An encoding of Distributed PlusCal in the Join Calculus

By Ghilain BERGERON (Université de Lorraine, CNRS, Inria, Loria)

On August 12, 2024

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- Correctly implementing such algorithms is way harder.

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- Correctly implementing such algorithms is way harder.
- One solution: deriving a working program through the use of a certified specification compiler.

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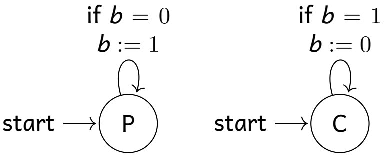

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- communication primitives
  - Channels, FIFOs (ordered channels)
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- and a distinction between local and distant concurrency

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- Better viewed as a programming model rather than a calculus

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- Better viewed as a programming model rather than a calculus
- Based on chemical phenomena

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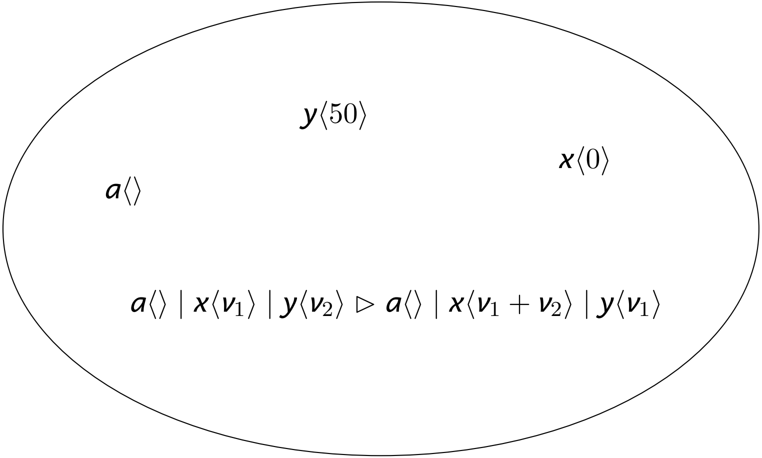
- Reactions $R ::= J \triangleright P$
- Processes $P ::= (R \mid A)^+$ as sets of reactions and atoms
- Solutions are multisets of molecules and reactions

The Join Calculus, graphically



$y\langle 50\rangle$

$x\langle 0\rangle$

$a\langle\rangle$

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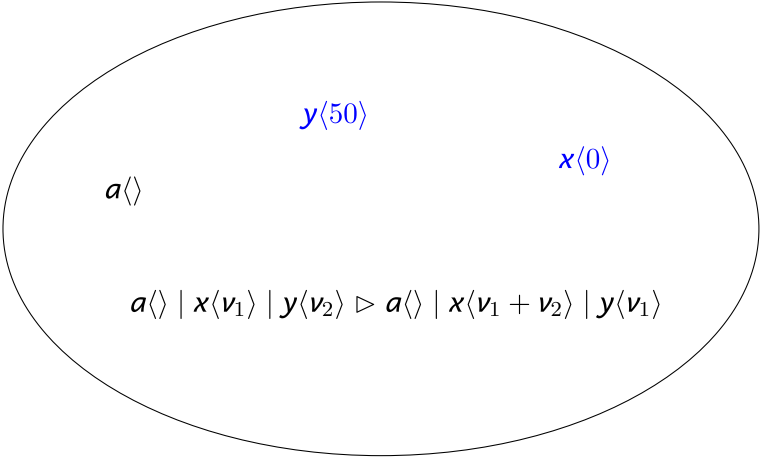

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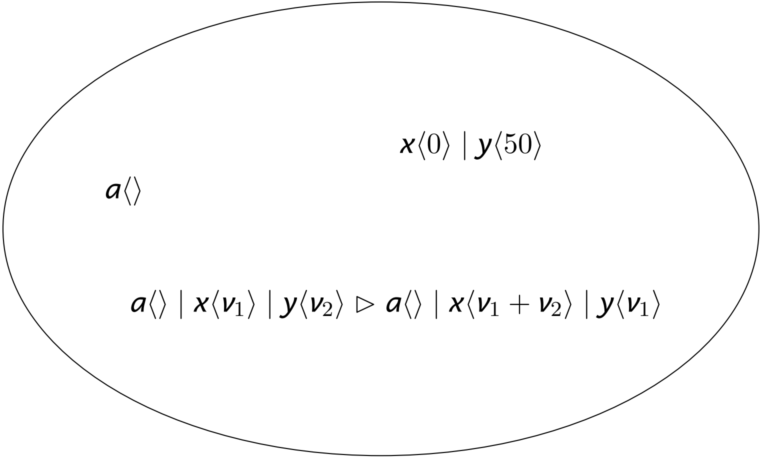

