Fully Abstract Trace Semantics for Low-level Isolation Mechanisms

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Outline

Why is PMA interesting?

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- can be exploited to enforce a control-flow safe execution of C code [APJ14]

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Let's see an example of PMA in action

PMA in action

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0x0001    call 0xb53
0x0002    movs r0 0x0b55
   ⋮
0x0b52    movs r0 0x0b55
0x0b53    call 0x0002
0x0b54    movs r0 0x0001
0x0b55    ...
   ⋮
0xab00    jmp 0xb53
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- memory space

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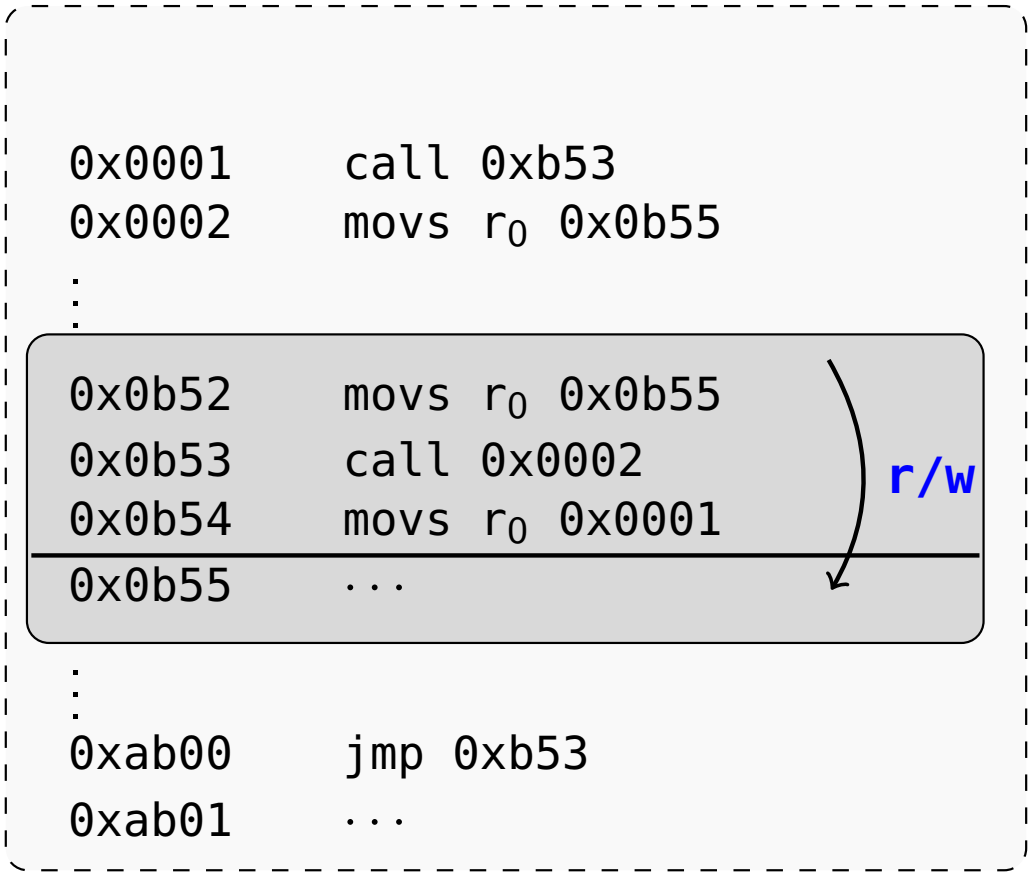

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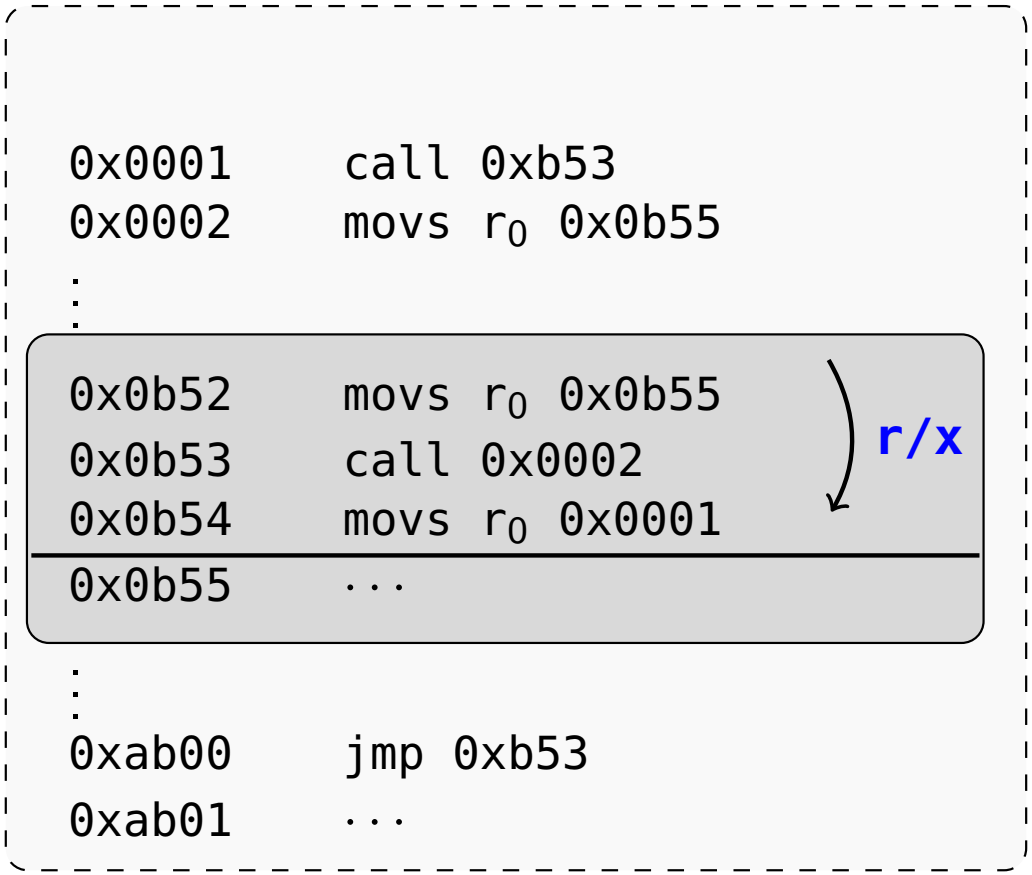

