Correctness Ensuring Process Configuration: An Approach Based on Partner Synthesis

Wil van der Aalst (TU/e, QUT)
Niels Lohmann (U-Rostock, TU/e)
Marcello La Rosa (QUT)
Jingxin Xu (QUT)

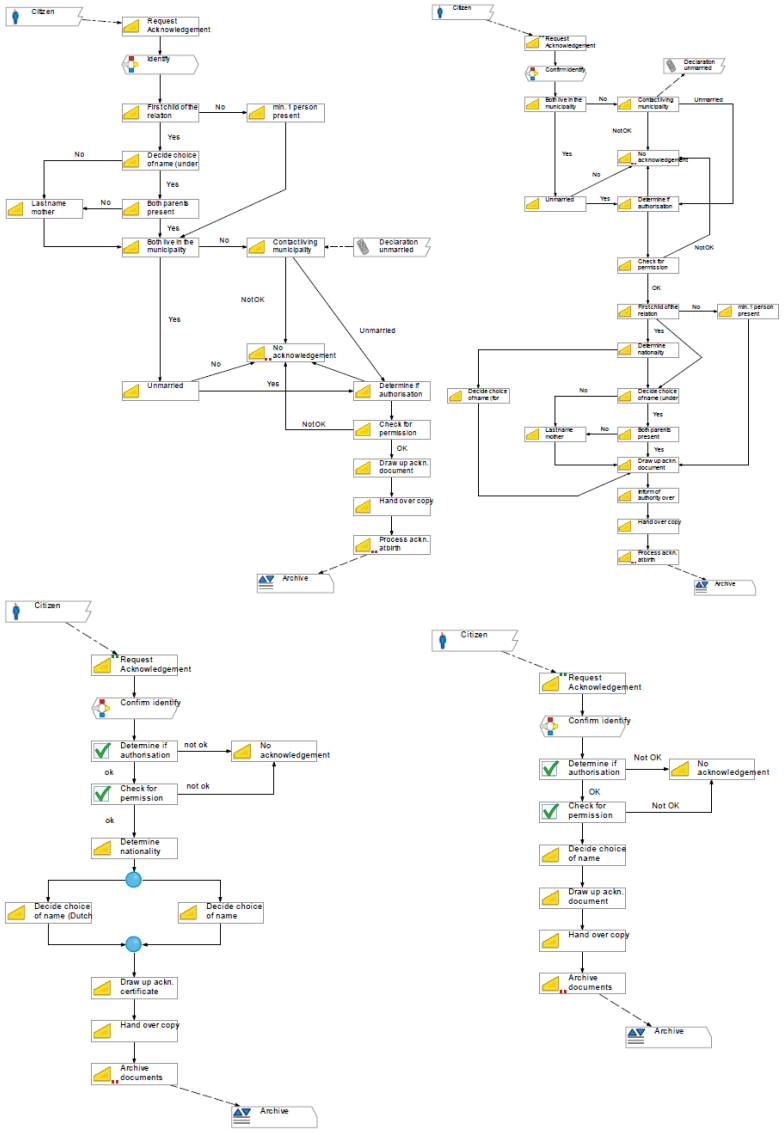
QUT

TU/e Technische Universiteit Eindhoven University of Technology

Where innovation starts

The need for configurable process models: CoSeLoG project

+/- 430 Dutch municipalities



The need for configurable process models: Suncorp case

End to end process has between 250-1000 process steps

- 25+ steps
- 50+ steps
- 75+ steps
- 100+ steps

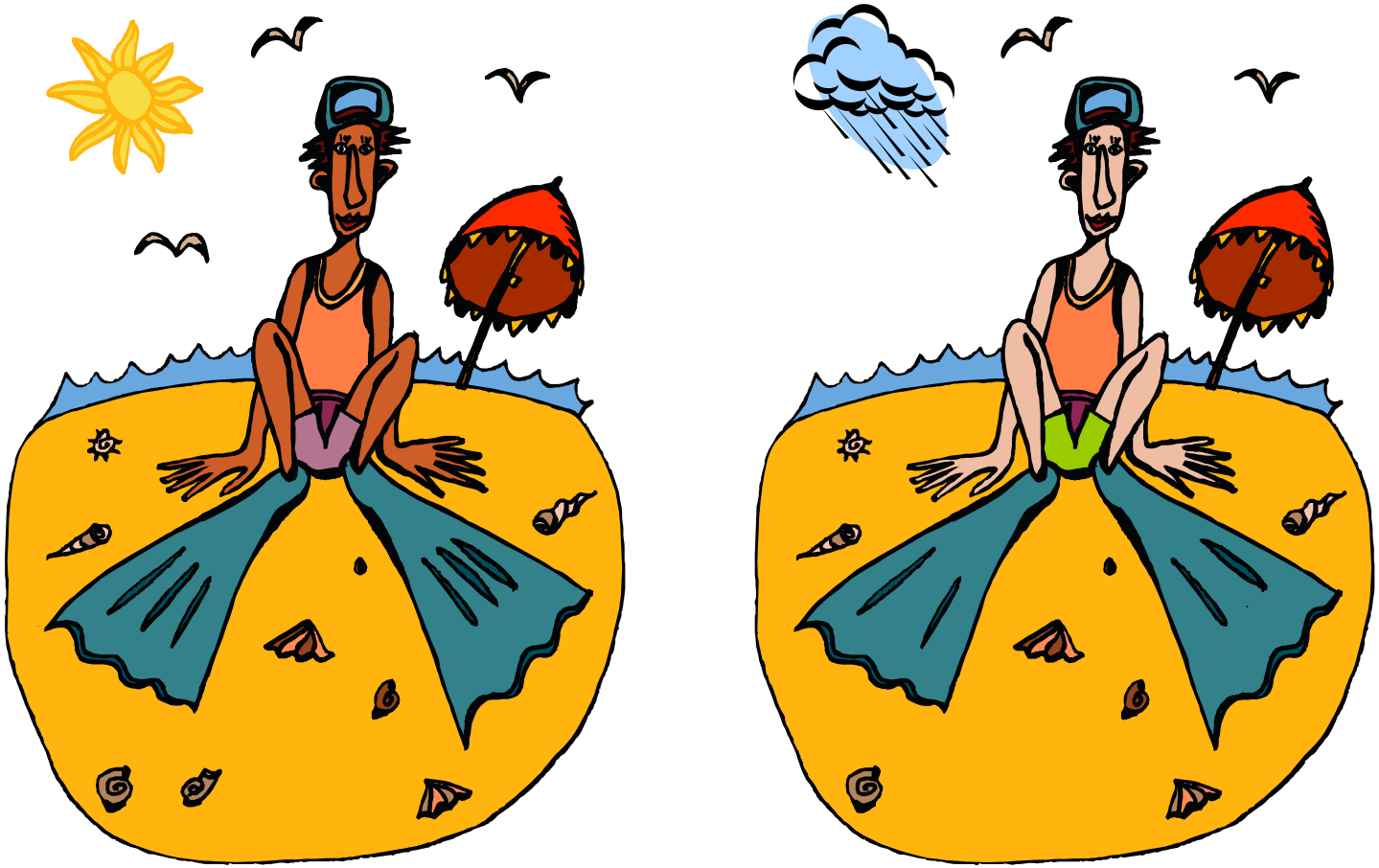
500
steps

Sources: Guidewire reference models, GIO CISSS Project, CI US&S P4PI Project

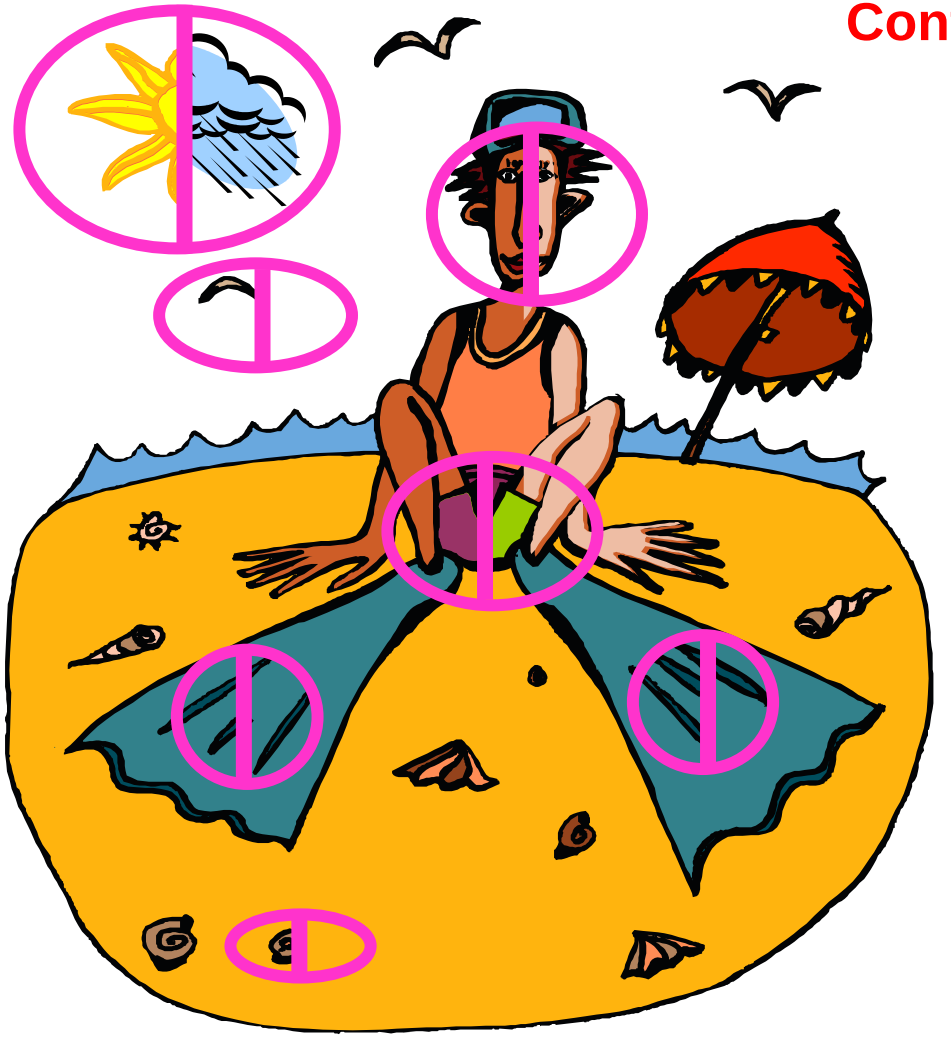
	Home	☑	☑			☑		☑	☑	☑
	Motor	☑	☑	☑		☑	☑	☑	☑	☑
	Commercial	☑			☑	☑			☑	☑
	Liability	☑	☑			☑			☑	☑
	CTP / WC	☑	☑			☑ ☑		☑	☑	

30
variations

Two variants of the same process …



Variation points

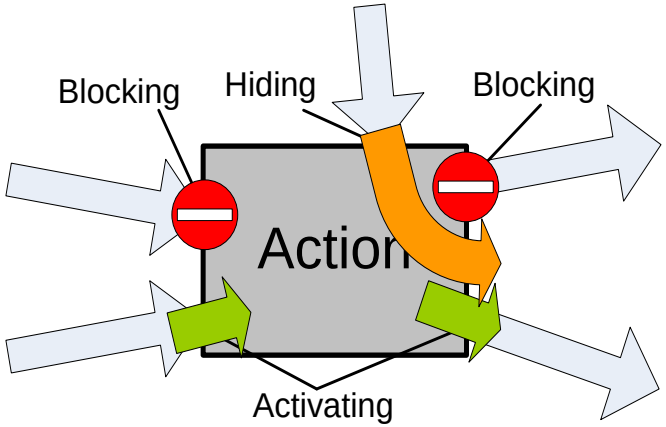


Configuration = limiting behavior !

