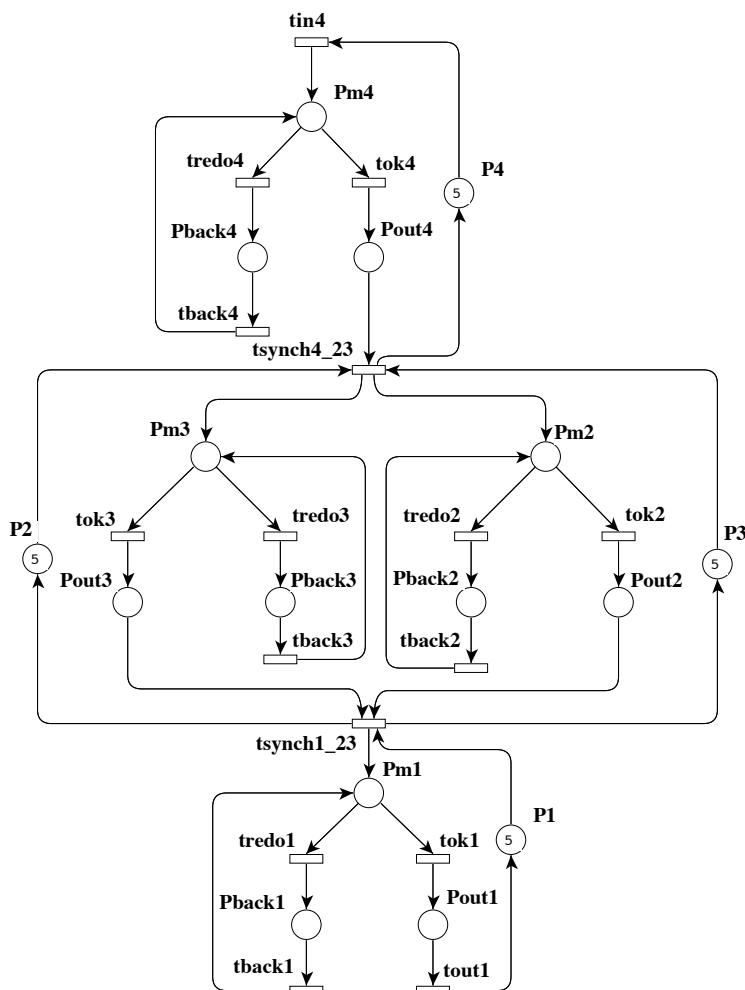


This form is a summary description of the model entitled “Kanban” proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together 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.



Graphical representation for $N = 5$

References

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

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	The scale factor is a value that changes the initial marking of places P1, P2, P3 and P4 ($M(P1)=M(P2)=M(P3)=M(P4)=N$)	5, 10, 20, 50, 100, 200, 500, 1000

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

Behavioural properties

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

(a) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(b) stated by [CÆSAR.BDD](#) version 2.6 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(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 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(f) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(g) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(h) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(i) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(j) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(k) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(l) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(m) stated by [CÆSAR.BDD](#) version 1.7 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

(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 GreatSPN on 6 instances, by Lola on 4 instances, and by Tapaal on 3 instances.

(q) stated by [CÆSAR.BDD](#) version 2.0 on all 8 instances (5, 10, 20, 50, 100, 200, 500, and 1000).

Size of the marking graphs

Parameter	Number of reach-able markings	Number of tran-sition firings	Max. number of tokens per place	Max. number of tokens per marking
$N = 5$	$2.5464E+6$ ^(r)	$2.4460E+7$ ^(s)	5 ^(t)	20 ^(u)
$N = 10$	$1.006E+9$ ^(v)	$1.2032E+10$ ^(w)	10 ^(x)	40 ^(y)
$N = 20$	$8.0542E+11$ ^(z)	$1.1012E+13$ ^(aa)	20 ^(ab)	80 ^(ac)
$N = 50$	$1.0426E+16$ ^(ad)	$1.5612E+17$ ^(ae)	50 ^(af)	200 ^(ag)
$N = 100$	$1.7263E+19$ ^(ah)	$2.6705E+20$ ^(ai)	100 ^(aj)	400 ^(ak)
$N = 200$	$3.1732E+22$ ^(al) ; confirmed at MCC'2014 by GreatSPN and PNMC	?	200 ^(am)	800 ^(an)
$N = 500$	$7.0860E+26$ ^(ao)	?	500 ^(ap)	2000 ^(aq)
$N = 1000$?	?	?	4000 ^(ar)

^(r) 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.

^(s) computed at MCC'2014 by Marcie.

^(t) computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.

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

^(v) computed at MCC'2013 by Alpina, GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, and Stratagem.

^(w) computed at MCC'2014 by Marcie.

^(x) computed at MCC'2014 by GreatSPN, Marcie, and PNMC.

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

^(z) computed at MCC'2013 by GreatSPN, ITS-Tools, Marcie, and PNXDD; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, PNXDD, and Stratagem.

^(aa) computed at MCC'2014 by Marcie.

^(ab) computed at MCC'2014 by GreatSPN, Marcie, and PNMC.

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

^(ad) computed at MCC'2013 by GreatSPN, ITS-Tools, and Marcie; confirmed at MCC'2014 by GreatSPN, Marcie, PNMC, and Stratagem.

^(ae) computed at MCC'2014 by Marcie.

^(af) computed at MCC'2014 by GreatSPN, Marcie, and PNMC.

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

^(ah) computed at MCC'2013 by GreatSPN, ITS-Tools, and Marcie; computed at MCC'2014 by GreatSPN, Marcie, and PNMC.

^(ai) computed at MCC'2014 by Marcie.

^(aj) computed at MCC'2014 by GreatSPN, Marcie, and PNMC.

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

^(al) computed at MCC'2013 by ITS-Tools.

^(am) computed at MCC'2014 by GreatSPN and Marcie.

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

^(ao) computed at MCC'2014 by PNMC.

^(ap) computed at MCC'2014 by PNMC.

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

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