On Compositional Information Flow Aware Refinement

Christoph Baumann
Mads Dam
Roberto Guanciale
Hamed Nemati

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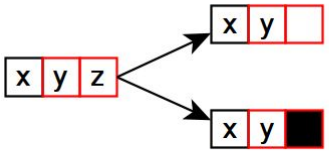
CISPA

Modular verification based on refinement

But relationship between Info flow security and refinement is troubled.



J. McLean: A general theory of composition for a class of ”possibilistic” properties

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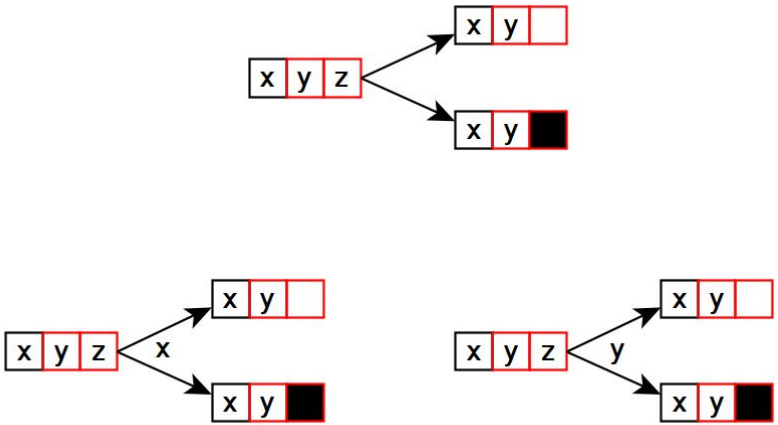
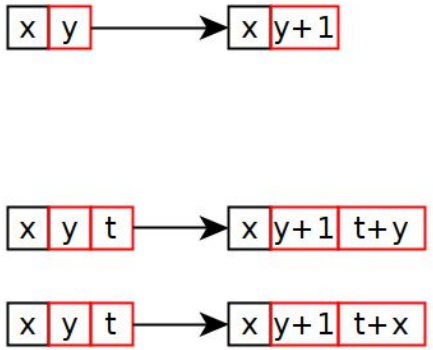


J. McLean: A general theory of composition for a class of ”possibilistic” properties

Well-formed refinement ⇓

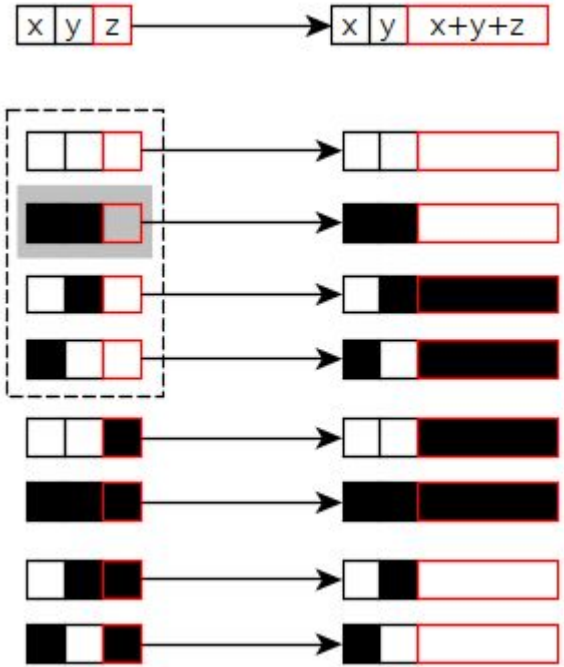
⇓ is a simulation that

- can reduce non-determinism
- can add new variable that introduce discriminating power (e.g. cache state, time)



Ignorance - Knowledge

- Semantic justification in terms of the knowledge an observer gains
- Given a run , ignorance = all runs that are observational equivalent (~)



A. Askarov and S. Chong: Learning is change in knowledge: Knowledge-based security for dynamic policies

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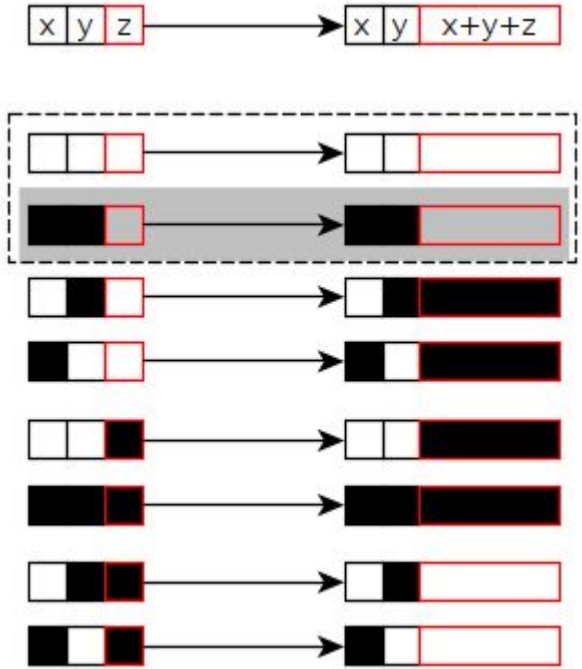

