

MODEL CHECKING CONTEST

REPORT FOR 2013

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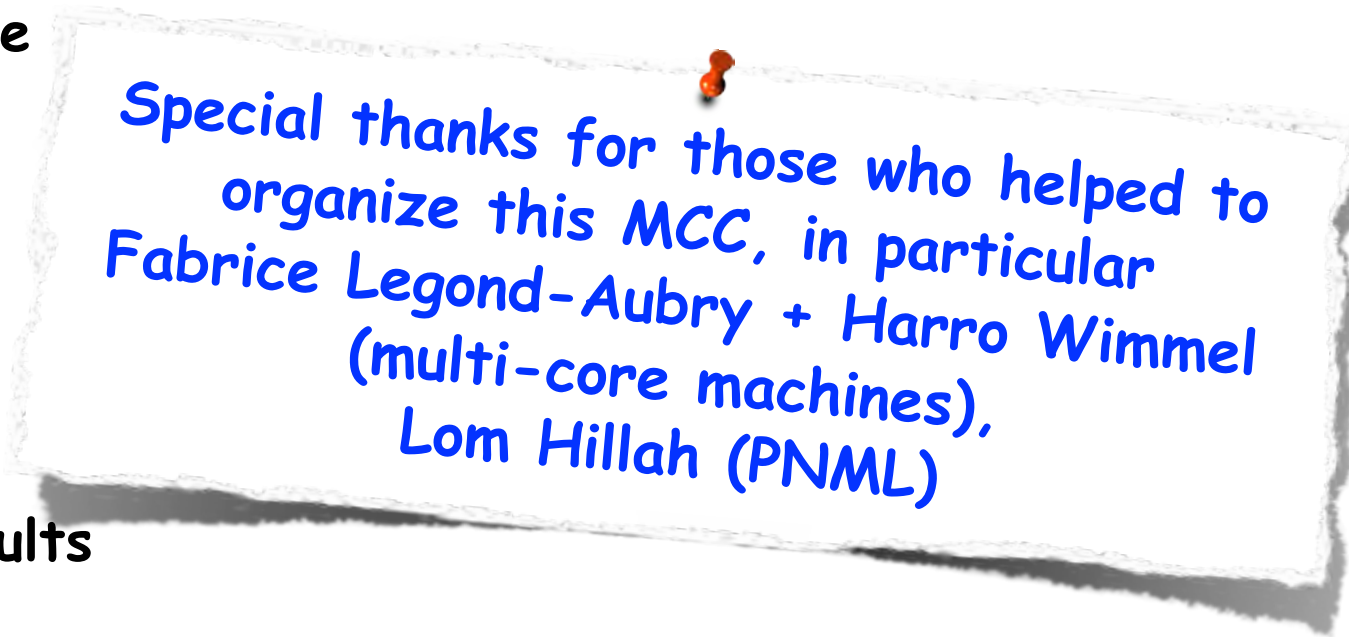
Franck Pommereau - IBISC, Univ. Evry Val d'Essonne

MCC
2013

Model Checking Contest @



- Objectives
- Evaluation procedure
- The models
- Participating tools
- Analysis of the results
- Concluding remarks



Special thanks for those who helped to
organize this MCC, in particular
Fabrice Legond-Aubry + Harro Wimmel
(multi-core machines),
Lom Hillah (PNML)



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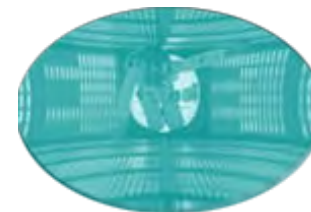
OBJECTIVES

- Lots of questions are raised...
 - To verify highly concurrent systems, should we use a symmetry-based or a partial order-based model checker?
 - For models with large variable domains, should we use decision diagram-based, or a symmetry-based model checker?
 - Can we combine structural reductions techniques with partial-order ones or symmetry-based ones?
 - How do tools evolve in the community?
 - ...
- A large variety of model checking techniques
 - and their potential combination
- A large variety of model categories
- A challenge with large scale specifications
- A need to evaluate in the fairest way current MC implementations

- **MCC is intended to:**
 - Exchange experience between tool programmers,
 - Imagine some association of techniques, and thus better tools
 - Stimulate development of tools
 - Provide visibility to these tools

- **MCC can also be of great help for the PN community (and users):**
 - Define a common set of models for benchmarks
 - Identify experimentally classes of problems (in models)
 - identify the techniques able to cope with a given class of problems...
 - Improve communication between tools (and PNML ;-)
 - Provides raw data for comparison

- **This is the third edition**
 - Stabilized evaluation procedure (BenchKit) + potential reproducibility
 - Enriched Benchmark...
 - ...still elements to be improved



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**EVALUATION
PROCEDURE**



The «enemies» of model checking



Memory consumption



CPU consumption

- The «enemies» of model checking
 - Memory consumption
 - CPU consumption

 - 17 classes of «Examinations» to be processed
 - State space generation
 - Formula evaluation
 - Reachability Formulas
 - CTL formulas
 - LTL formulas
 - Also a classification of atomic propositions in formulas
 - Cardinality or Place Comparison, Fireability, MarkingComparison, Deadlock, Mix
- } 😞 still difficult


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- 24 «known» models (7 from 2011 + 12 from 2012 + 5 from 2013)
 - Kripke-equivalent encoding allowed