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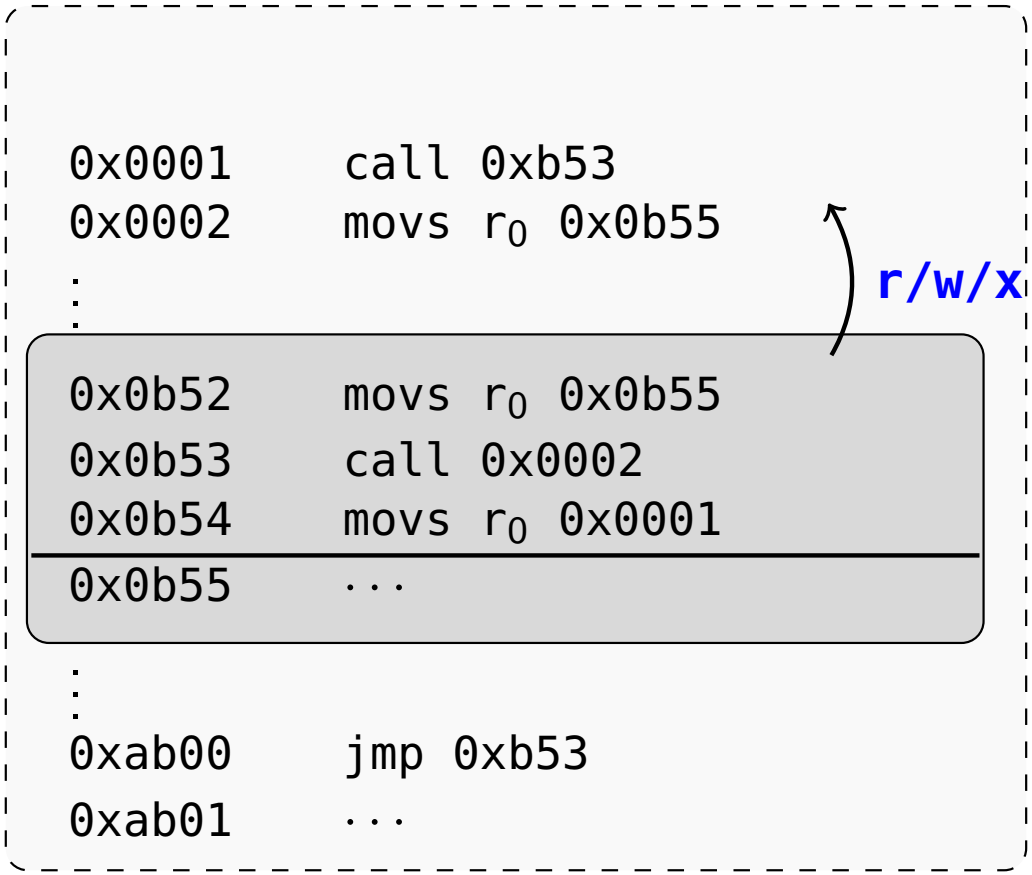

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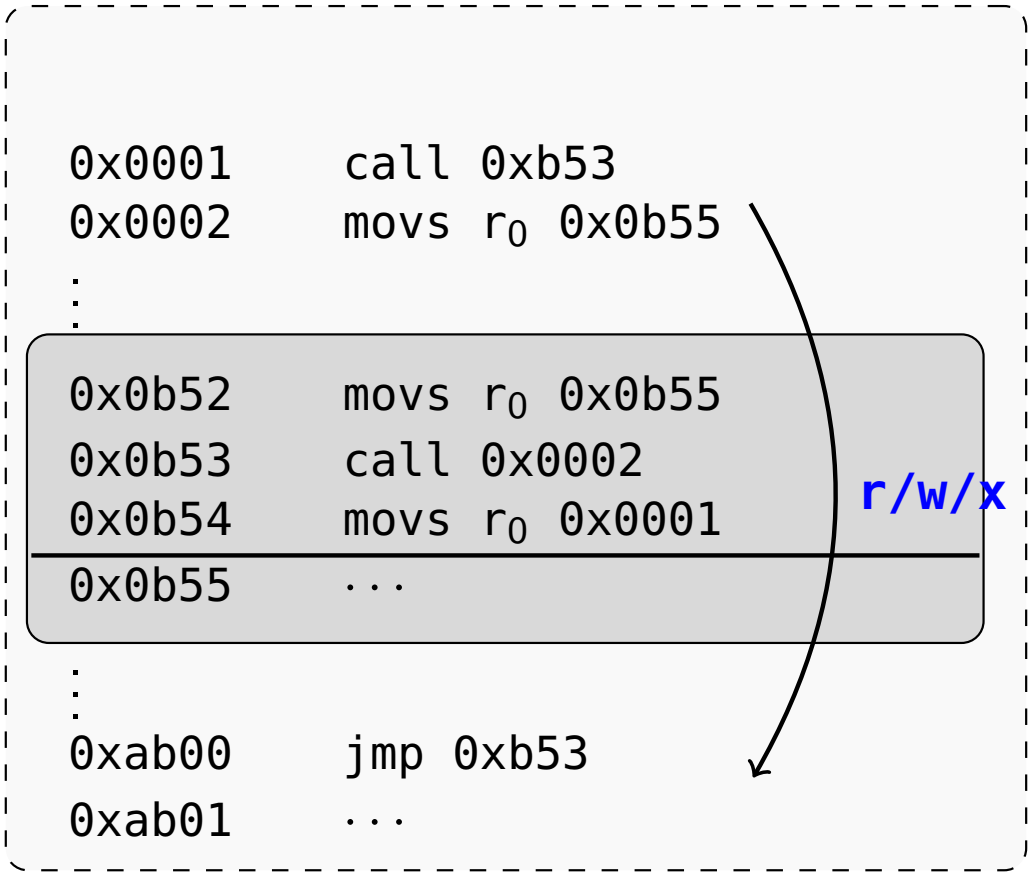

