An Automata Based Approach for Verification of Information Flow Properties

Deepak D'Souza, Raghavendra K.R., Barbara Sprick

Indian Institute of Science, Bangalore, India

Background

Granting, restricting & controlling the flow of information

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Goguen, Meseguer, ’82 - Non-Interference

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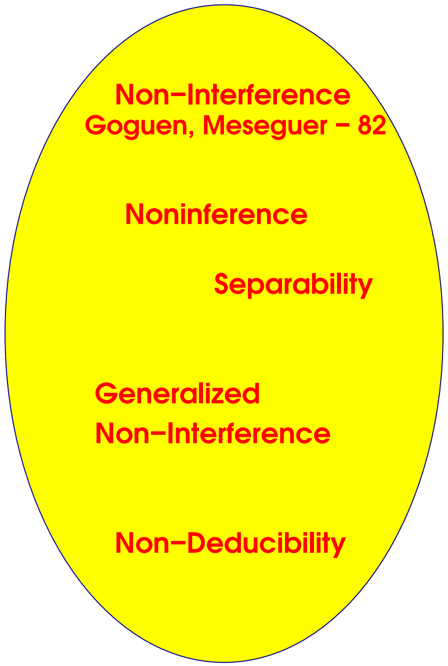

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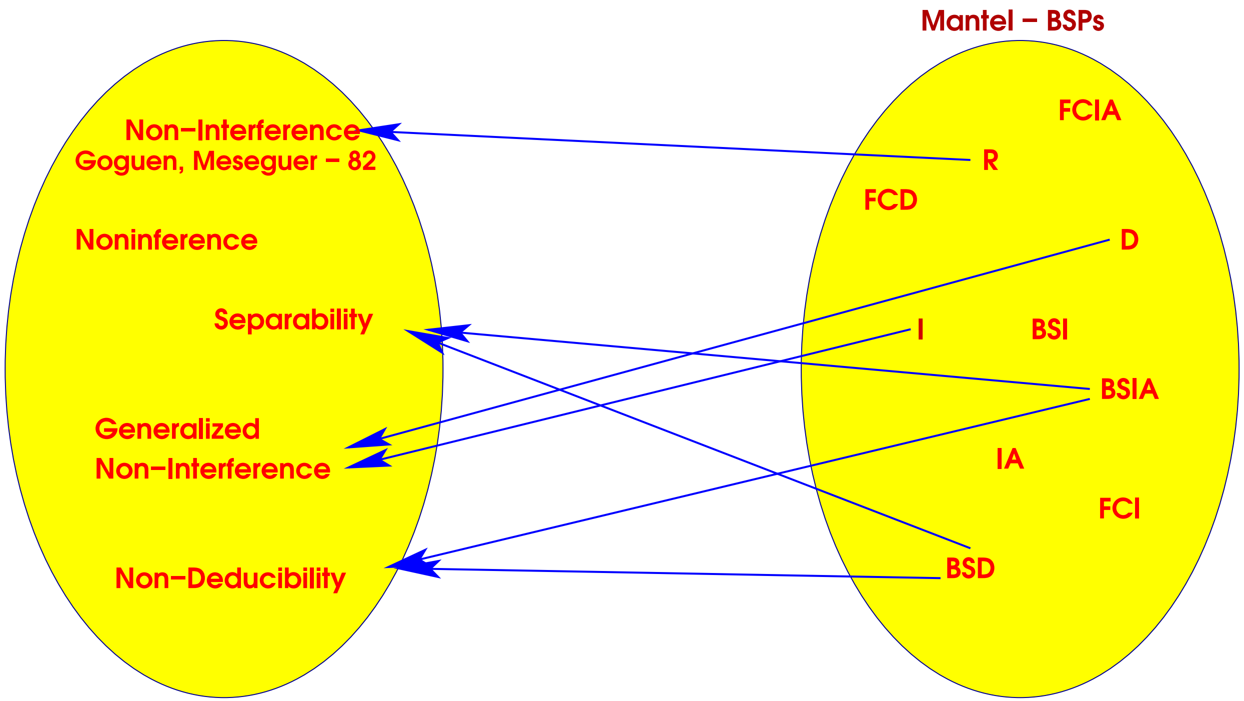