- The «enemies» of model checking
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 - LTL formulas}  still difficult
 - Also a classification of atomic propositions in formulas
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- 24 «known» models (7 from 2011 + 12 from 2012 + 5 from 2013)
 - Kripke-equivalent encoding allowed
- 4+1 «Surprise models»
 - Origins: LIG, Univ. P. & M. Curie, Petriweb.org, Univ. Rostock

cluster1 (Univ P. & M. Curie)



ebro (Univ. Rostock)



quadhexa-2 (Univ. Nanterre)



total of 46 CPU

23 x Intel Xeon E5645
2.4 GHz, 6-Core, 6x 1536KB/12288KB L2/L3

total of 64 CPU

4 x AMD Opteron™ 6200 Series (Interlagos)
2.7 GHz, 16-Core, 16x 1024KB/16MB L2/L3

total of 24 CPU

4 x Intel Xeon X7460
2.66 GHz, 6-Core, 3 x 3MB/16NB L2/L3

Memory

23 x 8GB (2x4GB) DDR3 / PC1333

512GB (32x 16GB) DDR3 / PC1600

128GB (8x 16GB) DDR3 / PC1333

Disks

23 x 500GB SATA 7200 +
1TB SATA 7200

2 x 1TB SAS2-Server-RAID +
2 x 128GB SSD Samsung 830 SERIES SATA III MLC

4 x 400GB RAID 1 (mirror) Seagate SAS Cheetah

Linux Kernel

2.6.38.8-server-10.mga

2.6.32-358.11.1.el6.x86_64

3.8.1-server-1.mga3

“Known” Models	“Surprise” Models
Confinement of the Execution	
Memory : 4GB CPU : 2700s	Memory : 4GB CPU : 2700s
Total Number of tool executions (one examination on one model instance)	
49380	4913
Execution per Machine	
cluster1 (Univ P. & M. Curie) : 24937 quadhexa-2 (Univ. Nanterre) : 24443	ebro (Univ. Rostock) : 1640 quadhexa-2 (@niv. Nanterre) : 3273
Total CPU Time required	
80 days, 18 hours, 17 minutes, 11 seconds	3 days, 11 hours, 45 minutes, 12 seconds
Size of collected raw data (CSV, outputs, etc. excluding charts)	
1,77GB	122,3MB
Produced Performance Charts (for models)	
1182	177
Produced Execution Charts (for relevant executions)	
13763	1541

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A Big Benchmark 



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THE MODELS

	Model Name	model type	safe	dead-lock	free choice	state machine	event graph	reversible
New in 2013 (incl. Surprise)	Dekker	P/T	✓	×	×	×	×	✓
	DotAndBoxes	colored	✓	✓	×	×	×	×
	DrinkVendingMachine	colored	✓	×	×	×	×	✓
	HouseConstruction	P/T	×	✓	✓	×	✓	×
	IBMB2S565S3960	P/T	?	?	?	?	?	?
	PermAdmissibility	colored	×	✓	×	×	×	×
	QuasiCertifProtocol	colored	×	✓	?	?	?	×
	RessAllocation	P/T	×	✓	×	×	×	×
	Vasy2003	P/T	✓	×	×	×	×	×

Model Name	model type	safe	dead-lock	free choice	state machine	event graph	reversible	
Models from 2012	cs_repetitions	colored + P/T	×	×	?	?	?	?
	rwmutex	colored + P/T	✓	×	×	×	×	✓
	echo	colored + P/T	✓	✓	×	×	×	×
	eratosthenes	colored + P/T	✓	✓	?	?	?	?
	galloc_res	colored + P/T	×	×	?	?	?	?
	lamport_fmea	colored + P/T	✓	×	×	×	×	×
	neoelection	colored + P/T	✓	✓	×	×	×	✓
	philo_dyn	colored + P/T	✓	✓	?	?	?	?
	planning	colored + P/T	×	?	×	×	?	?
	railroad	colored + P/T	×	×	?	?	?	?
	ring	colored + P/T	✓	?	×	×	?	?
	simple_lbs	colored + P/T	✓	×	×	×	×	×

	Model Name	model type	safe	dead-lock	free choice	state machine	event graph	reversible
Models from 2011	FMS	P/T	×	?	?	?	?	?
	Kanban	P/T	×	?	?	?	?	?
	MAPK	P/T	×	?	?	?	?	?
	Peterson	colored	✓	?	?	?	?	?
	Philosophers	colored	✓	?	?	?	?	?
	SharedMemory	colored	✓	×	?	?	?	?
	TokenRing	colored	✓	?	?	?	?	?



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**PARTICIPATING
TOOLS**

#

Tool

from

1	alpina	Univ. Geneva, Switzerland
2	cunf	ENS de Cachan France
3	greatSPN	Univ. Torino, Italy
4	ITS-Tools	Univ. P. & M. Curie, France
5	lola	Univ. Rostock, Germany
6	lola_optimistic	Univ. Rostock, Germany
7	lola_optimistic_incomplete	Univ. Rostock, Germany
8	lola_pessimistic	Univ. Rostock, Germany
9	marcie	Univ. Cottbus, Germany
10	neco	Univ. Evry Val d'Essone, France
11	pnxdd	Univ. P. & M. Curie, France
12	sara	Univ. Rostock, Germany

#

Tool

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9	marcie	Univ. Cottbus, Germany
10	neco	Univ. Evry Val d'Essone, France
11	pryde	Univ. P. & M. Curie, France
12		Univ. Ros



*Provided in
their VM*



*Nice hotline
too :-)*

Techniques reported by tools	
Tool Name	Reported Techniques
Apina	Decision Diagrams
Cunf	Net Unfolding, SAT/SMT
greatSPN	Decision Diagrams
ITS-Tools	Decision Diagrams Structural Reductions
LoLA (all variants)	Explicit model checking State compression Stubborn sets
Marcie	Decision Diagrams
Neco	Explicit model checking
PNXDD	Decision Diagrams Topological
Sara	SAT/SMT Stubborn Sets Topological



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**ANALYSIS OF THE
RESULTS**




Outputs are HUGE

- Almost 2Gbyte of csv + text
- Need for automated analysis
 - challenge for this year

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They may be difficult to compare

- State space generation, almost a consensus
 - The few differences are explained
 - Encoding errors (from Tools), Mistake from us (unfolding into P/T)
- For formulas, it is much more difficult
 - Predictability of formula satisfiability (random formulas),
 - Some mistakes in Formula generation,
 - Stability of formula transformations into a given Tool's language...

