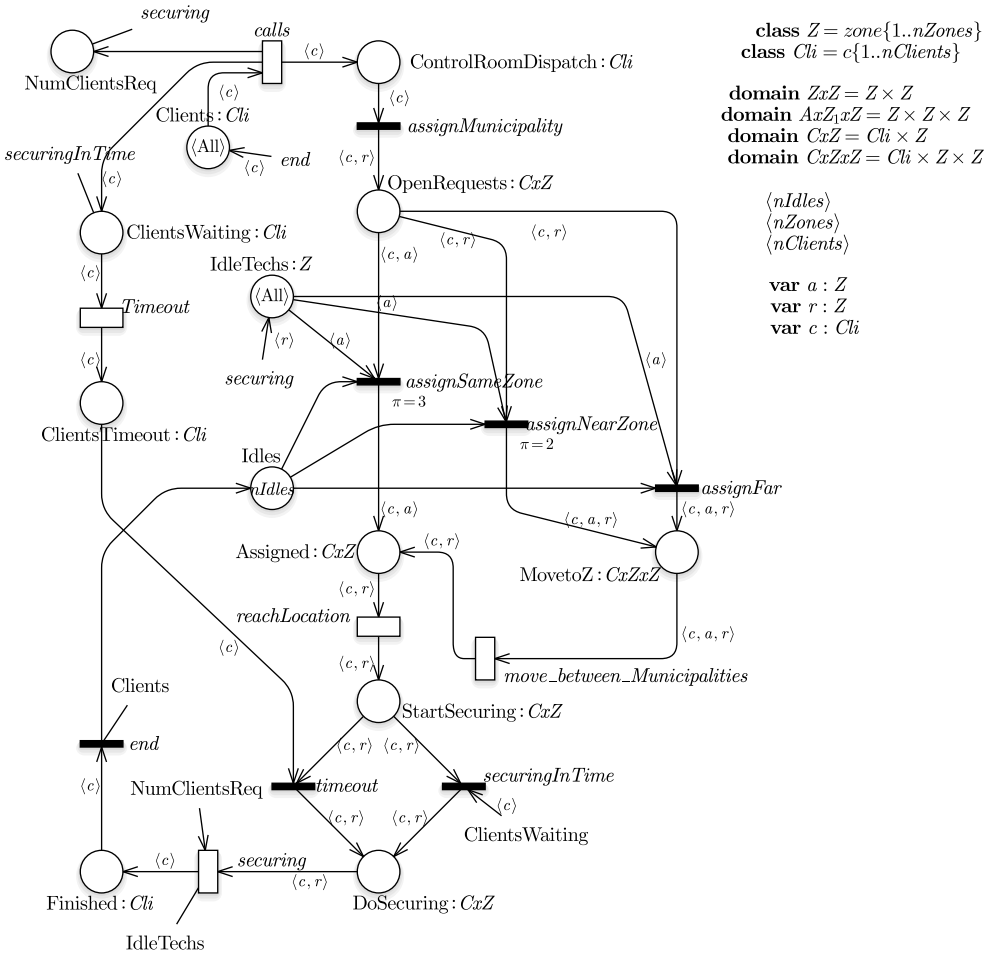
Elvio G. Amparore
amparore@di.unito.it

This form is a summary description of the model entitled "UtilityControlRoom" 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 use case of a control room of a utility company performed inside the EU Artemis project HoliDes, and described in details in [1]. The company operates in the gas energy market. Customers call the control room of the energy operator to signal malfunctioning of gas distribution and/or of gas apparatus. Upon a call the control room operators assign a technician delegated to physically reach the intervention site and make it, in first place, secure, and, in second place, back to normal operating condition. The distribution area is divided into zones Z, and there are T technicians that can travel around to reach the N customers.



Graphical representation of the model.

References

[1] Amparore E.G., Donatelli S., Landini E. (2017) *Modelling and Evaluation of a Control Room Application.* In: Application and Theory of Petri Nets and Concurrency. PETRI NETS 2017. Lecture Notes in Computer Science, vol 10258. Springer, Cham.

