GreatSPN for MRgP solution and CSL^{TA} model-checking

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GreatSPN features

A. Work with Stochastic Petri Nets (colored and regular) and Non-Markovian SPN
B. Qualitative analysis (CTL model checking, RG construction and visualization, structural analysis). Very good recent results in *state space exploration*
C. Quantitative analysis: steady state and transient, ergodic and non-ergodic. Recent advances in *non-ergodic MRgPs* and in efficient *model-checking of* CSL^{TA}
D. Still very weak on reward
E. Re-shaped for teaching

MRgP solution

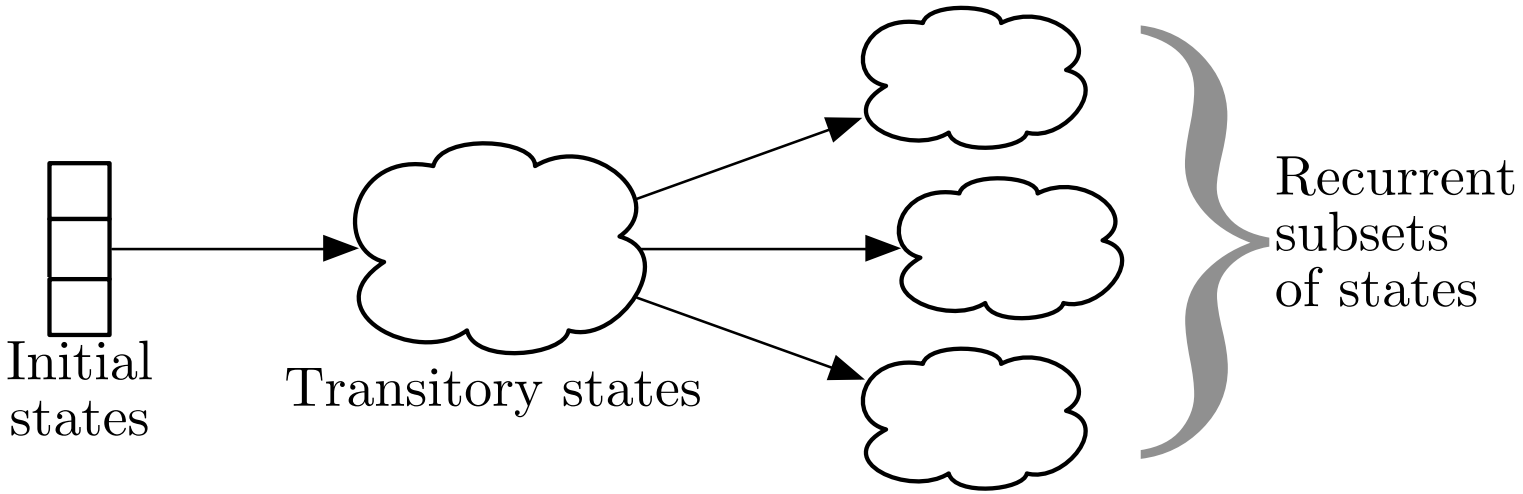
A. Non-ergodic: matrix-free and component-based (Perf. Eval. 2013)

B. Ergodic: matrix-free and Kronecker based. It exploits the tool nsolve fo Dortmund (QEST 2014)

C. Fully integrated in the tool, starting from a Non Markovian SPN (general distributions, but at most one non-Markovian enabled in any state)

Steady-state analysis of non-ergodic MRP

- Non-ergodic Markov Regenerative Process with finite state space.
- Goal: compute the steady-state probabilities of the recurrent states of this type of MRPs.



Solution cost depends on components' classes

Three classes: C_E , C_g , C_M

- C_E: only exponential events → steady state probability of CTMC of S_i.
- C_g: only exponential and general event g, no preemption → transient solution of CTMC of S_i
- C_M: more than a general event and/or preemption → steady state solution of a MRP
  = iterative solution of CTMC of S_i with a transient solution at each iteration step.

