

This form is a summary description of the model entitled “Three-Module Ring” 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

- Comment from the submitter: The Petri net is a nice example for a safe Petri net with a reasonably large state space. It originally models a hardware circuit.
- Original description: The net models a three-module ring architecture. The communication architecture contains as many channels as there are modules. It tests the occurrence of global deadlock arising from a local one. It uses pausable clocking scheme on arbitrated input and output channels.

In March 2020, Pierre Bowier and Hubert Garavel provided a decomposition of this model into a network of communicating automata. This network is expressed as a Nested-Unit Petri Net (NUPN) that can be found in the “toolspecific” section of the corresponding PNML file.

References

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Scaling parameter

This model is not parameterized.

Size of the model

number of places:	139
number of transitions:	87
number of arcs:	410
number of units:	62
HWB code (<i>height-width-bits</i>):	1-61-80

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)

(a) 105 arcs are not simple free choice, e.g., the arc from place “P138” (which has 3 outgoing transitions) to transition “T35” (which has 2 input places).

(b) transitions “T30” and “T32” share a common input place “P10”, but only the former transition has input place “P3”.

(c) 82 transitions are not of a state machine, e.g., transition “T1”.

(d) 60 places are not of a marked graph, e.g., place “P1”.

(e) stated by [CÆSAR.BDD](#) version 1.7.

(f) stated by [CÆSAR.BDD](#) version 1.7.

(g) stated by [CÆSAR.BDD](#) version 1.7.

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 transitions(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</i> ⁽ⁿ⁾	✓

Behavioural properties

safe — <i>in every reachable marking, there is no more than one token on a place</i>	✓ ^(o)
dead place(s) — <i>one or more places have no token in any reachable marking</i>	✗ ^(p)
dead transition(s) — <i>one or more transitions cannot fire from any reachable marking</i>	✗ ^(q)
deadlock — <i>there exists a reachable marking from which no transition can be fired</i>	? ^(r)
reversible — <i>from every reachable marking, there is a transition path going back to the initial marking</i>	?
live — <i>for every transition t, from every reachable marking, one can reach a marking in which t can fire</i>	?

Size of the marking graph

number of reachable markings:	9.0265×10^{11} ^(s)
number of transition firings:	$9.6628E \times 10^{12}$ ^(t)
max. number of tokens per place:	1 ^(u)
max. number of tokens per marking:	61 ^(v)

^(h) stated by [CÆSAR.BDD](#) version 1.7.

⁽ⁱ⁾ stated by [CÆSAR.BDD](#) version 1.7.

^(j) stated by [CÆSAR.BDD](#) version 1.7.

^(k) 21 transitions are not loop free, e.g., transition “T17”.

^(l) 56 transitions are not conservative, e.g., transition “T11”.

^(m) 27 transitions are not subconservative, e.g., transition “T11”.

⁽ⁿ⁾ the definition of Nested-Unit Petri Nets (NUPN) is available from <http://mcc.lip6.fr/nupn.php>

^(o) confirmed by [CÆSAR.BDD](#) version 3.3.

^(p) stated by [CÆSAR.BDD](#) version 3.3.

^(q) stated by [CÆSAR.BDD](#) version 3.3.

^(r) found to be false at MCC’2014 by GreatSPN.

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

^(t) computed at MCC’2014 by Marcie.

^(u) confirmed at MCC’2014 by GreatSPN, Marcie, and PNMC.

^(v) computed at MCC’2014 at Marcie and PNMC.