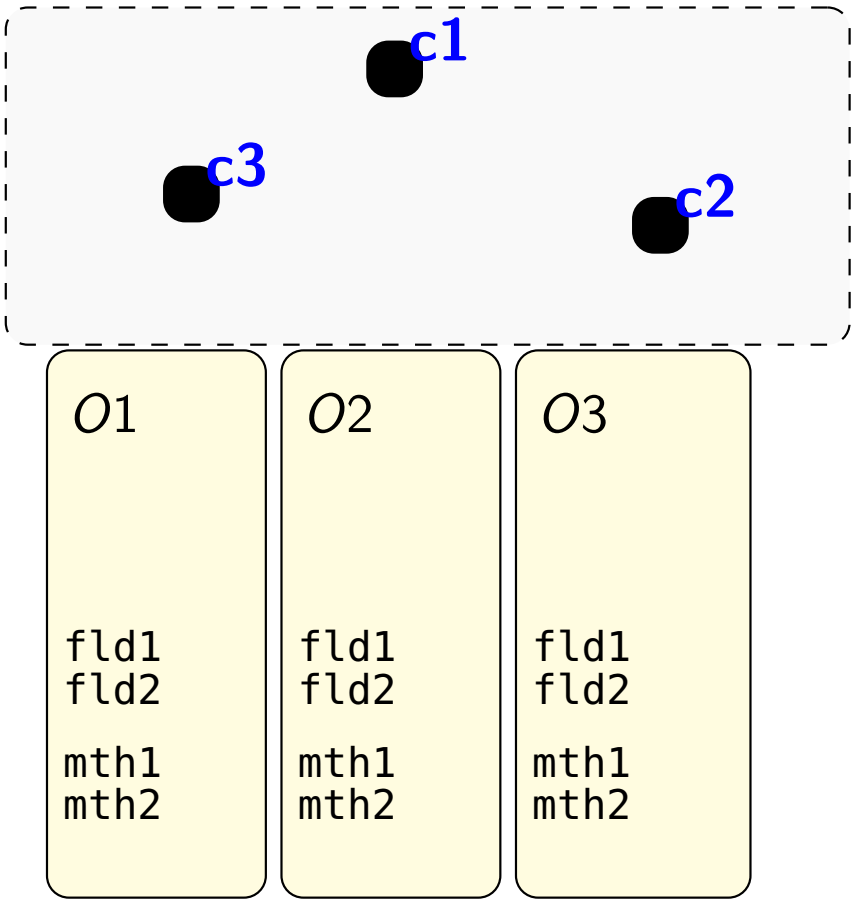

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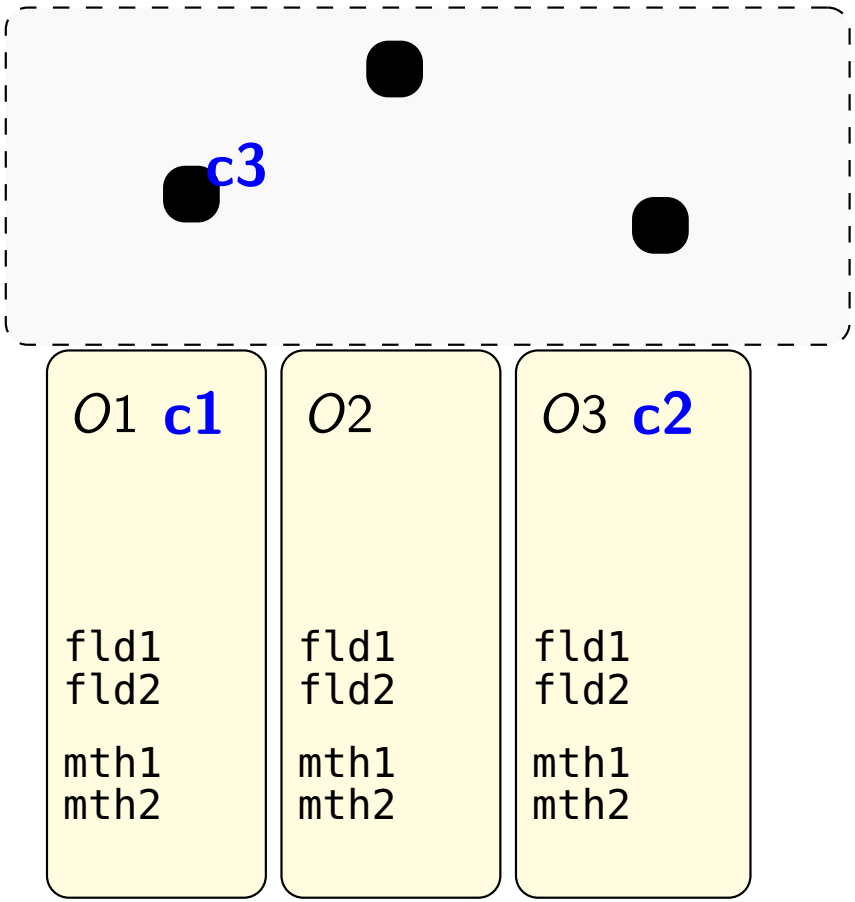