What we did

- State Space Generation, check that all differences could be explained
- For formulas
 - Existence of some output (at least one formula computed)

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Better for deadlock analysis

What we did

- State Space Generation, check that all differences could be explained
- For formulas
 - Existence of some output (at least one formula computed)

KNOWN MODELS, HOW DIFFICULT ARE THEY?

model	CTL					LTL					Reachability					State Space	
	Card. Comp.	Fire-ability	Marking Comp.	Mix	Place Comp.	Card. Comp.	Fire-ability	Mark. Comp.	Mix	Place Comp.	Card. Comp.	Deadlock	Fire-ability	Marking Comp.	Mix		Place Comp.
CSRepetitions (colored)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
CSRepetitions (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😄	😞	😞	😞	😞	😞
Dekker (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
DotAndBoxes (colored)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
DrinkVendingMachine (colored)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
DrinkVendingMachine (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
Echo (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
Eratosthenes (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
FMS (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😄	😞	😞	😞	😞
GlobalResAlloc (colored)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
GlobalResAlloc (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😄	😞	😞	😞	😞	😞
Kanban (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
LamportFastMutEx (colored)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
LamportFastMutEx (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
MAPK (P/T)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞
NeoElection (colored)	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞	😞



KNOWN MODELS, HOW DIFFICULT ARE THEY?

😊 ≥ 66%
😐 ≥ 33% and < 66%

😬 < 33% of the tools
😡 no tool

model	CTL					LTL					Reachability					State Space
	Card. Comp.	Fire-ability	Marking Comp.	Mix	Place Comp.	Card. Comp.	Fire-ability	Mark. Comp.	Mix	Place Comp.	Card. Comp.	Deadlock	Fire-ability	Marking Comp.	Mix	
CSRepetitions (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😬	😬	😬	😬	😬
CSRepetitions (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😊	😐	😐	😐	😐
Dekker (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐
DotAndBoxes (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😬	😬	😬	😬	😬
DrinkVendingMachine (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😬	😬	😬	😬	😬
DrinkVendingMachine (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐
Echo (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😬
Eratosthenes (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐
FMS (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😊	😬	😐	😐
GlobalResAlloc (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😬	😬	😬	😬	😬
GlobalResAlloc (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😊	😐	😐	😐	😐
Kanban (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐
LamportFastMutEx (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😬	😬	😬	😬	😬
LamportFastMutEx (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐
MAPK (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐
NeoElection (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😬	😬	😬	😬	😬

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NeoElection (P/T)																	
PermAdmissibility (colored)																	
PermAdmissibility (P/T)																	
Peterson (colored)																	
Peterson (P/T)																	
Philosophers (colored)																	
Philosophers (P/T)																	
PhilosophersDyn (colored)																	
PhilosophersDyn (P/T)																	
Planning (P/T)																	

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Railroad (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐	😐
RessAllocation (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐	😐
Ring (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😊	😐	😐	😐	😐	😐
RwMutex (P/T)	😐	😐	😬	😐	😐	😐	😐	😬	😐	😐	😐	😐	😐	😬	😐	😐	😐
SharedMemory (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬
SharedMemory (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😊	😐	😐	😐	😐	😐
SimpleLoadBal (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😐	😐	😐	😬	😐	😐	😐
SimpleLoadBal (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐
TokenRing (colored)	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬	😬
TokenRing (P/T)	😬	😐	😐	😐	😬	😬	😐	😐	😐	😬	😬	😊	😐	😐	😐	😬	😐

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Railroad (P/T)	☹️	☹️	😡	☹️	☹️	☹️	☹️	😡	☹️	☹️	☹️	☹️	☹️	😡	☹️	☹️	☹️
RessAllocation (P/T)	☹️	☹️	😡	☹️	☹️	☹️	☹️	😡	☹️	☹️	☹️	☹️	☹️	😡	☹️	☹️	☹️
Ring (P/T)	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	😊	☹️	☹️	☹️	☹️	☹️
RwMutex (P/T)	☹️	☹️	😡	☹️	☹️	☹️	☹️	😡	☹️	☹️	☹️	☹️	☹️	😡	☹️	☹️	☹️
SharedMemory (colored)	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡
SharedMemory (P/T)	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	😊	☹️	☹️	☹️	☹️	☹️
SimpleLoadBal (colored)	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	☹️	☹️	☹️	😡	☹️	☹️	☹️
SimpleLoadBal (P/T)	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️	☹️
TokenRing (colored)	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡
TokenRing (P/T)	😡	☹️	☹️	☹️	😡	😡	☹️	☹️	☹️	😡	😡	😊	☹️	☹️	☹️	😡	☹️

Harder for colored

model	CTL					LTL					Reachability					State Space	
	Card. Comp.	Fire-ability	Marking Comp.	Mix	Place Comp.	Card. Comp.	Fire-ability	Mark. Comp.	Mix	Place Comp.	Card. Comp.	Deadlock	Fire-ability	Marking Comp.	Mix		Place Comp.
HouseConstruction (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😐
IBMB2S565S3960 (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😡
QuasiCertifProtocol (colored)	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡
QuasiCertifProtocol (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐
Vasy2003 (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😡



≥ 66%



≥33% and < 66%



<33% of the tools



no tool

model	CTL					LTL					Reachability					State Space	
	Card. Comp.	Fire-ability	Marking Comp.	Mix	Place Comp.	Card. Comp.	Fire-ability	Mark. Comp.	Mix	Place Comp.	Card. Comp.	Deadlock	Fire-ability	Marking Comp.	Mix		Place Comp.
HouseConstruction (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😐
IBMB2S565S3960 (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😡
QuasiCertifProtocol (colored)	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡
QuasiCertifProtocol (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐
Vasy2003 (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😡

Harder than for «known models»

😄 ≥ 66%

😐 ≥33% and < 66%

😬 <33% of the tools

😡 no tool

model	CTL					LTL					Reachability					State Space	
	Card. Comp.	Fire-ability	Marking Comp.	Mix	Place Comp.	Card. Comp.	Fire-ability	Mark. Comp.	Mix	Place Comp.	Card. Comp.	Deadlock	Fire-ability	Marking Comp.	Mix		Place Comp.
HouseConstruction (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😐
IBMB2S565S3960 (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😐
QuasiCertifProtocol (colored)	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡	😡
QuasiCertifProtocol (P/T)	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐	😐
Vasy2003 (P/T)	😐	😐	😡	😐	😐	😐	😐	😡	😐	😐	😐	😐	😐	😡	😐	😐	😐

Harder than for «known models»

Some tools perform better with their «default settings»
(wait for trophies)

😄 ≥ 66%

😐 ≥33% and < 66%

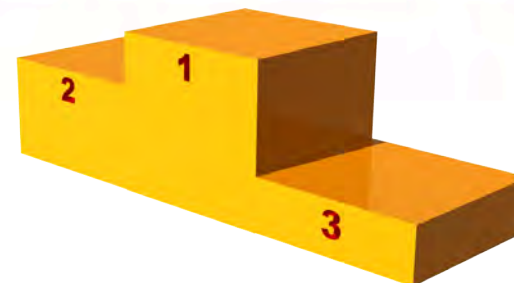
😬 <33% of the tools

😡 no tool

Too early for a «Global Race»

- Is it interesting?

