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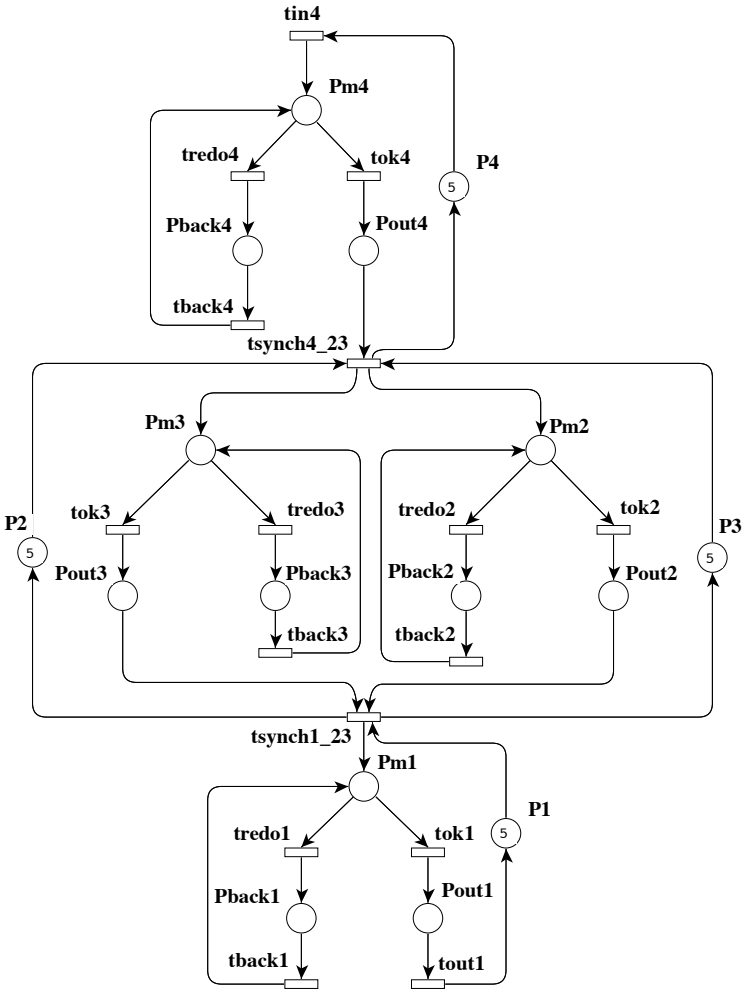
This form is a summary description of the model entitled "Kanban" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together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

Description

This Petri net is extracted a benchmark used for SMART. It models a Kanban system.

The five largest instances have been added in 2019.



Graphical representation for $N = 5$

References

http://www.cs.ucr.edu/~ciardo/SMART/

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Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	The scale factor is a value N that determines the initial marking of the places P_1, P_2, P_3, and P_4 ($M(P1) = M(P2) = M(P3) = M(P4) = N$)	5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, 50000

Size of the model

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

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

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]
dead place(s) — *one or more places have no token in any reachable marking* ..... ✗ [p]
dead transition(s) — *one or more transitions cannot fire from any reachable marking* ..... ✗ [q]

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[a] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[b] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[c] 2 transitions are not of a state machine, e.g., transition "tsynch1_23".
[d] 4 places are not of a marked graph, e.g., place "Pm3".
[e] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[f] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[g] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[h] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[i] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[j] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[k] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[l] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[m] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[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); confirmed by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[p] stated by CÆSAR.BDD version 3.3 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).
[q] stated by CÆSAR.BDD version 2.8 on all 13 instances (5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000, 10000, 20000, and 50000).

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deadlock — *there exists a reachable marking from which no transition can be fired* ..... ✗ [r]
reversible — *from every reachable marking, there is a transition path going back to the initial marking* ..... ?
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... ?

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
$N = 5$	2.5464E+6 [s]	2.4460E+7 [t]	5 [u]	20 [v]
$N = 10$	1.006E+9 [w]	1.2032E+10 [x]	10 [y]	40 [z]
$N = 20$	8.0542E+11 [aa]	1.1012E+13 [ab]	20 [ac]	80 [ad]
$N = 50$	1.0426E+16 [ae]	1.5612E+17 [af]	50 [ag]	200 [ah]
$N = 100$	1.7263E+19 [ai]	2.6705E+20 [aj]	100 [ak]	400 [al]
$N = 200$	3.1732E+22 [am]; confirmed at MCC'2014 by GreatSPN and PNMC	?	200 [an]	800 [ao]
$N = 500$	7.0860E+26 [ap]	?	500 [aq]	2000 [ar]
$N = 1000$	?	?	?	4000 [as]
$N = 2000$	?	?	?	8000 [at]
$N = 5000$	?	?	?	20000 [au]
$N = 10000$	?	?	?	40000 [av]
$N = 20000$	?	?	?	80000 [aw]
$N = 50000$	?	?	?	200000 [ax]

[r] confirmed at MCC'2014 by GreatSPN on 6 instances, by Lola on 4 instances, and by Tapaal on 3 instances.
[s] computed at MCC'2013 by Alpina, GreatSPN, ITS-Tools, Marcie, Neco, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, Stratagem, and Tapaal.
[t] computed at MCC'2014 by Marcie.
[u] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[v] number of initial tokens, because the net is conservative.
[w] computed at MCC'2013 by Alpina, GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, and Stratagem.
[x] computed at MCC'2014 by Marcie.
[y] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[z] number of initial tokens, because the net is conservative.
[aa] computed at MCC'2013 by GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, and Stratagem.
[ab] computed at MCC'2014 by Marcie.
[ac] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ad] number of initial tokens, because the net is conservative.
[ae] computed at MCC'2013 by GreatSPN, ITS-Tools, and Marcie; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, and Stratagem.
[af] computed at MCC'2014 by Marcie.
[ag] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[ah] number of initial tokens, because the net is conservative.
[ai] computed at MCC'2013 by GreatSPN, ITS-Tools, and Marcie; computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[aj] computed at MCC'2014 by Marcie.
[ak] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[al] number of initial tokens, because the net is conservative.
[am] computed at MCC'2013 by ITS-Tools.
[an] computed at MCC'2014 by GreatSPN and Marcie.
[ao] number of initial tokens, because the net is conservative.
[ap] computed at MCC'2014 by PNMC.
[aq] computed at MCC'2014 by PNMC.
[ar] number of initial tokens, because the net is conservative.
[as] number of initial tokens, because the net is conservative.
[at] number of initial tokens, because the net is conservative.
[au] number of initial tokens, because the net is conservative.
[av] number of initial tokens, because the net is conservative.
[aw] number of initial tokens, because the net is conservative.

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(ax) number of initial tokens, because the net is conservative.