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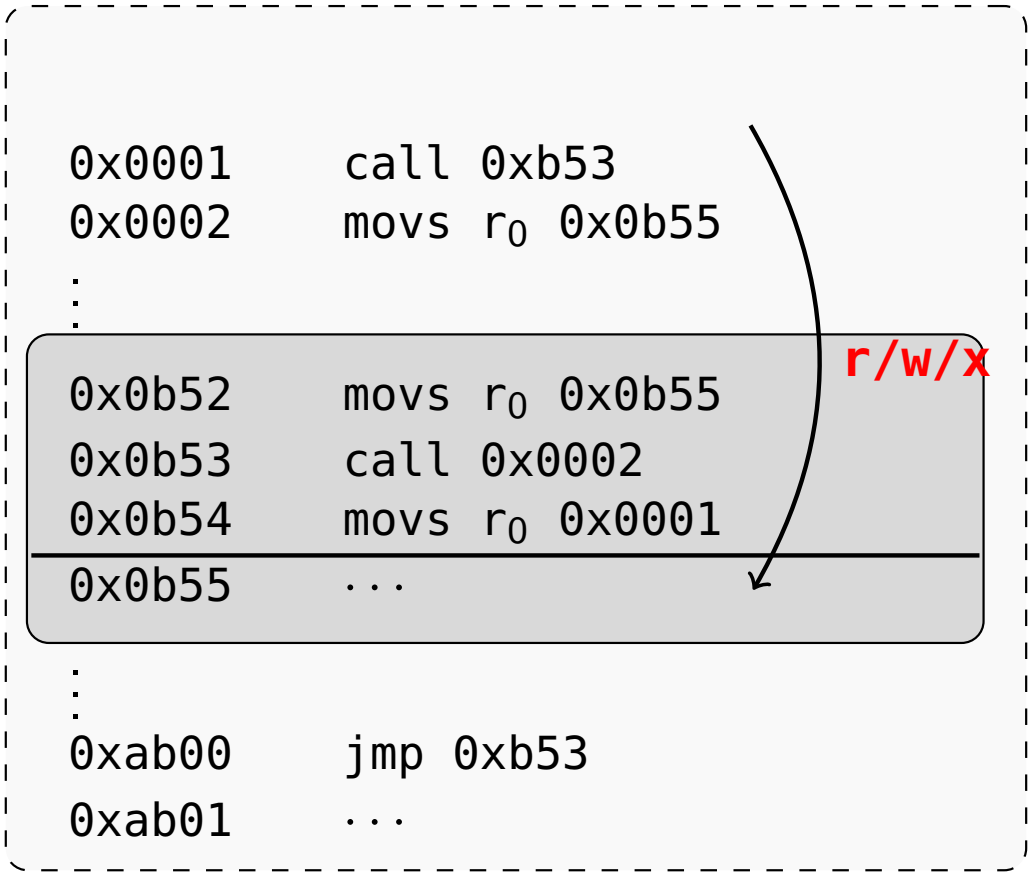

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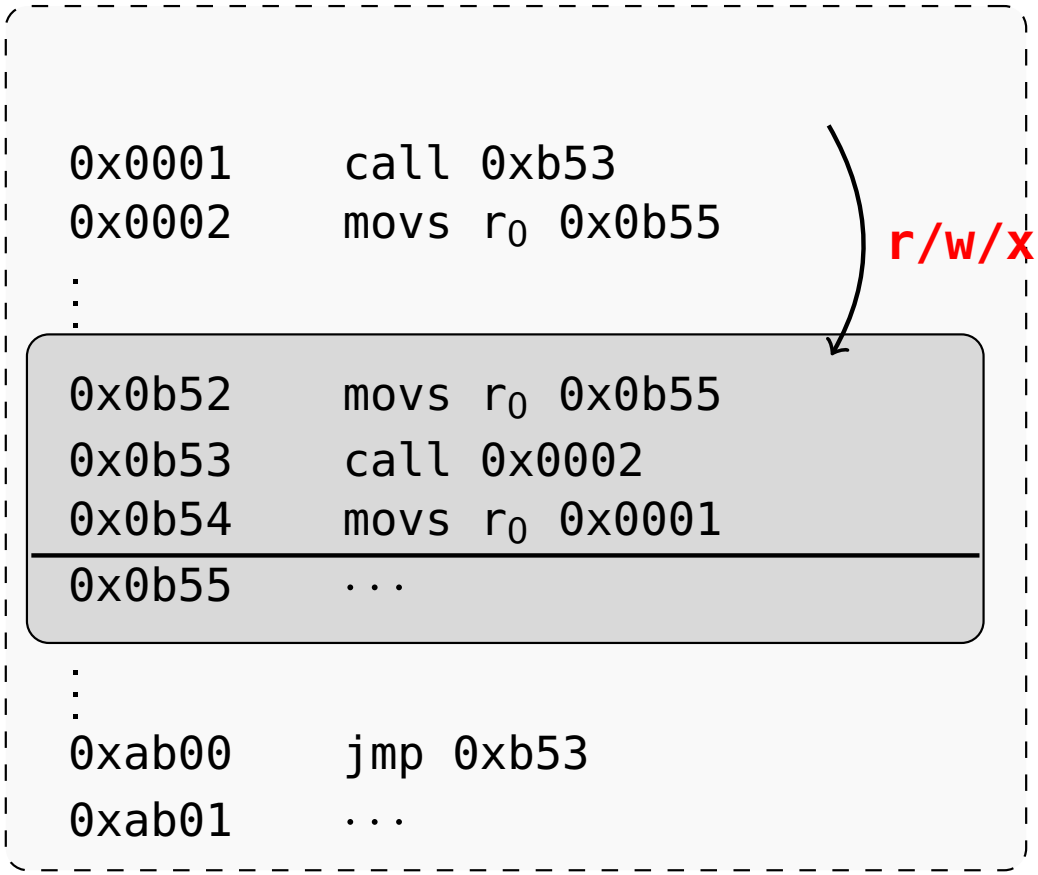