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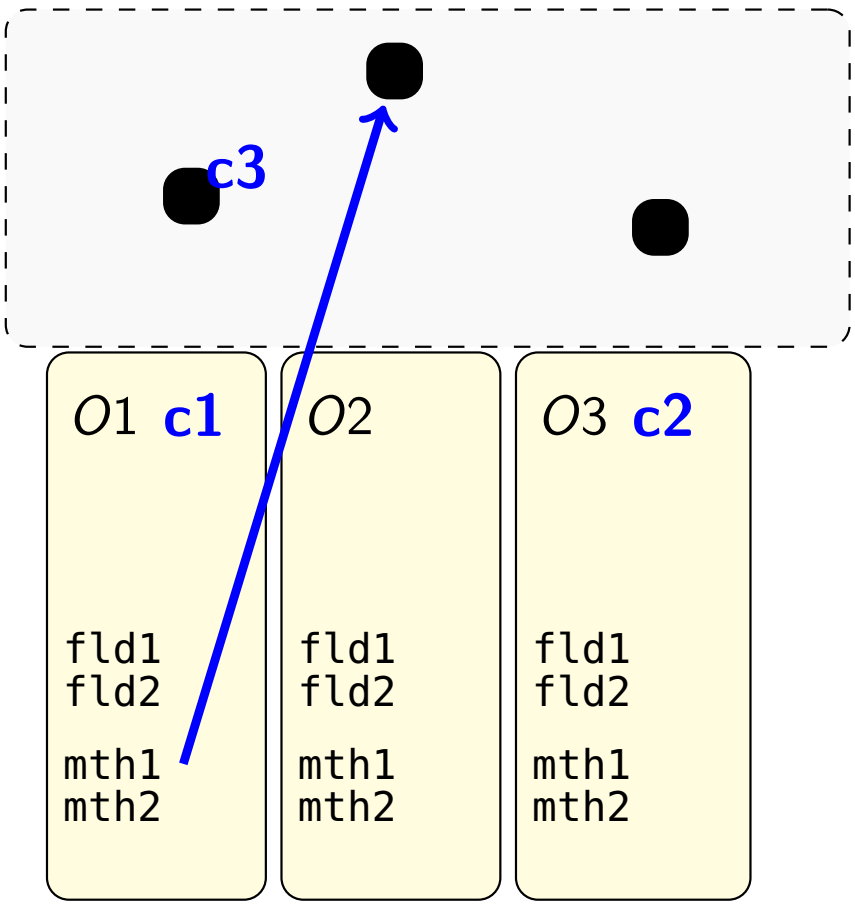

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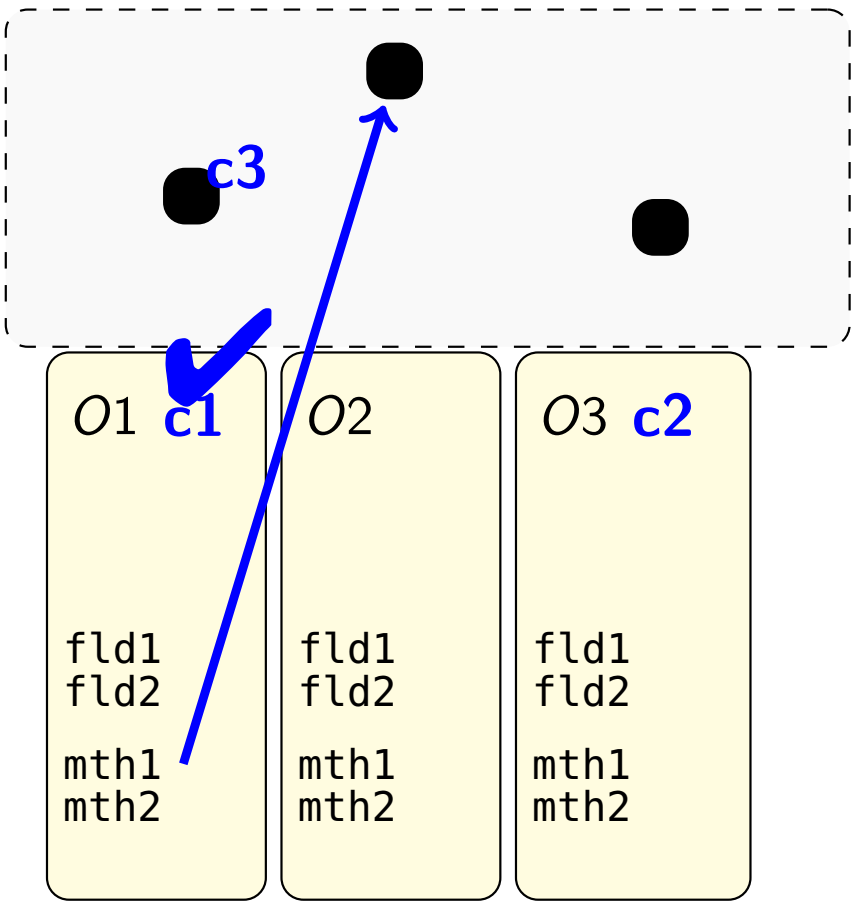