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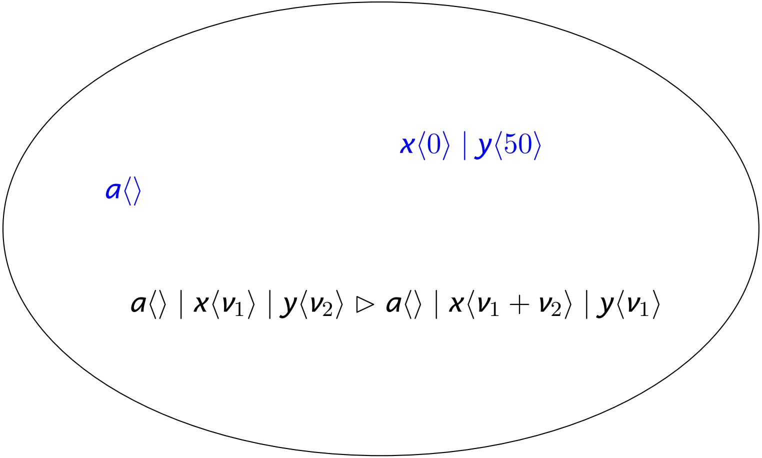

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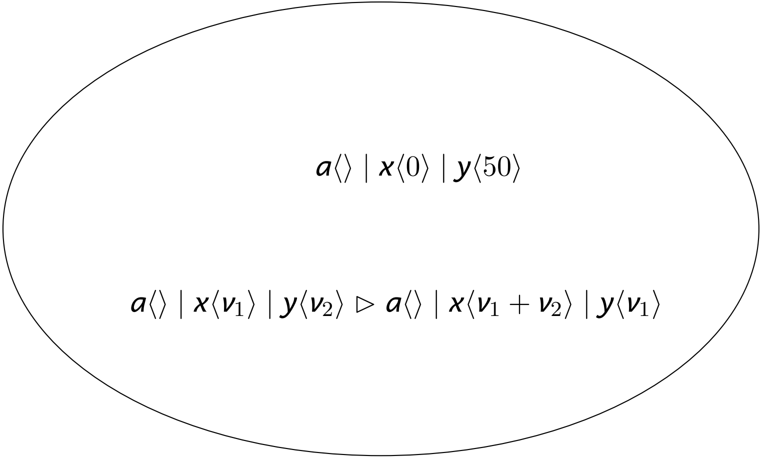

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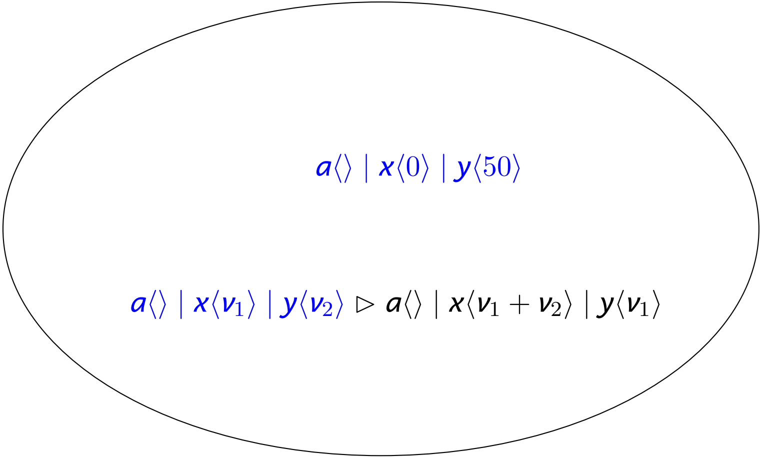