- Depends on the strength and weakness of tools...



For this year, how scoring was computed

- +1 point for each instance where a tangible result is produced

- +1 point bonus for the tool when it performs the first instance

- +2 points for when a tool is best for a model (i.e. the fastest in instances)

- +2 points when a tool reaches the last proposed instance of a model

- This has to be refined for models with only one instance ;-)**

Trophies are per examination only

- For «known» models

- For «surprise» models

- Globally (global = known + 2 * surprise)

- Consideration for the «default setting» mode + much less surprise models**



Available online: <http://mcc.lip6.fr>



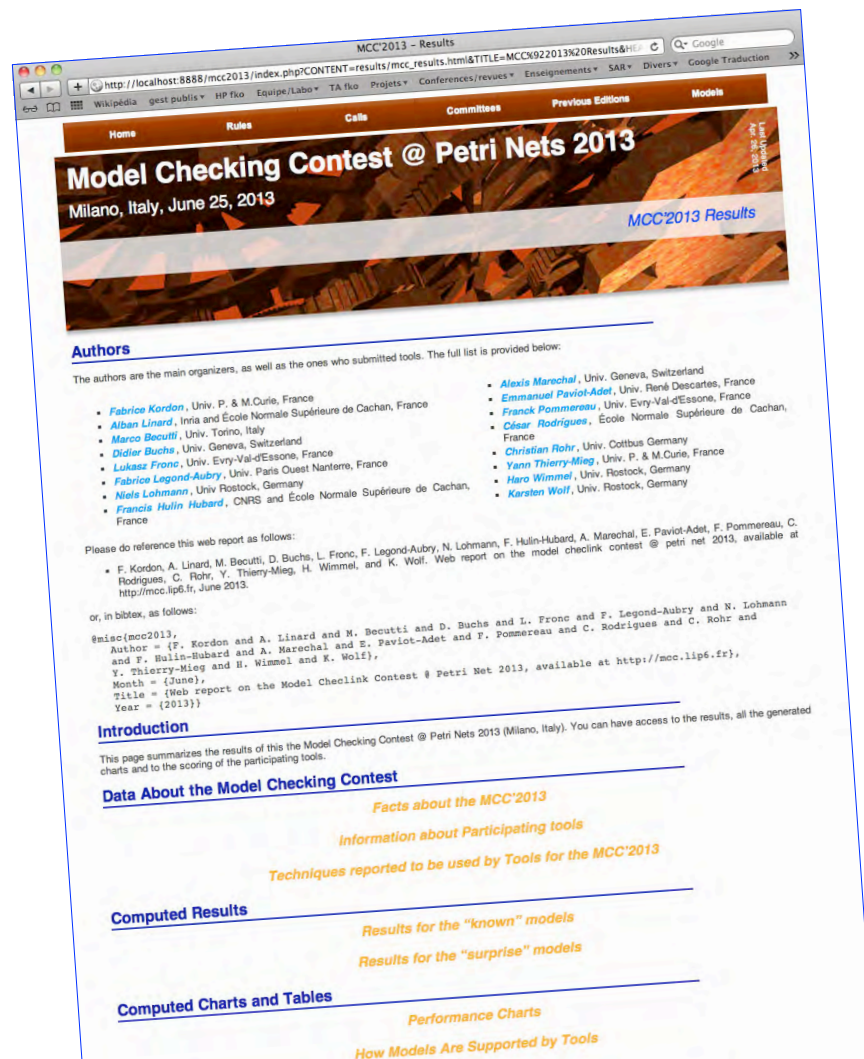
Partial previews where checked with tool developers



Available online: <http://mcc.lip6.fr>



Partial previews where checked with tool developers



The screenshot shows a web browser displaying the MCC'2013 Results page. The page has a dark header with the title "Model Checking Contest @ Petri Nets 2013" and the date "Milano, Italy, June 25, 2013". Below the header, there is a navigation menu with links for Home, Rules, Calls, Committees, Previous Editions, and Models. The main content area is titled "MCC'2013 Results" and features a section for "Authors".

Authors

The authors are the main organizers, as well as the ones who submitted tools. The full list is provided below:

- **Fabrice Kordon**, Univ. P. & M. Curie, France
- **Alban Linard**, Inria and Ecole Normale Supérieure de Cachan, France
- **Marco Beutli**, Univ. Torino, Italy
- **Didier Buchs**, Univ. Geneva, Switzerland
- **Lukas Fronc**, Univ. Evry-Val-d'Essonne, France
- **Fabrice Legond-Aubry**, Univ. Paris Ouest Nanterre, France
- **Niels Lohmann**, Univ. Rostock, Germany
- **Francis Hulin Hubard**, CNRS and Ecole Normale Supérieure de Cachan, France
- **Alexis Marechal**, Univ. Geneva, Switzerland
- **Emmanuel Paviot-Adet**, Univ. René Descartes, France
- **Franck Pommerau**, Univ. Evry-Val-d'Essonne, France
- **César Rodrigues**, Ecole Normale Supérieure de Cachan, France
- **Christian Rohr**, Univ. Cottbus, Germany
- **Yann Thierry-Mieg**, Univ. P. & M. Curie, France
- **Haro Wimmel**, Univ. Rostock, Germany
- **Karsten Wolf**, Univ. Rostock, Germany

Please do reference this web report as follows:

- F. Kordon, A. Linard, M. Beutli, D. Buchs, L. Fronc, F. Legond-Aubry, N. Lohmann, F. Hulin-Hubard, A. Marechal, E. Paviot-Adet, F. Pommerau, C. Rodrigues, C. Rohr, Y. Thierry-Mieg, H. Wimmel, and K. Wolf. Web report on the model checking contest @ petri net 2013, available at <http://mcc.lip6.fr>, June 2013.

or, in bibtex, as follows:

```
@misc{mcc2013,
  author = {F. Kordon and A. Linard and N. Beutli and D. Buchs and L. Fronc and F. Legond-Aubry and N. Lohmann and F. Hulin-Hubard and A. Marechal and E. Paviot-Adet and F. Pommerau and C. Rodrigues and C. Rohr and Y. Thierry-Mieg and H. Wimmel and K. Wolf},
  month = {June},
  title = {Web report on the Model CheckLink Contest @ Petri Net 2013, available at http://mcc.lip6.fr},
  year = {2013}}
```

Introduction

This page summarizes the results of this Model Checking Contest @ Petri Nets 2013 (Milano, Italy). You can have access to the results, all the generated charts and to the scoring of the participating tools.

Data About the Model Checking Contest

- [Facts about the MCC'2013](#)
- [Information about Participating tools](#)
- [Techniques reported to be used by Tools for the MCC'2013](#)

Computed Results

- [Results for the "known" models](#)
- [Results for the "surprise" models](#)

Computed Charts and Tables

- [Performance Charts](#)
- [How Models Are Supported by Tools](#)



Available online: <http://mcc.lip6.fr>



Partial previews where checked with tool developers

Model Checking Contest @ Petri Nets 2013
Milano, Italy, June 25, 2013

Results summary for the StateSpace Examination

Please find enclosed the brute results for the StateSpace examination. We display only the score of tools that provide a results for at least one instance of one model. You may access to the [scoring for this examination here](#).

The legend for the values is provided below:

- no: the tool does not complete this examination for this model/instance.
- ca: the tool cannot compute this examination for this model/instance.
- td: the tool cannot compute this examination for this model/instance within the maximum allowed time.
- mp: the tool encountered a memory problem (stack overflow or memory full).
- nf: there is no formula available for this type of examination (typically, this concerns P/T nets where comparing marking cardinality has no signification when there is no equivalent colored net).

Please note that, for some models/instances, we could not reformat the number of the state space (apparently over 10^{*239} states) and then provide "m" (ovr)" as an answer.

CSRepetitions (Colored)								
instances	alpina	greatSPN	ITS-Tools	pessimistic	lola	marcie	neco	prxddd
02	7424	nc	7424	nc	nc	nc	nc	nc
03	1.341E+08	nc	1.341E+08	nc	nc	nc	nc	nc
04	to	nc	mp	nc	nc	nc	nc	nc
05	to	nc	mp	nc	nc	nc	nc	nc
07	cc	nc	mp	nc	nc	nc	nc	nc
10	cc	nc	mp	nc	nc	nc	nc	nc

CSRepetitions (P/T)								
instances	alpina	greatSPN	ITS-Tools	pessimistic	lola	marcie	neco	prxddd
02	7424	1872	1872	nc	1872	1872	1872	1872
03	1.341E+08	3.952E+08	3.952E+08	nc	3.952E+08	3.952E+08	3.952E+08	3.952E+08
04	to	6.417E+10	6.417E+10	nc	to	cc	6.417E+10	to
05	to	to	6.668E+15	nc	to	nc	6.668E+15	to
07	cc	mp	1.308E+25	nc	to	nc	to	to
10	cc	mp	mp	nc	to	nc	to	to

Dekker (P/T)								
instances	alpina	greatSPN	ITS-Tools	pessimistic	lola	marcie	neco	prxddd
010	to	nc	8144	nc	8144	8144	8144	8144
015	to	nc	278528	nc	278528	278528	278528	278528
020	to	nc	mp	nc	1.153E+07	1.153E+07	1.153E+07	nc
050	cc	nc	mp	nc	to	nc	to	to
100	cc	nc	mp	nc	to	nc	to	to
200	to	nc	mp	nc	to	nc	to	to

DotAndBoxes (Colored)								
instances	alpina	greatSPN	ITS-Tools	pessimistic	lola	marcie	neco	prxddd
2	11	nc	11	nc	nc	nc	nc	nc
3	cc	nc	383	nc	nc	nc	nc	nc
4	cc	nc	270156	nc	nc	nc	nc	nc
5	cc	nc	mp	nc	nc	nc	nc	nc

DrinkVendingMachine (Colored)								
instances	alpina	greatSPN	ITS-Tools	pessimistic	lola	marcie	neco	prxddd
02	1024	nc	1024	nc	nc	nc	nc	nc
10	cc	nc	1.153E+18	nc	nc	nc	nc	nc

DrinkVendingMachine (P/T)								
instances	alpina	greatSPN	ITS-Tools	pessimistic	lola	marcie	neco	prxddd
02	1024	nc	1024	nc	nc	nc	nc	nc
10	cc	nc	1.153E+18	nc	nc	nc	nc	nc



Available online: <http://mcc.lip6.fr>



Partial previews were checked with tool developers

The image shows a collage of screenshots from the MCC 2013 website. The main screenshot is the 'StateSpace Scores' page, which displays the contest title, date, and location. It includes a table of scores for various tools across different models and a legend for the line labels used in the tables.

Model Checking Contest @ Petri Nets 2013
Milano, Italy, June 25, 2013

Scores for the StateSpace Examination

Please find enclosed the scores for the [StateSpace](#) examination. We display only the scores of tools that provide a results for at least one instance of one model. The total is first listed in the table below followed by a detail, for each proposed model. You may [access the corresponding result page](#) here.

Meaning of the line labels are:

- 1st instance**: the tool gets a bonus for having processed the first instance of this model (+1 point).
- instances**: the tool gets 1 point per instances treated (for that, we assume that a number of state is provided).
- max reached**: the tool could process all the instances for the model (+2 points).
- best**: the tool is among the ones that processed a maximum of instances within the time and memory confinement (+2 points).

For known, a tool may collect up to 411 points.