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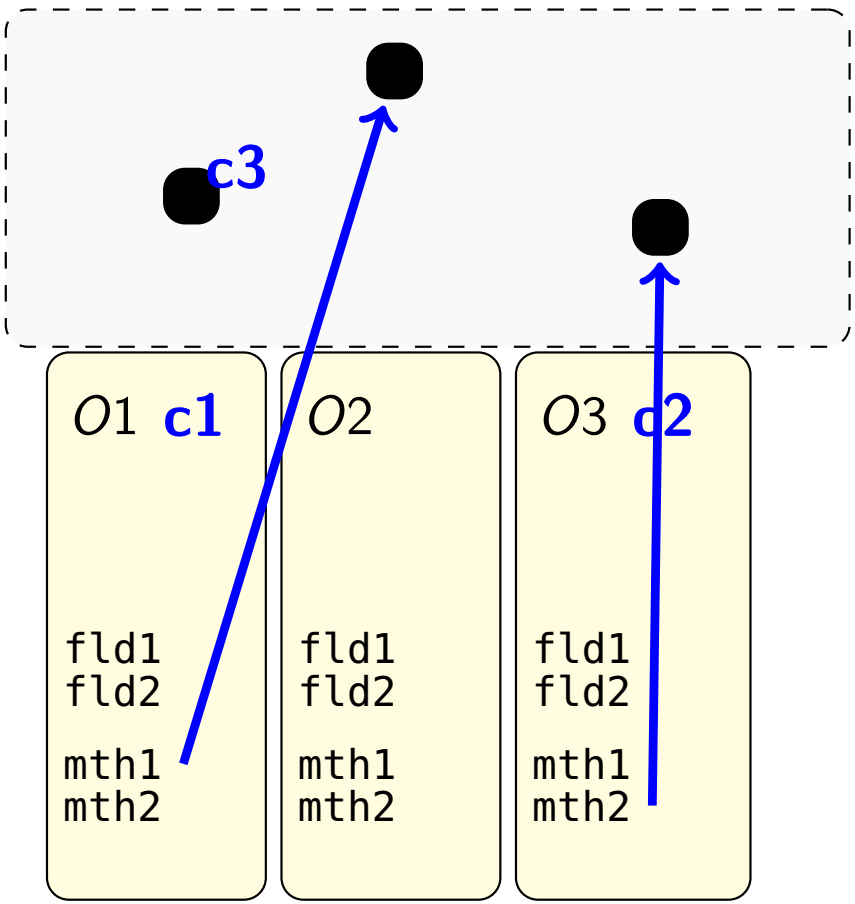

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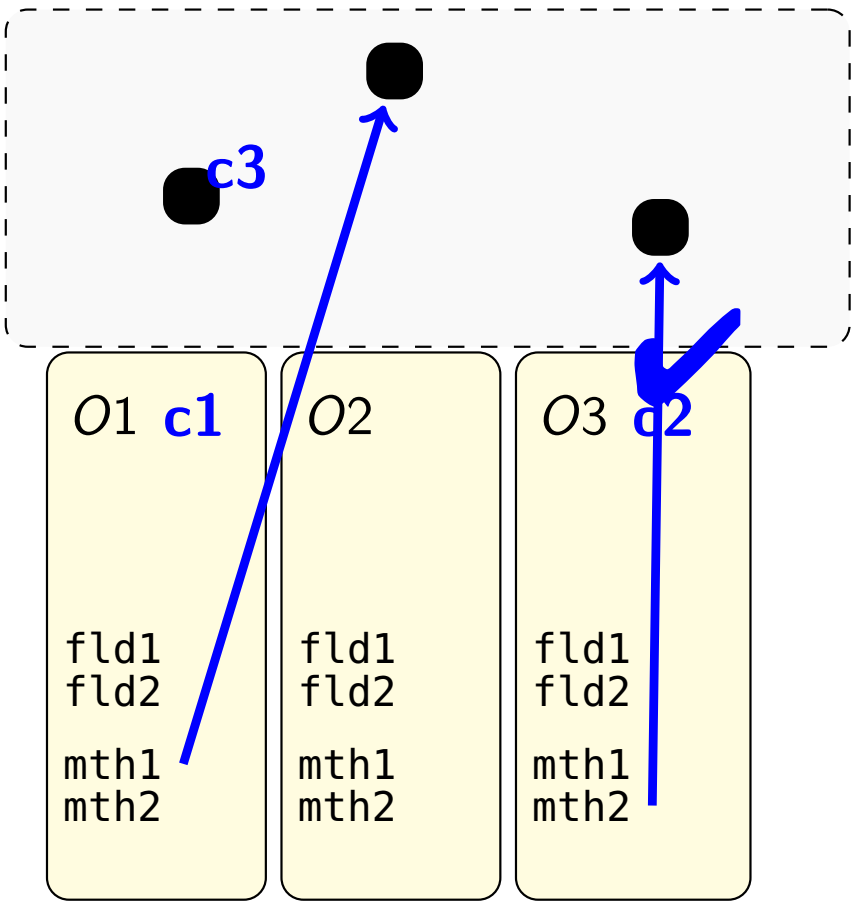

