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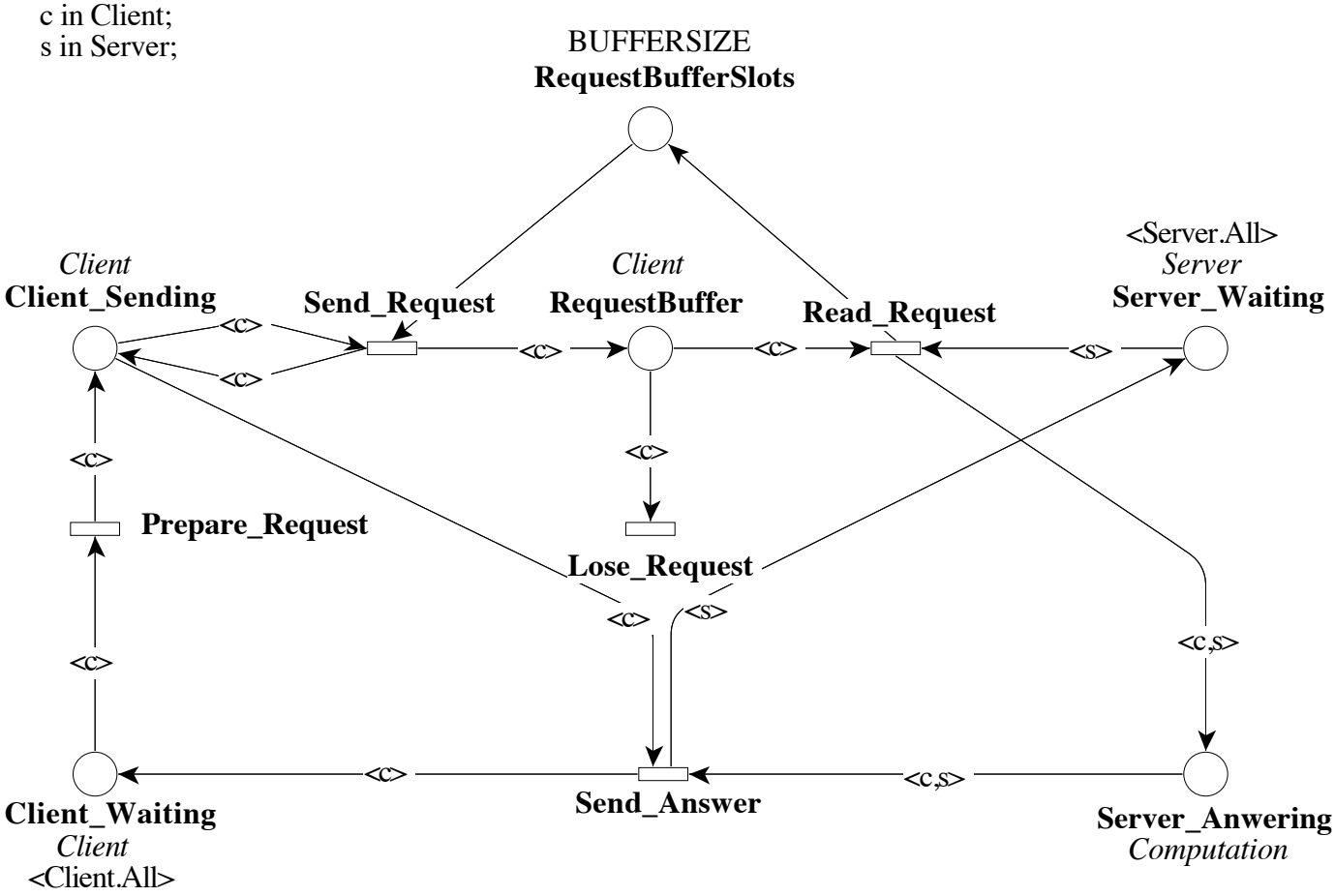
*This form is a summary description of the model entitled "Client/Server with Repetitions" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. 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 NCLIENTS clients and NSERVERS 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..NCLIENTS;
  Server is 1..NSERVERS;
Domain
  Computation is <Client,Server>;
Var
  c in Client;
  s in Server;
```





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

[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 1.7 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); transition "Lose_Request" is a sink transition.
[j] stated by CÆSAR.BDD version 1.7 on all 6 instances (2, 3, 4, 5, 7, and 10).
[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] 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* ..... ✗ [n]
**deadlock** — *there exists a reachable marking from which no transition can be fired* ..... ✓ [o]
**reversible** — *from every reachable marking, there is a transition path going back to the initial marking* ..... ?
**quasi-live** — *for every transition t, there exists a reachable marking in which t can fire* ..... ? [p]
**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 reachable markings | Number of transition firings | Max. number of tokens per place | Max. number of tokens per marking |
|---|---|---|---|---|
| $n = 2$ | 7424 [q] | 37 088 [r] | 2 [s] | 8 [t] |
| $n = 3$ | 1.3408E+8 [u] | 1.2939E+9 [v] | 3 [w] | 15 [x] |
| $n = 4$ | 3.0948E+13 [y] | ? | 4 [z] | 24 [aa] |
| $n = 5$ | ? | ? | ? | $\geq 35$ |
| $n = 7$ | ? | ? | ? | $\geq 63$ |
| $n = 10$ | ? | ? | ? | $\geq 120$ |

[n] stated by CÆSAR.BDD version 2.0 on all 6 instances (2, 3, 4, 5, 7, and 10).
[o] confirmed at MCC'2014 by Helena on all 6 colored instances, and by Lola and Tapaal on all 6 P/T instances.
[p] stated by CÆSAR.BDD version 2.0 to be true on 2 instance(s) out of 6, and unknown on the remaining 4 instance(s).
[q] 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, PNXDD, Stratagem, and Tapaal on the P/T net instance.
[r] computed at MCC'2014 by Helena on the colored net instance, and by Marcie on the P/T net instance.
[s] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[t] computed at MCC'2014 by GreatSPN, Marcie, PNMC, and Tapaal.
[u] 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, PNXDD, and Stratagem.
[v] computed at MCC'2014 by Marcie.
[w] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[x] computed at MCC'2014 by GreatSPN, Marcie, and PNMC.
[y] computed at MCC'2014 by GreatSPN on the colored net instance, and by PNMC on the P/T net instance.
[z] computed at MCC'2014 by PNMC.
[aa] computed at MCC'2014 by PNMC.