CSL^{TA} model-checking

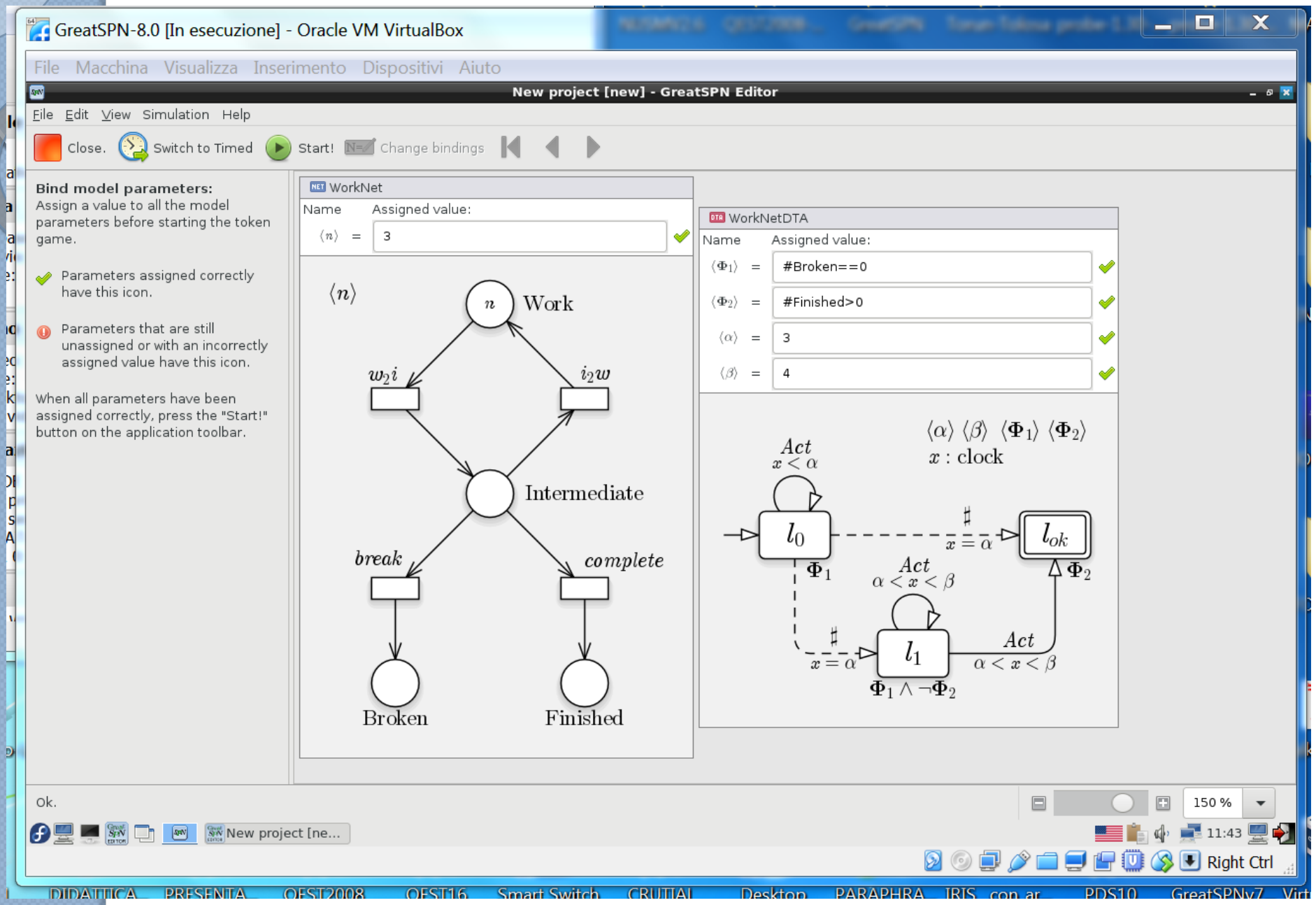
A. The property is the probability of a subset of paths of the CTMC, the ones accepted by a deterministic timed automaton DTA