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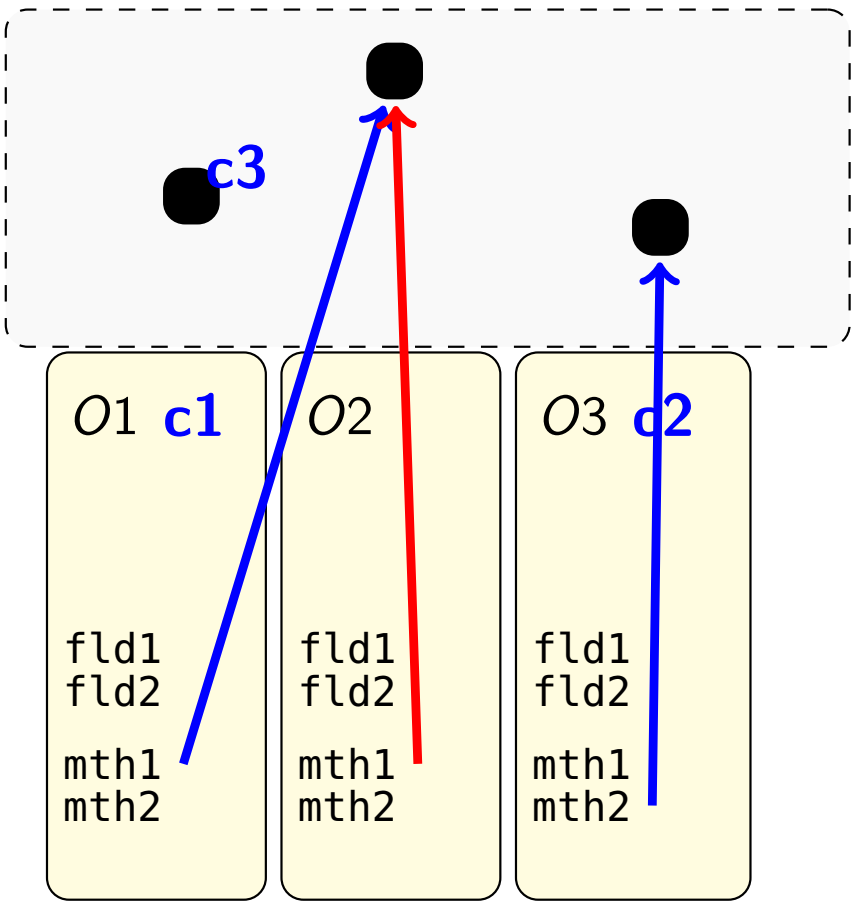

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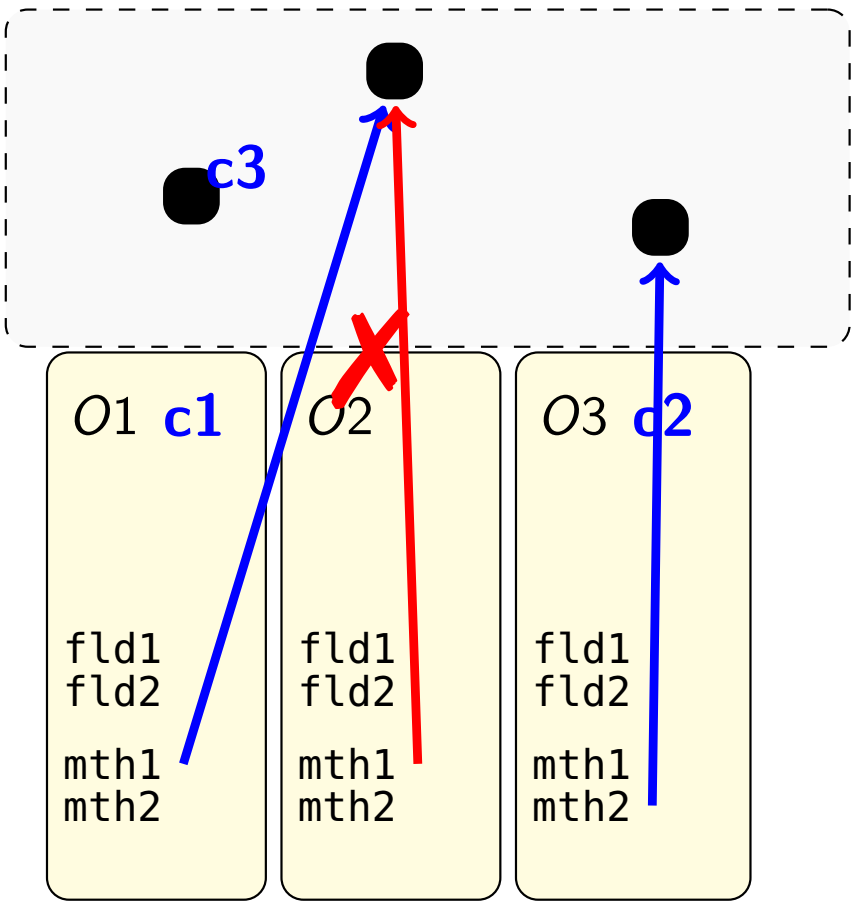

