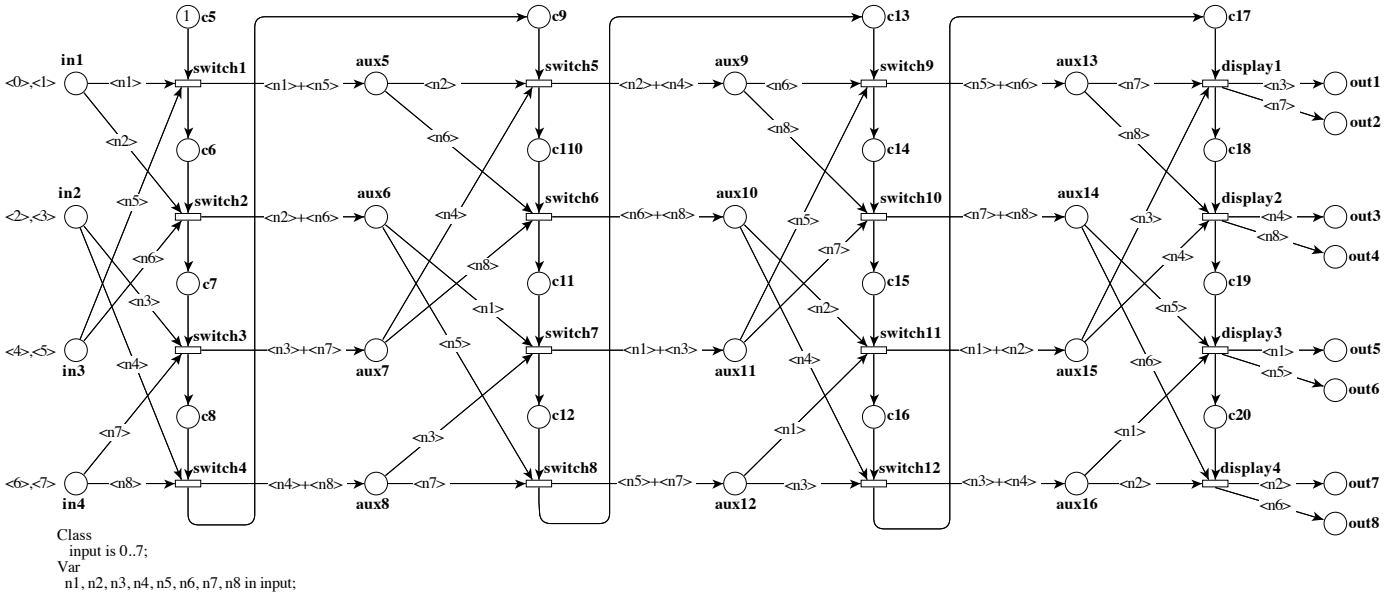
Fabrice Kordon
Fabrice.Kordon@lip6.fr

This form is a summary description of the model entitled "Permutation admissibility in multistage interconnection networks" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together with property files (possibly, one per model instance) giving a set of properties to be checked on the model.

Description

The model describes a 8×8 4 stages shuffle-exchange network. In order to ease readability, the net components are grouped in columns similar to the way the switches are arranged in stages. Thus, whole net is represented as a cascade of columns alternating in type of the components being either place or transition. Transitions occur column-wise from the leftmost to the rightmost and in columns from the topmost to the bottommost. It can be easily seen that no token can visit a place more than once. Direction of the arcs indicates the flow of tokens through the net.

Here, we consider the scaling parameter N as a multiplier for the initial marking in places $\mathbf{in}\langle x \rangle$ and **c5**. The figure shows the model when $N = 1$.



Graphical representation for $N = 1$

References

R. Bashirov, F. Kordon, and H. Lort. Exploiting colored Petri nets to decide on permutation admissibility. *Acta Informatica*, 46(1):43–55, February 2009.

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	Multiplier for the marking of places $\mathbf{in}\langle x \rangle$ and **c5**	1, 2, 5, 10, 20, 50

Size of the model

Although the model is parameterized, its size does not depend on parameter values.

