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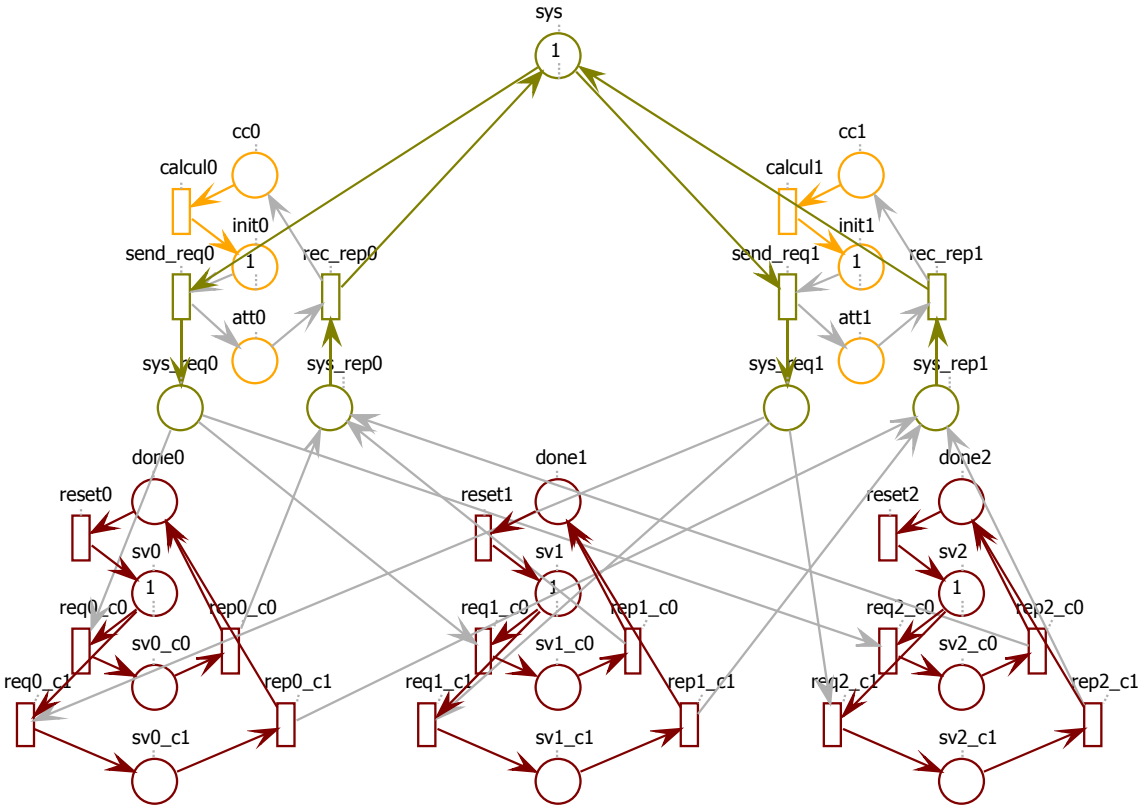
This form is a summary description of the model entitled "ServersAndClients" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given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

Description

This is a simple model of a Client server system produced from a Petri net generator to explore simple communication configurations. This was one of the Tra My Nguyen's exercices during her bachelor.



Graphical representation for $nbc = 2$ and $nbs = 3$

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
nbc, *nbs*	*nbc* is the number of clients, *nbs* is the number of servers	(100,020), (100,040), (100,080), (100,160), (100,320), (200,040), (200,080), (200,160), (200,320), (400,080), (400,160)

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Size of the model

Parameter	Number of places	Number of transitions	Number of arcs	Number of units	HWB code
$nbc = 100, nbs = 20$	2 421	4 200	12 800	123	1–122–139
$nbc = 100, nbs = 40$	4 441	8 200	24 800	143	1–142–160
$nbc = 100, nbs = 80$	8 481	16 200	48 800	183	1–182–201
$nbc = 100, nbs = 160$	16 561	32 200	96 800	263	1–262–281
$nbc = 100, nbs = 320$	32 721	64 200	192 800	423	1–422–442
$nbc = 200, nbs = 40$	8 841	16 400	49 600	243	1–242–262
$nbc = 200, nbs = 80$	16 881	32 400	97 600	283	1–282–303
$nbc = 200, nbs = 160$	32 961	64 400	193 600	363	1–362–383
$nbc = 200, nbs = 320$	65 121	128 400	385 600	523	1–522–544
$nbc = 400, nbs = 80$	33 681	64 800	195 200	483	1–482–505
$nbc = 400, nbs = 160$	65 761	128 800	387 200	563	1–562–585