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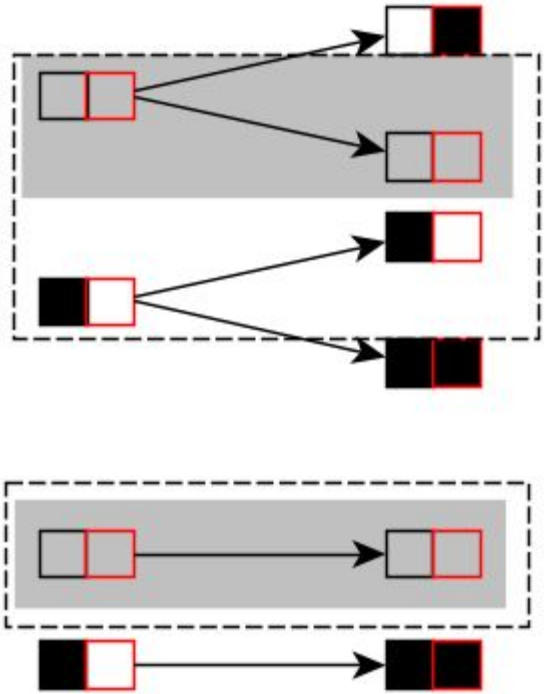
Ignorance Preserving Refinement (IPR)



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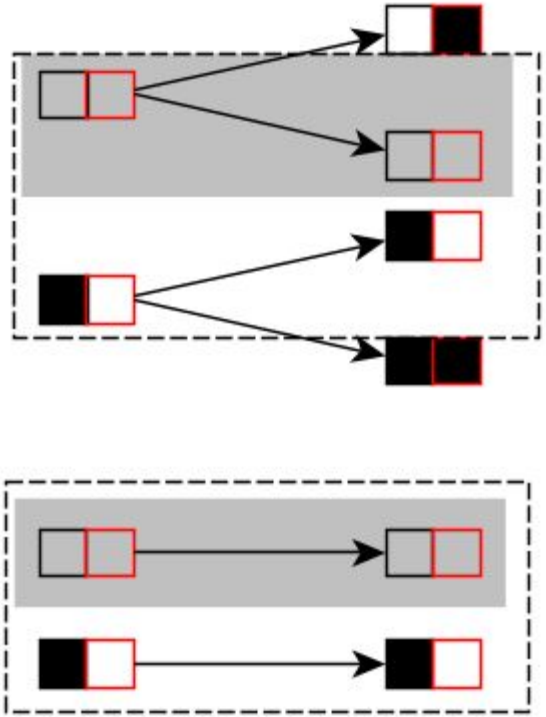

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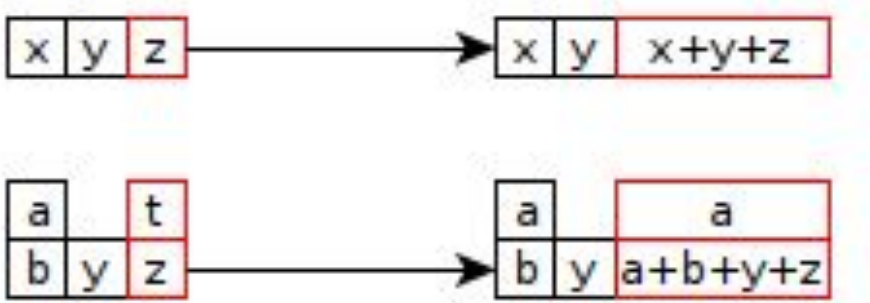
Ignorance Preserving Refinement (IPR)

$\blacksquare^{a\Downarrow} \blacksquare^{c}$ implies that $\boxed{\ }^{a} = \boxed{\ }^{c\Uparrow}$

covers the intentional leakage of abstract secret information (e.g. pwd check) and data refinement