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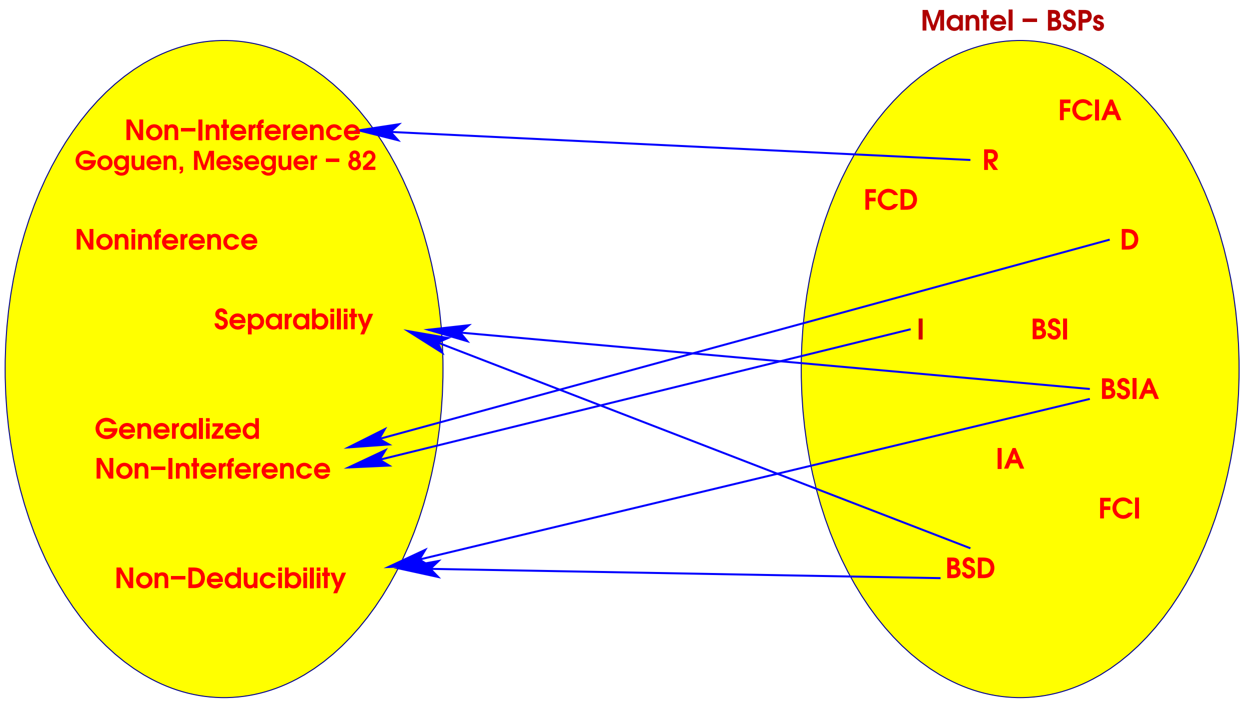

Can we automate Verification of Security?

Basic Security Predicates (BSPs)

Events. Visible, Confidential, Neither

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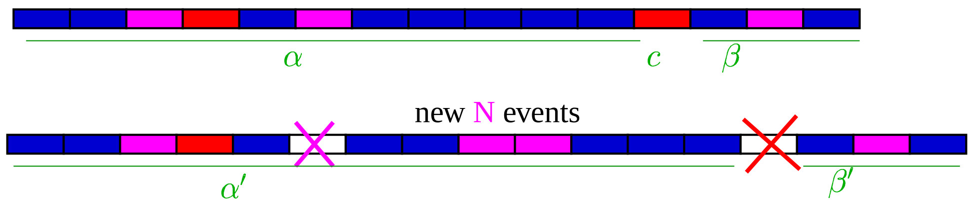
BSP Deletion (D)



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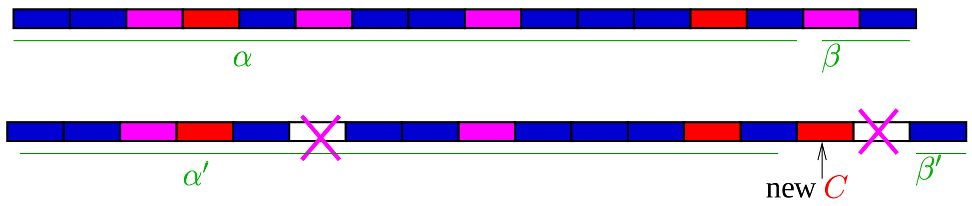
BSP Insertion (I)



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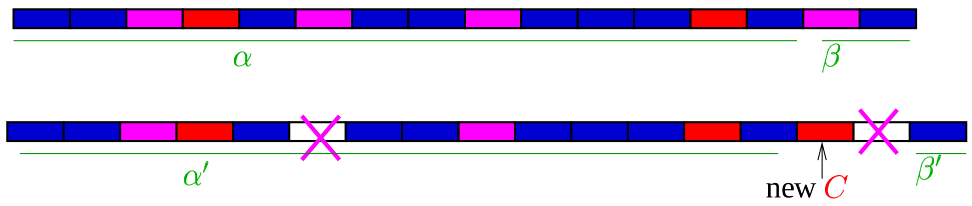

