

This form is a summary description of the model entitled “SemanticWebServices” 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

Given is an ontology, a couple of web services that are semantically annotated based on this ontology, an initial and a final (goal) state. The task is to find a composition of (some of the given) services such that the initial state is transformed into the goal state. This task is referred to as *abstract planning* in the web services community. In the given Petri nets, feasibility of the problem refers to reachability of a certain marking. The path to that marking codes the particular *plan*, i.e. the proposed composition of services. The nets were obtained in a case study that aimed at evaluating the feasibility of the tool LoLA as abstract planning engine in the PlanICS framework.

References

A. Niewiadomski, K. Wolf: LoLA as Abstract Planning Engine of PlanICS. PNSE @ Petri Nets 2014: 349-350 r (<http://ceur-ws.org/Vol-1160/paper26.pdf>)

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
$\langle s, p \rangle$	s is the number of available services, and p is the length of the shortest possible plan, i.e. the number of services in the resulting composition.	$\langle 64, 6 \rangle$, $\langle 64, 9 \rangle$, $\langle 64, 12 \rangle$, $\langle 64, 15 \rangle$, $\langle 64, 18 \rangle$, $\langle 128, 6 \rangle$, $\langle 128, 9 \rangle$, $\langle 128, 12 \rangle$, $\langle 128, 15 \rangle$, $\langle 128, 18 \rangle$, $\langle 256, 6 \rangle$, $\langle 256, 9 \rangle$, $\langle 256, 12 \rangle$, $\langle 256, 15 \rangle$, $\langle 256, 18 \rangle$

Size of the model

Parameter	Number of places	Number of transitions	Number of arcs
$s = 64, p = 6$	97	164	661
$s = 64, p = 9$	100	164	719
$s = 64, p = 12$	104	158	863
$s = 64, p = 15$	118	194	1007
$s = 64, p = 18$	154	236	1265
$s = 128, p = 6$	262	1328	9727
$s = 128, p = 9$	242	946	6609
$s = 128, p = 12$	191	414	1559
$s = 128, p = 15$	188	416	1593
$s = 128, p = 18$	184	466	1873
$s = 256, p = 6$	439	14102	130267
$s = 256, p = 9$	418	27524	270595
$s = 256, p = 12$	356	20464	190527
$s = 256, p = 15$	329	29492	267319
$s = 256, p = 18$	198	9732	78799

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)	✗ (s)

Behavioural properties

safe — in every reachable marking, there is no more than one token on a place	? (p)
dead place(s) — one or more places have no token in any reachable marking	✓ (q)
dead transition(s) — one or more transitions cannot fire from any reachable marking	✓ (r)
deadlock — there exists a reachable marking from which no transition can be fired	? (s)
reversible — from every reachable marking, there is a transition path going back to the initial marking	? (s)
live — for every transition t , from every reachable marking, one can reach a marking in which t can fire	? (s)

(a) stated by [CÆSAR.BDD](#) version 3.5 to be true on 7 instance(s) out of 15, and false on the remaining 8 instance(s).

(b) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(c) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(d) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(e) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(f) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(g) from place “p4” one cannot reach place “p1”.

(h) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(i) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(j) stated by [CÆSAR.BDD](#) version 3.5 to be true on 12 instance(s) out of 15, and false on the remaining 3 instance(s).

(k) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(l) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(m) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(n) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

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

(p) stated by [CÆSAR.BDD](#) version 3.5 to be false on 7 instance(s) out of 15, and unknown on the remaining 8 instance(s).

(q) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(r) stated by [CÆSAR.BDD](#) version 3.5 on all 15 instances (see all aforementioned scaling parameter values).

(s) stated by [CÆSAR.BDD](#) version 3.5 to be false on 7 instance(s) out of 15, and unknown on the remaining 8 instance(s).

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
$s = 64, p = 6$	$\geq 1.99418e+17$ ^(t)	?	?	≥ 85
$s = 64, p = 9$?	?	?	≥ 2 ^(u)
$s = 64, p = 12$	$\geq 1.84641e+10$ ^(v)	?	?	≥ 92
$s = 64, p = 15$	$\geq 1.05102e+11$ ^(w)	?	?	≥ 106
$s = 64, p = 18$	$\geq 1.31607e+12$ ^(x)	?	?	≥ 142
$s = 128, p = 6$?	?	?	≥ 2 ^(y)
$s = 128, p = 9$?	?	?	≥ 2 ^(z)
$s = 128, p = 12$	$\geq 1.98474e+33$ ^(aa)	?	?	≥ 179
$s = 128, p = 15$	$\geq 5.98138e+29$ ^(ab)	?	?	≥ 176
$s = 128, p = 18$	$\geq 1.26275e+21$ ^(ac)	?	?	≥ 172
$s = 256, p = 6$?	?	?	≥ 2 ^(ad)
$s = 256, p = 9$?	?	?	≥ 2 ^(ae)
$s = 256, p = 12$?	?	?	≥ 2 ^(af)
$s = 256, p = 15$?	?	?	≥ 2 ^(ag)
$s = 256, p = 18$?	?	?	≥ 2 ^(ah)

Other properties

The original property of interest – existence of a plan – refers to “EF(ExpectedWorld > 0)” in all individual models.

^(t) stated by [CÆSAR.BDD](#) version 3.5.
^(u) lower bound given by the number of initial tokens.
^(v) stated by [CÆSAR.BDD](#) version 3.5.
^(w) stated by [CÆSAR.BDD](#) version 3.5.
^(x) stated by [CÆSAR.BDD](#) version 3.5.
^(y) lower bound given by the number of initial tokens.
^(z) lower bound given by the number of initial tokens.
^(aa) stated by [CÆSAR.BDD](#) version 3.5.
^(ab) stated by [CÆSAR.BDD](#) version 3.5.
^(ac) stated by [CÆSAR.BDD](#) version 3.5.
^(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.
^(ag) lower bound given by the number of initial tokens.
^(ah) lower bound given by the number of initial tokens.