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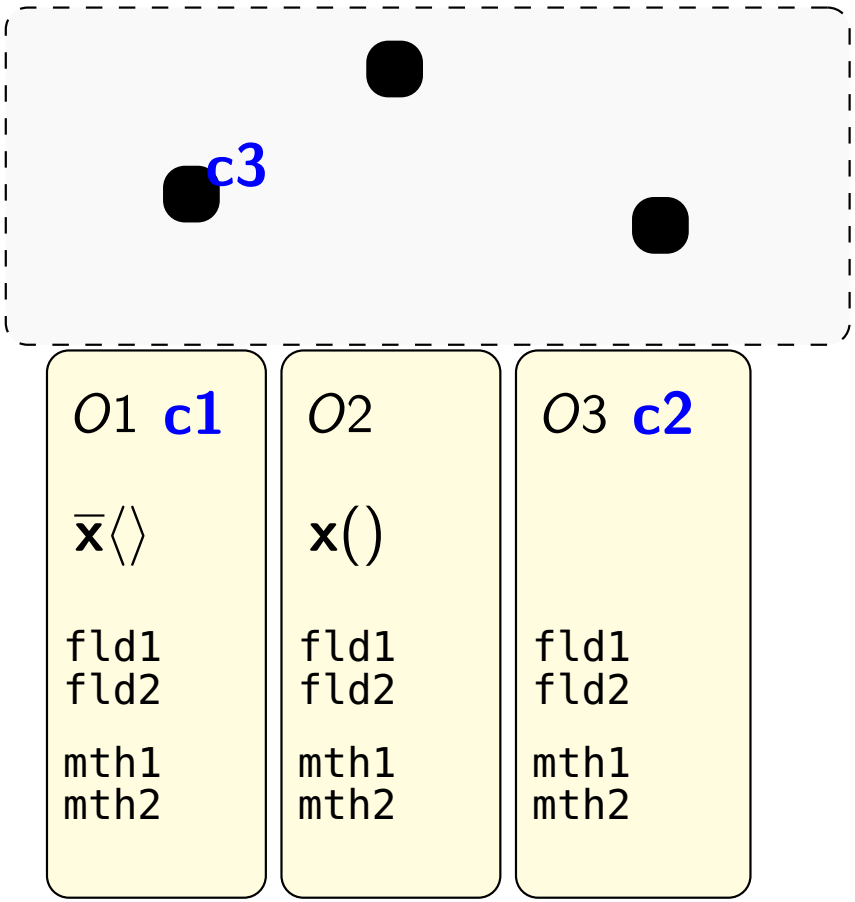

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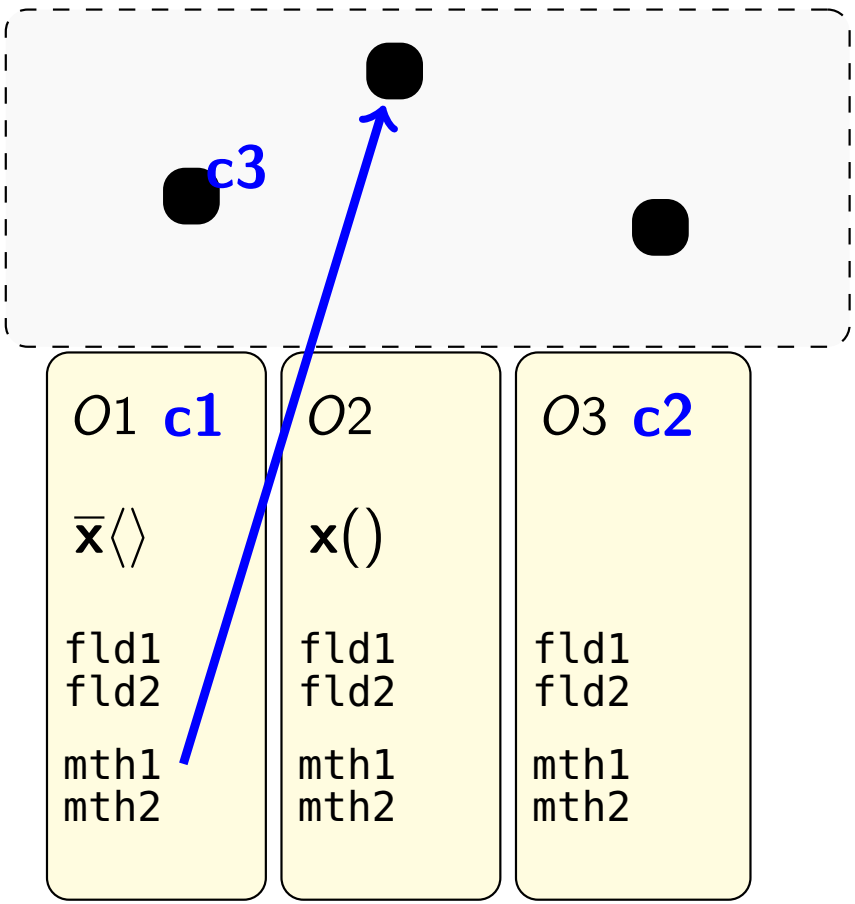