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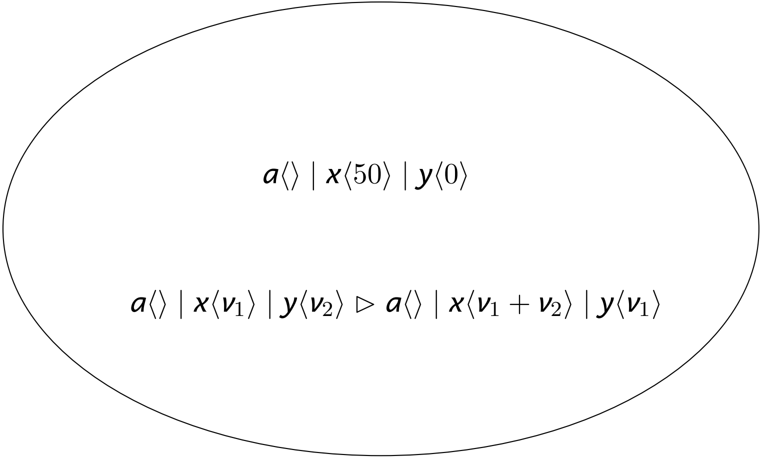

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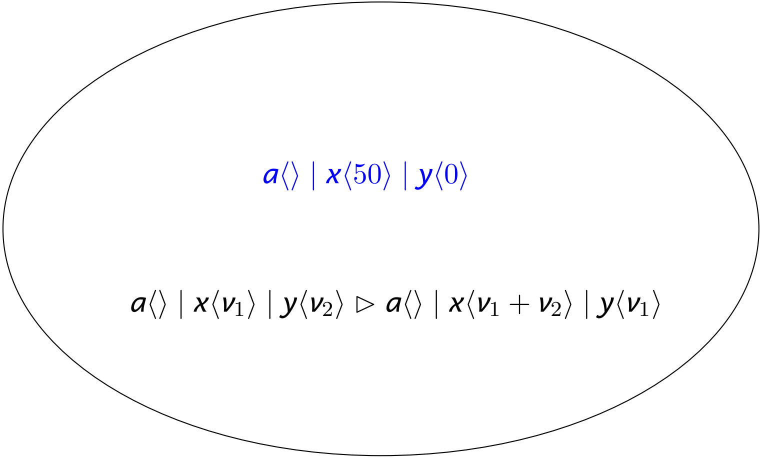

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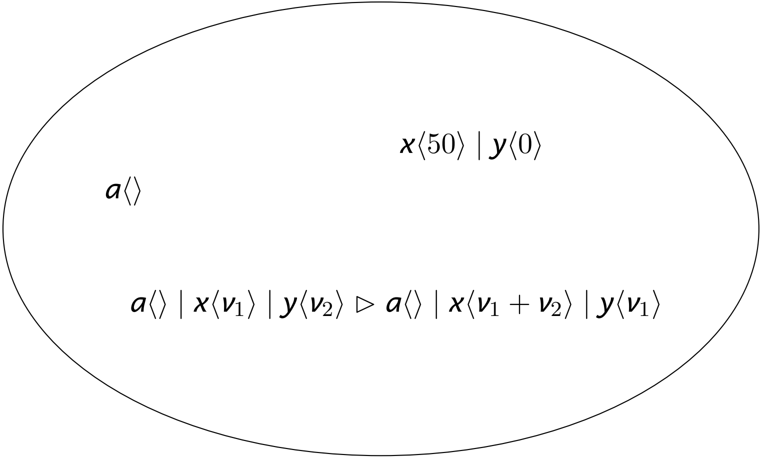