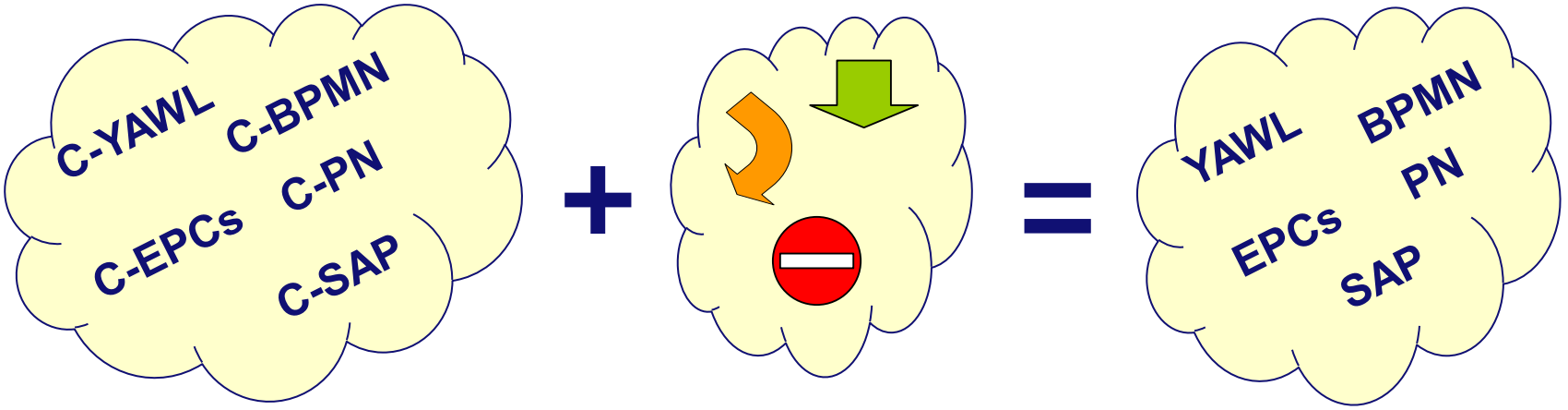
Activate

Hide/skip

Block



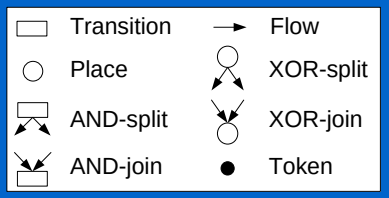
Correctness of configurations

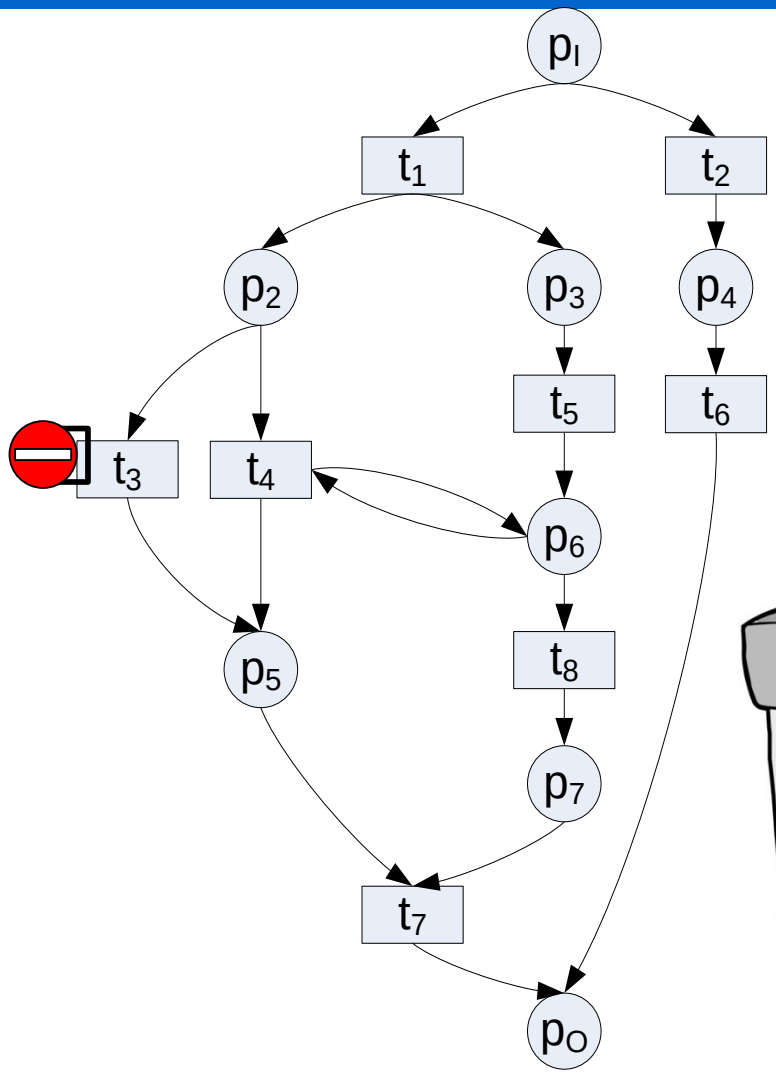


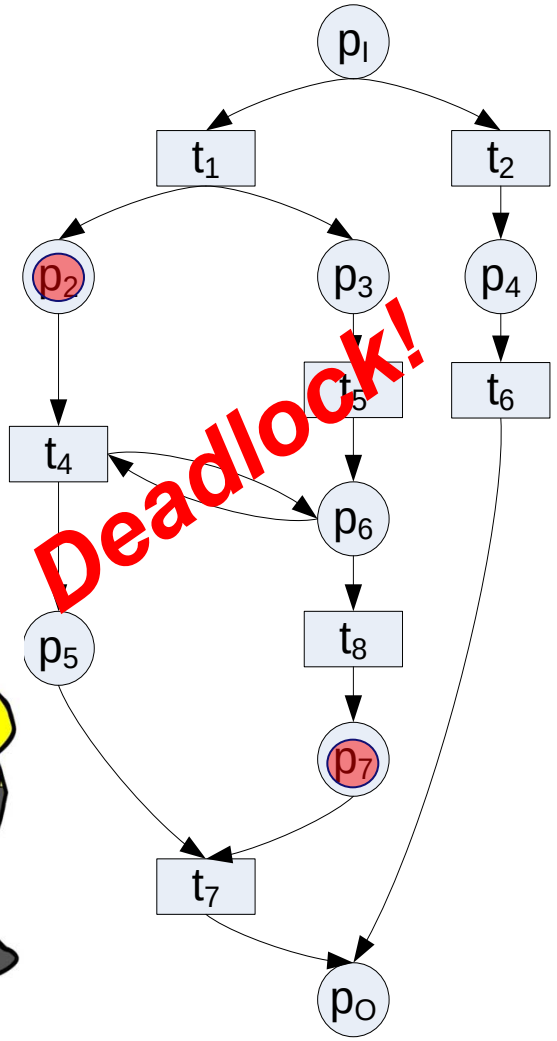
Configurable Model + Configuration = Configured model

- **Question 1:**
  Is a particular configuration correct?
- **Question 2:**
  Is there a correct configuration?
- **Question 3:**
  How to characterize the set of all correct configurations?
- **Question 4:**
  How to auto-complete a configuration?

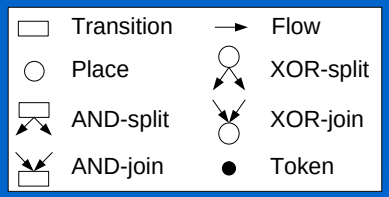
Can t_3 be blocked?