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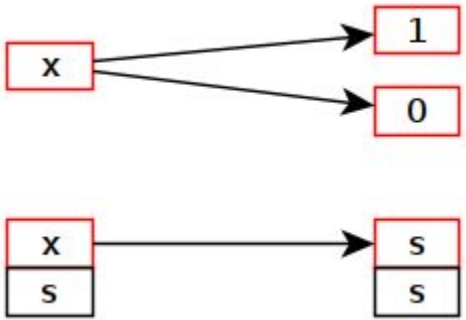
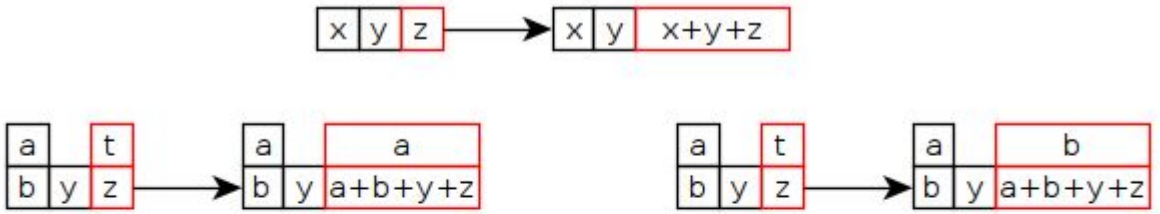


Compositionality



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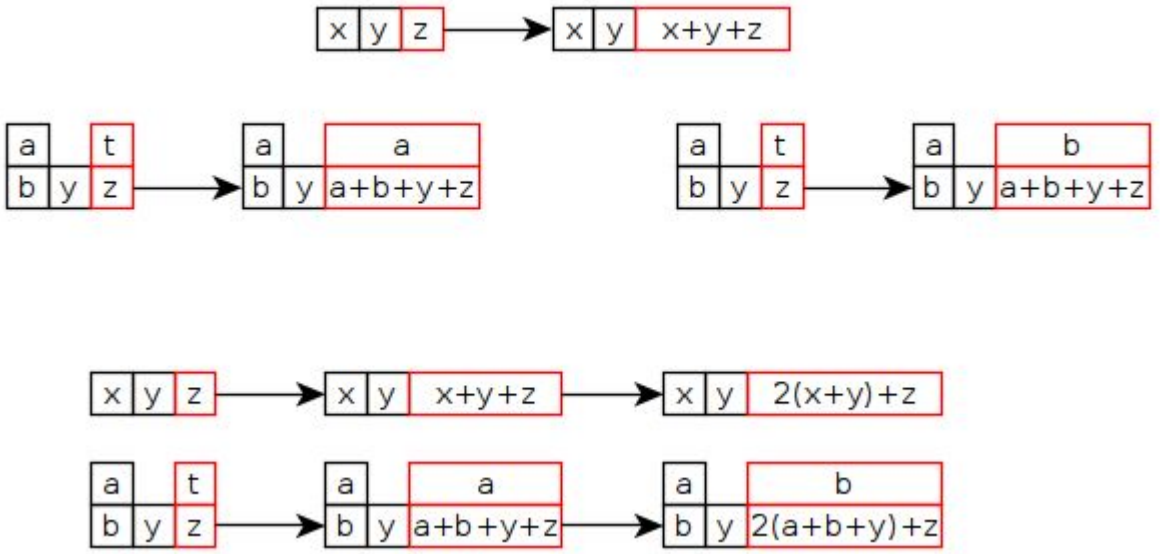
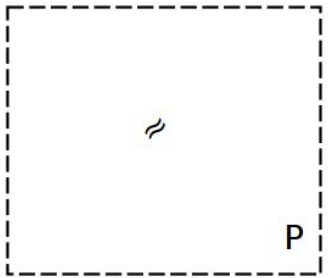


