

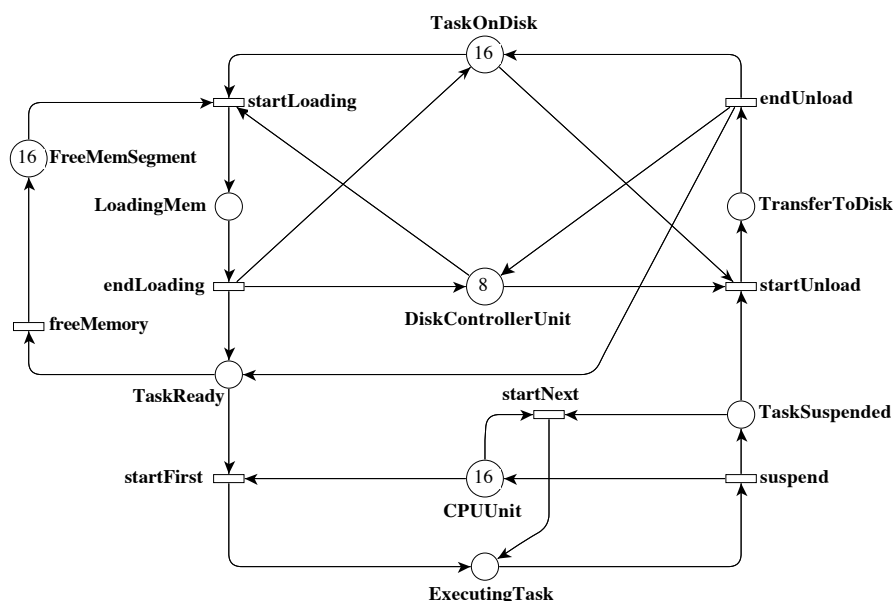
This form is a summary description of the model entitled "SmallOperatingSystem" proposed for the Model Checking Contest @ Petri Nets. Models can be given in several instances parameterized by scaling parameters. Colored nets can be accompanied by one or many equivalent, unfolded P/T nets. Models are 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 simplified Operating System handling the execution of tasks on a machine with several so-called "memory segments", Disk controller units, and cores. The typical lifecycle of a task is the following:

- 1 A ask is loaded from disk to memory (requires a segment and a disk controller),
- 2 When the task is ready to execute, it can get a core, be suspended and get a core again as long as its execution is not finished. It can also be removed from the memory if some is needed otherwise
- 3 When the execution finishes, the task is saved back on the disk.

The system has several scaling parameters: M (memory segments), T (tasks), D (Disk controllers) and C (cores). However, to simplify this in the MCC, we reduce it to two parameters, MT and DC with the following correspondence: $M = T = MT$, $D = DC$ and $C = 2 \times DC$.



Graphical representation for $MT=16$ and $DC = 8$

Scaling parameter

Parameter name	Parameter description	Chosen parameter values
<i>MT</i> and <i>DC</i>	<i>MT</i> to compute available tasks and memory and <i>DC</i> to compute available disk controllers and cores	(MT=16, DC=8), (MT=32, DC=8), (MT=32, DC=16), (MT=64, DC=16), (MT=64, DC=32), (MT=128, DC=32), (MT=128, DC=64), (MT=256, DC=64), (MT=256, DC=128), (MT=512, DC=128), (MT=512, DC=256), (MT=1024, DC=256), (MT=1024, DC=512), (MT=2048, DC=512), (MT=2048, DC=1024), (MT=4096, DC=1024), (MT=4096, DC=2048), (MT=8192, DC=2048), (MT=8192, DC=4096)

Size of the model

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

number of places: 9
 number of transitions: 8
 number of arcs: 27

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 ✗

(a) stated by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (b) stated by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (c) stated by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (d) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (e) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (f) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (g) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (h) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (i) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (j) confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (k) stated by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (l) stated by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).
 (m) the definition of Nested-Unit Petri Nets (NUPN) is available from <http://mcc.lip6.fr/nupn.php>
 (n) by construction of the model (the initial marking is not safe); confirmed by [CÆSAR.BDD](#) version 2.3 on all 19 instances ((MT=16, DC=8), (MT=32, DC=8), etc.).

- 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 ✓
- 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 reach-able markings	Number of tran-sition firings	Max. number of tokens per place	Max. number of tokens per marking
MT=16, DC=8	16 587 ^(o)	100 896 ^(p)	?	≥ 32 ^(q)
MT=32, DC=8	166 515 ^(r)	1 112 454 ^(s)	?	≥ 64 ^(t)
MT=32, DC=16	354 501 ^(u)	2 451 264 ^(v)	?	≥ 64 ^(w)
MT=64, DC=16	7 245 654 ^(x)	29 675 132 ^(y)	?	≥ 128 ^(z)
MT=64, DC=32	9 133 641 ^(aa)	67 762 816 ^(ab)	?	≥ 128 ^(ac)
MT=128, DC=32	?	?	?	≥ 256 ^(ad)
MT=128, DC=64	?	?	?	≥ 256 ^(ae)
MT=256, DC=64	?	?	?	≥ 512 ^(af)
MT=256, DC=128	?	?	?	≥ 512 ^(ag)
MT=512, DC=128	?	?	?	≥ 1024 ^(ah)
MT=512, DC=256	?	?	?	≥ 1024 ^(ai)
MT=1024, DC=256	?	?	?	≥ 2048 ^(aj)
MT=1024, DC=512	?	?	?	≥ 2048 ^(ak)
MT=2048, DC=512	?	?	?	≥ 4096 ^(al)
MT=2048, DC=1024	?	?	?	≥ 4096 ^(am)
MT=4096, DC=1024	?	?	?	≥ 8192 ^(an)
MT=4096, DC=2048	?	?	?	≥ 8192 ^(ao)
MT=8192, DC=2048	?	?	?	≥ 16384 ^(ap)
MT=8192, DC=4096	?	?	?	≥ 16384 ^(aq)

-
- ^(o) computed by PROD in March 2015.
 - ^(p) computed by PROD in March 2015.
 - ^(q) lower bound given by the number of initial tokens.
 - ^(r) computed by PROD in March 2015.
 - ^(s) computed by PROD in March 2015.
 - ^(t) lower bound given by the number of initial tokens.
 - ^(u) computed by PROD in March 2015.
 - ^(v) computed by PROD in March 2015.
 - ^(w) lower bound given by the number of initial tokens.
 - ^(x) computed by PROD in March 2015.
 - ^(y) computed by PROD in March 2015.
 - ^(z) lower bound given by the number of initial tokens.
 - ^(aa) computed by PROD in March 2015.
 - ^(ab) computed by PROD in March 2015.
 - ^(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.
 - ^(ag) lower bound given by the number of initial tokens.
 - ^(ah) lower bound given by the number of initial tokens.
 - ^(ai) lower bound given by the number of initial tokens.
 - ^(aj) lower bound given by the number of initial tokens.
 - ^(ak) lower bound given by the number of initial tokens.
 - ^(al) lower bound given by the number of initial tokens.
 - ^(am) lower bound given by the number of initial tokens.
 - ^(an) lower bound given by the number of initial tokens.
 - ^(ao) lower bound given by the number of initial tokens.
 - ^(ap) lower bound given by the number of initial tokens.
 - ^(aq) lower bound given by the number of initial tokens.