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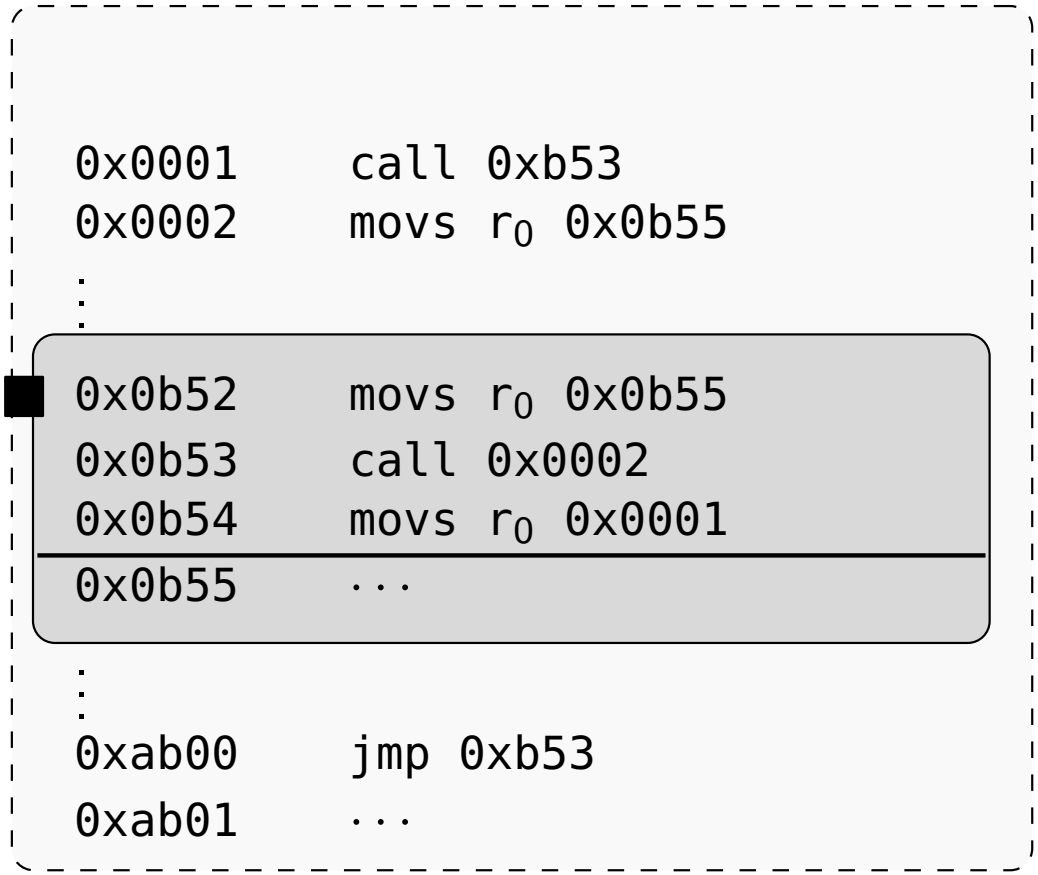

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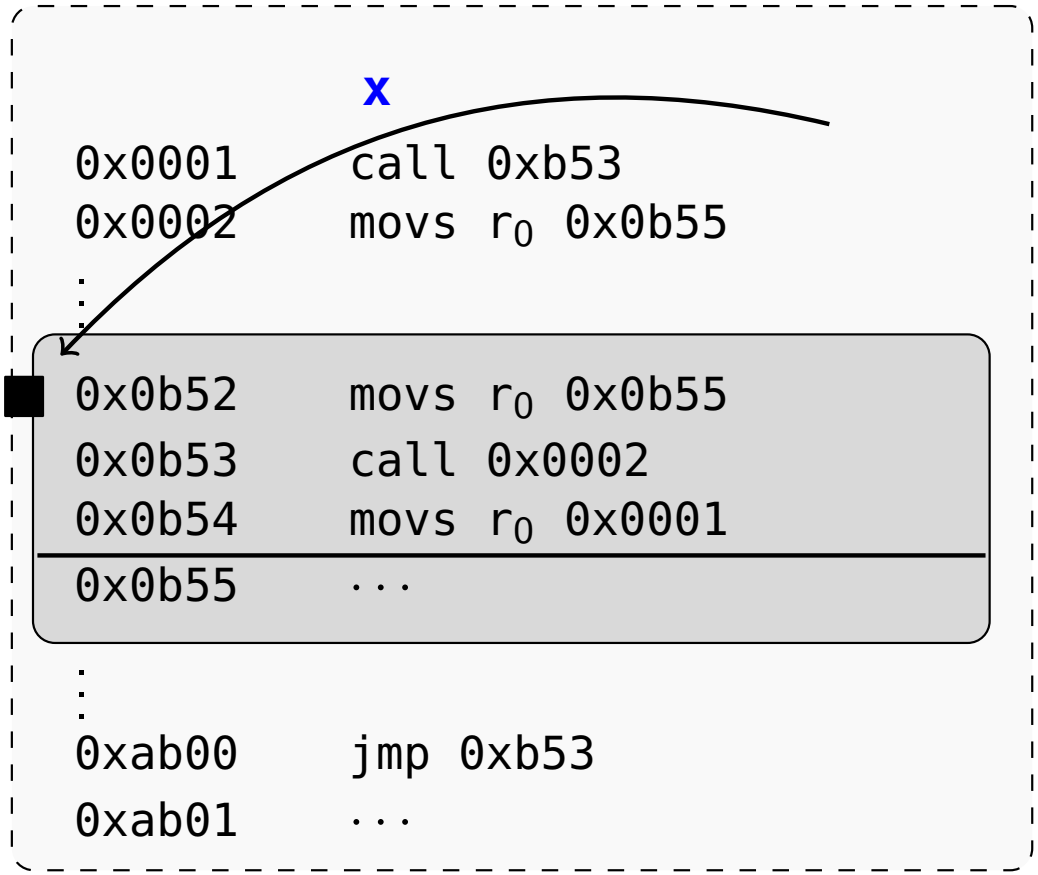

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- contexts are complex to reason about (but very precise)