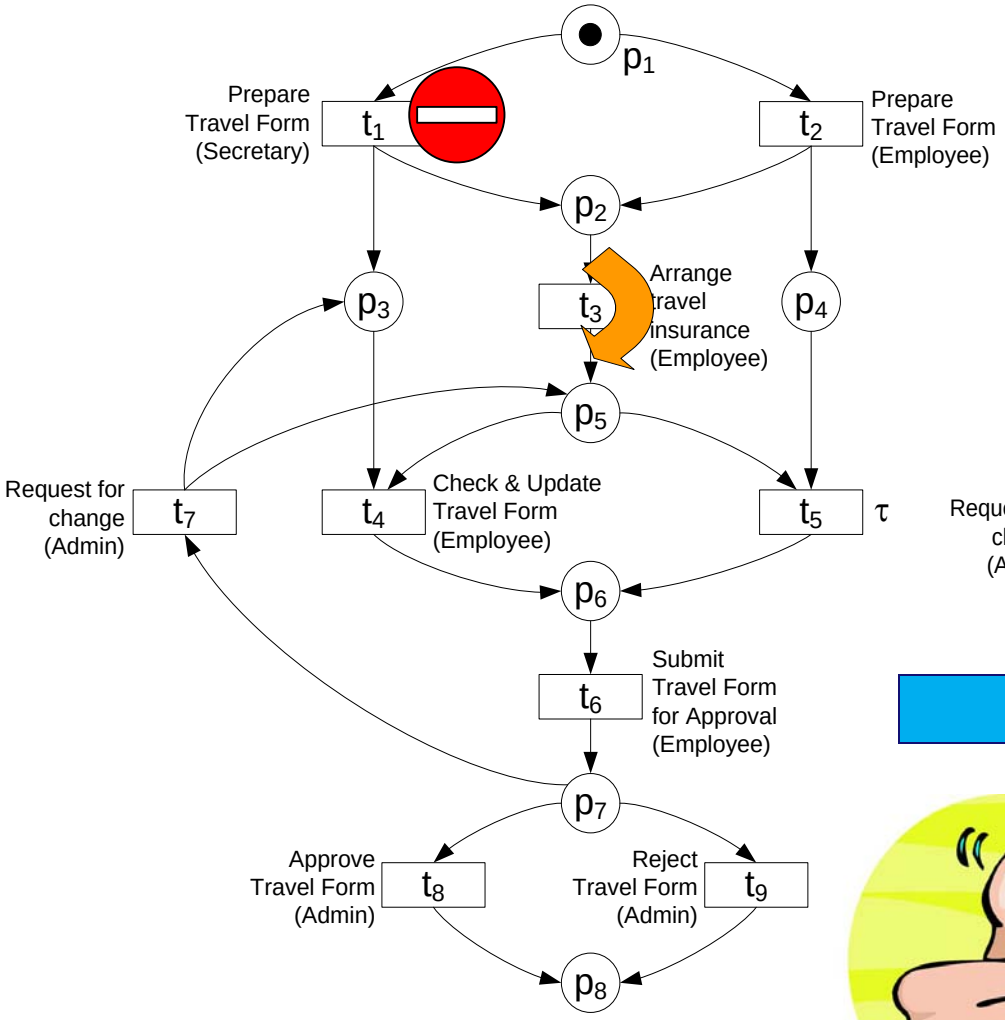




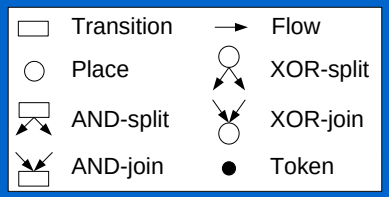


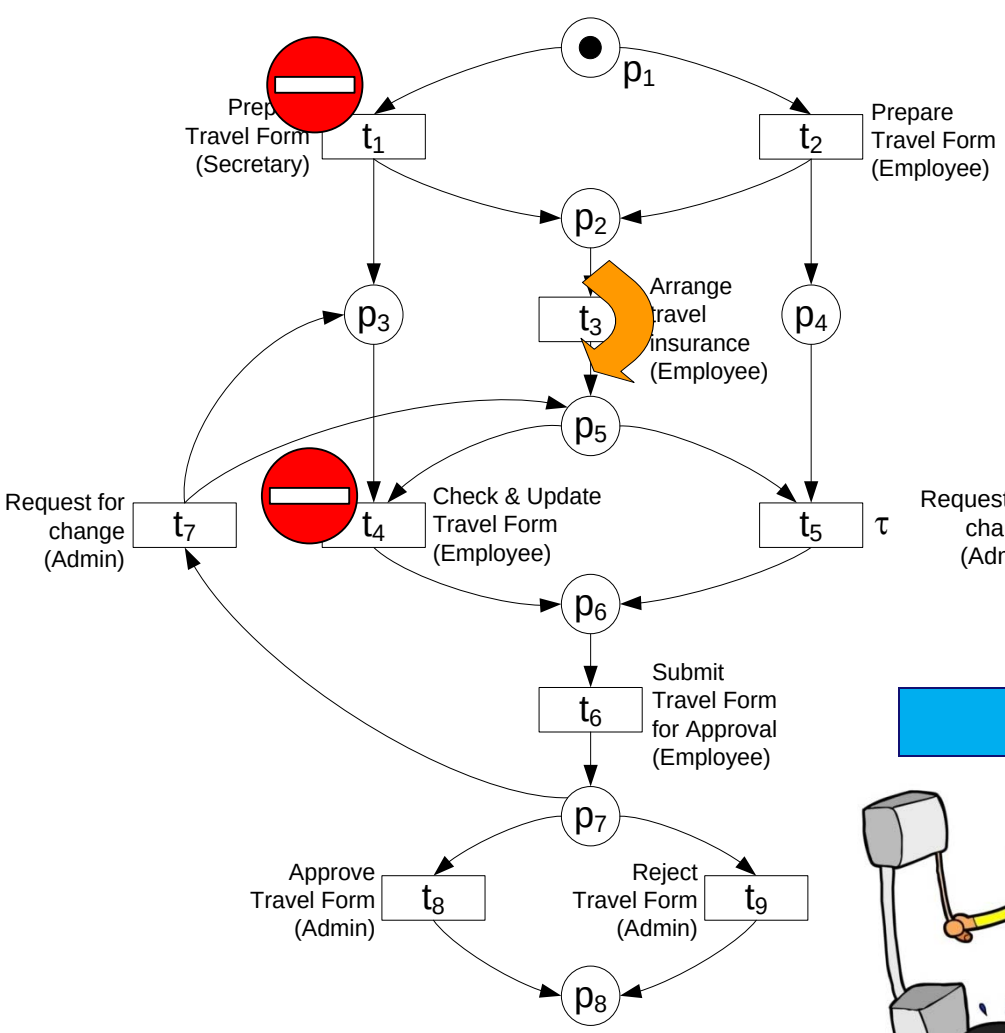
Block t_1 and hide t_3 ?





Block t_4 also?





Existing approaches

- **Most approaches only consider the syntactical issues or simply create the configured model and analyze it (i.e., trail and error).**
- **Our earlier approach using a SAT solver is an exception to this rule, but is limited to free-choice WF-nets.**

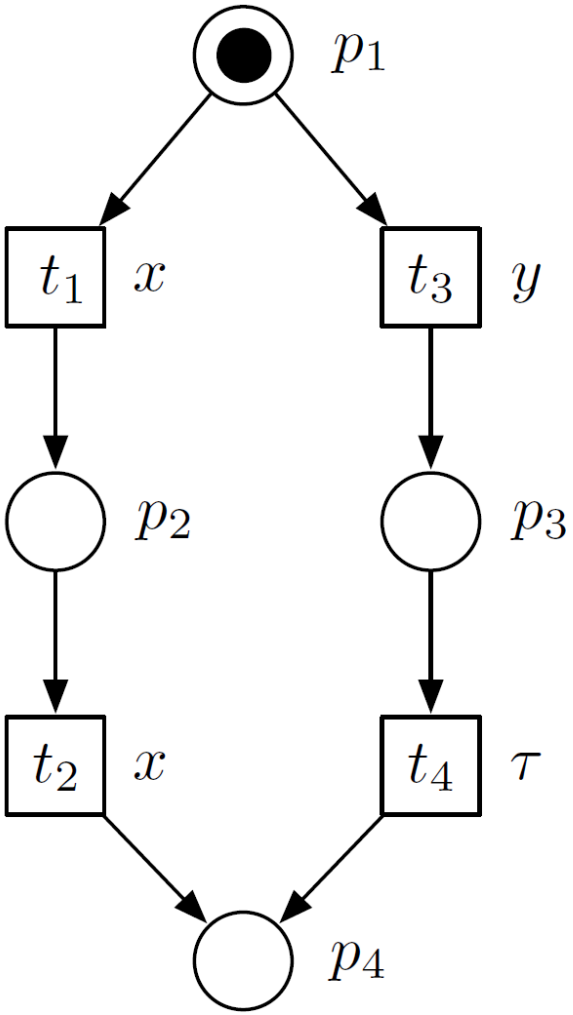
W.M.P. van der Aalst, M. Dumas, F. Gottschalk, A.H.M. ter Hofstede, M. La Rosa, J. Mendling, Preserving Correctness During Business Process Model Configuration. In Formal Aspects of Computing (FACS). Vol. 22 No. 3-4, 2010.

New approach

- **Based on partner synthesis developed in the Rostock group.**
- **Implemented in C-YAWL using Wendy.**

- **Advantages:**
  1. **No syntactical restrictions (i.e. beyond WF-nets and free-choice).**
  2. **Complete characterization of all correct configurations at design time: the so-called configuration guideline.**
  3. **Computation time is moved from configuration time to design time.**

Open nets and weak termination



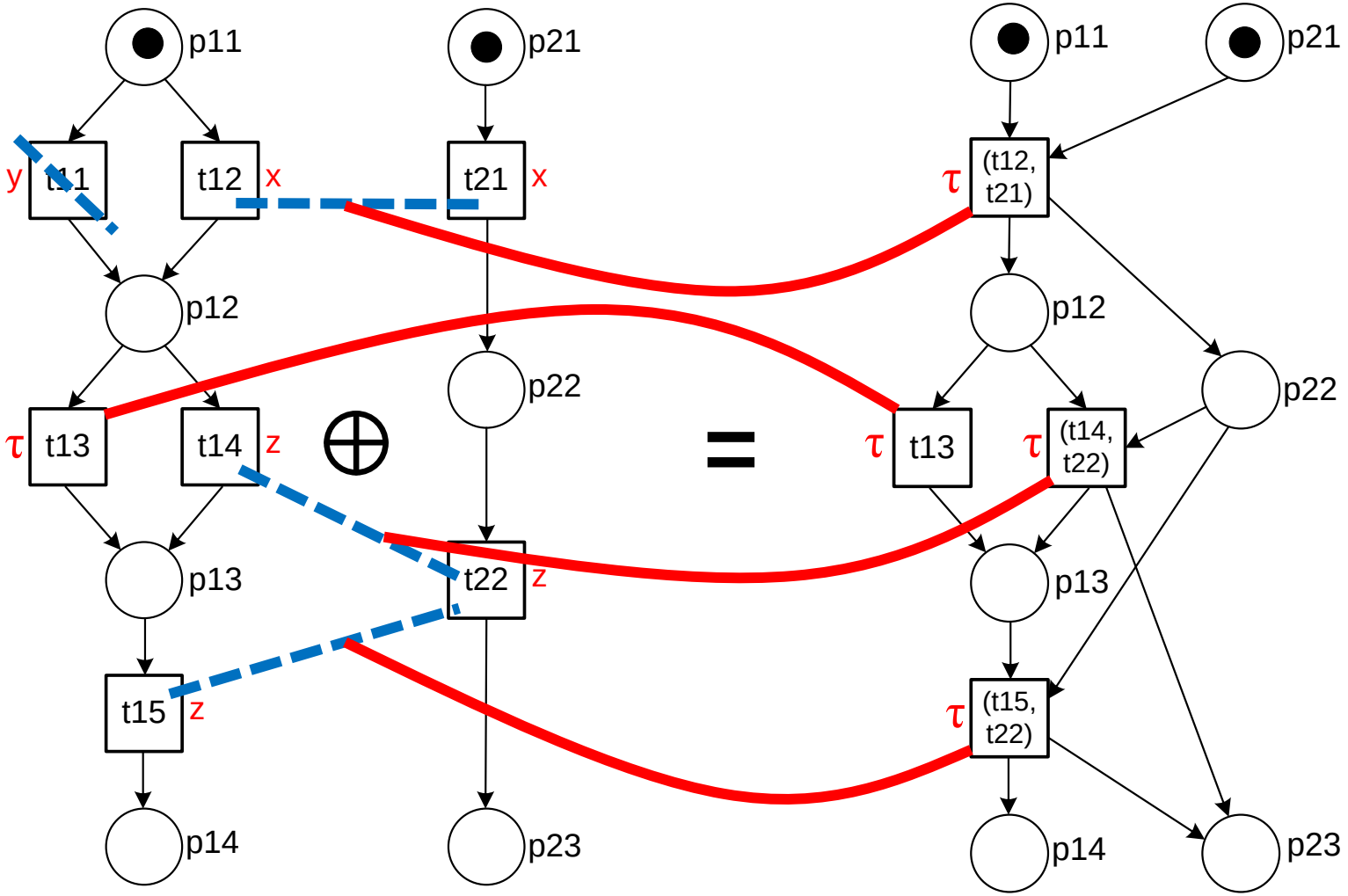
Open net:

