

This form is a summary description of the model entitled "Client/Server with Repetitions" 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 models a client/server application with $N_{CLIENTS}$ clients and $N_{SERVERS}$ servers. Communication from clients to servers is not reliable, with requests stored in a buffer of size $BUFFERSIZE$. Communication from servers to clients are reliable. A client send its message until it receives an answer.

The interesting point is that place `RequestBuffer` is not 1-bounded. This model can thus be used to assess how model checkers behave for colored non-safe nets.

Class

Client is $1..N_{CLIENTS}$;

Server is $1..N_{SERVERS}$;

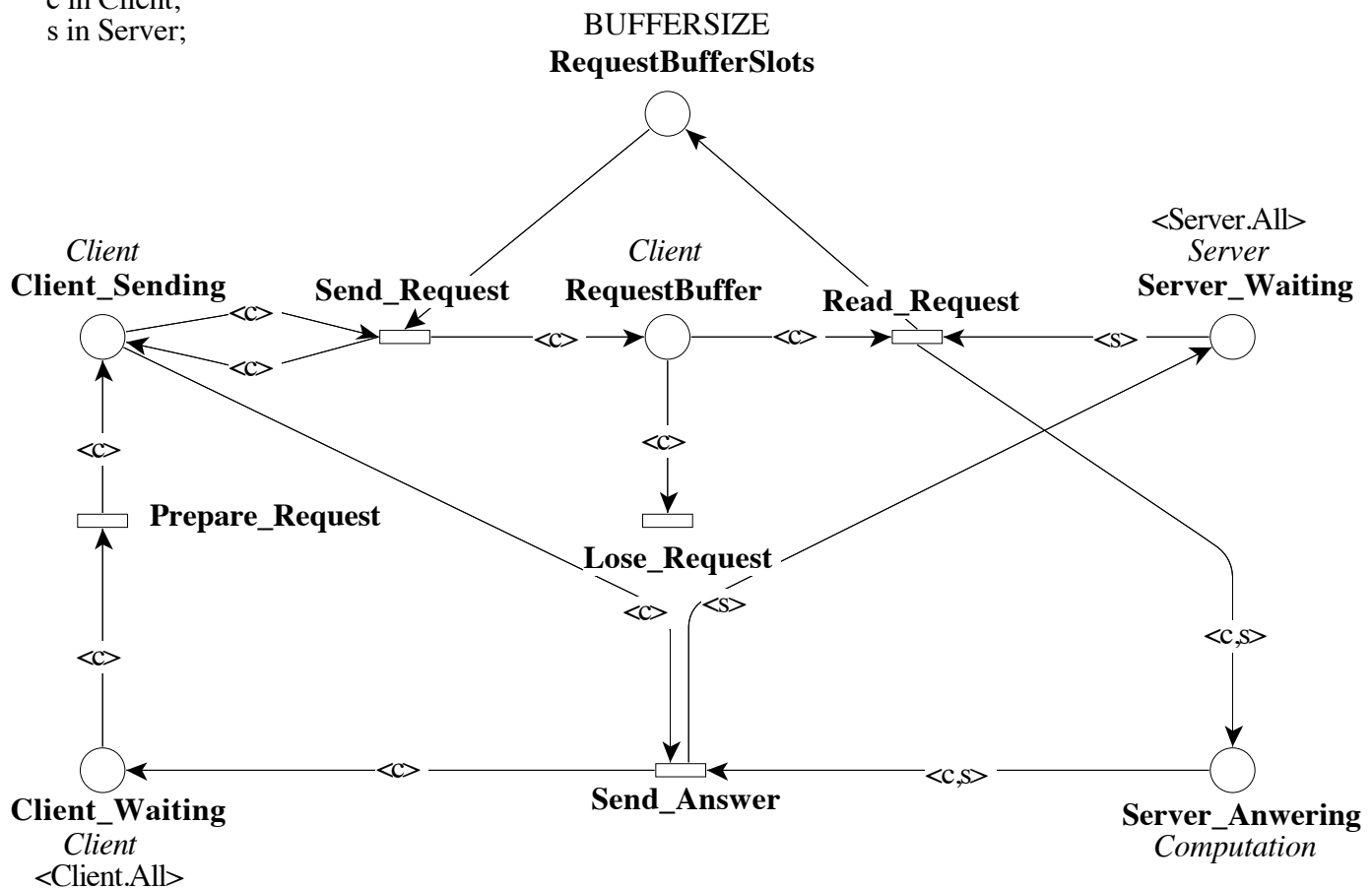
Domain

Computation is $\langle \text{Client}, \text{Server} \rangle$;