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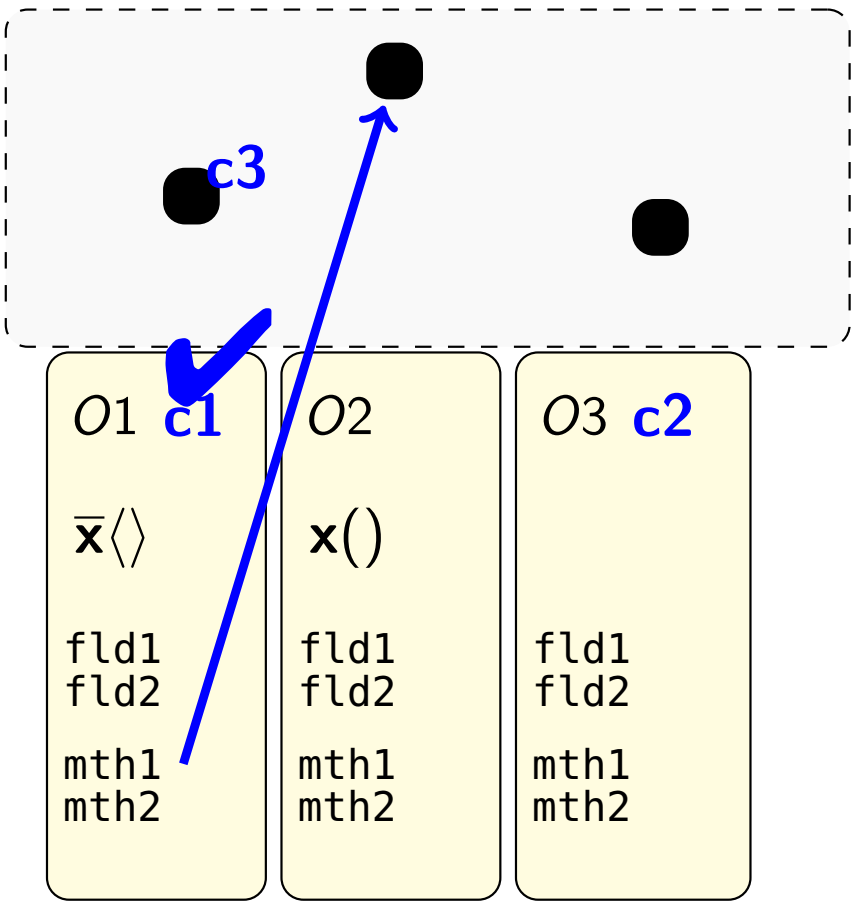

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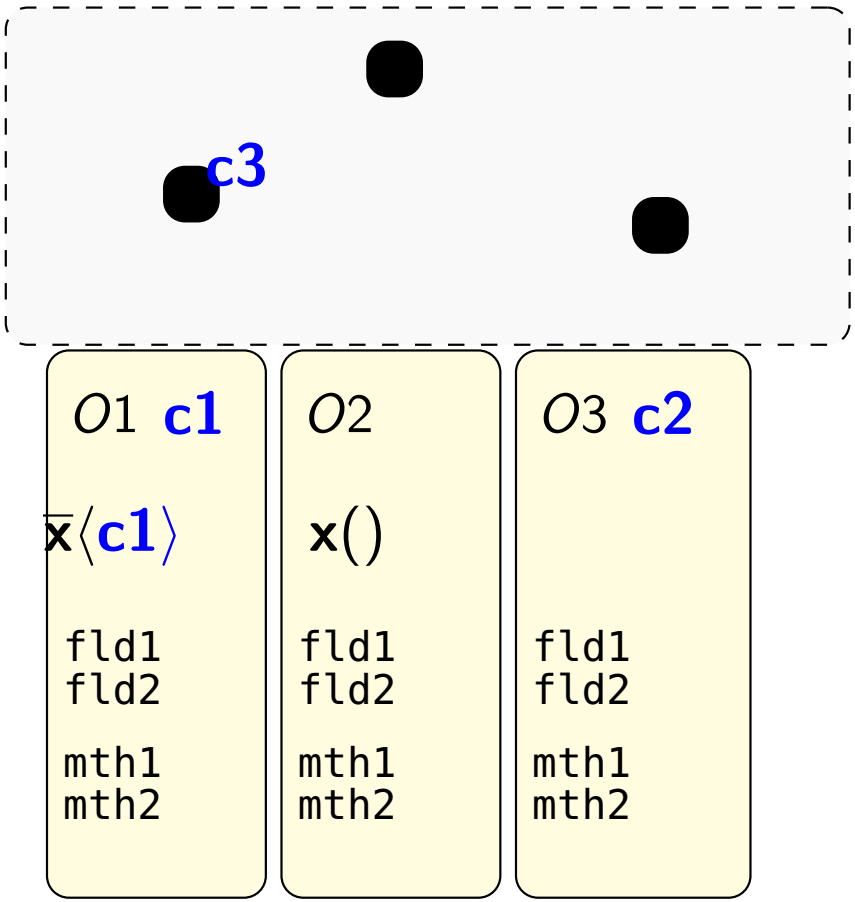