- **Labeled Petri net without any syntactical restrictions.**
- **Special label: τ**
- **Set of final markings, in this case [p4].**

Correctness notion:

- **weak termination: it is always possible to reach a final marking (weaker than classical soundness)**

Composition of open nets

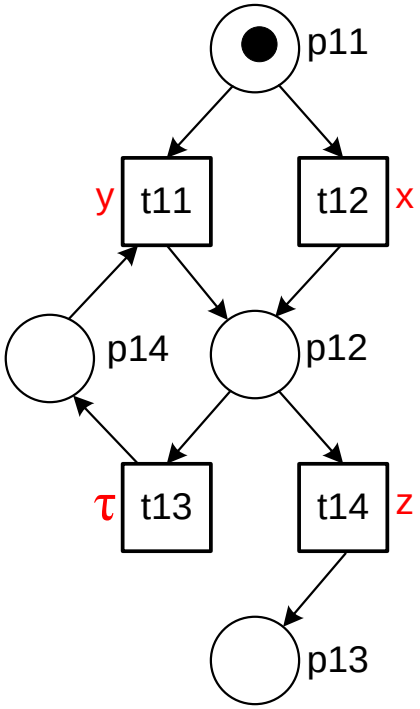


$\Omega = \{[p14]\}$ $\Omega = \{[p23]\}$ $\Omega = \{[p14,p23]\}$

Controllability

- An open net is controllable if there exists another open net such that their composition is weakly terminating.
- An open net is called a partner of another open net if their composition is weakly terminating.
- A controllable open net has at least one partner.
- There are efficient techniques to check controllability and to synthesize partners.
  [Karsten Wolf. Does My Service Have Partners?. T. Petri Nets and Other Models of Concurrency 2: 152-171 (2009)]
- These are implemented in Wendy.
  [Niels Lohmann, Daniela Weinberg. Wendy: A Tool to Synthesize Partners for Services. Petri Nets 2010: 297-307.]

Controllability



$\Omega = \{[p13]\}$

$\oplus$

partner??

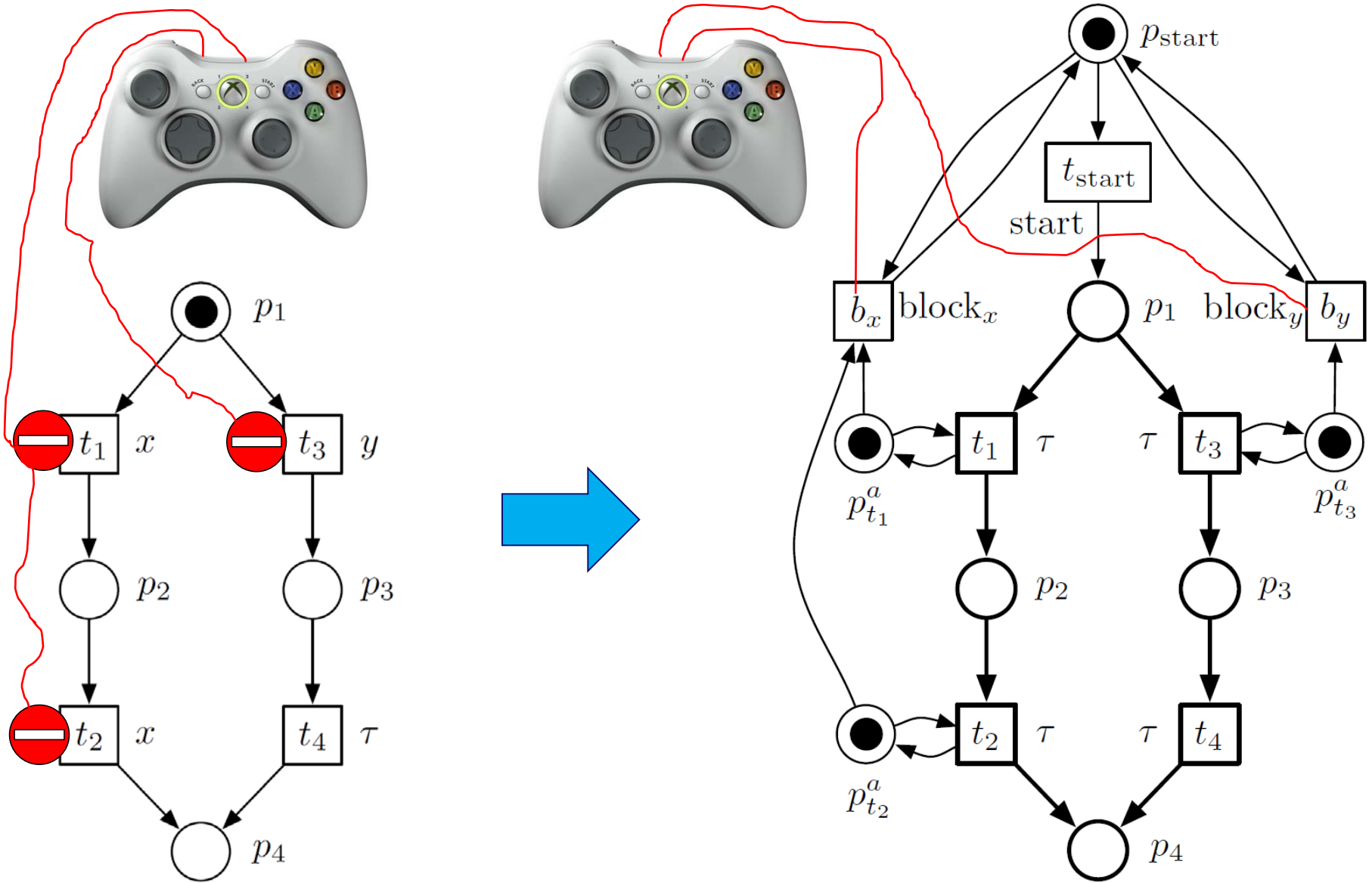
=

weakly terminating

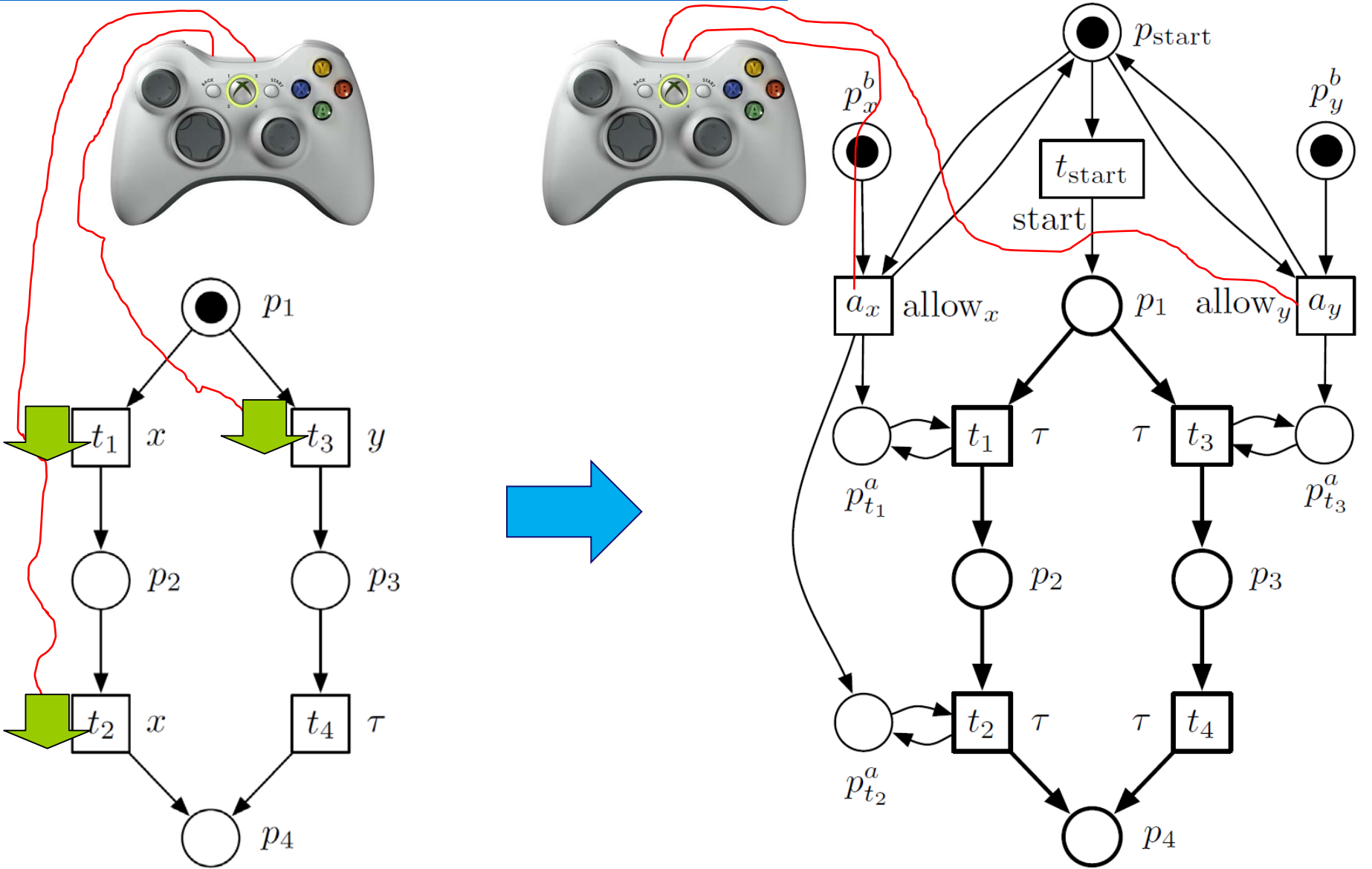
Idea:

good configuration = partner!