Var

c in Client;

s in Server;



Scaling parameter

Parameter name	Parameter description	Chosen parameter values
n	To set only one parameter, we set a parameter n and compute model parameters with: $NCLIENTS=n^2$, $NSERVERS=n$, $BUFFERSIZE=n$	2, 3, 4, 5, 7, 10

Size of the model

Parameter	Number of places	Number of transitions	Number of arcs
(NCLIENTS, NSERVERS, BUFFER-SIZE)	$1 + 3*NCLIENTS + NSERVERS + NCLIENTS*NSERVERS$	$3*NCLIENTS + 2*NCLIENTS*NSERVERS$	$7*NCLIENTS + 8*NCLIENTS+NSERVERS$
n	$n^3 + 3n^2 + n + 1$	$2n^3 + 3n^2$	$8n^3 + 7n^2$
$n = 2$	23	28	92
$n = 3$	58	81	279
$n = 4$	117	176	624
$n = 5$	206	325	1175
$n = 7$	498	833	3087
$n = 10$	1311	2300	8700

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⁾	✗

(a) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(b) stated by CÆSAR.BDD version 2.6 on all 6 instances (2, 3, 4, 5, 7, and 10).

(c) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(d) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(e) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(f) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(g) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(h) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(i) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(j) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10); transition “Lose_Request” is a sink transition.

(k) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(l) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

(m) stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).

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

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)
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 reach- able markings	Number of tran- sition firings	Max. number of tokens per place	Max. number of tokens per marking
$n = 2$	7424 ^(s)	37 088 ^(t)	2 ^(u)	8 ^(v)
$n = 3$	1.3408E+8 ^(w)	1.2939E+9 ^(x)	3 ^(y)	15 ^(z)
$n = 4$	3.0948E+13 ^(aa)	?	4 ^(ab)	24 ^(ac)
$n = 5$?	?	?	35 ^(ad)
$n = 7$?	?	?	63 ^(ae)
$n = 10$?	?	?	120 ^(af)

^(o) stated by CÆSAR.BDD version 2.0 on all 6 instances (2, 3, 4, 5, 7, and 10).

^(p) stated by CÆSAR.BDD version 3.3 to be false on 3 instance(s) out of 6, and unknown on the remaining 3 instance(s).

^(q) stated by CÆSAR.BDD version 2.0 to be false on 2 instance(s) out of 6, and unknown on the remaining 4 instance(s).

^(r) confirmed at MCC'2014 by Helena on all 6 colored instances, and by Lola and Tapaal on all 6 P/T instances.

^(s) computed at MCC'2013 by Alpina and ITS-Tools; confirmed at MCC'2014 by GreatSPN and Helena on the colored net instance, and by GreatSPN, Marcie, PNMC, PNDD, Stratagem, and Tapaal on the P/T net instance.

^(t) computed at MCC'2014 by Helena on the colored net instance, and by Marcie on the P/T net instance.

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

^(v) number of initial tokens, because the net is sub-conservative.

^(w) computed at MCC'2013 by Alpina and ITS-Tools; confirmed at MCC'2014 by GreatSPN on the colored net instance, and by GreatSPN, Marcie, PNMC, PNDD, 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 sub-conservative.

^(aa) computed at MCC'2014 by GreatSPN on the colored net instance, and by PNMC on the P/T net instance.

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

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

^(ad) number of initial tokens, because the net is sub-conservative.

^(ae) number of initial tokens, because the net is sub-conservative.

^(af) number of initial tokens, because the net is sub-conservative.