Total Score of the tools							
	alpina	greatSPN	ITS-Tools	lola pessimistic	marcie	neco	praxdd
Global Score	103	47	234	0	129	64	130

CSRepetitions (Colored)							
	alpina	greatSPN	ITS-Tools	lola pessimistic	marcie	neco	praxdd
1st instance	1	0	1	0	0	0	0
instances	2	0	2	0	0	0	0
max reached	0	0	0	0	0	0	0
best	2	0	2	0	0	0	0
subtotal	5	0	5	0	0	0	0

CSRepetitions (P/T)							
	alpina	greatSPN	ITS-Tools	lola pessimistic	marcie	neco	praxdd
1st instance	1	1	1	0	1	1	1
instances	2	3	5	0	2	2	4
max reached	0	0	0	0	0	0	0
best	0	0	2	0	0	0	0
subtotal	3	4	8	0	3	3	5

Dekker (P/T)							
	alpina	greatSPN	ITS-Tools	lola pessimistic	marcie	neco	praxdd
1st instance	0	0	1	0	1	1	1
instances	0	0	2	0	3	3	3
max reached	0	0	0	0	0	0	0
best	0	0	0	0	2	2	2
subtotal	0	0	3	0	6	6	6

DotAndBoxes (Colored)							
	alpina	greatSPN	ITS-Tools	lola pessimistic	marcie	neco	praxdd
1st instance	1	0	1	0	0	0	0
instances	1	0	3	0	0	0	0
max reached	0	0	0	0	0	0	0
best	0	0	2	0	0	0	0
subtotal	2	0	6	0	0	0	0

DrinkVendingMachine (Colored)							
	alpina	greatSPN	ITS-Tools	lola pessimistic	marcie	neco	praxdd
1st instance	1	0	1	0	0	0	0
instances	1	0	2	0	0	0	0
max reached	0	0	2	0	0	0	0
best	0	0	2	0	0	0	0
subtotal	2	0	7	0	0	0	0



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Partial previews where checked with tool developers

The collage displays several screenshots of the MCC 2013 website. The main page features the title 'Model Checking Contest @ Petri Nets 2013' and 'Milano, Italy, June 25, 2013'. It includes a 'Results summary for the StateSpace Examination' section. The 'Authors' page lists the main organizers: Fabrice Kordon, Alban Linard, Marco Becutti, Didier Buchs, Lukasz Franc, Fabrice Legend-Aubry, Niels Lohmann, and Francis Hulin Hubard. The 'Computed Results' section shows a table of scores for various models and tools. The 'Computed Charts and' section shows a table of scores for various models and tools.

Model	alpha	greatSPN	ITS-T
Global Score	103	47	23

Instances	alpha	greatSPN	ITS-T
1st instance	1	0	1
Instances	2	0	2
max reached	0	0	0
best	2	0	2
subtotal	3	0	3

Instances	alpha	greatSPN	ITS-T
1st instance	1	1	1
Instances	2	3	3
max reached	0	0	0
best	0	0	0
subtotal	3	4	4

Instances	alpha	greatSPN	ITS-T
1st instance	0	0	0
Instances	0	0	0
max reached	0	0	0
best	0	0	0
subtotal	0	0	0

Instances	alpha	greatSPN	ITS-T
1st instance	1	0	0
Instances	1	0	0
max reached	0	0	0
best	0	0	0
subtotal	2	0	0

Instances	alpha	ITS-Tools	marcie	neco	pnvdd
002	1501	1501	1501	1501	1501
005	1187984	1187984	1187984	1187984	1187984
010	10	1.664E+09	1.664E+09	1.664E+09	1.664E+09
020	10	1.387E+13	1.387E+13	1.387E+13	1.387E+13
050	10	mp	cc	cc	cc
100	10	mp	cc	cc	cc
200	10	mp	cc	cc	cc
300	10	mp	cc	cc	cc

Instances	alpha	ITS-Tools	marcie	neco	pnvdd
none	cc	cc	1.551E+16	10	1.551E+16

Instances	alpha	ITS-Tools	marcie	neco	pnvdd
02	cc	cc	cc	cc	cc
06	cc	cc	cc	cc	cc
10	cc	cc	cc	cc	cc
18	cc	cc	cc	cc	cc
22	cc	cc	cc	cc	cc
28	cc	cc	cc	cc	cc
32	cc	cc	cc	cc	cc

Instances	alpha	ITS-Tools	marcie	neco	pnvdd
02	1029	1029	1029	1029	1029
06	10	2.272E+06	2.272E+06	10	2.272E+06
10	10	mp	cc	cc	cc
18	cc	mp	cc	cc	cc
22	cc	mp	cc	cc	cc
28	cc	mp	cc	cc	cc
32	cc	mp	cc	cc	cc

Instances	alpha	ITS-Tools	marcie	neco	pnvdd
none	cc	mp	9.795E+21	cc	10



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Partial previews where checked with tool developers

The collage displays several pages from the MCC 2013 website:

- Home Page:** "Model Checking Contest @ Petri Nets 2013", "Milano, Italy, June 25, 2013".
- Rules Page:** "Please find enclosed the brute results for the StateSpace exam model. The total is first listed in the table below followed by the meaning of the line labels are:
 - nc:** the tool does not complete this exam
 - cc:** the tool cannot compute this exam
 - sp:** the tool encountered a memory problem
 - mp:** there is no formula available to be processed
- Introduction Page:** "This page shows the outputs produced by the execution of marcie on HouseConstruction020 (P/T). We provide:
 - A short summary,
 - The execution chart (evolution of CPU and memory over the execution),
 - The sequence of actions to be executed by the VM,
 - The results of these actions.
- About the Execution Page:** "Execution Summary" table:

Memory (MB)	CPU (s)	End
1580.40	82.68	normal
- Execution Chart Page:** "marcie: StateSpace for HouseConstruction/020 (P/T)" line graph showing CPU and Memory usage over 100 seconds.
- Computed Results Page:** Tables for various benchmarks:

instances	alpha	greatSPN	ITS-T
02	7424	nc	nc
03	1.341E+08	nc	nc
04	10	nc	nc
05	10	nc	nc
07	cc	nc	nc
10	cc	nc	nc



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Partial previews where checked with tool developers

Over 25K+ pages generated

Better access to outputs

Better reproducibility and reuse of the MCC for papers?

