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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

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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* ..... ? [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* ..... ?
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* ..... ? [s]

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[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).

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