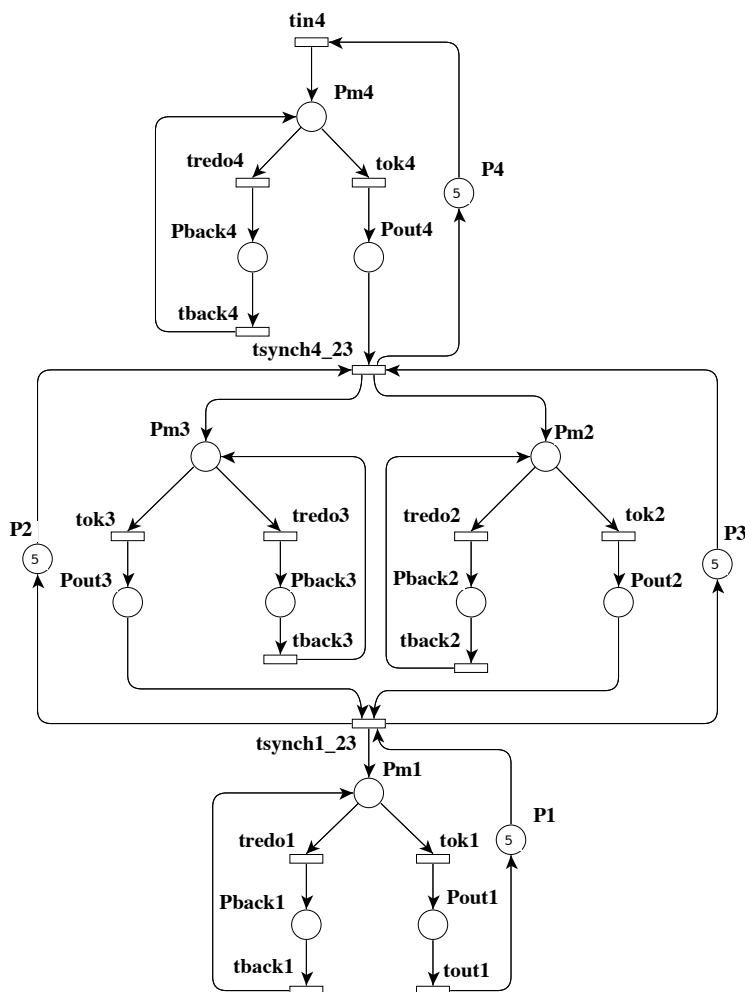


This form is a summary description of the model entitled “Kanban” proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together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