Elvio G. Amparore
amparore@di.unito.it

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
$\langle Z, T, N \rangle$	Number of zones, technicians and clients.	$\langle 2,3,4 \rangle$, $\langle 2,3,6 \rangle$, $\langle 2,3,8 \rangle$, $\langle 2,3,10 \rangle$, $\langle 2,4,2 \rangle$, $\langle 2,4,4 \rangle$, $\langle 2,4,6 \rangle$, $\langle 2,4,8 \rangle$, $\langle 2,4,10 \rangle$, $\langle 4,3,6 \rangle$, $\langle 4,3,8 \rangle$, $\langle 4,3,10 \rangle$, $\langle 4,4,2 \rangle$, $\langle 4,4,4 \rangle$, $\langle 4,4,6 \rangle$, $\langle 4,4,8 \rangle$, $\langle 4,4,10 \rangle$

Size of the model

Parameter	Number of places	Number of transitions	Number of arcs
Z=2, T=3, N=4	72	108	340
Z=2, T=3, N=6	106	162	510
Z=2, T=3, N=8	140	216	680
Z=2, T=3, N=10	174	270	850
Z=2, T=4, N=2	38	54	170
Z=2, T=4, N=4	72	108	340
Z=2, T=4, N=6	106	162	510
Z=2, T=4, N=8	140	216	680
Z=2, T=4, N=10	174	270	850
Z=4, T=3, N=6	228	450	1446
Z=4, T=3, N=8	302	600	1928
Z=4, T=3, N=10	376	750	2410
Z=4, T=4, N=2	80	150	482
Z=4, T=4, N=4	154	300	964
Z=4, T=4, N=6	228	450	1446
Z=4, T=4, N=8	302	600	1928
Z=4, T=4, N=10	376	750	2410

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]

[a] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[b] transitions "assignSameZone_0_0" and "assignSameZone_0_1" share a common input place "IdleTechs_0", but only the former transition has input place "OpenRequests_0_0".
[c] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[d] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[e] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[f] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[g] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[h] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[i] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[j] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[k] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[l] stated by CÆSAR.BDD version 3.5 on all 17 instances (see all aforementioned scaling parameter values).

Elvio G. Amparore
amparore@di.unito.it

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]
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* ..... ✗
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
Z=2, T=3, N=4	?	?	?	≥ 9 [p]
Z=2, T=3, N=6	?	?	?	≥ 11 [q]
Z=2, T=3, N=8	?	?	?	≥ 13 [r]
Z=2, T=3, N=10	?	?	?	≥ 15 [s]
Z=2, T=4, N=2	?	?	?	≥ 8 [t]
Z=2, T=4, N=4	?	?	?	≥ 10 [u]
Z=2, T=4, N=6	?	?	?	≥ 12 [v]
Z=2, T=4, N=8	?	?	?	≥ 14 [w]
Z=2, T=4, N=10	?	?	?	≥ 16 [x]
Z=4, T=3, N=6	?	?	?	≥ 13 [y]
Z=4, T=3, N=8	?	?	?	≥ 15 [z]
Z=4, T=3, N=10	?	?	?	≥ 17 [aa]
Z=4, T=4, N=2	?	?	?	≥ 10 [ab]
Z=4, T=4, N=4	?	?	?	≥ 12 [ac]
Z=4, T=4, N=6	?	?	?	≥ 14 [ad]
Z=4, T=4, N=8	?	?	?	≥ 16 [ae]
Z=4, T=4, N=10	?	?	?	≥ 18 [af]

[m] stated by CÆSAR.BDD version 3.5 on all 17 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 3.5 on all 17 instances (see all aforementioned scaling parameter values).
[p] lower bound given by the number of initial tokens.
[q] lower bound given by the number of initial tokens.
[r] lower bound given by the number of initial tokens.
[s] lower bound given by the number of initial tokens.
[t] lower bound given by the number of initial tokens.
[u] lower bound given by the number of initial tokens.
[v] lower bound given by the number of initial tokens.
[w] lower bound given by the number of initial tokens.
[x] lower bound given by the number of initial tokens.
[y] lower bound given by the number of initial tokens.
[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.
[ac] lower bound given by the number of initial tokens.
[ad] lower bound given by the number of initial tokens.
[ae] lower bound given by the number of initial tokens.
[af] lower bound given by the number of initial tokens.