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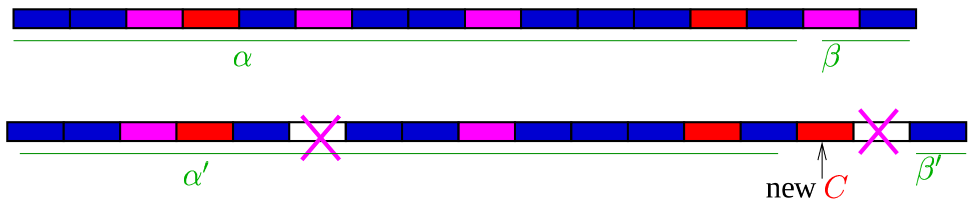
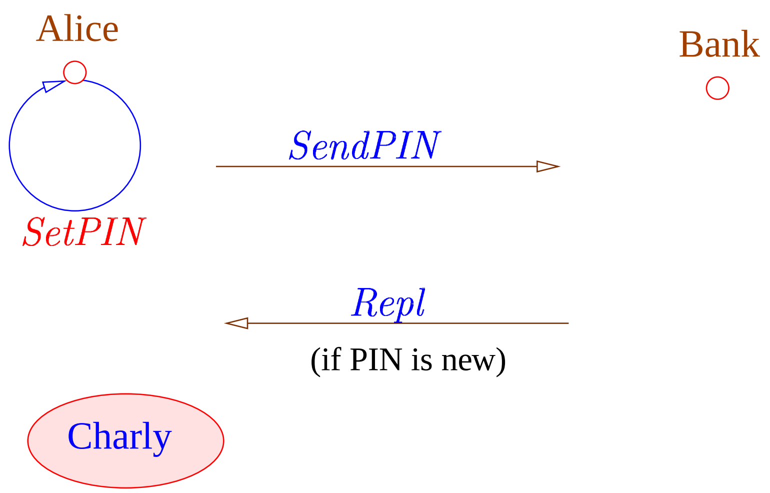


Generalized Non-Interference - I and D

Noninference - R

An Example



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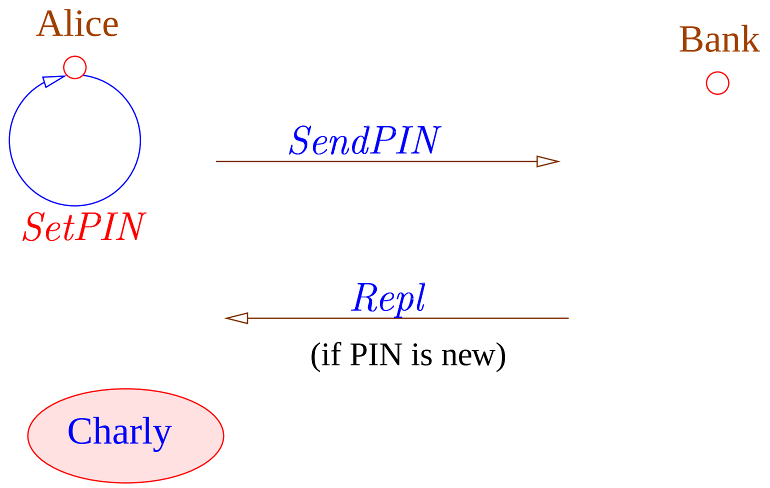

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$C = \{SetPIN\}$
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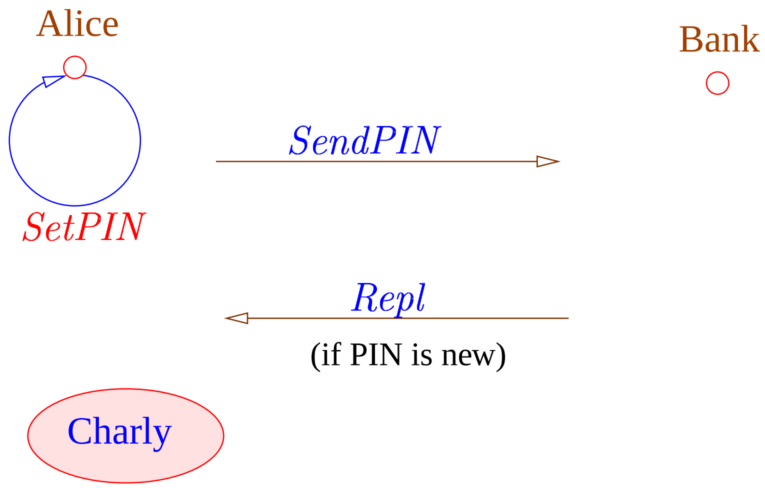