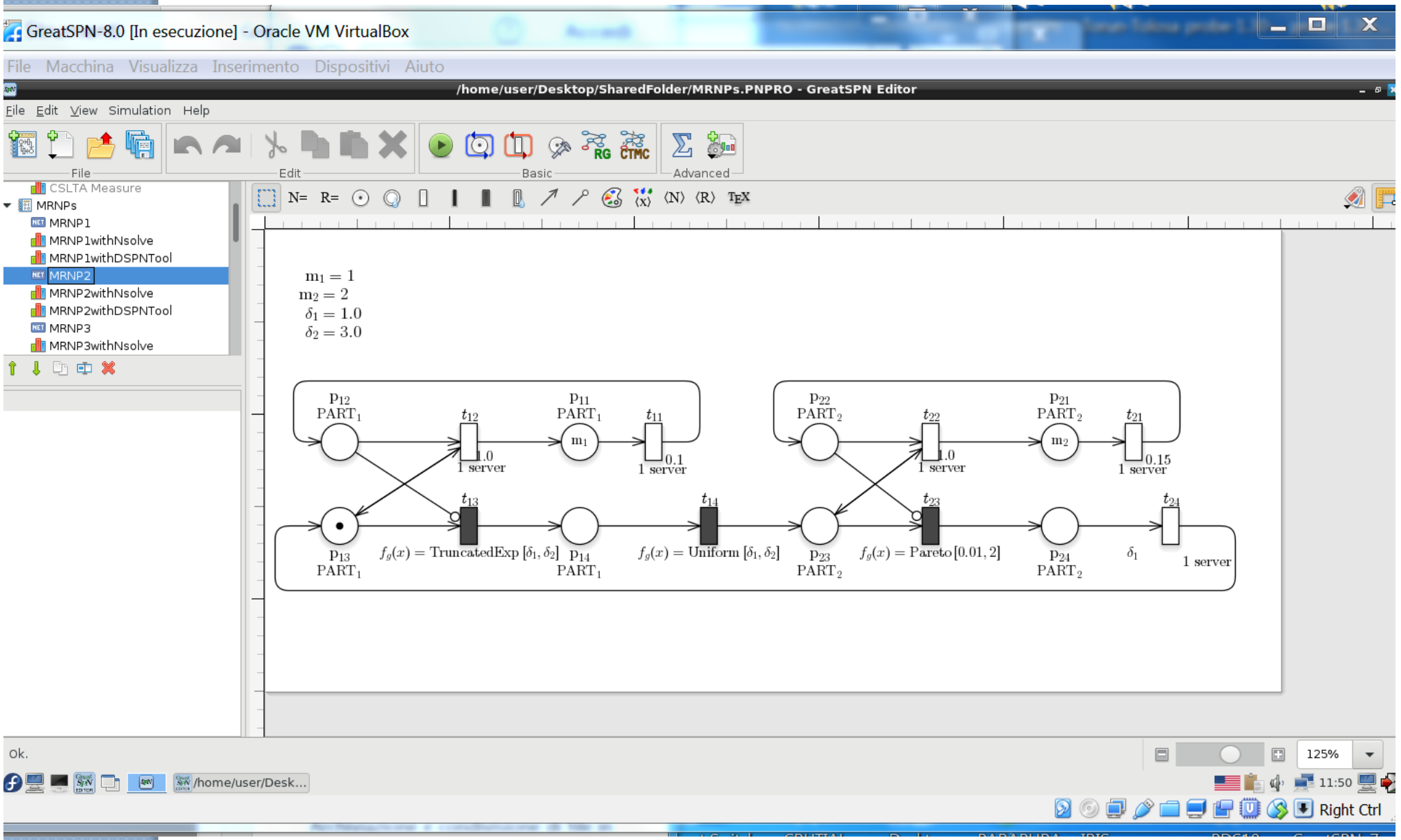
B. CSL^{TA} subsumes the CSL of PRISM

C. Property specified by DTA is true for a CTMC M depending on the probability of the absorbing states of the MRgP built by DTA x M

D. Uses the component method and components are built and solved ``on the fly and matrix free", following the structure of the formula (PE 2018)

E. Fully integrated in the tool
   1. DTA is drawn graphically
   2. CTMC is generated from a GSPN
   3. Graphical execution of a DTA path on the CTMC
   4. Evaluation of the CSL^{TA} formula


GreatSPN-8.0 [In esecuzione] - Oracle VM VirtualBox
File Macchina Visualizza Inserimento Dispositivi Aiuto
New project [new] - GreatSPN Editor
File Edit View Simulation Help
Close.
Switch to Timed
Start!
Change bindings
Bind model parameters:
Assign a value to all the model parameters before starting the token game.
Parameters assigned correctly have this icon.
Parameters that are still unassigned or with an incorrectly assigned value have this icon.
When all parameters have been assigned correctly, press the "Start!" button on the application toolbar.
WorkNet
Name
Assigned value:
⟨n⟩ = 3
n
Work
w2i
i2w
Intermediate
break
complete
Broken
Finished
WorkNetDTA
Name
Assigned value:
⟨Φ1⟩ = #Broken==0
⟨Φ2⟩ = #Finished>0
⟨α⟩ = 3
⟨β⟩ = 4
⟨α⟩ ⟨β⟩ ⟨Φ1⟩ ⟨Φ2⟩
x : clock
Act
x < α
l0
Φ1
x = α
lok
Φ2
Act
α < x < β
l1
Act
α < x < β
Φ1 ∧ ¬Φ2
Ok.
150 %
New project [ne...
11:43
Right Ctrl


GreatSPN-8.0 [In esecuzione] - Oracle VM VirtualBox
File Macchina Visualizza Inserimento Dispositivi Aiuto
/home/user/Desktop/SharedFolder/MRNPs.PNPRO - GreatSPN Editor
File Edit View Simulation Help
File
Edit
Basic
Advanced
CSLTA Measure
MRNPs
MRNP1
MRNP1withNsolve
MRNP1withDSPNTool
MRNP2
MRNP2withNsolve
MRNP2withDSPNTool
MRNP3
MRNP3withNsolve
$m_1 = 1$
$m_2 = 2$
$\delta_1 = 1.0$
$\delta_2 = 3.0$
P_{12} PART$_1$
t_{12}
1.0
1 server
P_{11} PART$_1$
m_1
t_{11}
0.1
1 server
P_{22} PART$_2$
t_{22}
1.0
1 server
P_{21} PART$_2$
m_2
t_{21}
0.15
1 server
t_{13}
t_{14}
t_{23}
t_{24}
P_{13} PART$_1$
$f_g(x) = \text{TruncatedExp}\,[\delta_1, \delta_2]$
P_{14} PART$_1$
$f_g(x) = \text{Uniform}\,[\delta_1, \delta_2]$
P_{23} PART$_2$
$f_g(x) = \text{Pareto}\,[0.01, 2]$
P_{24} PART$_2$
δ_1
1 server
Ok.
125%
/home/user/Desk...
11:50
Right Ctrl