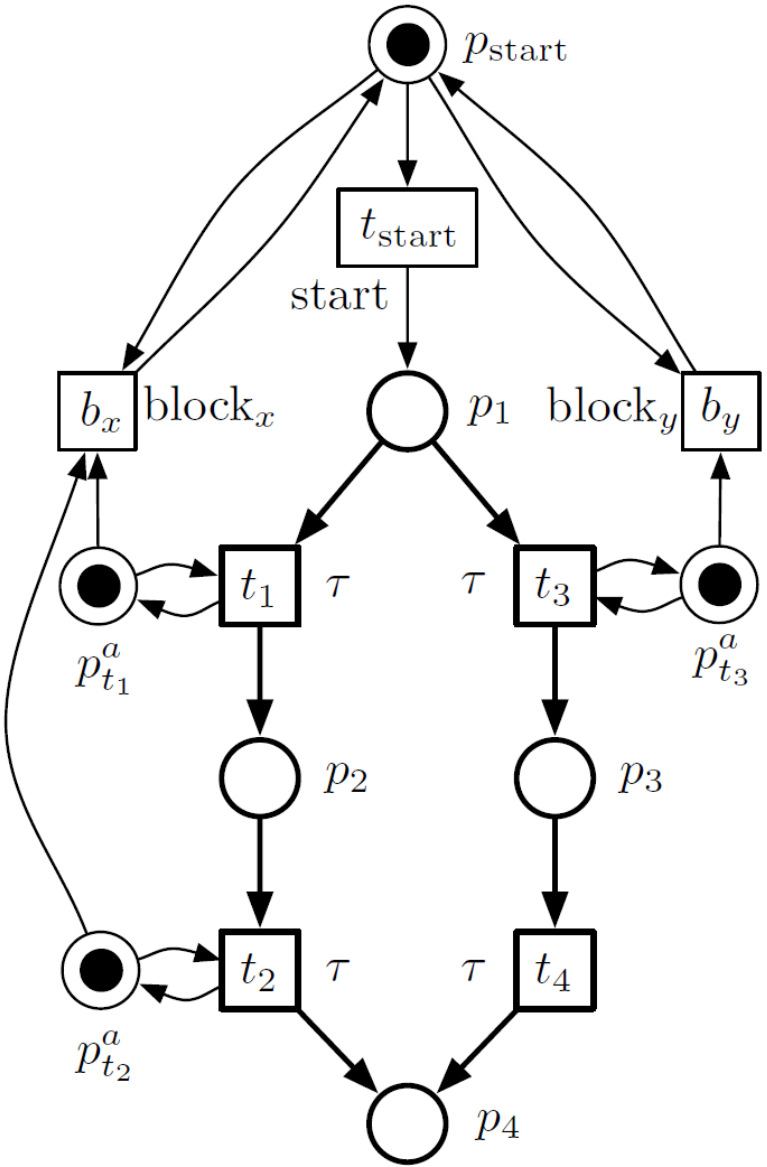
Configurable interface (allow by default)

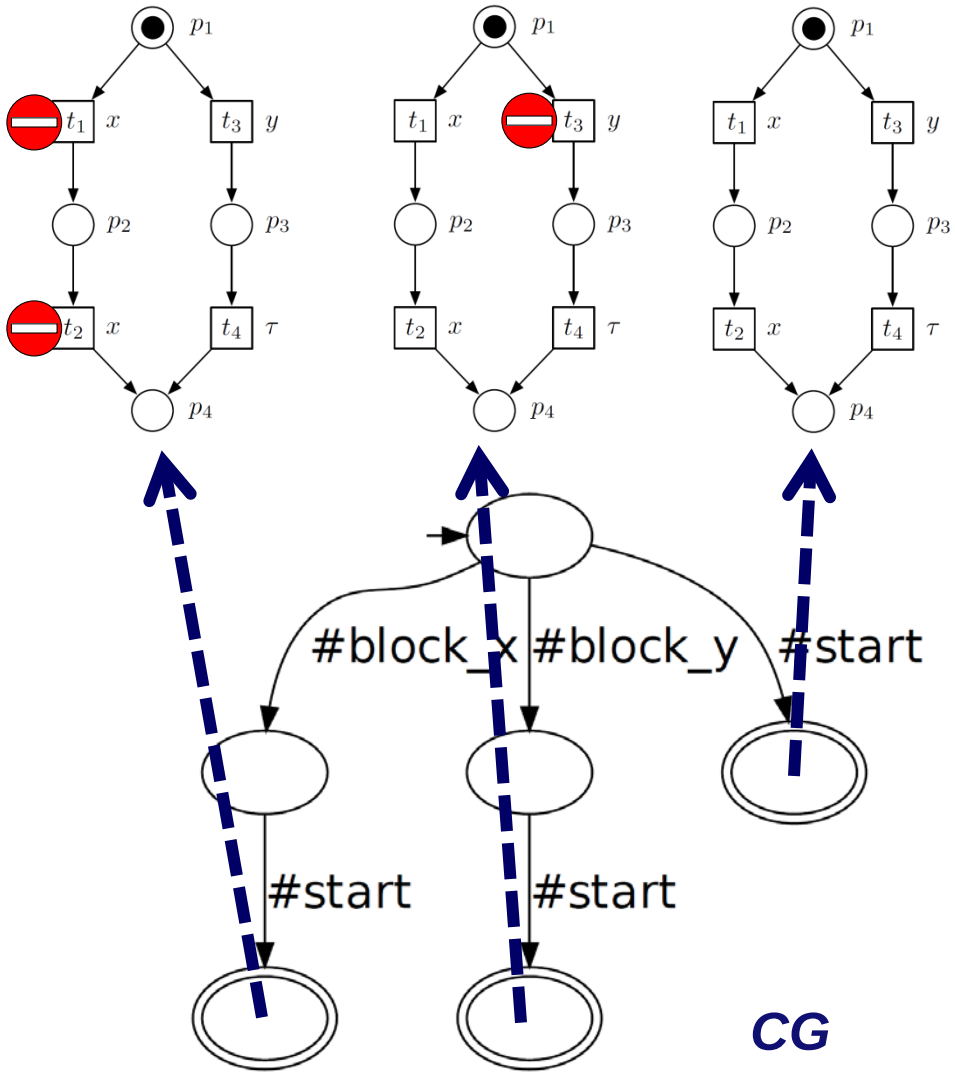


Configurable interface (block by default)

