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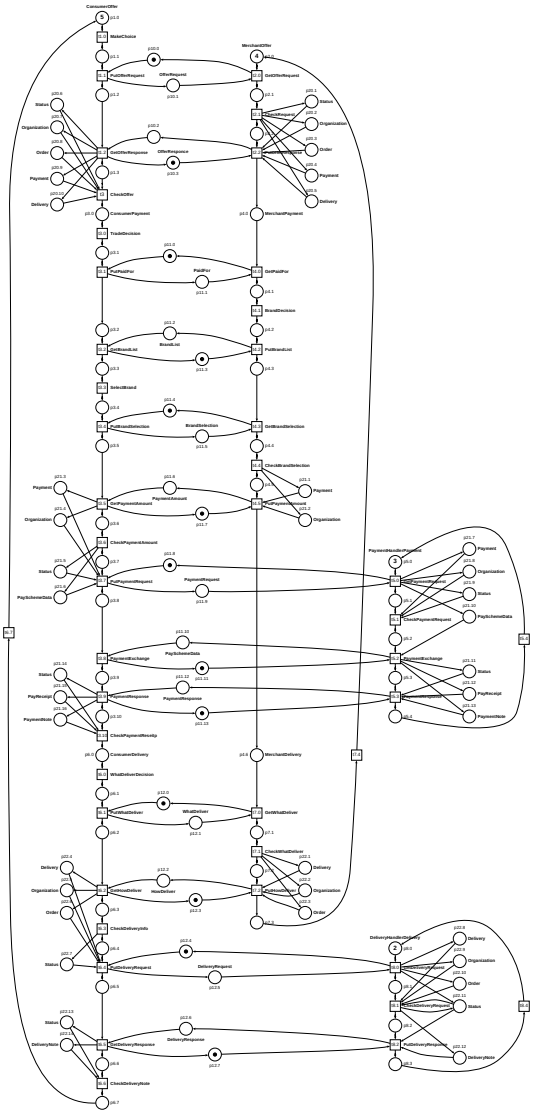
This form is a summary description of the model entitled "IOTPpurchase" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are given together with property files (possibly, one per model instance) giving a set of properties to be checked on the model.

Description

The model specifies the Purchase Transaction of Internet Open Trading Protocol as described in [Z13]. It represents Offer, Payment, and Delivery Trading Exchanges, and reflects IOTP Message structure with distinct Trading Components according to RFC 2801.



Graphical representation for $CO = 5, MO = 4, PH = 3, DH = 2$

References

[Z13] Zaitsev D.A. Clans of Petri Nets: Verification of protocols and performance evaluation of networks, LAP LAMBERT Academic Publishing, 2013, 292 p.

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Scaling parameter

Parameter name	Parameter description	Chosen parameter values
CO, MO, PH, DH	CO is the number of ConsumerOffers; MO is the number of MerchantOffers; PH is the number of PaymentHandlers; DH is the number of DeliveryHandlers.	$(1,1,1,1)$, $(3,3,3,3)$, $(5,4,3,2)$, $(12,10,15,17)$

Size of the model

Although the model is parameterized, its size does not depend on parameter values.

number of places:	111
number of transitions:	45
number of arcs:	224

Structural properties

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

Behavioural properties

safe — *in every reachable marking, there is no more than one token on a place* ..... ? [n]
deadlock — *there exists a reachable marking from which no transition can be fired* ..... ✘ [o]
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* ..... ✔ [p]

[a] 2 arcs are not free choice, e.g., the arc from place "p-13F4-CD52-98" (which has 2 outgoing transitions) to transition "t-13F4-C885-8" (which has 5 input places).
[b] 36 transitions are not of a state machine, e.g., transition "t-13F4-C875-5".
[c] place "p-13F4-CD52-98" is not of a marked graph.
[d] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.
[e] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.
[f] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.
[g] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.
[h] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.
[i] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.
[j] transition "t-13F4-C885-8" is not loop free.
[k] 25 transitions are not conservative, e.g., transition "t-13F4-C875-5".
[l] 13 transitions are not subconservative, e.g., transition "t-13F4-C875-5".
[m] the definition of Nested-Unit Petri Nets (NUPN) is available from http://mcc.lip6.fr/nupn.php
[n] stated by CÆSAR.BDD version 2.2 to be true on 1 instance(s) out of 4, and false on the remaining 3 instance(s).
[o] Checked by the Tina http://www.laas.fr/tina tool version 3.3.0 as well as other behavioural properties..
[p] stated by CÆSAR.BDD version 2.2 on all 4 instances $((1,1,1,1), 3,3,3,3), (5,4,3,2), (12,10,15,17))$.

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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
$(1, 1, 1, 1)$	204	436	1	22
$(3, 3, 3, 3)$	354,176	1,684,054	3	40
$(5, 4, 3, 2)$	17,406,024	108,419,358	5	51
$(12, 10, 15, 17)$	?	?	17	?