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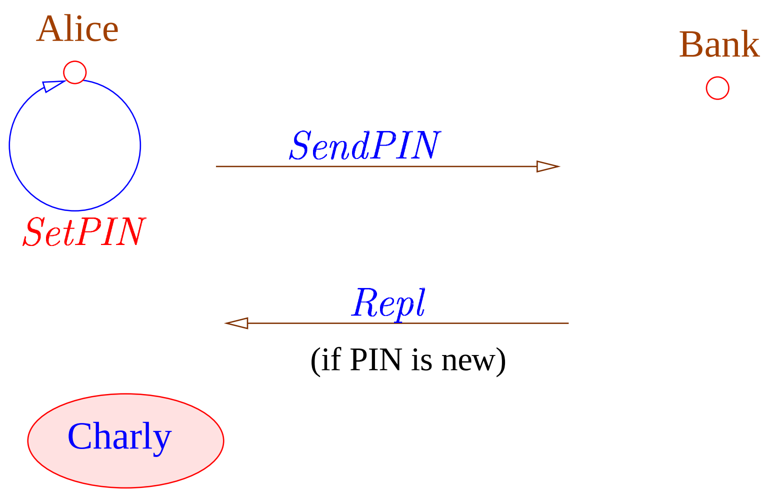

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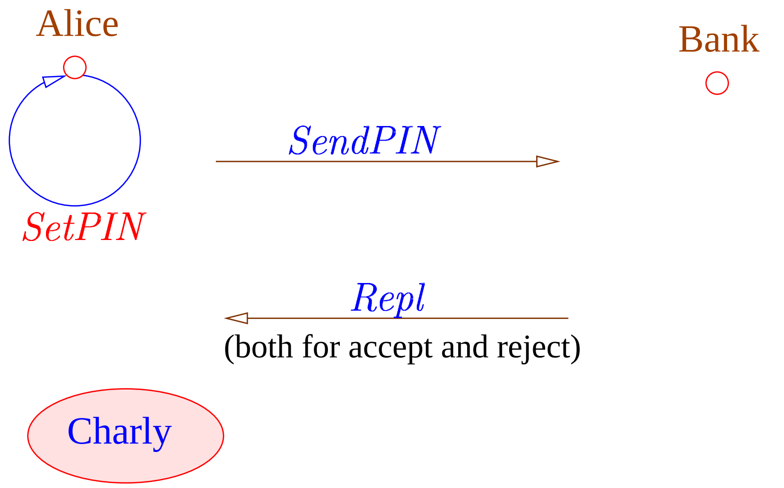
Confidentiality compromised. BSP Deletion fails

Example ..contd



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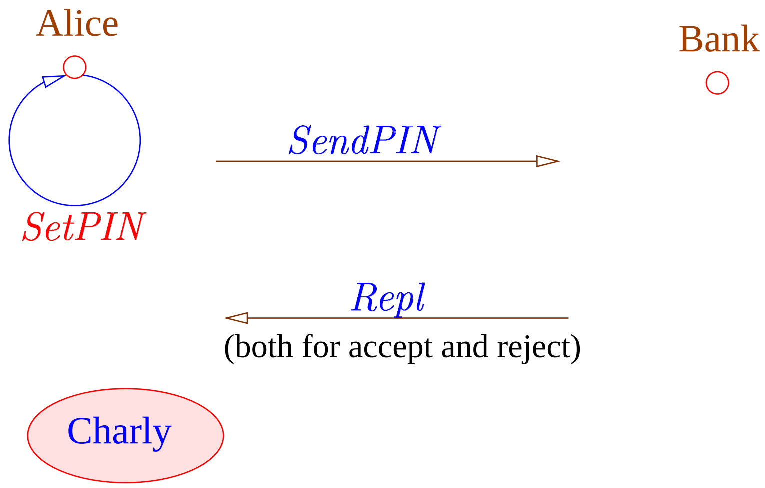

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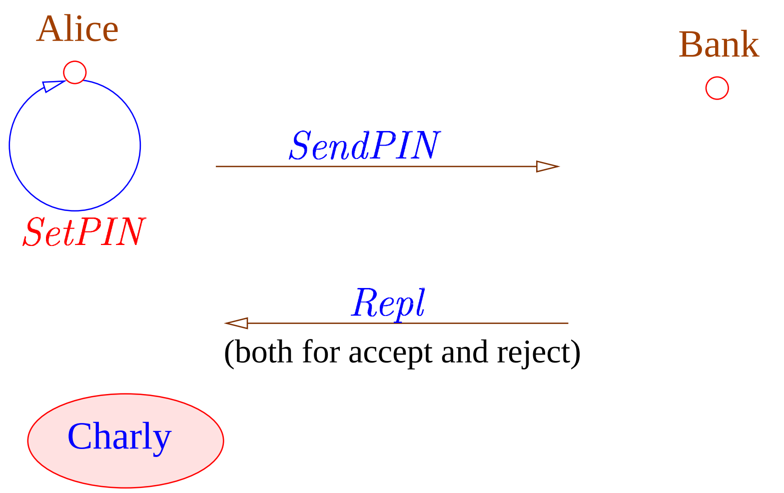

