Working with Models in the Model Checking Contest

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Organisation of the MCC

FABRICE KORDON

MODEL BOARD

production of
Petri net models
for the competition

FORMULA BOARD

production of
temporal logic
formulas for
the competition

- access to computing clusters
- BenchKit infrastructure
- launch of the experiments
- computation of statistics
- presentation of the results

Missions of the Model Board

■ Every year:

- ▶ prepare a dozen new models for the MCC competition
- ▶ issue a yearly call for models
- ▶ check the new models sent by the MCC community
- ▶ if needed, correct these models

■ On the long run:

- ▶ maintain the MCC collection of models

■ Neutrality:

- ▶ the members of the Model Board are not competitors

Definition of MCC models

In the context of the MCC, a model is:

- a set of instances (between 1 and 20)

- a story that explains where the model comes from (academic, industrial, etc.)

- a nice picture (if possible)

- a form (LaTeX/PDF file presenting the model)

and each instance is:

- a PNML file containing a Petri net

- three classes: P/T without structure, NUPN, or colored

Checking submitted models

■ The MCC community answers the yearly call for models by contributing new models

- ▶ these models may be erroneous (e.g., invalid PNML)
- ▶ their stated properties may be wrong or incomplete

■ The Model Board checks these models

■ Automatic completion of the model form:

.pnml −PNML2NUPN→ .nupn −CAESAR.BDD→ .tex

■ Discussion with the author of submitted models

Automatic decomposition to NUPNs

- Non-structured P/T nets are converted to NUPNs
- 205 MCC instances have been upgraded this way
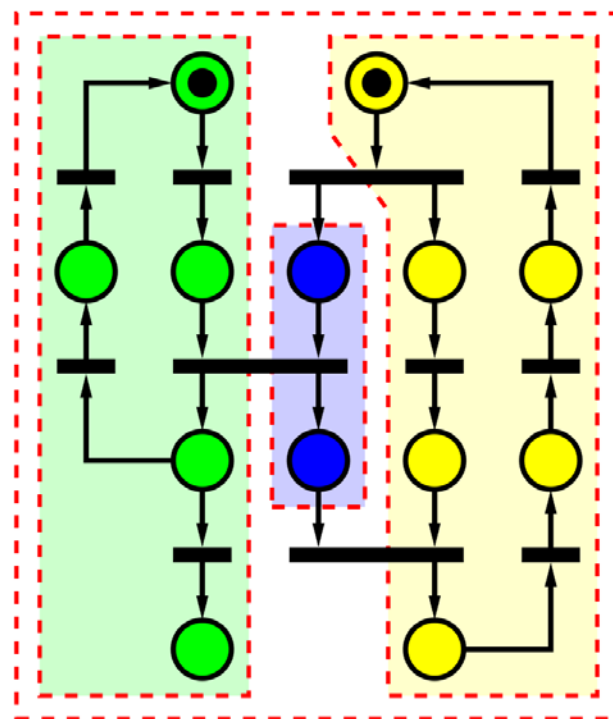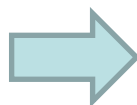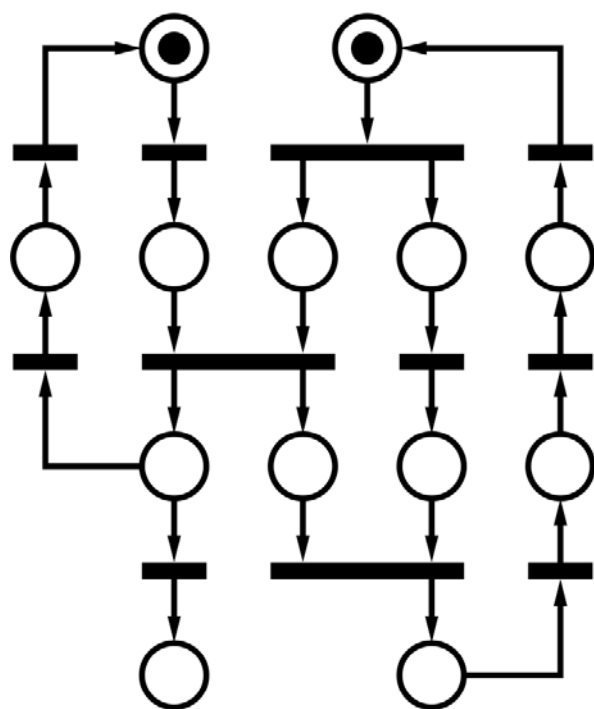
NUPNs allow more efficient verification