Fabrice Kordon
Fabrice.Kordon@lip6.fr

number of places:	40
number of transitions:	16
number of arcs:	83

Structural properties

ordinary — *all arcs have multiplicity one* ..... ✗
simple free choice — *all transitions sharing a common input place have no other input place* ..... ✗ (a)
extended free choice — *all transitions sharing a common input place have the same input places* ..... ✗ (b)
state machine — *every transition has exactly one input place and exactly one output place* ..... ✗ (c)
marked graph — *every place has exactly one input transition and exactly one output transition* ..... ✗ (d)
connected — *there is an undirected path between every two nodes (places or transitions)* ..... ✓ (e)
strongly connected — *there is a directed path between every two nodes (places or transitions)* ..... ✗ (f)
source place(s) — *one or more places have no input transitions* ..... ✓ (g)
sink place(s) — *one or more places have no output transitions* ..... ✓ (h)
source transition(s) — *one or more transitions have no input places* ..... ✗ (i)
sink transitions(s) — *one or more transitions have no output places* ..... ✗ (j)
loop-free — *no transition has an input place that is also an output place* ..... ✓ (k)
conservative — *for each transition, the number of input arcs equals the number of output arcs* ..... ✗ (l)
subconservative — *for each transition, the number of input arcs equals or exceeds the number of output arcs* ..... ✗ (m)
nested units — *places are structured into hierarchically nested sequential units* (n) ..... ✗

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ✗ (o)
deadlock — *there exists a reachable marking from which no transition can be fired* ..... ✓ (p)
reversible — *from every reachable marking, there is a transition path going back to the initial marking* ..... ✗
quasi-live — *for every transition t, there exists a reachable marking in which t can fire* ..... ?
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... ?

(a) the net is not ordinary in all its 6 instances (1, 2, 5, 10, 20, and 50).
(b) the net is not ordinary in all its 6 instances (1, 2, 5, 10, 20, and 50).
(c) the net is not ordinary in all its 6 instances (1, 2, 5, 10, 20, and 50).
(d) the net is not ordinary in all its 6 instances (1, 2, 5, 10, 20, and 50).
(e) stated by CÆSAR.BDD version 1.7 on all 6 instances (1, 2, 5, 10, 20, and 50).
(f) from place "aux16_0" one cannot reach place "in4_6".
(g) there exist 9 source places, e.g., place "in4_6".
(h) there exist 64 sink places, e.g., place "out7_1".
(i) stated by CÆSAR.BDD version 1.7 on all 6 instances (1, 2, 5, 10, 20, and 50).
(j) stated by CÆSAR.BDD version 1.7 on all 6 instances (1, 2, 5, 10, 20, and 50).
(k) stated by CÆSAR.BDD version 1.7 on all 6 instances (1, 2, 5, 10, 20, and 50).
(l) stated by PNML2NUPN 1.3.0 on all 6 instances (1, 2, 5, 10, 20, and 50).
(m) stated by PNML2NUPN 1.3.0 on all 6 instances (1, 2, 5, 10, 20, and 50).
(n) the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php
(o) in the initial marking, some places have several tokens (the number of which depends on N).
(p) confirmed at MCC'2014 by Helena on all 6 colored instances, and by Lola and Tapaal on all 6 P/T instances.

Fabrice Kordon
Fabrice.Kordon@lip6.fr

Size of the marking graphs

Parameter	Number of reachable markings	Number of transition firings	Max. number of tokens per place	Max. number of tokens per marking
$N = 1$	52 537 [q]	54 600 [r]	1 [s]	9 [t]
$N = 2$	?	?	?	≥ 18
$N = 5$	?	?	?	≥ 45
$N = 10$	?	?	?	≥ 90
$N = 20$	?	?	?	≥ 180
$N = 50$	?	?	?	≥ 450

[q] Computed by Alpina, and ITS-Tools at MCC'2013; confirmed at MCC'2014 by Helena on the colored net instance, and by GreatSPN, Marcie, PNMC, PNXDD, and Tapaal on the P/T net instance.
[r] computed at MCC'2014 by Helena on the colored net instance, and by Marcie on the P/T net instance.
[s] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal on the P/T net instance.
[t] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal on the P/T net instance.