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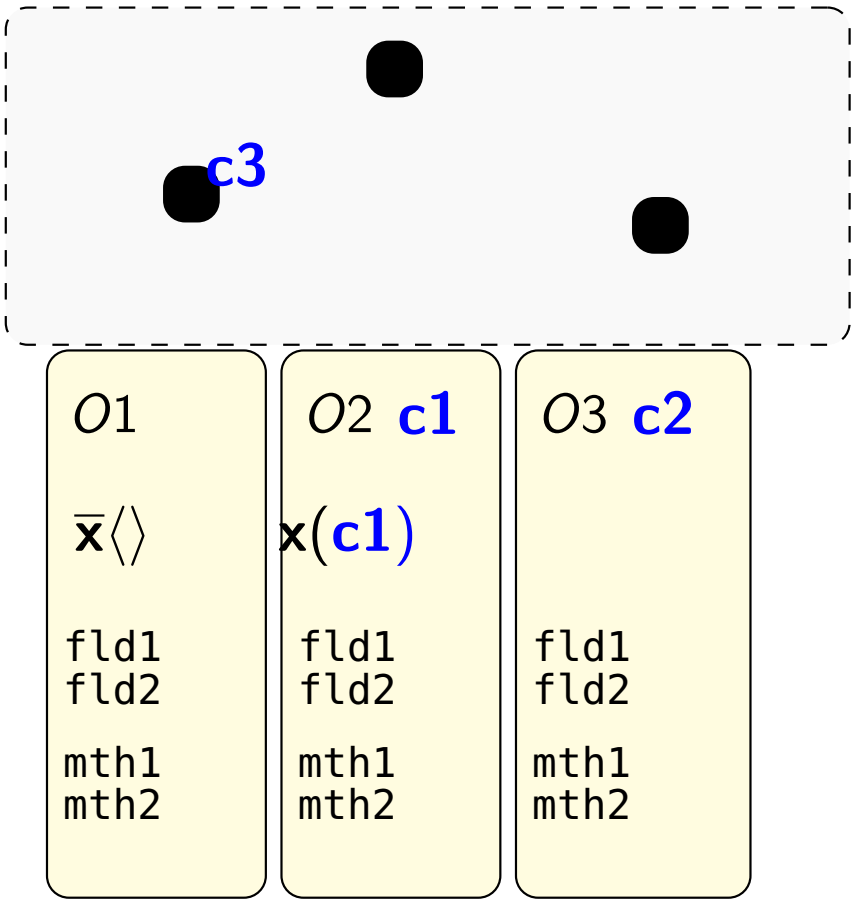

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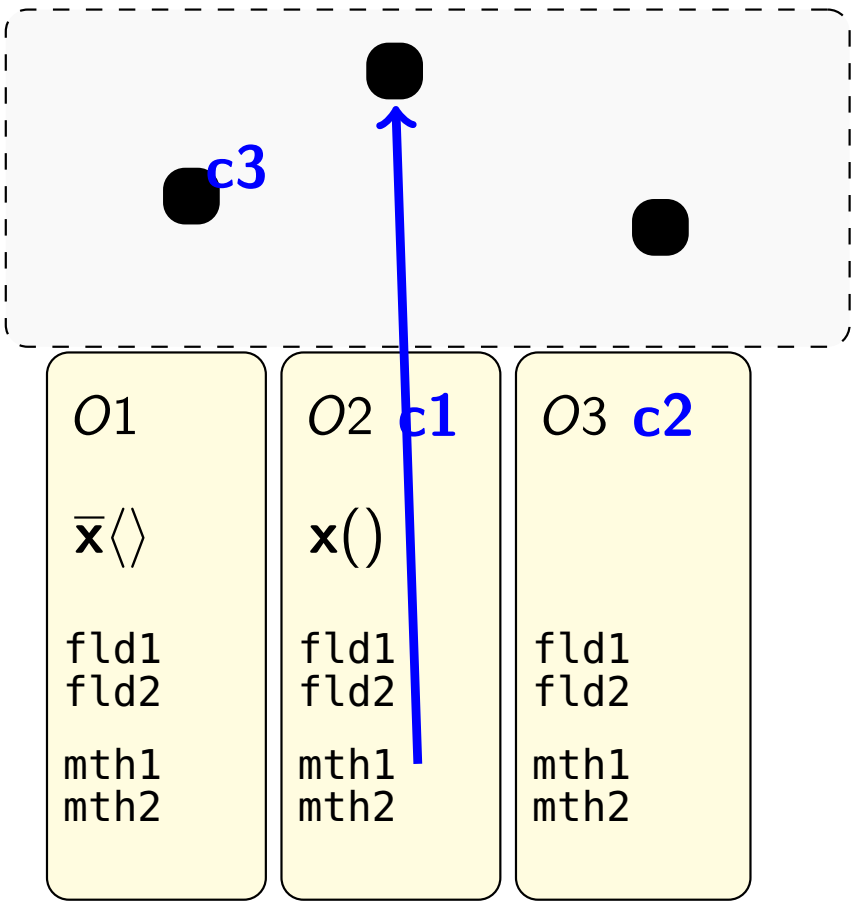