Relational Refinement

{P} ⇓ {Q} is a relational refinement iff



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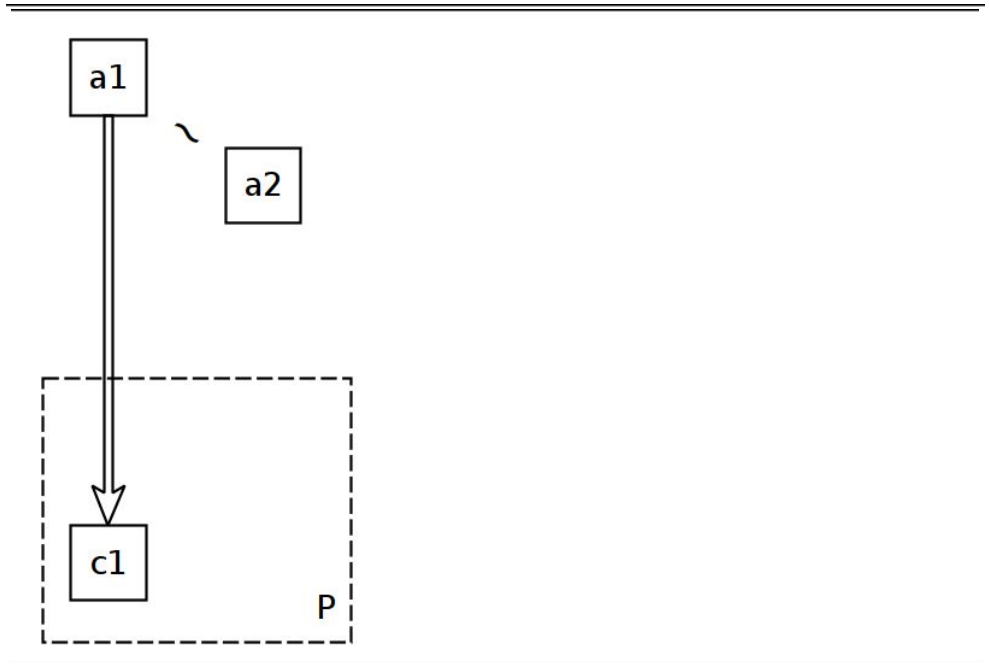

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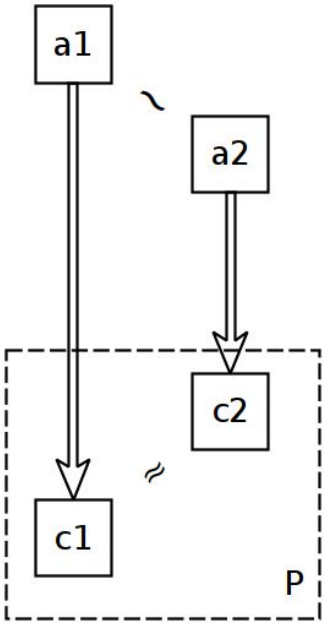

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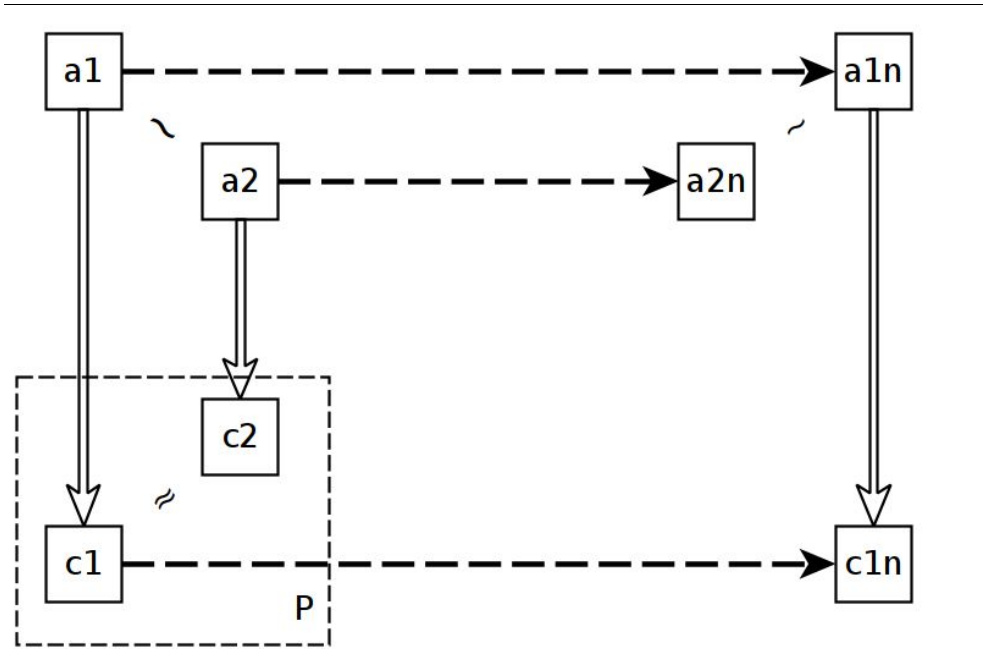