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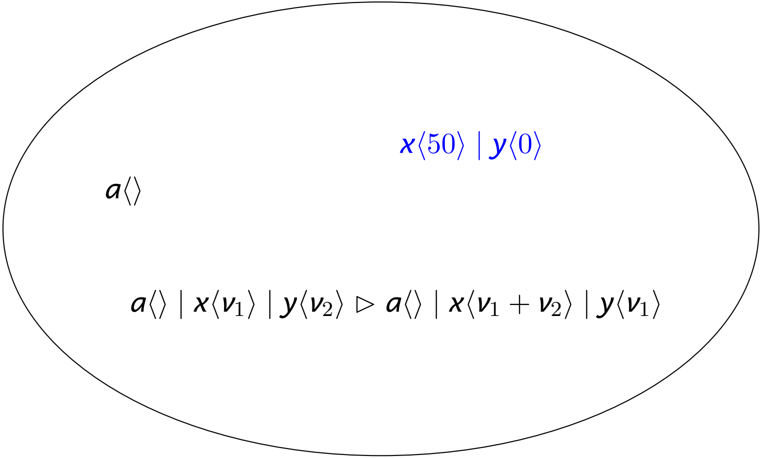

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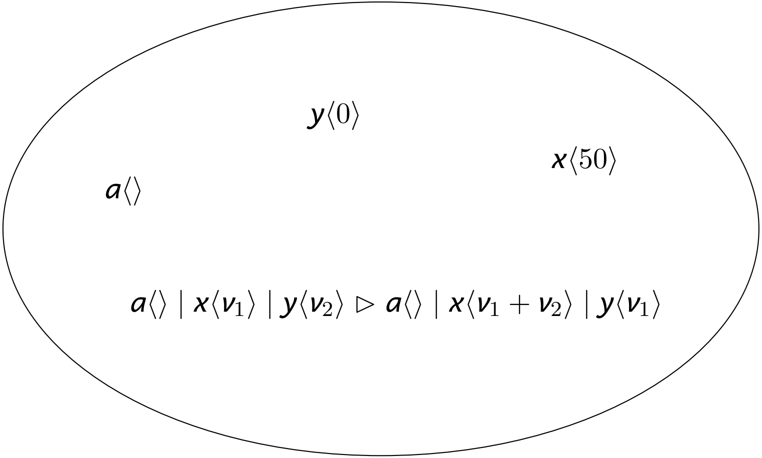

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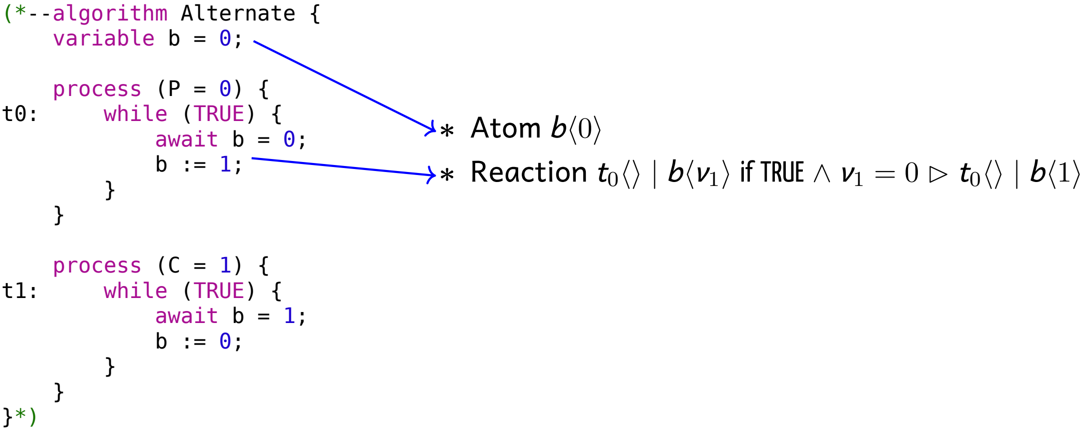