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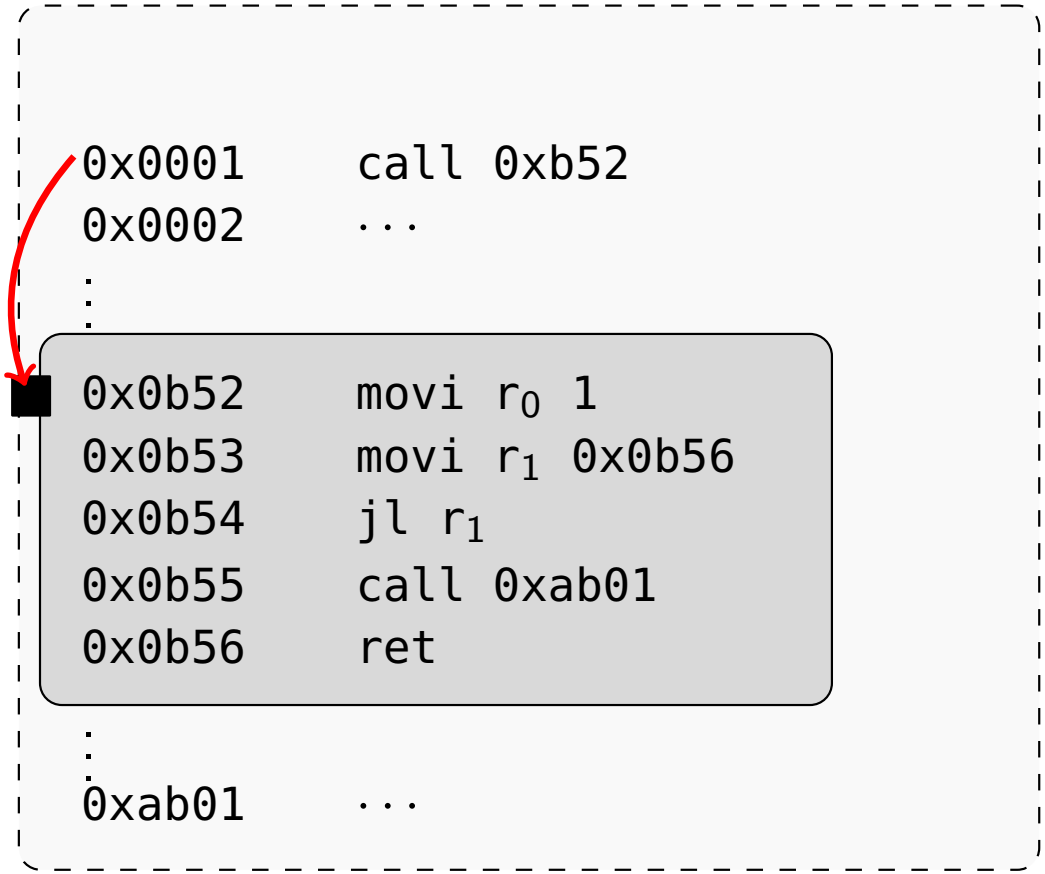

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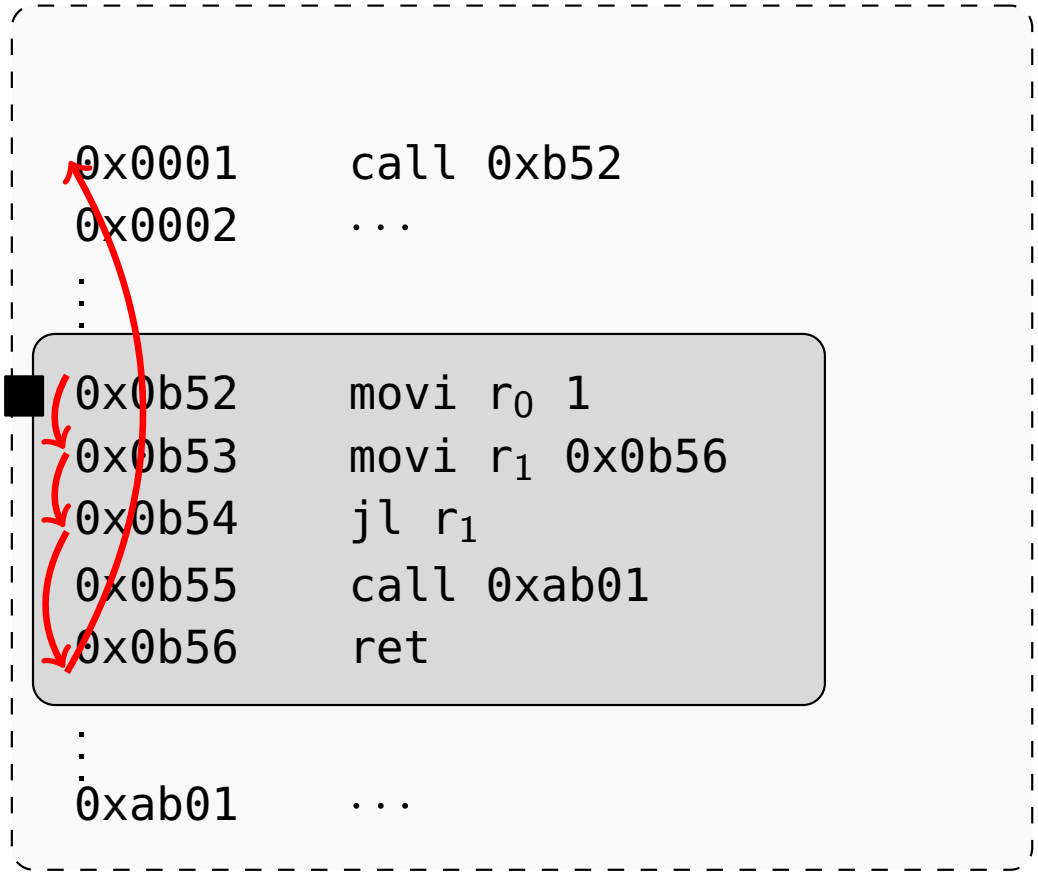