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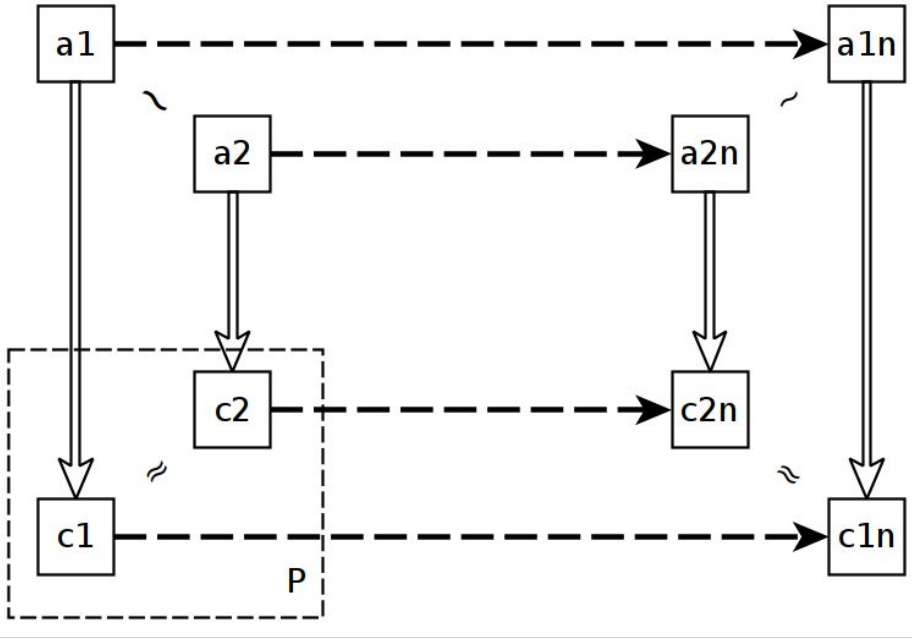

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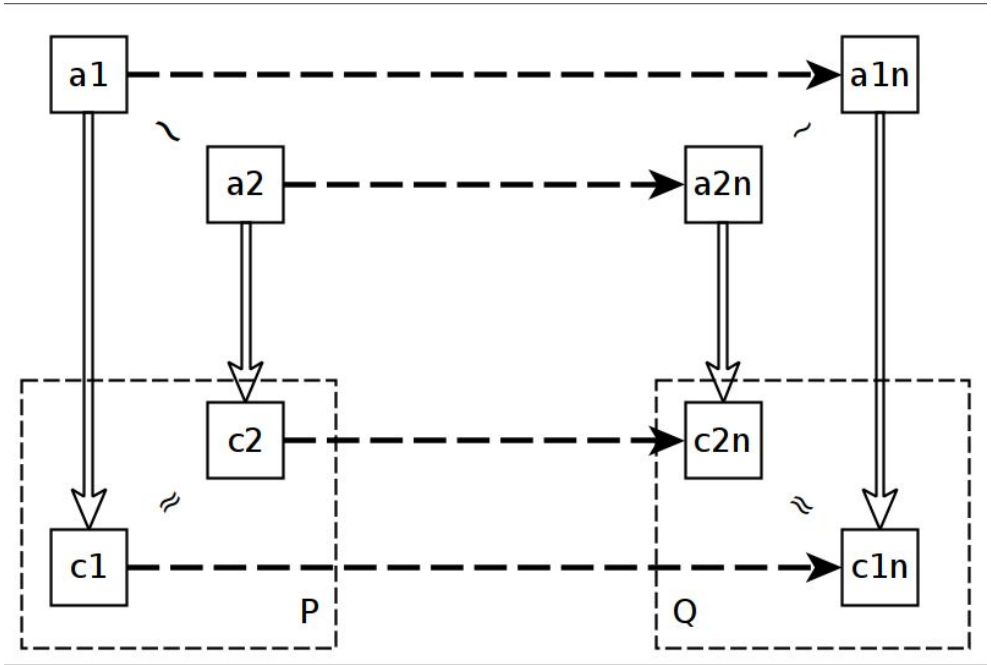

Relational Refinement

If $\{P\} \Downarrow \{Q\}$ is a relational refinement the it is an IPR

If $\{P\} \Downarrow_1 \{Q\}$ and $\{Q\} \Downarrow_2 \{R\}$ are relational refinements then

$\{P\} \Downarrow_1 : \Downarrow_2 \{R\}$ is a relational refinement

In the paper

- Two example applications:
  - SMC addition
  - Oblivious RAM
- Vertical composition
- Related work