Structural properties

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

[a] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[b] transitions “send_req0” and “send_req1” share a common input place “sys”, but only the former transition has input place “init0”.
[c] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[d] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[e] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[f] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[g] By construction, all involved processes have cyclic behavior; confirmed by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[h] By construction, all involved processes have cyclic behavior; confirmed by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[i] By construction, all involved processes have cyclic behavior; confirmed by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[j] By construction, all involved processes have cyclic behavior; confirmed by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[k] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[l] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[m] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[n] the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php

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Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... yes [o]
dead place(s) — *one or more places have no token in any reachable marking* ..... no [p]
dead transition(s) — *one or more transitions cannot fire from any reachable marking* ..... no [q]
deadlock — *there exists a reachable marking from which no transition can be fired* ..... no [r]
reversible — *from every reachable marking, there is a transition path going back to the initial marking* ..... yes [s]
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... yes [t]

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
$nbc = 100, nbs = 20$	2 201 [u]	4 200 [v]	1	$\in [121, 122]$ [w]
$nbc = 100, nbs = 40$	4 201 [x]	8 200 [y]	1	$\in [141, 142]$ [z]
$nbc = 100, nbs = 80$	8 201 [aa]	?	1	$\in [181, 182]$ [ab]
$nbc = 100, nbs = 160$	16 201 [ac]	?	1	$\in [261, 262]$ [ad]
$nbc = 100, nbs = 320$	32 201 [ae]	?	1	$\in [421, 422]$ [af]
$nbc = 200, nbs = 20$	8 401 [ag]	16 400 [ah]	1	$\in [241, 242]$ [ai]
$nbc = 200, nbs = 40$	16 401 [aj]	32 400 [ak]	1	$\in [281, 282]$ [al]
$nbc = 200, nbs = 160$	32 401 [am]	?	1	$\in [361, 362]$ [an]
$nbc = 200, nbs = 320$	64 401 [ao]	?	1	$\in [521, 522]$ [ap]
$nbc = 400, nbs = 80$	32 801 [aq]	?	1	$\in [481, 482]$ [ar]
$nbc = 400, nbs = 160$	64 801 [as]	?	1	$\in [561, 562]$ [at]

[o] By construction, only one token should be located in places; confirmed by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[p] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[q] stated by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[r] By construction, all involved processes have cyclic behavior; confirmed by CÆSAR.BDD version 3.5 on all 11 instances (see all aforementioned parameter values).
[s] By construction, all involved processes have cyclic behavior.
[t] By construction, all involved processes have cyclic behavior.
[u] computed by PROD in January 2021; confirmed by CÆSAR.BDD version 3.5.
[v] computed by PROD in January 2021.
[w] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[x] computed by PROD in January 2021; confirmed by CÆSAR.BDD version 3.5.
[y] computed by PROD in January 2021.
[z] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[aa] stated by CÆSAR.BDD version 3.5.
[ab] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[ac] stated by CÆSAR.BDD version 3.5.
[ad] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[ae] stated by CÆSAR.BDD version 3.5.
[af] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[ag] computed by PROD in January 2021; confirmed by CÆSAR.BDD version 3.5.
[ah] computed by PROD in January 2021.
[ai] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[aj] computed by PROD in January 2021; confirmed by CÆSAR.BDD version 3.5.
[ak] computed by PROD in January 2021.
[al] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[am] stated by CÆSAR.BDD version 3.5.
[an] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[ao] stated by CÆSAR.BDD version 3.5.
[ap] lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
[aq] stated by CÆSAR.BDD version 3.5.

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(ar) lower bound given by the number of initial tokens and upper bound given by the number of leaf units.
(as) stated by CÆSAR.BDD version 3.5.
(at) lower bound given by the number of initial tokens and upper bound given by the number of leaf units.