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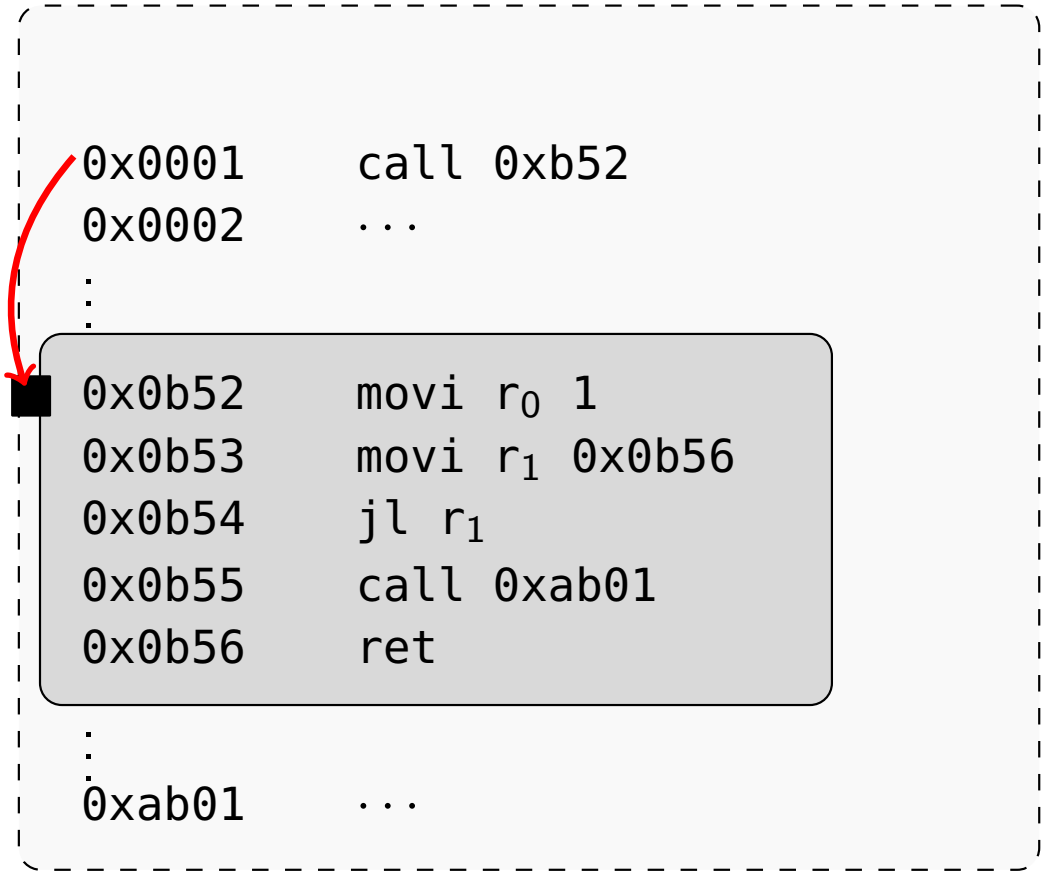

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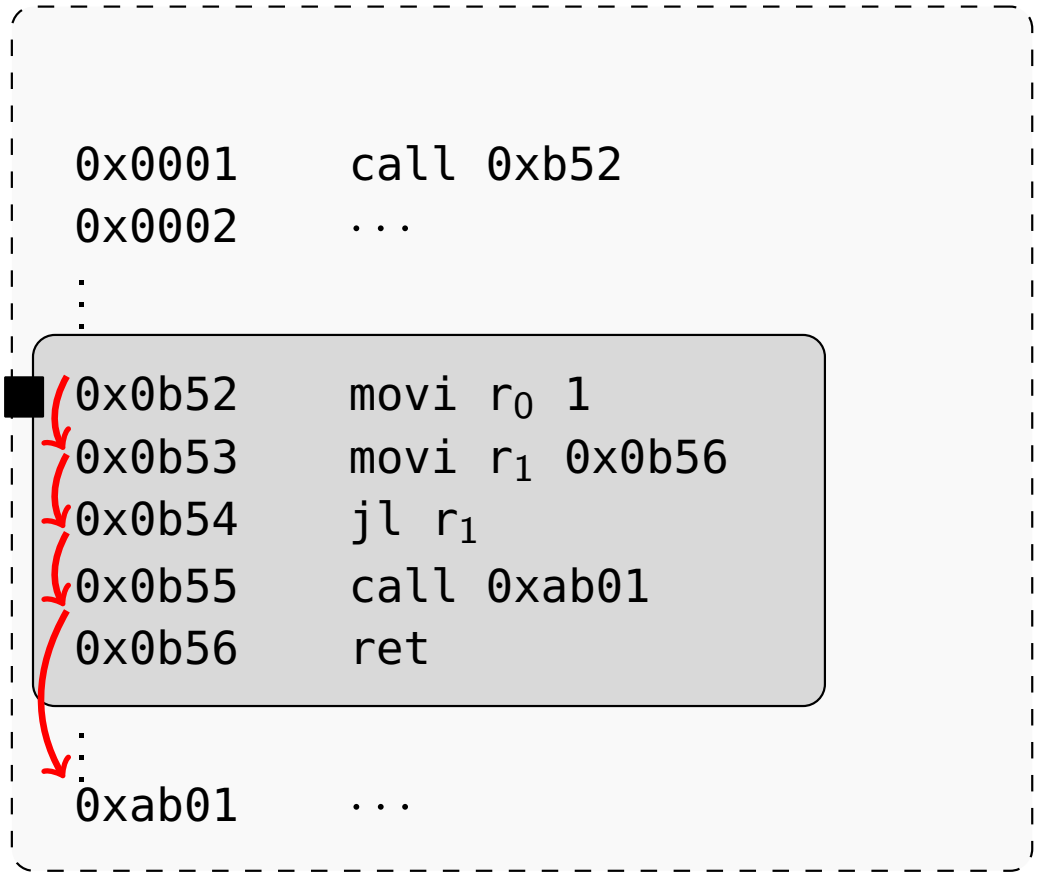

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- they describe what can be observed from the outside of protected PMA code

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  3. registers besides r_0 in `ret` as well

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i.e. there are no other things that we missed

The spectrum of full abstraction [Cur07]

$$\mathsf{TR} = \left\{ \alpha = \left\{ \begin{array}{l} \xrightarrow{i}; \\ \texttt{call p } \overline{\texttt{r}} \\ \texttt{ret r}_0 \\ \Longrightarrow^{\alpha} \end{array} \right\}; \right\}^{\checkmark}$$