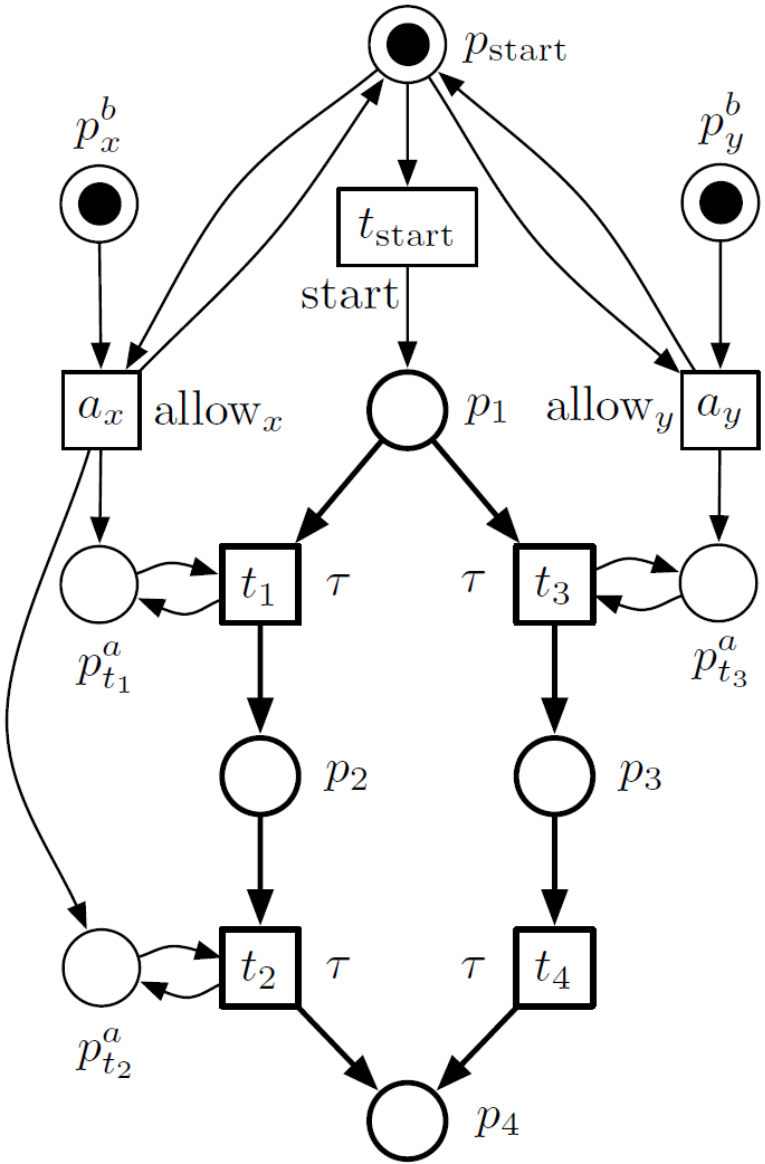


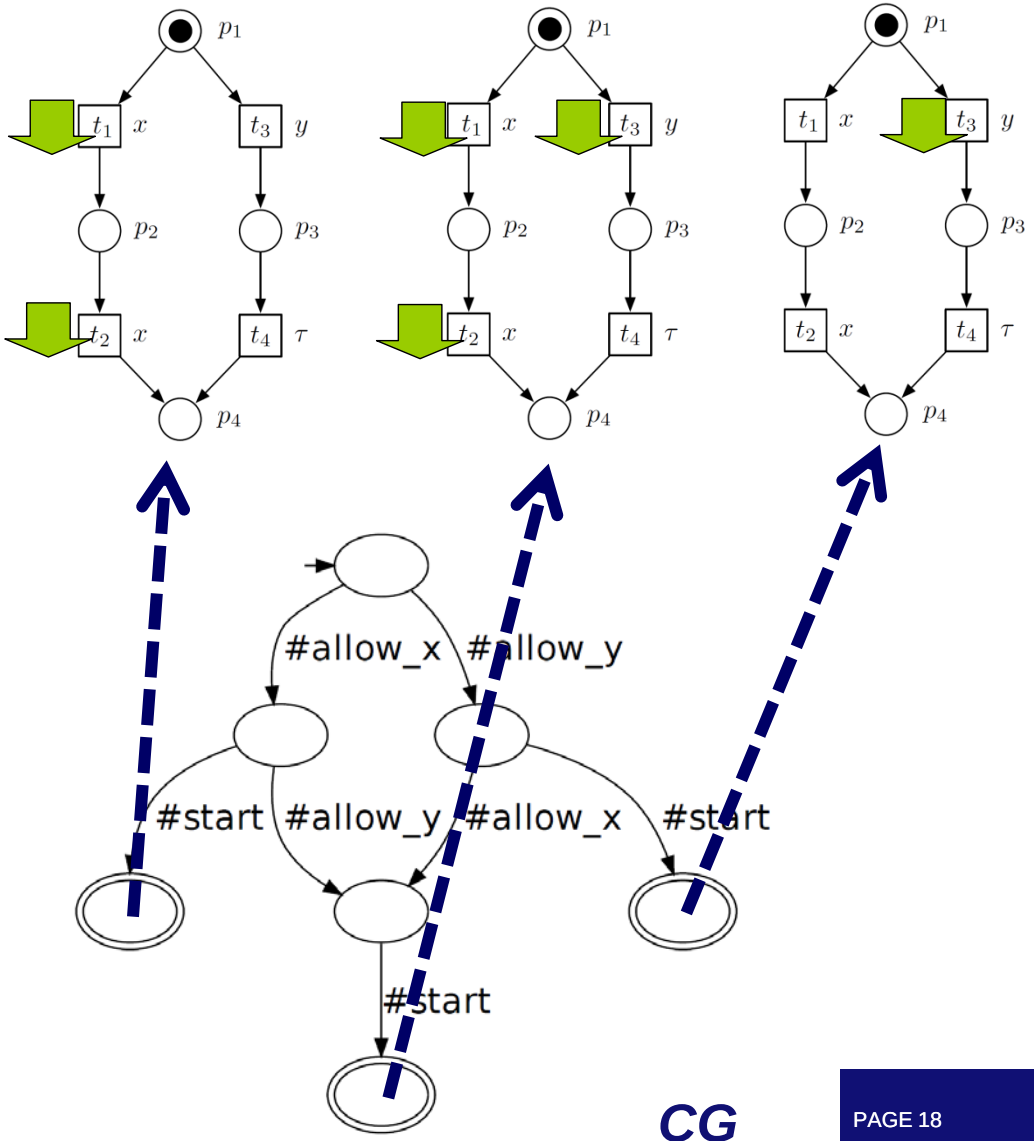
Configuration guideline (allow by default)





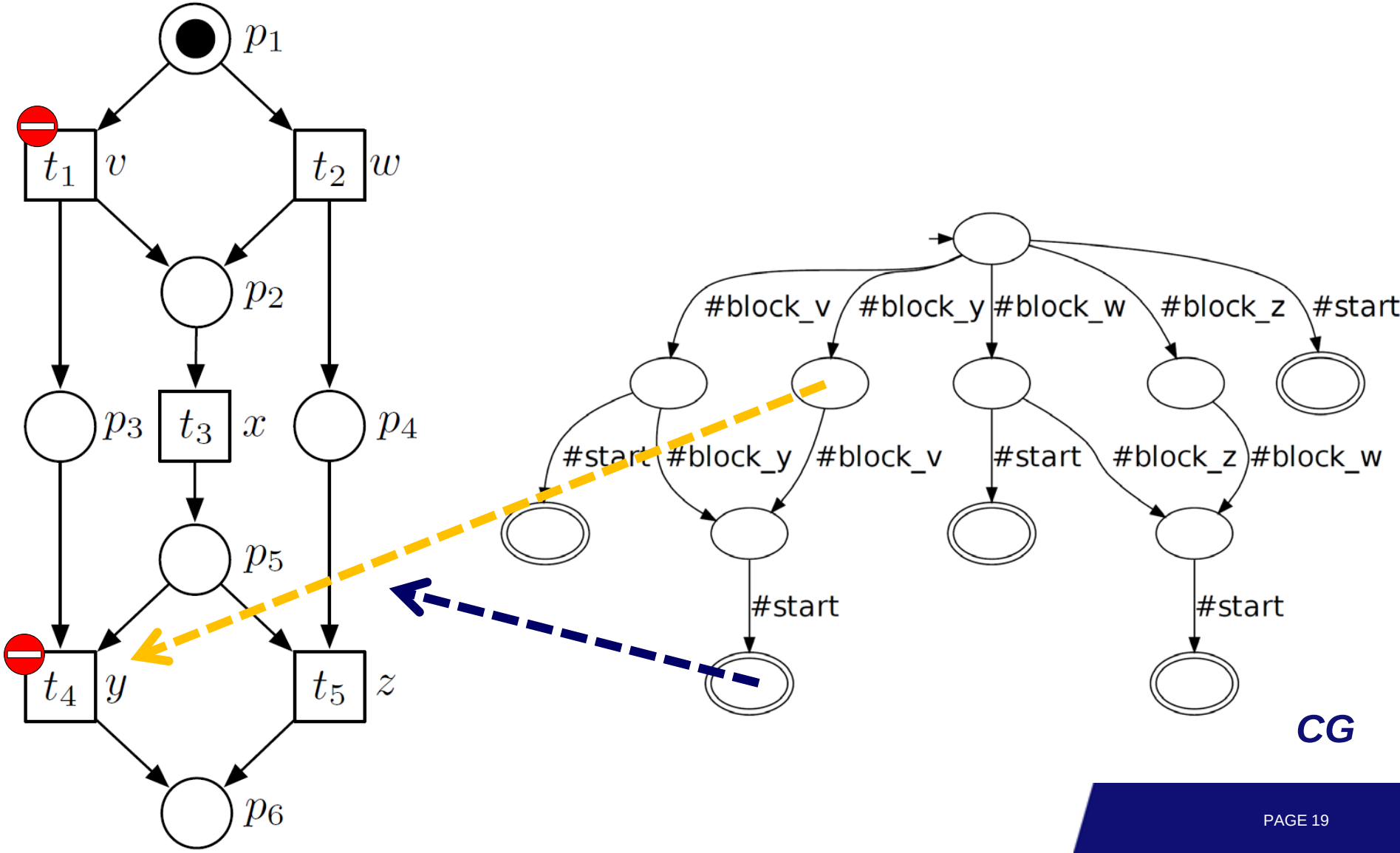
Configurable interface (block by default)





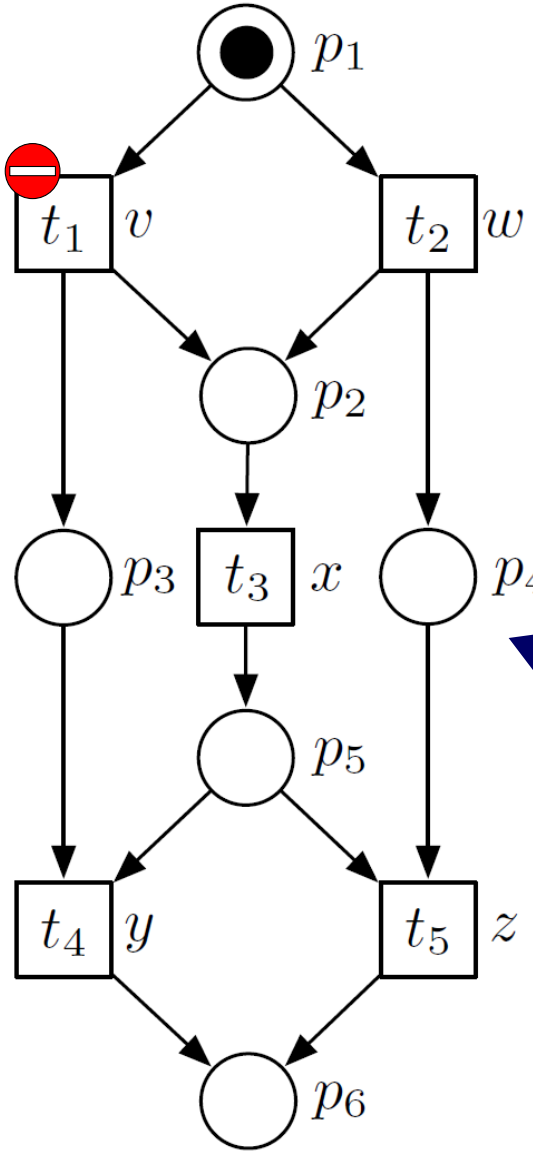
CG

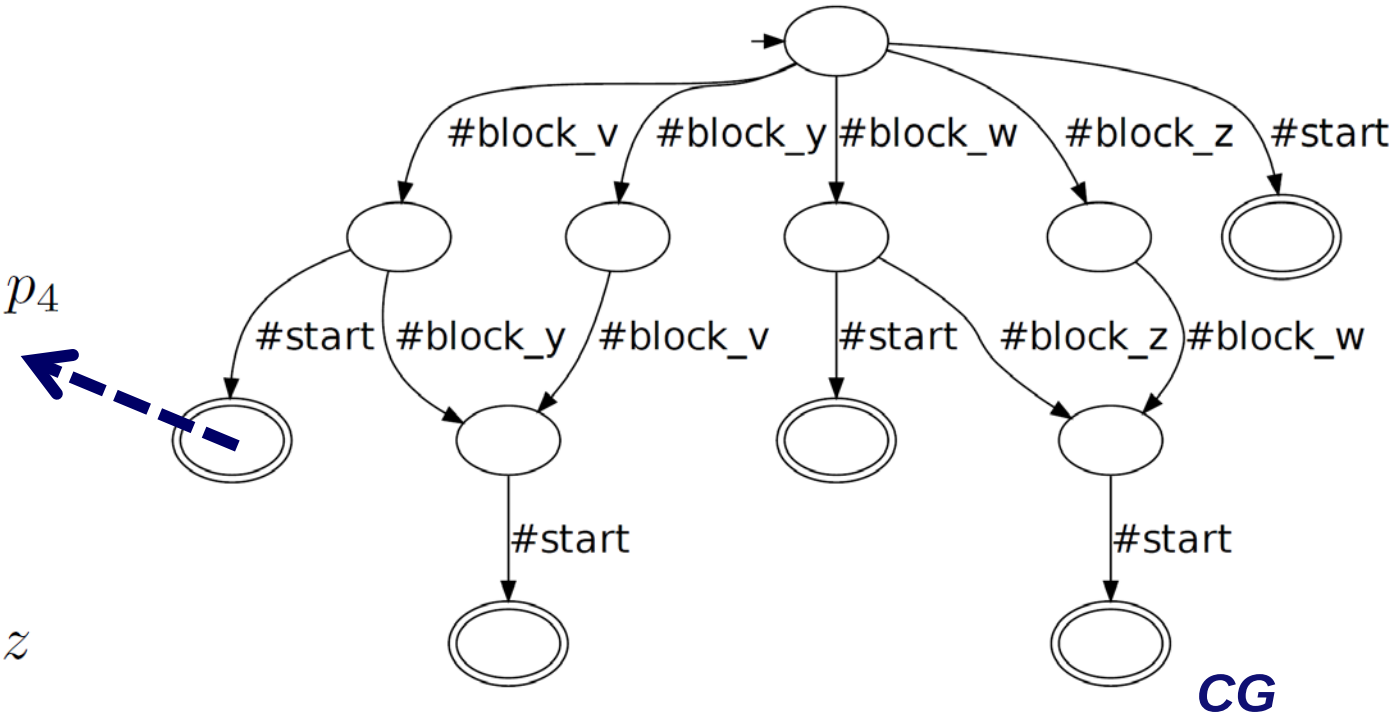
Configuration guideline (allow by default)



