Improving Reachability Analysis For Partially Symmetric High Level Petri Nets

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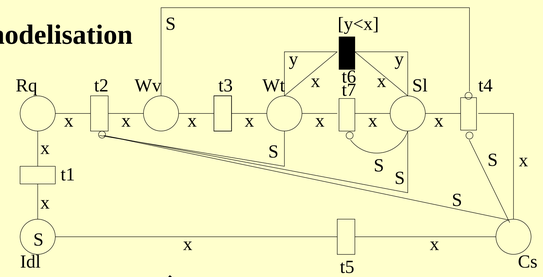
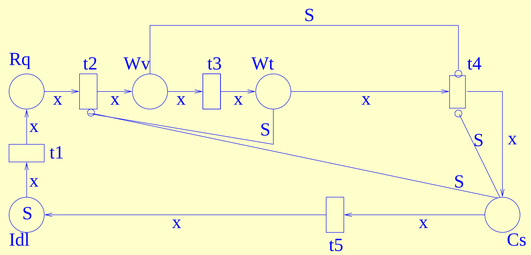
The modelling stage

Asymmetric modelisation

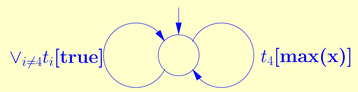


- More intuitive
- Dynamic management of Asymmetries

Symmetric modelisation



Event−based Control automaton



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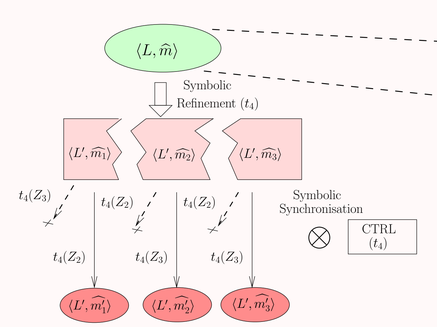
Synchronized Product

Symbolic Computation of Successors



	Color Parition	Symbolic Representation		
$\langle L, \widehat{m}\rangle$	$\{\{1,2,3\}\}$	$Rq(Z_1), Wt(Z_2)$ $\lvert Z_1\rvert = 1, \lvert Z_2\rvert = 2$ $Z_1 \to \{1,2,3\}, Z_2 \to \{1,2,3\}$		
$\langle L', \widehat{m_1}\rangle$	$\{\{1\},\{2\},\{3\}\}$	$Rq(Z_1), Wt(Z_2 + Z_3)$ $\lvert Z_1\rvert = \lvert Z_2\rvert = \lvert Z_3\rvert = 1$	$Z_1 \to \{3\}$ $Z_2 \to \{2\}$	$Z_3 \to \{1\}$
$\langle L', \widehat{m_2}\rangle$			$Z_1 \to \{2\}$ $Z_2 \to \{1\}$	$Z_3 \to \{3\}$
$\langle L', \widehat{m_3}\rangle$			$Z_1 \to \{1\}$ $Z_2 \to \{2\}$	$Z_3 \to \{3\}$
$\langle L', \widehat{m'_1}\rangle$		$Rq(Z_1), Wt(Z_2), Cs(Z_3)$ $\lvert Z_1\rvert = \lvert Z_2\rvert = \lvert Z_3\rvert = 1$	$Z_1 \to \{3\}$ $Z_2 \to \{2\}$	$Z_3 \to \{1\}$
$\langle L', \widehat{m'_2}\rangle$			$Z_1 \to \{2\}$ $Z_2 \to \{1\}$	$Z_3 \to \{3\}$
$\langle L', \widehat{m'_3}\rangle$			$Z_1 \to \{1\}$ $Z_2 \to \{2\}$	$Z_3 \to \{3\}$

- Stored symbolic marking
- Refinement of a symbolic marking
- Symbolic firing
- Rejected instance of the symbolic firing
- Valid successor (not yet stored !)

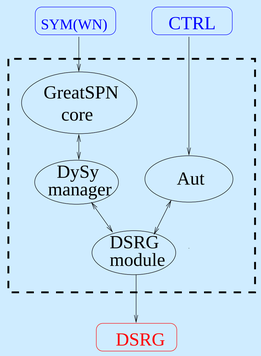
Evaluation vs GreatSPN

In several cases, we have a large reduction in space and time, but this is not the general case because of a non empty intesection between symbolic markings

# Proc.	SRG(RG) Time	SRG(RG) # Nodes	ESRG Time	ESRG # Nodes	DSRG Time	DSRG # Nodes
3	0	139	0	54	0	28
5	2	2709	1	441	0	96
7	41	50159	25	4918	3	253
9	1147	911017	939	57211	45	559
11	----	16378179	54074	639056	1830	1090

To minimize the number of non empty intersections, the most symmetric symbolic markings are constructed first.

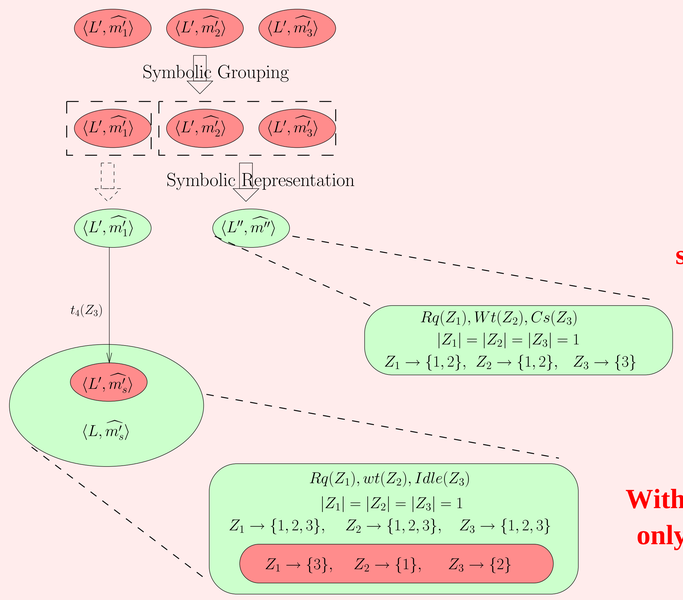
The DSRG module implements the construction algorithm



The Aut module, manages the control automaton

The DySy manager hides the use of dynamic symmetries to the core of GreatSPN

Symbolic State Space Reduction



The Symbolic Grouping operation, searches an optimal representation for a set of successors

With the Symbolic Inclusion operation, only the most symmetric symbolic markings are kept