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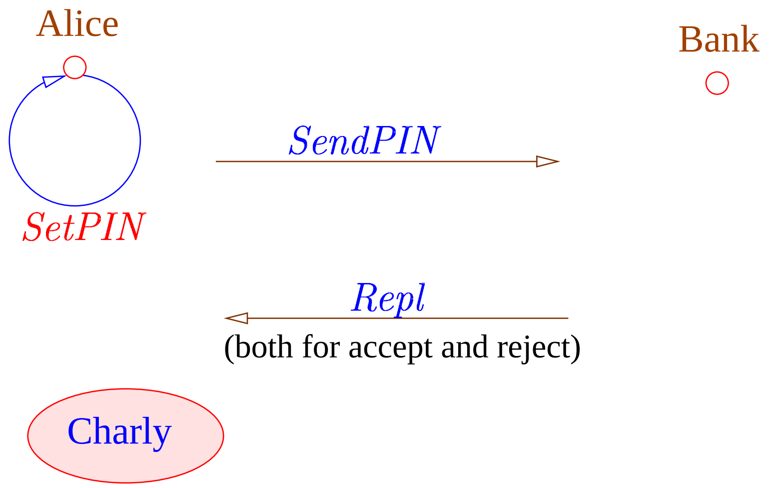

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Confidentiality maintained. BSP Deletion holds

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Automated Verification technique - BSP on Finite State Automaton

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L be a language over Σ, X subset of Σ

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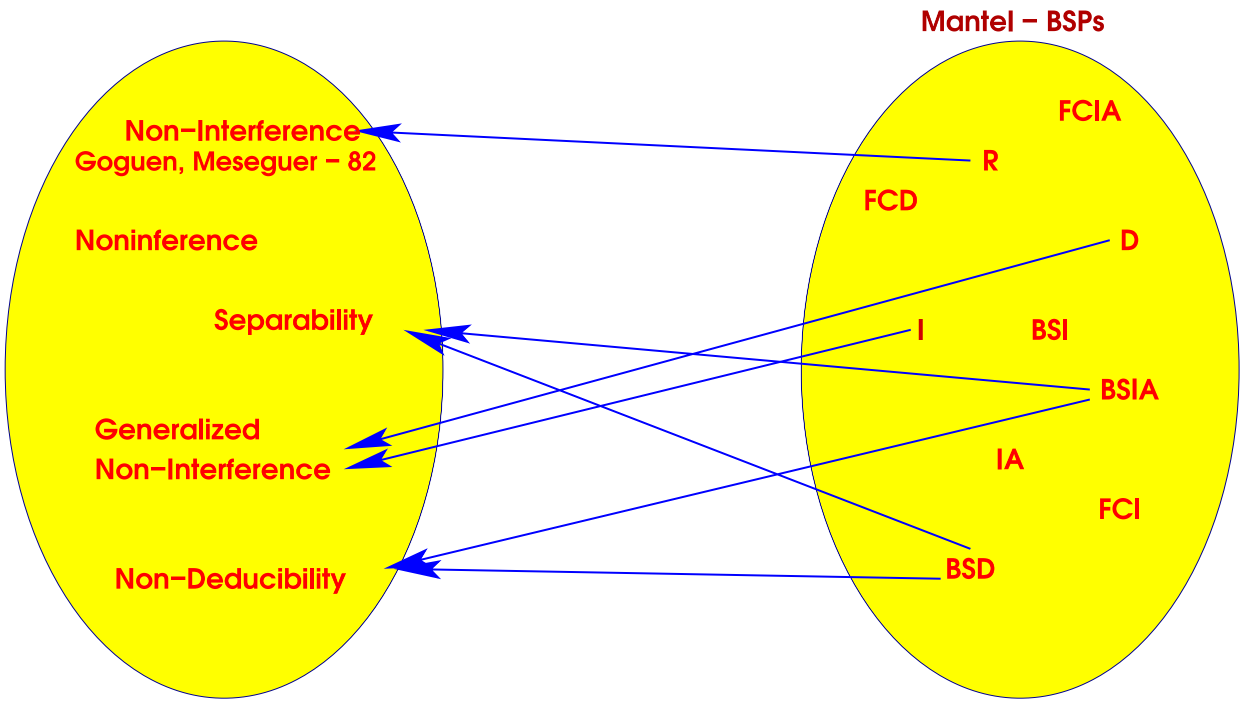