CG

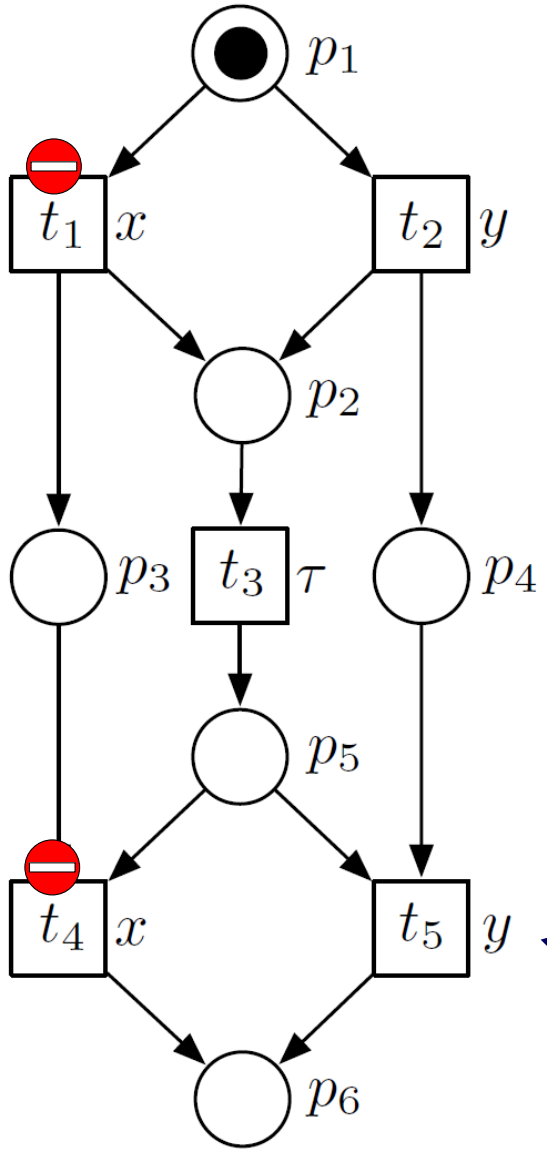
Configuration guideline (allow by default)

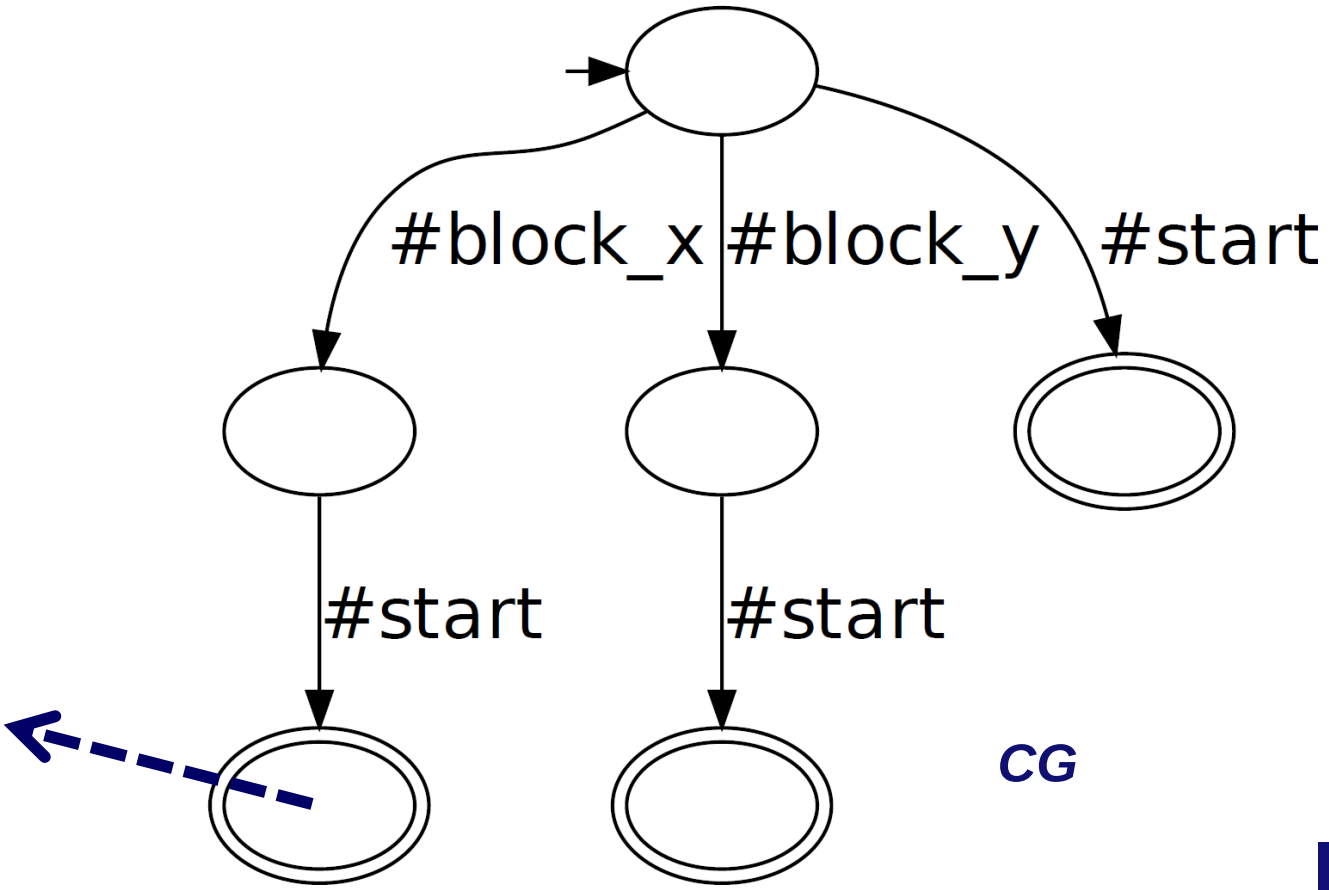




CG

Configuration guideline (allow by default)





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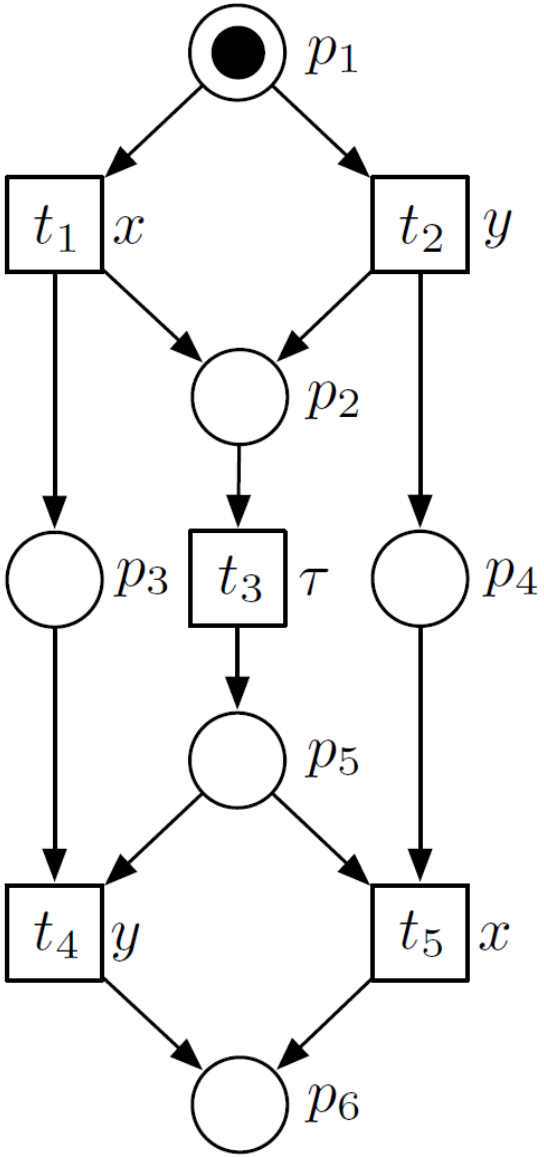
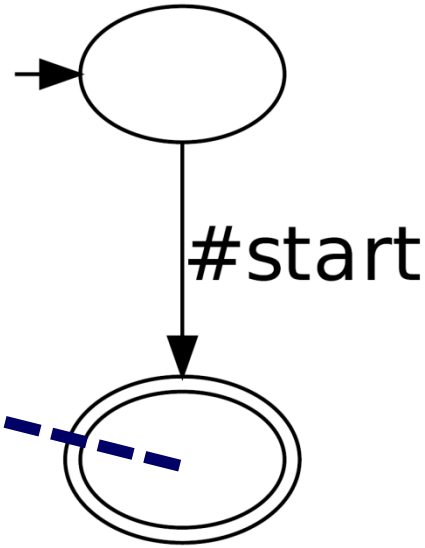
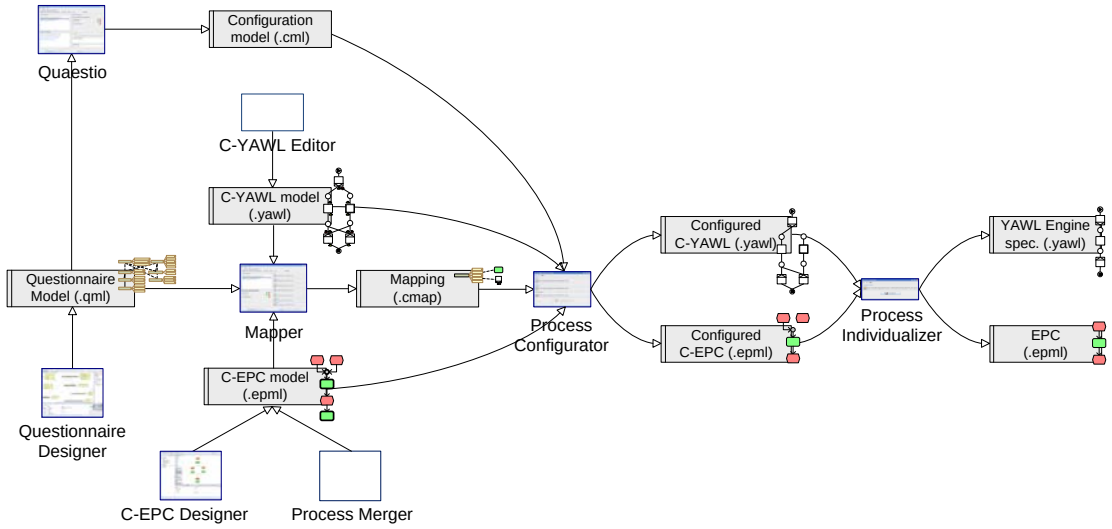