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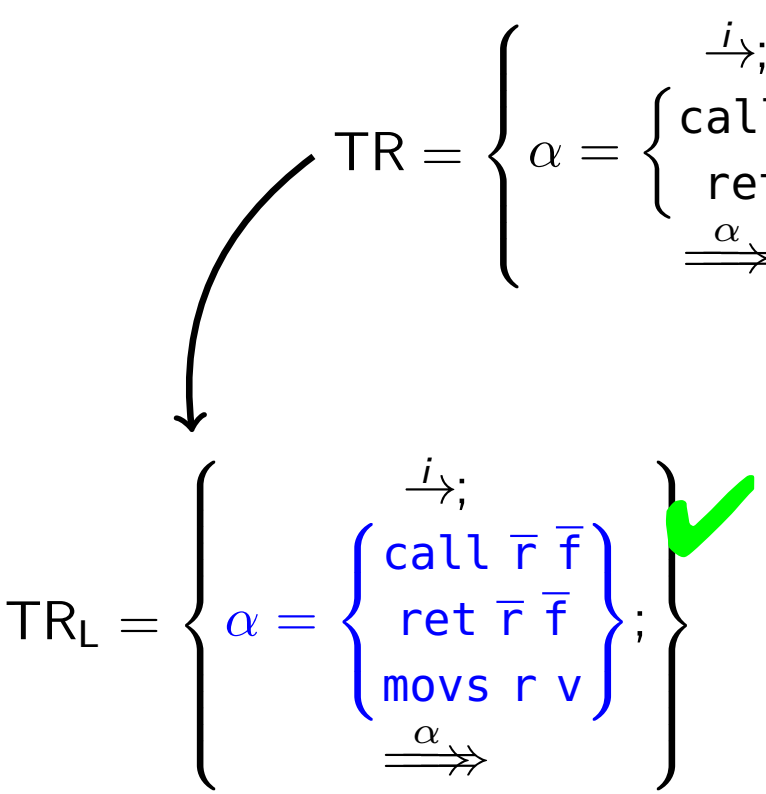

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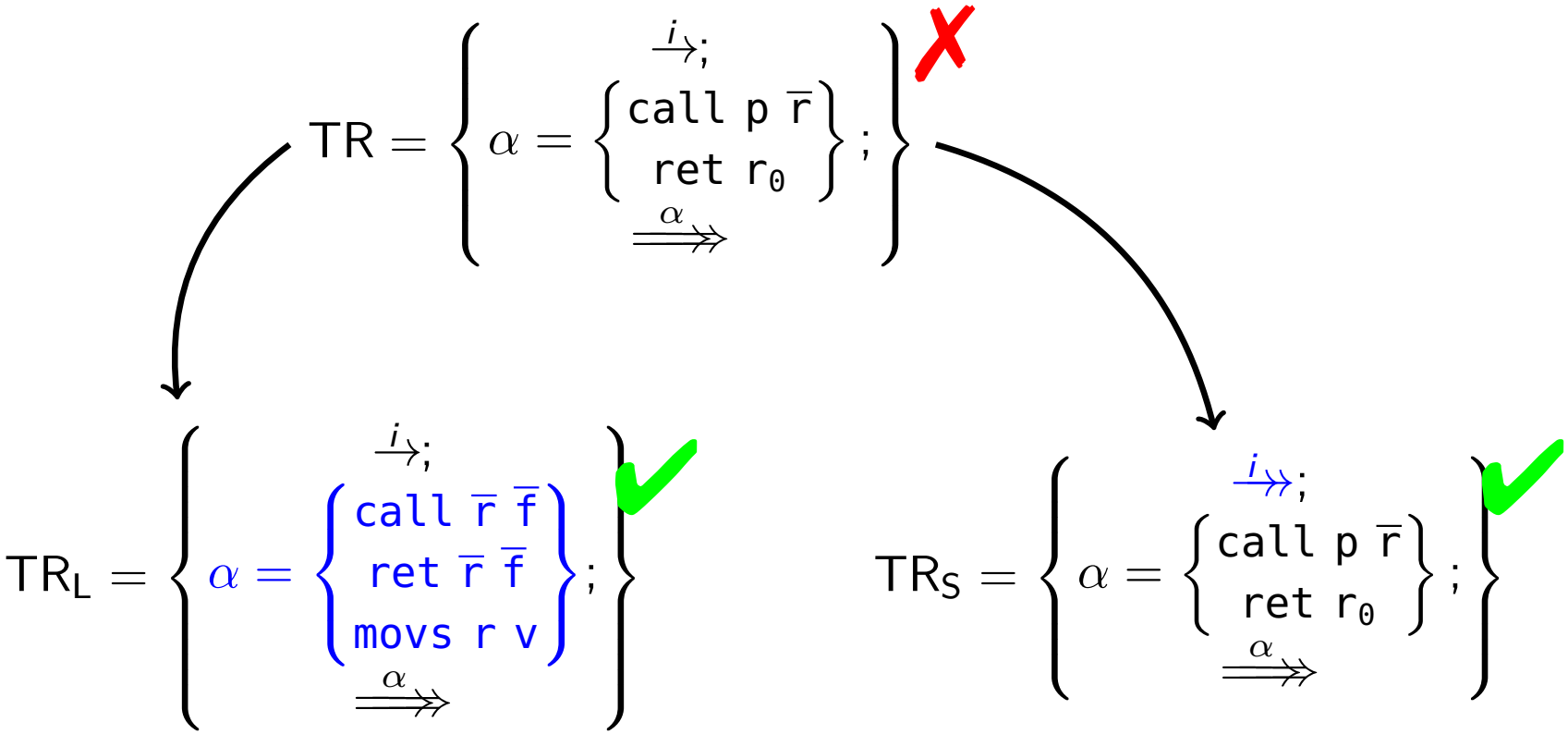