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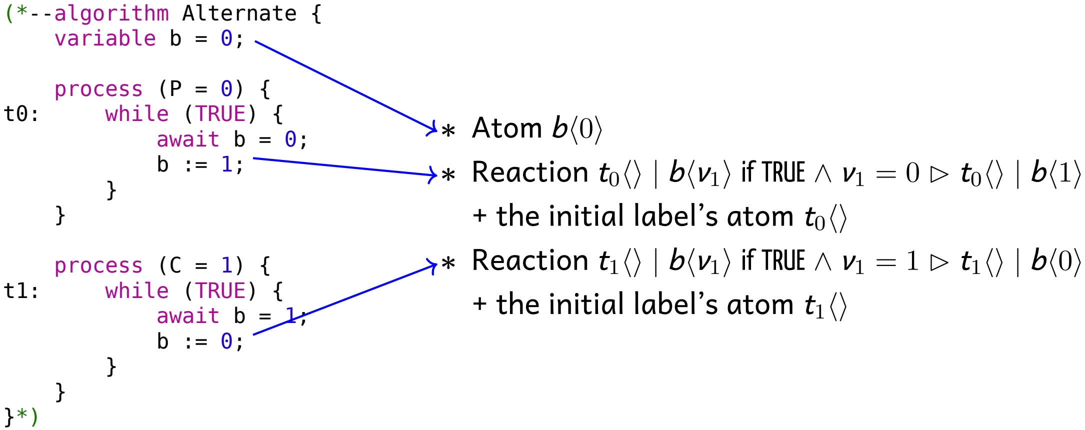

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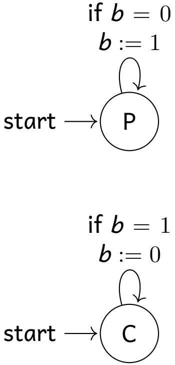

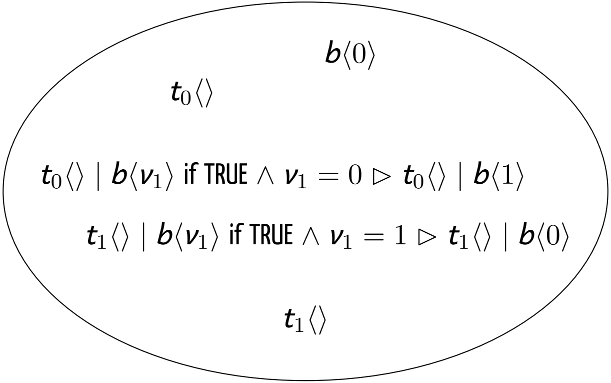

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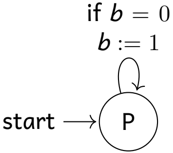

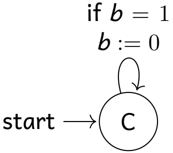

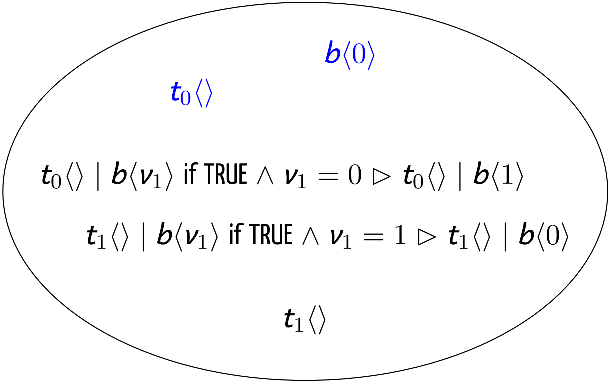

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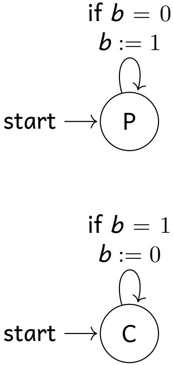
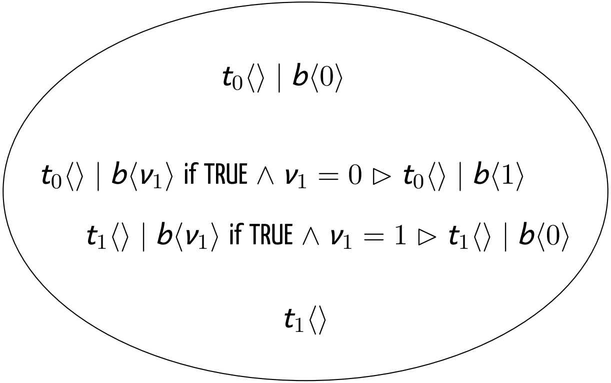
$t_1\langle\rangle$