[Bouvier, Garavel, Ponce de Leon, Petri Nets 2020] [Bouvier, Garavel, Petri Nets 2021]
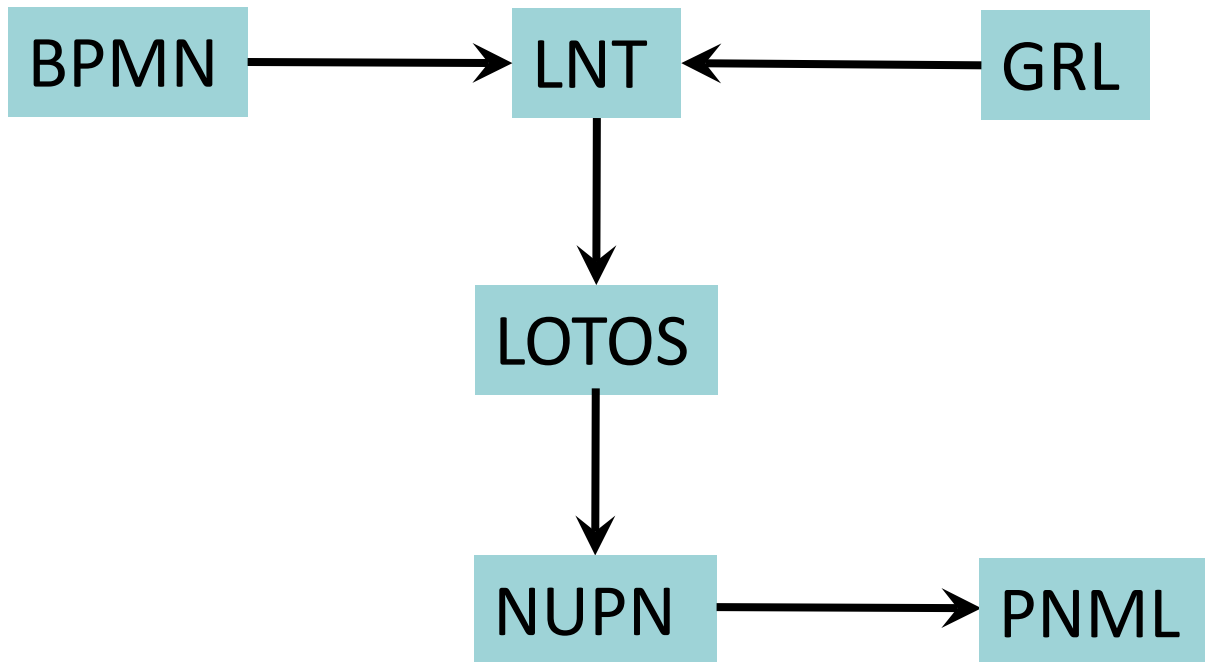
Detection of duplicate models (1/2)

- 1. How to prevent tools from improving their performance by "caching" known MCC models?
  - ▶ Fabrice proposed "scrambled nets": random permutations of places and transitions

- 2. How to detect duplicates in MCC models?
  - ▶ Too many duplicates may bias the competition
  - ▶ In Grenoble, this problem is even more acute: we have tenths of thousands of NUPNs used for testing

Detection of duplicate models (2/2)

■ Concept of isomorphic P/T nets (or NUPNs):

  ► nets identical modulo permutations (of places, transitions, and units) that preserve arcs, initial markings, unit inclusion, etc.

■ A dedicated software toolchain:

  ► signatures and net canonization

  ► reduction to graph isomorphism and to SMT solving

■ Findings:

  ► 1. Net scrambling is not an effective countermeasure

  ► 2. There are few duplicates among the MCC models

Construction of new models

■ Models generated by CADP (https://cadp.inria.fr)

```
BPMN ──────────→ LNT ←────────── GRL
                  │
                  ↓
                LOTOS
                  │
                  ↓
                NUPN ──────────→ PNML
```

■ 1/3 of MCC models have been produced this way

■ The generated models are correct by construction

Frequent issues

Statistically, the 3 most common problems are:

- Issues with the tool that unifies the PNML "name" and "id" attributes

- Issues with the unfolding tool that converts colored nets to equivalent P/T nets

- Incompatibilities between the submitted colored nets and their corresponding P/T instances

Conclusion

- **MCC**: much work is done in the background

- The MCC collection of models in 2023:
  - 133 models
  - 1729 instances
  - 175+ publications

- Current Model Board members:
  - Pierre Bouvier, Fabrice Kordon, Hubert Garavel
  - (Lom Messan Hillah left to industry)

- We would heartily welcome new members