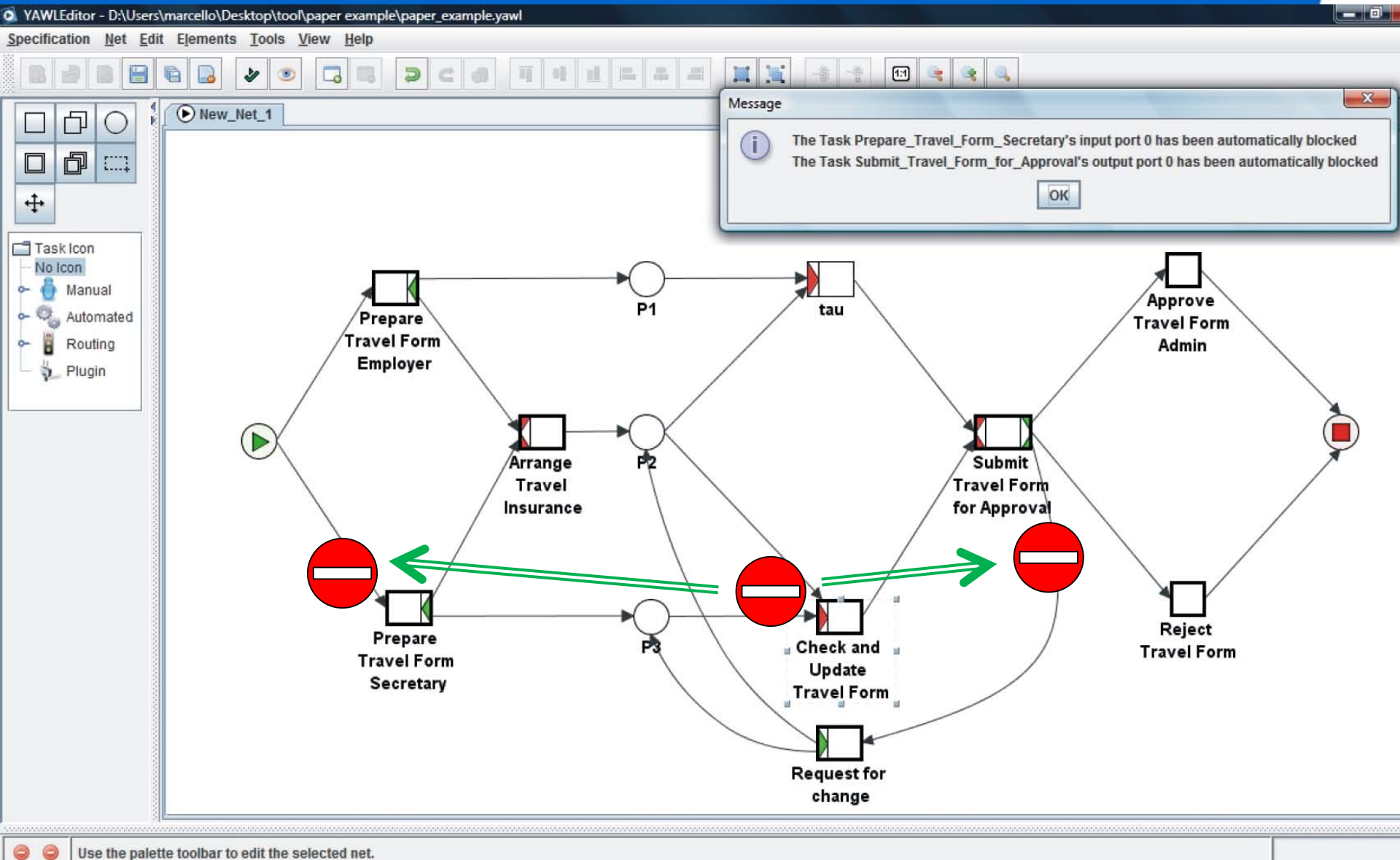
CG

Tool support

- YAWL editor
  - Creating C-YAWL models
  - Configuring C-YAWL models
  - Verification and auto-completion (using SAT solver and/or Wendy)
- YAWL engine
- YAWL services



C-YAWL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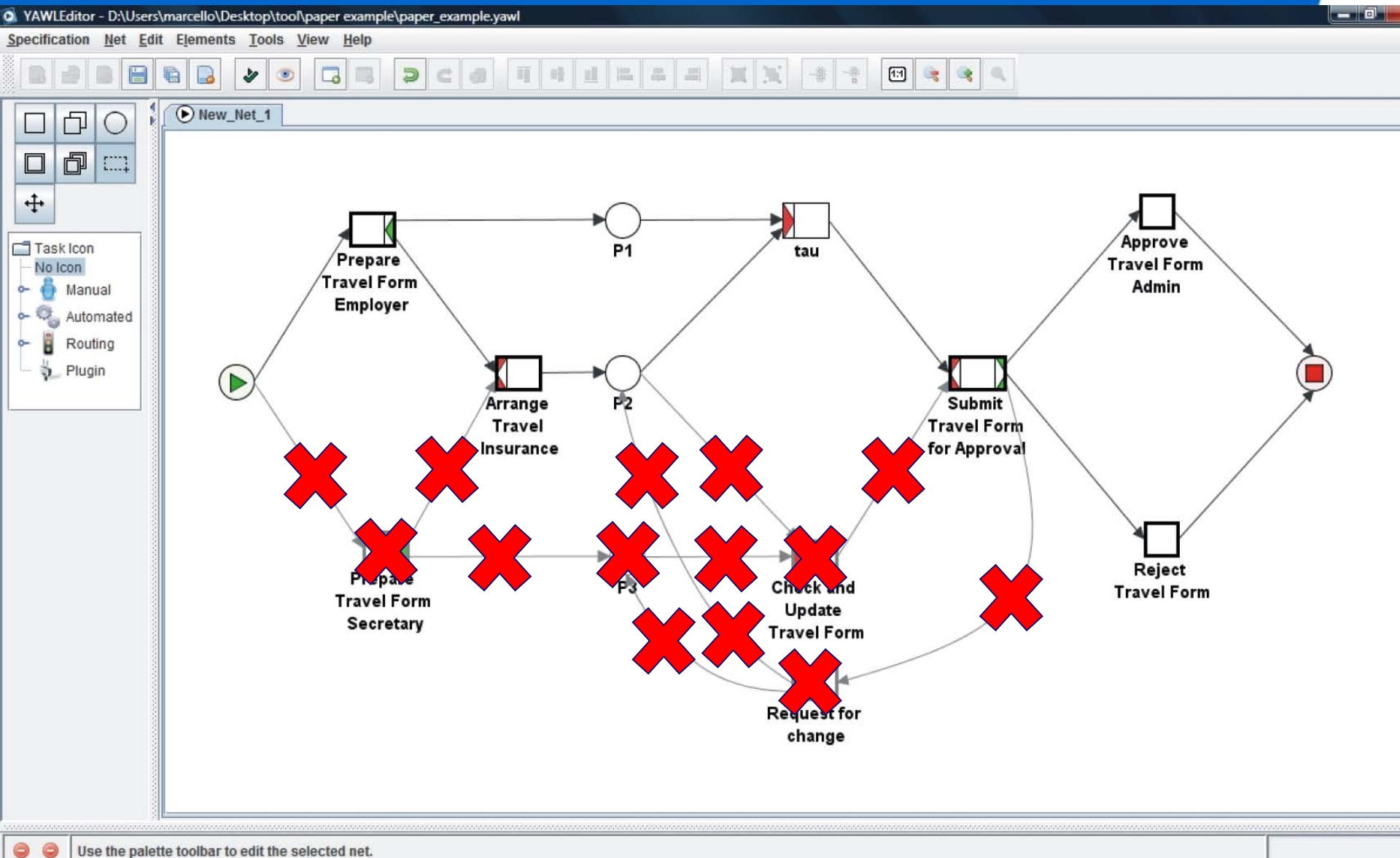
Specification Net Edit Elements Tools View Help
New_Net_1
Message
The Task Prepare_Travel_Form_Secretary's input port 0 has been automatically blocked
The Task Submit_Travel_Form_for_Approval's output port 0 has been automatically blocked
OK
Task Icon
No Icon
Manual
Automated
Routing
Plugin
Prepare Travel Form Employer
P1
tau
Approve Travel Form Admin
Arrange Travel Insurance
P2
Submit Travel Form for Approval
Prepare Travel Form Secretary
P3
Check and Update Travel Form
Reject Travel Form
Request for change
Use the palette toolbar to edit the selected net.

C-YAWL


YAWLEditor - D:\Users\marcello\Desktop\tool\paper example\paper_example.yawl
Specification Net Edit Elements Tools View Help
New_Net_1
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Automated
Routing
Plugin
Prepare Travel Form Employer
P1
tau
Approve Travel Form Admin
Arrange Travel Insurance
P2
Submit Travel Form for Approval
Prepare Travel Form Secretary
P3
Check and Update Travel Form
Reject Travel Form
Request for change
Use the palette toolbar to edit the selected net.

Conclusion

- New approach for ensuring the correctness of process configurations based on partner synthesis.
- Advantages:
  1. No syntactical restrictions (i.e. beyond WF-nets and free-choice).
  2. Complete characterization of all correct configurations at design time: the so-called configuration guideline.
  3. Computation time is moved from configuration time to design time.
- Implemented in C-YAWL using Wendy.
  - Complete support for workflow configuration, verification, and enactment.
  - Autocomplete, domain knowledge, etc.

More information

- **www.processconfiguration.com**
  (various references to configuration literature and a comprehensive toolset)
- **www.yawlfoundation.org**
  (YAWL has been extended to support configuration, cf. C-YAWL)
- **service-technology.org**
  (paper and tools - including Wendy - related to the analysis of services)
- **www.win.tue.nl/coselog**
  (webpage of the CoSeLoG project)