Execution Summary

Memory (MB)	CPU (s)	End
1560.40	62.68	

Execution Chart

We display below the execution chart for this examination (boot time has been removed).

Sequence of Actions to be Executed by the VM

```

export BK_INPUT=HouseConstruction-PT-020
export BK_EXAMINATION=StateSpace
export BK_TOOL=marcie
export BK_RESULT_DIR=/tmp
export BK_LOG_FILE=/tmp/the_log_file.1721
export BIN_DIR=/home/mcc/BenchKit/bin
BIN_DIR=/home/mcc/BenchKit/bin
od /home/mcc/BenchKit/INPUTS/HouseConstruction-PT-020
echo =====
echo * Generated by BenchKit 1.0*
echo * Executing tool marcie:
echo * Test is HouseConstruction-PT-020.
echo =====
    
```




Available online: <http://mcc.lip6.fr>



Partial previews where checked with tool developers

Over 25K+ pages generated

Better access to outputs

Better reproducibility and reuse of the MCC for papers?

Information shown today comes from here

A PDF version will be derived from it

Go and play with the displays

Sequence of Actions to be Executed by the VM

```
export BK_IMAGE=HouseConstruction-PT-020
export BK_TOOL=marcie
export BK_LOG_FILE=/tmp/the_log_files/22
export BIN_DIR=/home/mcc/BenchKit/bin
BIN_DIR=/home/mcc/BenchKit/bin
od /home/mcc/BenchKit/INPUTS/HouseConstruction-PT-020
echo * Generated by BenchKit 1.0*
echo * Executing tool marcie:
echo * Test is HouseConstruction-PT-020.
```

Trophies for the "Known" Models



LoLA
172 (points)



LoLA optimistic
172 (points)



marcie
102 (points)

Trophies for the "Surprise" Models



marcie
22 (points)



LoLA
12 (points)



LoLA optimistic
12 (points)

Trophies for All Models



LoLA
196 (points)



LoLA optimistic
196 (points)



marcie
146 (points)

Trophies for the "Known" Models			Trophies for the "Surprise" Models			
						
LoLA 198 (points)	LoLA optimistic 198 (points)	LoLA optimistic incomplete 178 (points)	marcie 17 (points)	LoLA 12 (points)	LoLA optimistic 12 (points)	LoLA optimistic incomplete 12 (points)

Trophies for All Models		
		
LoLA 222 (points)	LoLA optimistic 222 (points)	LoLA optimistic incomplete 202 (points)

Trophies for the "Known" Models



sara
87 (points)



LoLA
71 (points)



LoLA optimistic
71 (points)

Trophies for the "Surprise" Models



sara
12 (points)



marcie
3 (points)

Trophies for All Models









sara
111 (points)



LoLA
71 (points)



LoLA optimistic
71 (points)

Trophies for the "Known" Models			Trophies for the "Surprise" Models			
						
LoLA 192 (points)	LoLA optimistic 187 (points)	LoLA optimistic incomplete 135 (points)	marcie 22 (points)	LoLA 6 (points)	LoLA optimistic 6 (points)	LoLA optimistic incomplete 6 (points)

Trophies for All Models		
		
LoLA 204 (points)	LoLA optimistic 199 (points)	LoLA optimistic incomplete 147 (points)

Trophies for the "Known" Models			Trophies for the "Surprise" Models			
						
LoLA 191 (points)	LoLA optimistic 191 (points)	LoLA optimistic incomplete 158 (points)	marcie 17 (points)	LoLA 12 (points)	LoLA optimistic 12 (points)	LoLA optimistic incomplete 12 (points)
Trophies for All Models						
						
LoLA 215 (points)	LoLA optimistic 215 (points)	LoLA optimistic incomplete 182 (points)				

Globally on CTL

-  **Marcie comes often first on «surprise» models**
-  **Rostock Tools (LoLA, Sara) compete well on these examinations**

Trophies for the "Known" Models



Neco
114 (points)

Trophies for the "Surprise" Models

Trophies for All Models



Neco
114 (points)

Trophies for the "Known" Models



Neco
88 (points)

Trophies for the "Surprise" Models

Trophies for All Models



Neco
88 (points)

Trophies for the "Known" Models



Neco
54 (points)

Trophies for the "Surprise" Models

Trophies for All Models



Neco
54 (points)

Trophies for the "Known" Models



Neco
114 (points)

Trophies for the "Surprise" Models

Trophies for All Models



Neco
114 (points)

Trophies for the "Known" Models



Neco
110 (points)

Trophies for the "Surprise" Models








Trophies for All Models










Neco
110 (points)

 **Globally on LTL**

-  Neco is the only too to deliver some output
-  Rostock tools participate but cannot compute

Trophies for the "Known" Models			Trophies for the "Surprise" Models			
						
LoLA 174 (points)	LoLA optimistic 174 (points)	LoLA optimistic incomplete 148 (points)	marcie 24 (points)	LoLA 12 (points)	LoLA optimistic 12 (points)	LoLA optimistic incomplete 12 (points)

Trophies for All Models		
		
LoLA 198 (points)	LoLA optimistic 198 (points)	LoLA optimistic incomplete 172 (points)

Trophies for the "Known" Models			Trophies for the "Surprise" Models			
						
Sara 251 (points)	LoLA 216 (points)	LoLA optimistic 216 (points)	Sara 37 (points)	LoLA 37 (points)	LoLA optimistic 37 (points)	LoLA optimistic incomplete 37 (points)

Trophies for All Models		
		
Sara 325 (points)	LoLA 290 (points)	LoLA optimistic 290 (points)

Trophies for the "Known" Models			Trophies for the "Surprise" Models				
							
LoLA 200 (points)	LoLA optimistic 200 (points)	LoLA optimistic incomplete 161 (points)	Marcie 18 (points)	ITS-Tools 12 (points)	LoLA 12 (points)	LoLA optimistic 12 (points)	LoLA optimistic incomplete 12 (points)

Trophies for All Models		
		
LoLA 224 (points)	LoLA optimistic 224 (points)	LoLA optimistic incomplete 185 (points)