Comparison with the initial automata





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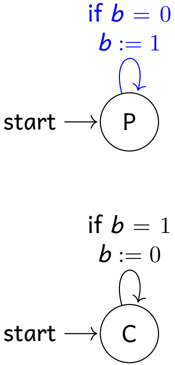
$$t_1\langle\rangle$$



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$t_1\langle\rangle$

$\rightarrow (v_1 := 0)$

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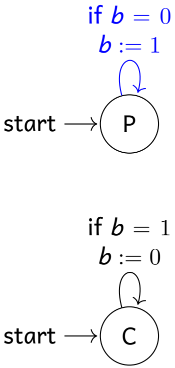
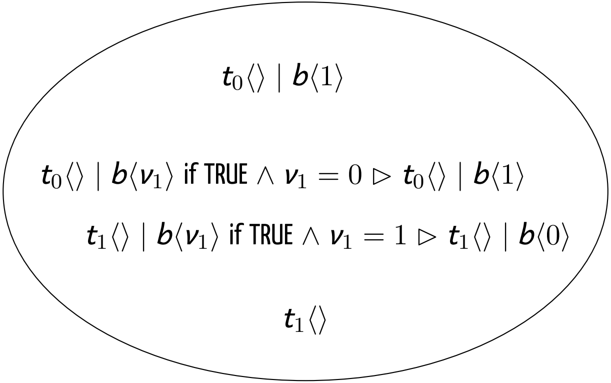




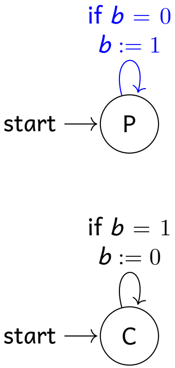
$t_0\langle\rangle \mid b\langle 1\rangle$

$t_0\langle\rangle \mid b\langle v_1\rangle \text{ if TRUE} \wedge v_1 = 0 \triangleright t_0\langle\rangle \mid b\langle 1\rangle$

$t_1\langle\rangle \mid b\langle v_1\rangle \text{ if TRUE} \wedge v_1 = 1 \triangleright t_1\langle\rangle \mid b\langle 0\rangle$

$t_1\langle\rangle$

Comparison with the initial automata



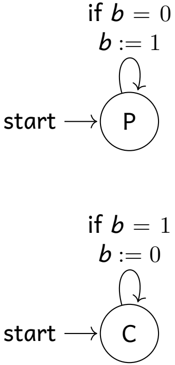
$t_0\langle\rangle \mid b\langle 1\rangle$

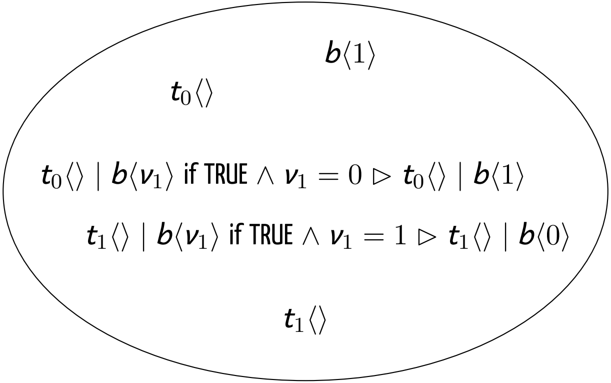
$t_0\langle\rangle \mid b\langle v_1\rangle$ if TRUE $\wedge\ v_1 = 0 \rhd t_0\langle\rangle \mid b\langle 1\rangle$

$t_1\langle\rangle \mid b\langle v_1\rangle$ if TRUE $\wedge\ v_1 = 1 \rhd t_1\langle\rangle \mid b\langle 0\rangle$

$t_1\langle\rangle$

$\longrightarrow$





$b\langle 1\rangle$

$t_0\langle\rangle$

$t_0\langle\rangle \mid b\langle v_1\rangle$ if TRUE $\wedge\ v_1 = 0 \triangleright t_0\langle\rangle \mid b\langle 1\rangle$

$t_1\langle\rangle \mid b\langle v_1\rangle$ if TRUE $\wedge\ v_1 = 1 \triangleright t_1\langle\rangle \mid b\langle 0\rangle$

$t_1\langle\rangle$

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    - ...from the Join Calculus to executable code?