Fabrice Kordon
Fabrice.Kordon@lip6.fr

This form is a summary description of the model entitled "SafeBus" 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.

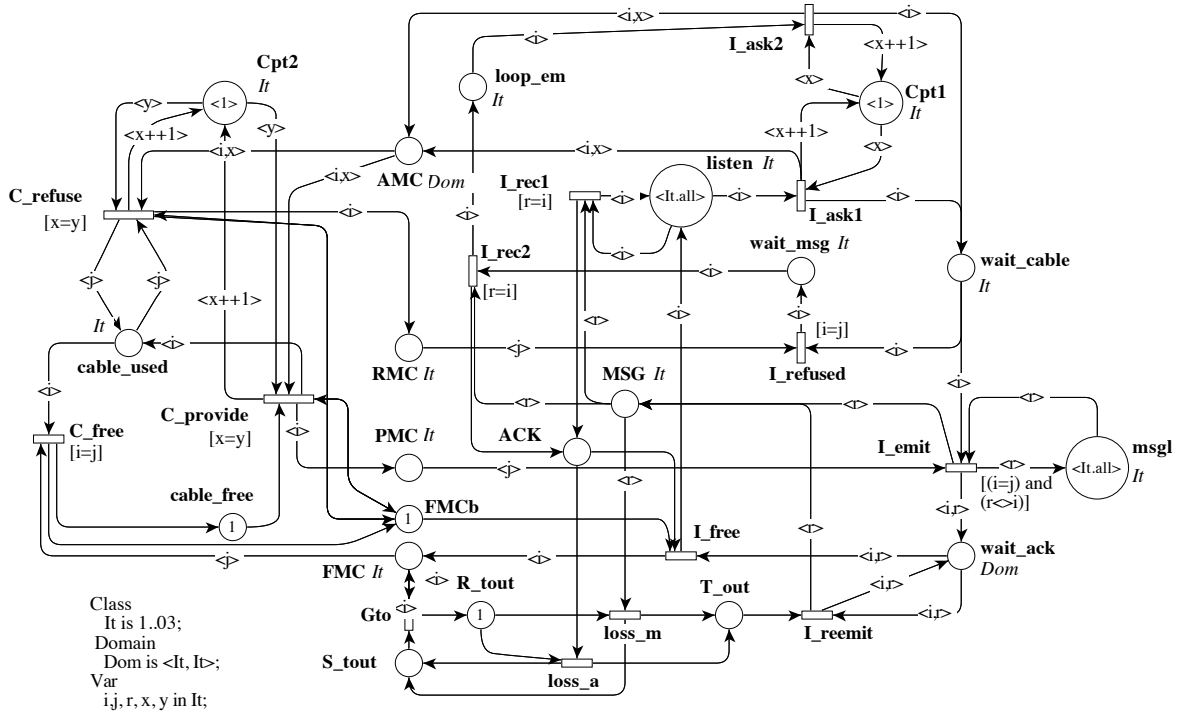
Description

This model represents a safe bus that relates N interlocutors.

Each interlocutor is connected to the controller using a dedicated control cable and have a unique identification number. Each one is also connected to the maim cable. When an interlocutor sends a message, it provides the identification of its corespondent. Acknowledge does not requires identification while only the sender is listening to it in the main cable.

Each interlocutor tries to get the cable and if it refused, it must wait for an incoming message and send back an acknowledge before trying again to get the vable.

In this model, we consider that both messages or acknowledgements can be lost (but a limited number of time only). The protocol tolerant to such failures but is not fair to the interlocutors.



Graphical representation for $N = 3$

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
N	N, the number of interlocutors connected to the bus [(a)].	$3, 6, 10, 15, 20, 50, 80$

[(a)] These parameters affect the initial marking and thus do not impact the size of the model.

Fabrice Kordon
Fabrice.Kordon@lip6.fr

Size of the colored net model

number of places:	20
number of transitions:	14
number of arcs:	68

Size of the derived P/T model instances

Parameter	Number of places	Number of transitions	Number of arcs
$N = 3$	57	91	541
$N = 6$	144	451	2 968
$N = 10$	316	1 631	11 384
$N = 15$	621	4 771	34 549
$N = 20$	1 026	10 461	77 364

Structural properties

ordinary — *all arcs have multiplicity one* ..... ✔
simple free choice — *all (different) transitions with a shared input place have no other input place* ..... ✘ [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] ..... ✘

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ? [o]
deadlock — *there exists a reachable marking from which no transition can be fired* ..... ? [p]
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* ..... ? [q]
live — *for every transition t, from every reachable marking, one can reach a marking in which t can fire* ..... ? [r]

[b] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[c] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[d] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[e] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[f] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[g] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[h] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[i] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[j] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[k] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[l] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[m] stated by CÆSAR.BDD version 2.3 on all 5 instances (see all aforementioned scaling parameter values).
[n] the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php
[o] stated by CÆSAR.BDD version 2.3 to be true on 1 instance(s) out of 5, and unknown on the remaining 4 instance(s).
[p] stated by CÆSAR.BDD version 2.3 to be false on 1 instance(s) out of 5, and unknown on the remaining 4 instance(s).
[q] stated by CÆSAR.BDD version 2.3 to be false on 1 instance(s) out of 5, and unknown on the remaining 4 instance(s).
[r] stated by CÆSAR.BDD version 2.3 to be false on 1 instance(s) out of 5, and unknown on the remaining 4 instance(s).

Fabrice Kordon
Fabrice.Kordon@lip6.fr

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
$N = 3$	4 650 [(s)]	12 888 [(t)]	1	$\in [11, 57]$ [(u)]
$N = 6$	6 816 756 [(v)]	29 904 912 [(w)]	?	≥ 17 [(x)]
$N = 10$	$\geq$ 9.8641e+06 [(y)]	?	?	≥ 25 [(z)]
$N = 15$	?	?	?	≥ 35 [(aa)]
$N = 20$	?	?	?	≥ 45 [(ab)]

(s) computed by PROD in December 2014; confirmed by CÆSAR.BDD version 2.3.
(t) computed with PROD on December 2014.
(u) lower and upper bounds given by the number of initial tokens and the number of places.
(v) computed by PROD in December 2014.
(w) computed with PROD on December 2014.
(x) lower bound given by the number of initial tokens.
(y) stated by CÆSAR.BDD version 2.3.
(z) lower bound given by the number of initial tokens.
(aa) lower bound given by the number of initial tokens.
(ab) lower bound given by the number of initial tokens.