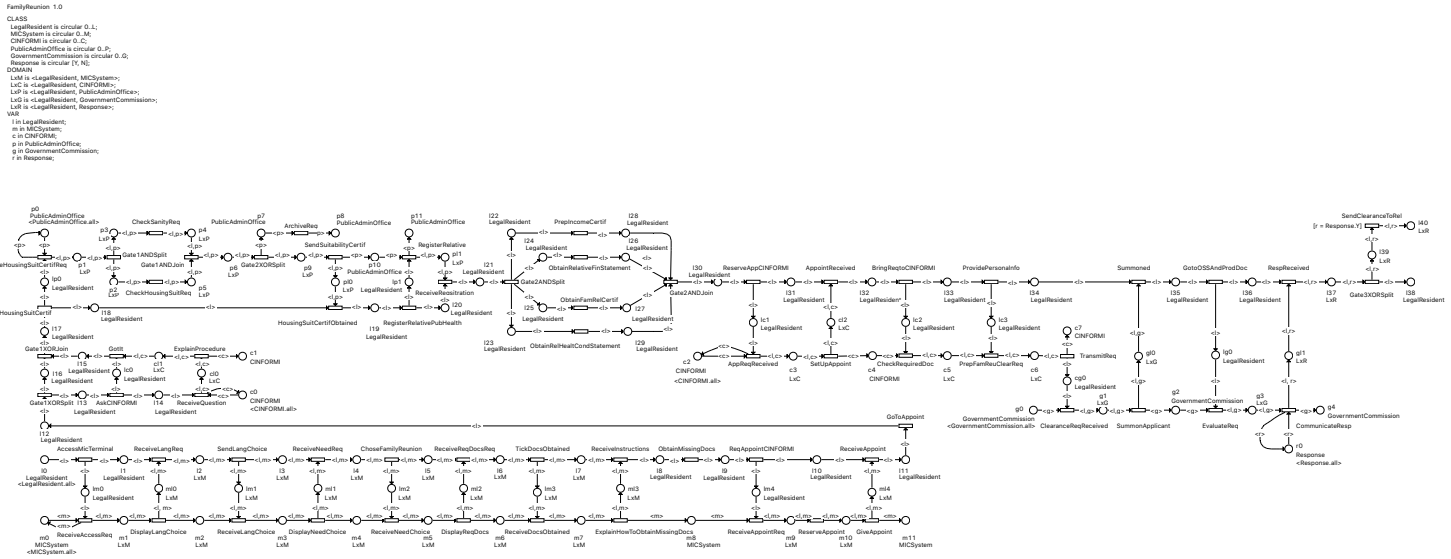
Lom Messan Hillah
lom-messan.hillah@lip6.fr

This form is a summary description of the model entitled "Family Reunion" 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

Legal permanent resident aliens in Italy are allowed by the Italian law, as in many other countries in Europe, to reunite with their families. This Petri net translates the reunification process they must follow, initially described in Business Process Modeling Notation (BPMN). During the process, the legal resident interacts with different public administrations offices and a government commission. Each of these participants in the process maps to a parameterized color class in the Petri net.



Graphical representation for generic scaling parameters $L, M, C, P,$ and G

References

Ciaghi et al., 2011 Ciaghi, A., Weldemariam, K., and Villafiorita, A. (2011). Law Modeling with Ontological Support and BPMN: a Case Study. In CYBERLAWS 2011, The Second International Conference on Technical and Legal Aspects of the e-Society, pages 29–34.

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
$\langle L, M, C, P, G\rangle$	There are L legal residents, M threads in the software application they connect to, C agents in the CINFORMI body, P agents in the municipal and public health offices, and G agents in the government commission. For any value of L, $M = L/10$ $C = M/2$, $P = C$ and $G = P/2$.	$\langle L = 10, M = 1, C = 1, P = 1, G = 1\rangle$, $\langle L = 20, M = 2, C = 1, P = 1, G = 1\rangle$, $\langle L = 50, M = 5, C = 2, P = 2, G = 1\rangle$, $\langle L = 100, M = 10, C = 5, P = 5, G = 2\rangle$, $\langle L = 200, M = 20, C = 10, P = 10, G = 5\rangle$, $\langle L = 400, M = 40, C = 20, P = 20, G = 10\rangle$

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Size of the model

Parameter	Number of places	Number of transitions	Number of arcs
colored model	104	66	198
$\langle L = 10, M = 1, C = 1, P = 1, G = 1\rangle$	1475	1234	3799
$\langle L = 20, M = 2, C = 1, P = 1, G = 1\rangle$	3271	2753	8446
$\langle L = 50, M = 5, C = 2, P = 2, G = 1\rangle$	12194	10560	32238
$\langle L = 100, M = 10, C = 5, P = 5, G = 2\rangle$	40605	36871	112728
$\langle L = 200, M = 20, C = 10, P = 10, G = 5\rangle$	143908	134279	411469
$\langle L = 400, M = 40, C = 20, P = 20, G = 10\rangle$	537708	508489	1558729

Structural properties

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

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ✗
dead place(s) — *one or more places have no token in any reachable marking* ..... ?
dead transition(s) — *one or more transitions cannot fire from any reachable marking* ..... ✓

[a] true for the colored model; probably false for the P/T model (stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s)).
[b] true for the colored model; probably false for the P/T model (stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s)).
[c] true for the colored model; .
[d] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[e] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[f] stated by CÆSAR.BDD version 2.8 to be true on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[g] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[h] stated by CÆSAR.BDD version 2.8 to be true on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[i] stated by CÆSAR.BDD version 2.8 to be true on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[j] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[k] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[l] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[m] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[n] stated by CÆSAR.BDD version 2.8 to be false on 5 instance(s) out of 6, and unknown on the remaining 1 instance(s).
[o] the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php

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deadlock — *there exists a reachable marking from which no transition can be fired* ..... ✔
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 reachable markings	Number of transition firings	Max. number of tokens per place	Max. number of tokens per marking
$\langle L = 10, M = 1, C = 1, P = 1, G = 1\rangle$	?	?	?	≥ 45
$\langle L = 20, M = 2, C = 1, P = 1, G = 1\rangle$	?	?	?	≥ 76
$\langle L = 50, M = 5, C = 2, P = 2, G = 1\rangle$	?	?	?	≥ 172
$\langle L = 100, M = 10, C = 5, P = 5, G = 2\rangle$	?	?	?	≥ 337
$\langle L = 200, M = 20, C = 10, P = 10, G = 5\rangle$	?	?	?	≥ 665
$\langle L = 400, M = 40, C = 20, P = 20, G = 10\rangle$	?	?	?	≥ 518

Other properties

P_1: A first property to verify is that every resident's request goes through the complete process:

$$F_{ack} : \quad |l38| = L \tag{1}$$
$$P_1 : \quad AF(F_{ack}) \tag{2}$$

P_2: Another property to verify is that every resident's request ends up being granted with a clearance, or rejected:

$$F_{ack} : \quad |l38| = L \tag{3}$$
$$F_{grant} : \quad |l40| > 0 \wedge |l39| + |l40| = L \tag{4}$$
$$F_{reject} : \quad |l40| = 0 \wedge |l39| = L \tag{5}$$
$$P_2 : \quad AF(F_{ack} \wedge (F_{grant} \vee F_{reject})) \tag{6}$$