Trophies for the "Known" Models				Trophies for the "Surprise" Models		
						
LoLA 170 (points)	LoLA optimistic 170 (points)	LoLA pessimistic 120 (points)	Marcie 120 (points)	Marcie 22 (points)	LoLA 12 (points)	LoLA optimistic 12 (points)

Trophies for All Models		
		
LoLA 194 (points)	LoLA optimistic 194 (points)	Marcie 164 (points)

Trophies for the "Known" Models



Sara
71 (points)



LoLA
71 (points)



LoLA optimistic
69 (points)

Trophies for the "Surprise" Models



Sara
12 (points)



Marcie
3 (points)

Trophies for All Models



Sara
95 (points)



LoLA
71 (points)



LoLA optimistic
69 (points)

Trophies for the "Known" Models			Trophies for the "Surprise" Models			
						
LoLA optimistic 189 (points)	LoLA 184 (points)	LoLA optimistic incomplete 154 (points)	Marcie 24 (points)	LoLA optimistic 12 (points)	LoLA 12 (points)	LoLA optimistic incomplete 12 (points)







Trophies for All Models			
			
LoLA optimistic 213 (points)	LoLA 208 (points)	Marcie 166 (points)	LoLA optimistic incomplete 166 (points)

 **Germany gets (almost) all Reachability Analysis** 

 **Rostock (LoLA, Sara)**

 **Cottbus (Marcie)**

 **ITS-Tool is not German but appears once only :-)**

Trophies for the "known" Models			Trophies for the "Surprise" Models		
					
ITS-Tools 234 (points)	PNXDD 139 (points)	Marcie 129 (points)	Marcie 24 (points)	PNXDD 15 (points)	ITS-Tool 12 (points)

Trophies for All Models		
		
ITS-Tools 258 (points)	Marcie 177 (points)	PNXDD 169 (points)

Interesting inversions for the State Space Generation

The winning triplet

-  **ITS-Tools,**
-  **Marcie,**
-  **PNXDD**

- These podiums do not show all aspects of tools
 - Expressivity
 - Formula translation problems
 - Reminder: we only considered the outputs for formula this year
 - Various bugs
 - etc.

- So this should not be considered as an absolute classification!
 - See it as outputs for tool developers
 - They can focus their effort and evaluate some strategies
 - **Fours variants of LoLA submitted!**



**MCE
2013**

**CONCLUDING
REMARKS**



An HTML report

- More available data reachable contextually
- Still many difficulties... and lessons learned
 - Automation of the analysis must be enhanced
 - Think about a better way to rate examinations.
- BenchKit (<http://benchkit.cosyverif.org>)



MCC 2014 @ Petri Nets?

- The team is ready to go



What to be proposed in MCC 2014 @ Petri Nets?

- **IMPORTANT** : the integration effort of this year will be reused
- More models: models from 2013 and more?
- Enable personal use of BenchKit to ease preliminary tests by tool developers
- Enhance the generation of formulas
 - Possibly include some «by hand» when available
 - Generate the others (this year, we needed 40800 formulas)
- Live Event
 - Evaluate usability of tools



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Interesting
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An HTML report

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We really need help!



See the description page on the web site



Possibility to download the disk image used in MCC'2013



Access to the official distribution page

MCC'2013 - Participating Tools

http://localhost:8888/mcc2013/index.php?CONTENT=results/mcc_participating_tools.html&TITLE=MCC'922' Lector

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Model Checking Contest @ Petri Nets 2013

Milano, Italy, June 25, 2013

MCC'2013, Participating Tools

Introduction

This page summarizes some facts about the elaboration of the MCC'2013. There were twelve submissions from five countries this year, including several variants of a tool (LoLA). The organizers thanks the tool developers for their effort and cooperation during the evaluation of their submission.

A short description of these tools, as well as some references are provided below. We also provide a link to the official web site and to the disk image that was submitted.

AIPINA (Univ. Geneva, Switzerland)

AIPINA [[Alpina1](#), [Alpina2](#), [Alpina3](#)] stands for Algebraic Petri Nets Analyzer and is a model checker for Algebraic Petri Nets created by the SMV Group at the University of Geneva. It is 100% written in Java and it is available under the terms of the GNU general public license. Our goal is to provide a user friendly suite of tools for checking models based of the Algebraic Petri Net formalism. AIPINA provides a user-friendly user interface that was built with the latest metamodeling techniques on the eclipse platform.

Usually, the number of states of concurrent systems grows exponentially in relation to the size of the system. This is called the State Space Explosion. Symbolic Model Checking (SMC) and particularly SMC based on Decision Diagrams is a proven technique to handle the State Space Explosion for simple formalisms such as P/T Petri nets./p>

Algebraic Petri Nets (APN : Petri Nets + Abstract Algebraic Data Types) are a powerful formalism to model concurrent systems. The State Space Explosion is even worse in the case of the APNs than in the P/T nets, mainly because their high expressive power allows end users to model more complex systems. To tackle this problem, AIPINA uses evolutions of the well known Binary Decision Diagrams (BDDs), such as Data Decision Diagrams, Set Decision Diagrams and Sigma-DDs. It also includes some optimizations specific to the APN formalism, such as algebraic clustering and partial algebraic unfolding, to reduce the memory footprint. With these optimisations, AIPINA provides a good balance between user-friendliness, modeling expressivity and computational performances.

References

- [[Alpina1](#)] D. Buchs, S. Hostettler, A. Marechal, and M. Risoldi. AIPINA: A symbolic model checker. In J. Lilius and W. Penczek, editors, Applications and Theory of Petri Nets, volume 6128 of Lecture Notes in Computer Science, pages 287-296. Springer, 2010.
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Links

- Disk image submitted to MCC'2013@Petri Nets (634MB compressed).
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Cunf (Univ. Normale Supérieure de Caen, France)

Cunf is a set of programs for carrying out unfolding-based verification of Petri nets extended with read arcs, also known as contextual nets, or c-nets. The



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**MCE
2013**

**THANK YOU FOR YOUR
ATTENTION**

**READY FOR
DISCUSSION?**

**I will try to report outcomes
of this discussion in a «issues» page**