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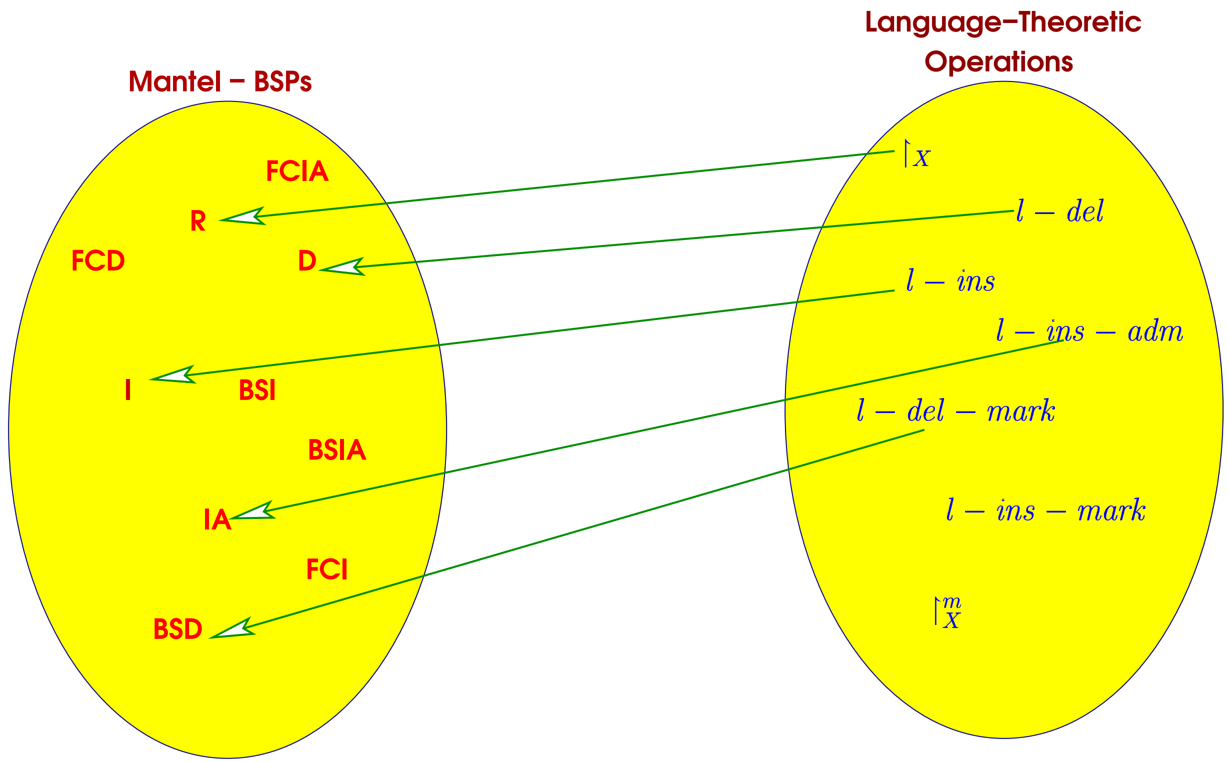

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l-ins-adm$^X(L) := \{\alpha c\beta \mid \alpha\beta$ in L, no C events in β, there exists γc in L, $\gamma =_{\bar{X}} \alpha\}$

Language Inclusion Problem

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- Removal R iff $L\upharpoonright_V \subseteq_N L$.
- Deletion D iff *l-del*$(L) \subseteq_N L$.
- Insertion I iff *l-ins*$(L) \subseteq_N L$.
- Strict Removal SR iff $L\upharpoonright_{\overline{C}} \subseteq L$.
- Strict Deletion SD iff *l-del*$(L) \subseteq L$.

Language Inclusion Problem for BSP D

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τ' equivalent to τ modulo N-corrections

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$L \upharpoonright_X$

by replacing transitions $p \xrightarrow{a} q$, with $a \notin X$, in $\mathcal{A}$, by an ϵ-transition $p \xrightarrow{\epsilon} q$

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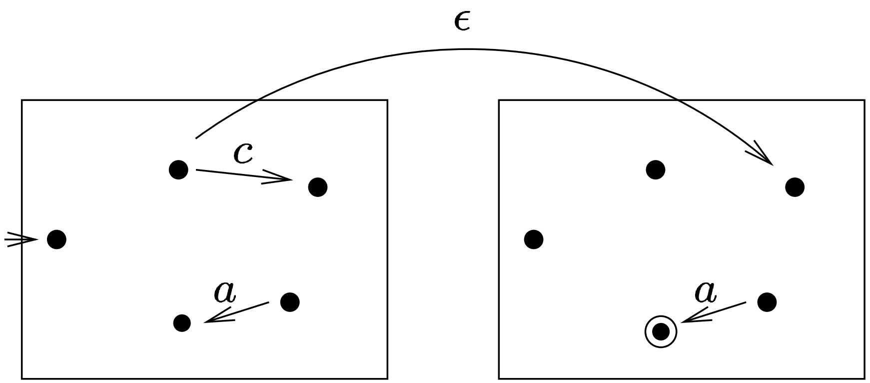