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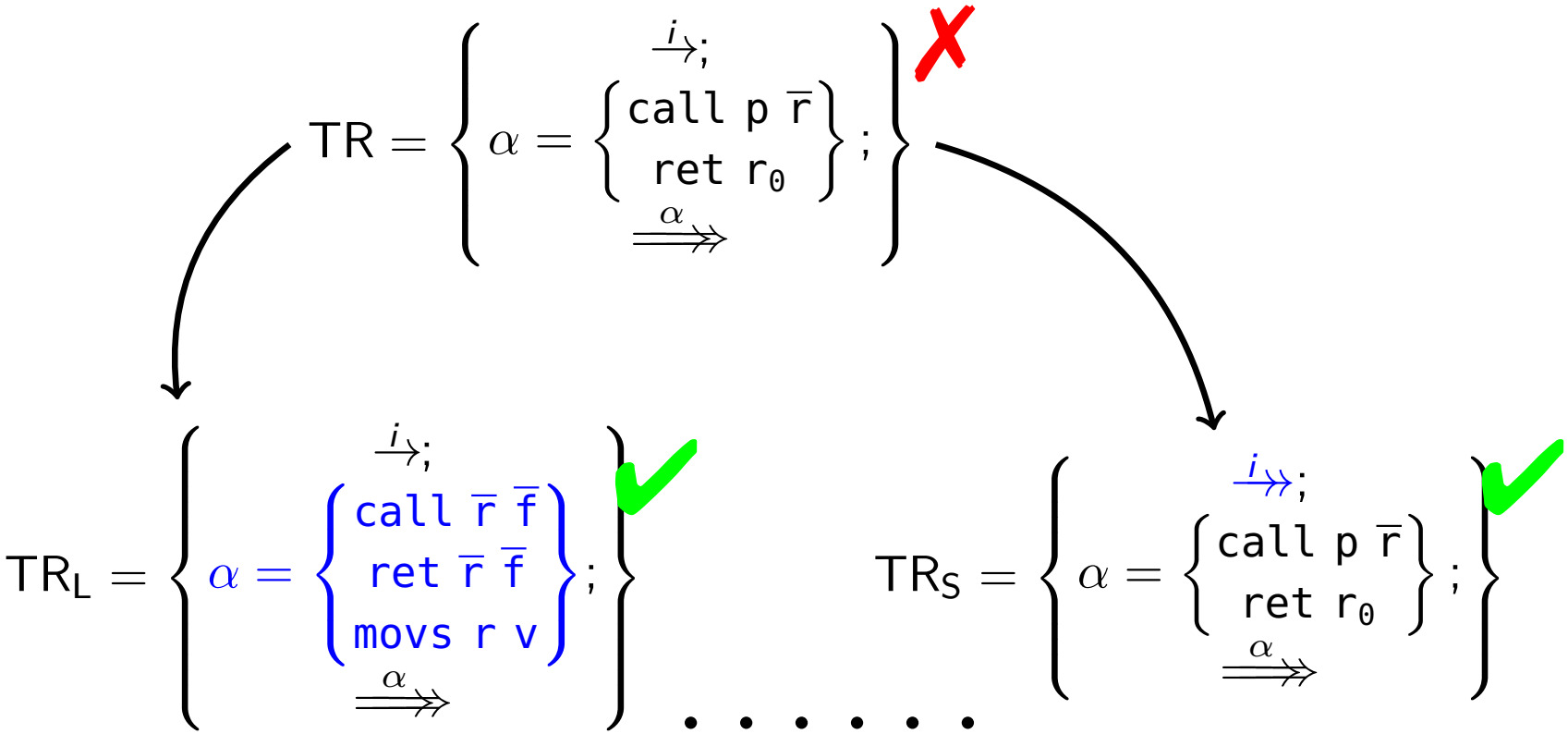

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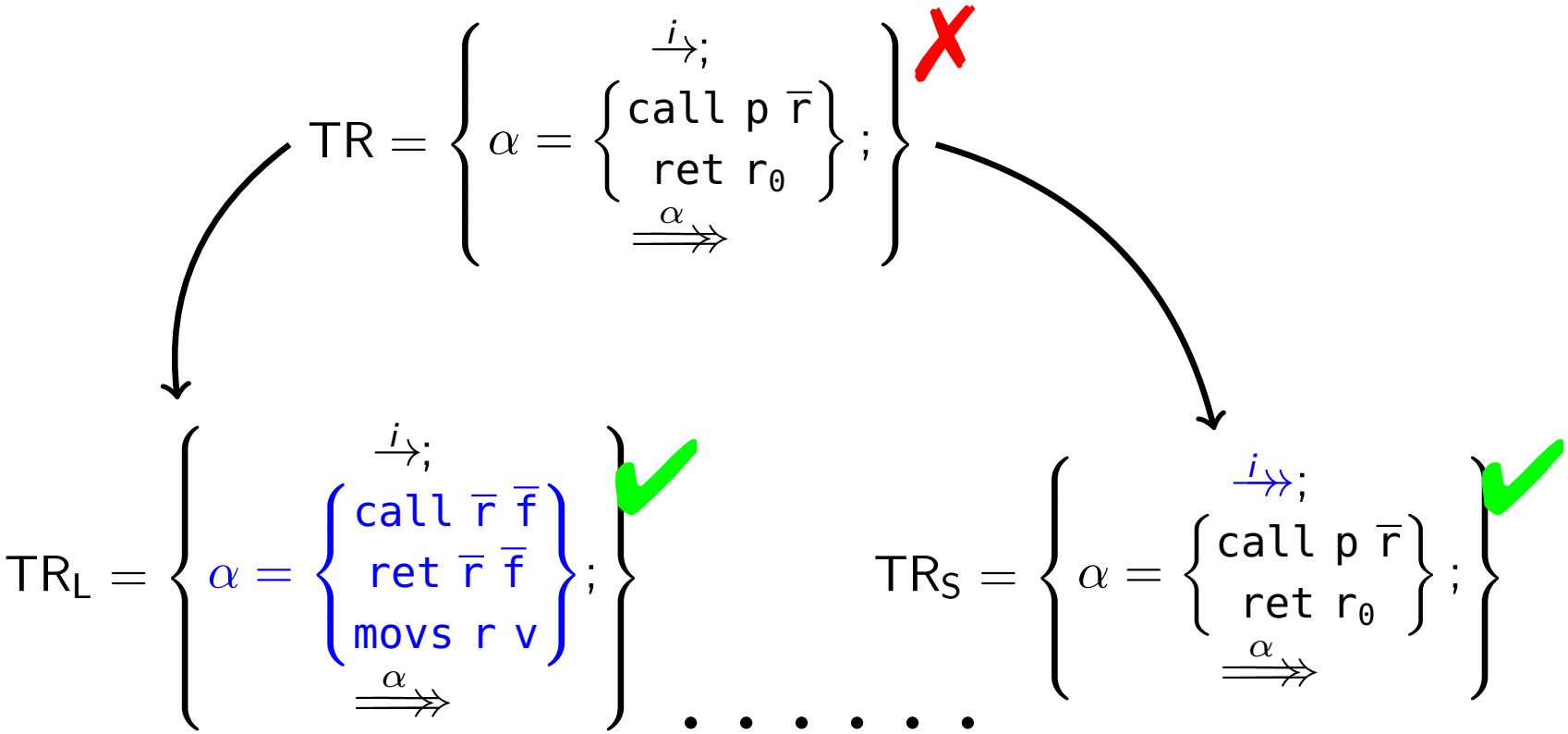

$$\mathrm{TR}_X(P_1) = \mathrm{TR}_X(P_2) \iff P_1 \simeq P_2$$

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- if the trace semantics is fully abstract, trace equivalence can replace contextual equivalence altogether
- the paper provides two, examples of fully abstract trace semantics for PMA

Questions

Thank you!

Qs ?

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