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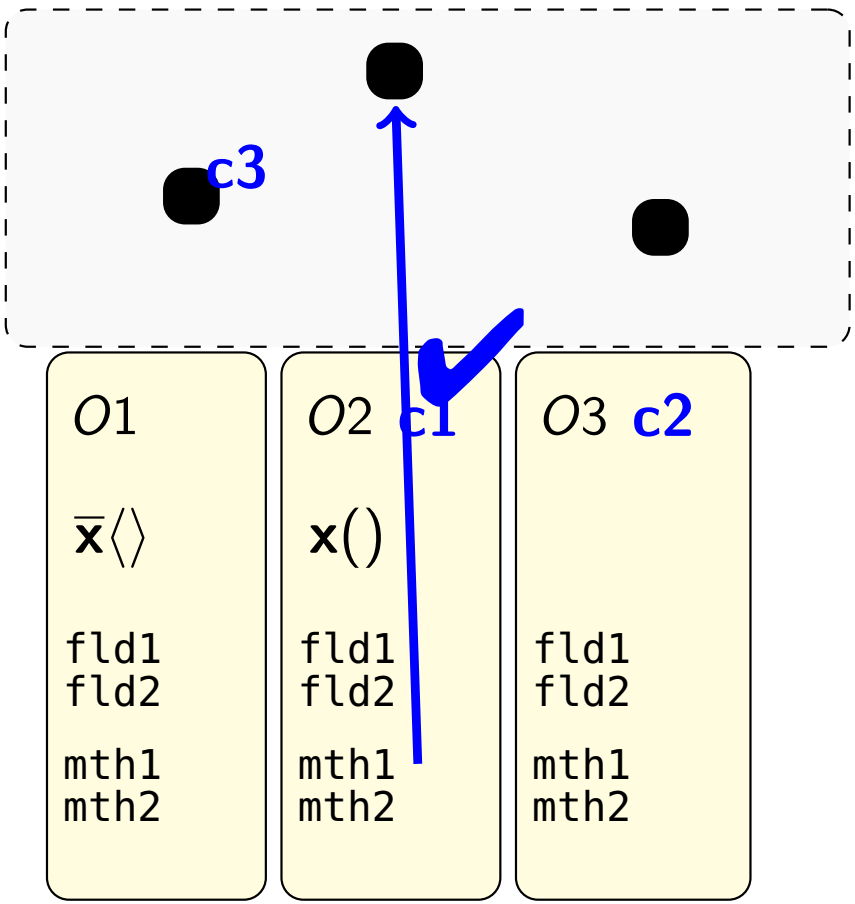

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Two processes P and Q write (W) to a shared resource (*file*).

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  2. we want to reason about concurrent operations on resources

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- so $W(fvar)$ in Q succeeds

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- $W(file)$ happens in Q

Idea

- core calculus (π-calculus inspired)
- session types regulate sharing of capabilities
- capabilities are abstract and linear
- well-typed processes have no race conditions (for some def. of race condition)

Syntax of processes

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\begin{array}{lll}
P ::= \emptyset & \mid P \mid P & \mid x\langle y \rangle.P \\
\quad \mid x(y).P & \mid x \lhd a.P & \mid x.\{a_i.P_i\}_{i \in I} \\
\quad \mid (\nu xy : S)P & \mid (\nu r^{\overline{c}:\overline{\sigma}} : R)P & \mid \varphi(r).P
\end{array}
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- (abstract) operation on resource r

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- capability types specify what (abstract) operation can be executed on a resource
- existential quantifiers bind resource variables α in the continuation of the session

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  - no race conditions: $\vdash P$ implies $P \not\rightarrow P'$ and $P' \equiv \varphi(r).Q | \varphi'(r').Q'$ where $\varphi(r) \not\simeq \varphi'(r')$

    Where $\varphi(r) \simeq \varphi'(r')$
    if $\varphi(r).\varphi'(r') = \varphi'(r')\varphi(r)$
    (i.e. the order of execution of $\varphi(r)$ and $\varphi'(r')$ does not matter)

So far, this is very much WIP

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