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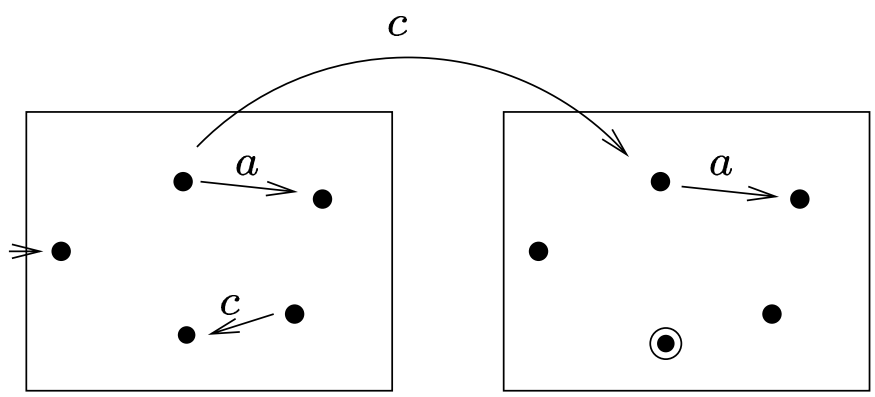

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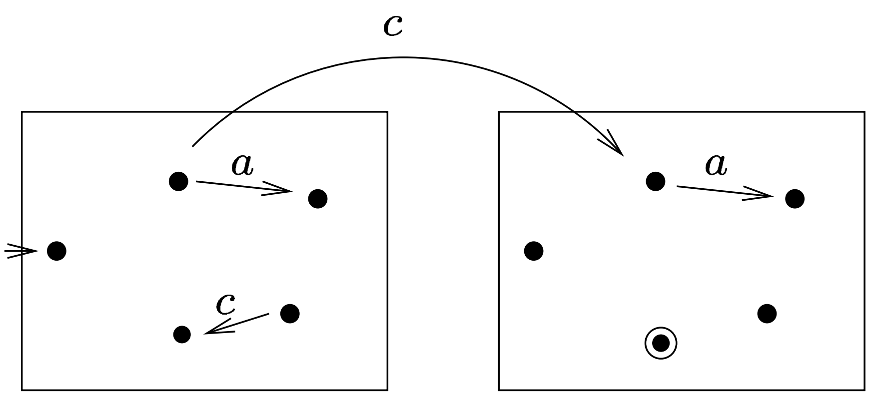

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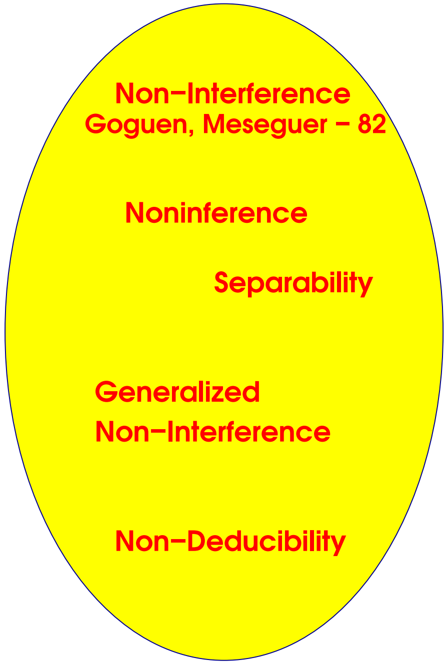
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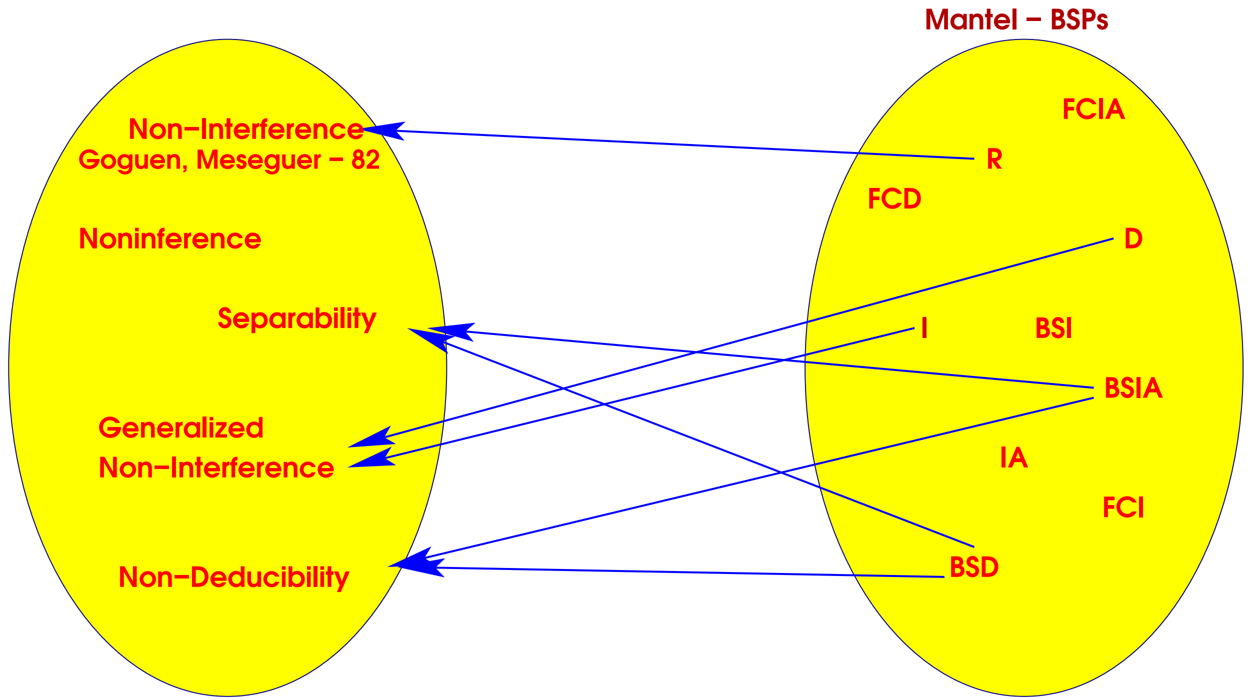
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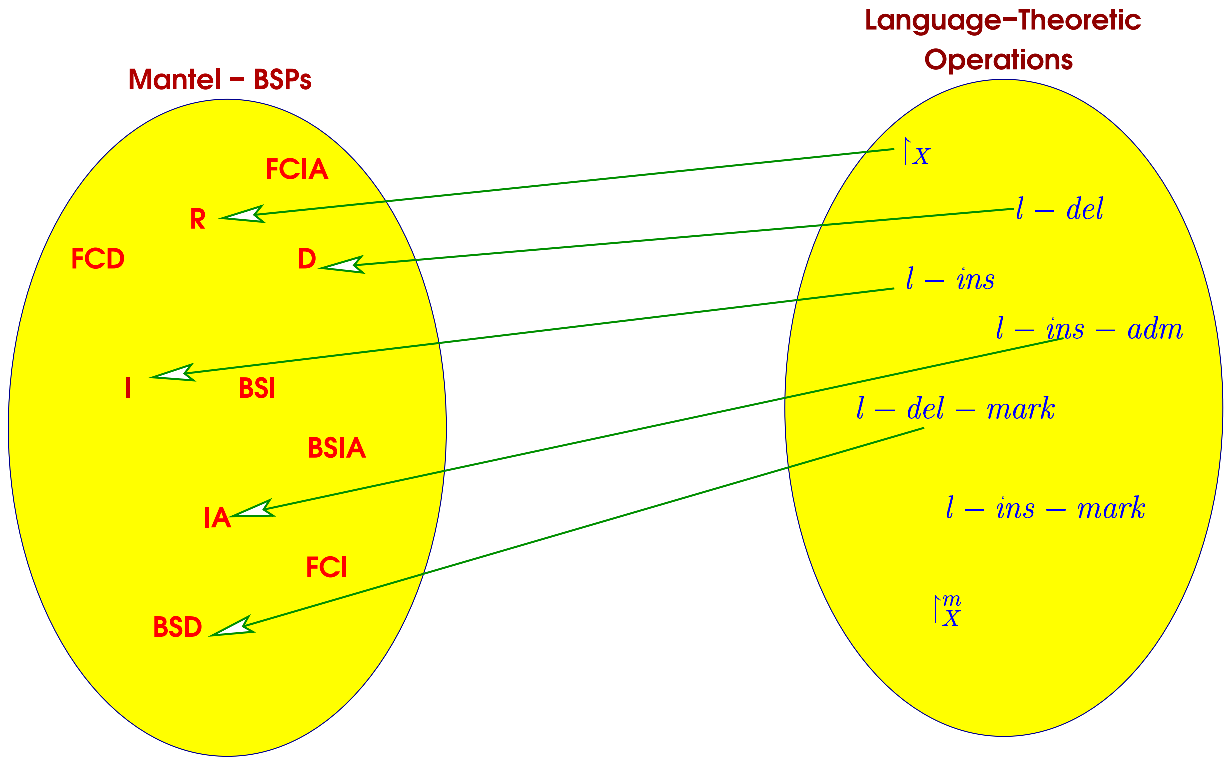

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For infinite state systems?

Thank You